BIBLIOGRAPHIC DATA SHEET	1. CONTROL NUMBER	2. SUBJECT CLASSIFICATION (695)
	PN-AAJ-123	AP00-0000-0000

3. TITLE AND SUBTITLE (240)

Recommendations for a five year program in environmental protection and natural resource management

4. PERSONAL AUTHORS (100)

Berry, Leonard; Ford, Richard

5. CORPORATE AUTHORS (101)

Clark Univ.

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1979	312p.	333.72.B534

9. REFERENCE ORGANIZATION (150)

Clark

10. SUPPLEMENTARY NOTES (500)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Environmental management
Planning
Program planning
Coasts
Pollution
Environmental engineering
Natural resources
Project design
Forestry

13. PROJECT NUMBER (150)	
698013500	
14. CONTRACT NO.(140)	15. CONTRACT TYPE (140)
AID/afr-G-1356	
16. TYPE OF DOCUMENT (160)	

AID 590-7 (10-79)

RECOMMENDATIONS FOR A FIVE YEAR PROGRAM IN ENVIRONMENTAL PROTECTION AND NATURAL RESOURCE MANAGEMENT

prepared for the

INSTITUTE FOR SCIENTIFIC AND TECHNOLOGICAL COOPERATION

Leonard Berry
Richard Ford
Program for International Development
Center for Technology, Environment and Development
Clark University
Worcester, Massachusetts 01610

April, 1979

FOREWORD

AND

ACKNOWLEDGEMENTS

This report attempts to achieve two purposes. First it reviews recent literature, conferences, and institutional capabilities related to environmental issues in the developing world. Second, it offers a series of recommendations with regard to possible environmental activities for the proposed Institute for Scientific and Technological Cooperation to consider.

We have received considerable help in preparing the document. George Kinter in the Office of Coastal Zone Management, NOAA, prepared a helpful list of key individuals to contact. Dozens of people, as listed in Appendix V, sent reports and suggestions. In AID and State, Molly Kux and Bill Long brought together both many people and much information. Walter Parham, now in the Office of Technology Assessment and formerly with AID, offered invaluable help in forestry. James Talbot at the National Academy of Sciences; G. M. Woodwell at the Marine Biological Laboratory, Woods Hole; and Jeffrey Shane, Environmental Consultant, also offered especially helpful materials. Finally, Clint Stone of the ISTC staff helped put this small report into the much larger context of the long range goals of ISTC.

We also owe a special debt to our colleagues and research assistants at Clark--Mary Goodhouse, Ellen Hughes-Cromwick, Joan McGrath, Shrilene McGrath, and Nazar Memon.

Most important, we find that the greatest help has come from our many colleagues in Asia, Africa, and Latin America, whose knowledge and experience of local environments are the most important ingredients in the work that may result from this report.

Leonard Berry

Richard Ford

TABLE OF CONTENTS

Table of Contents (continued)

APPENDICES

Table of Contents (continued)

I. EXECUTIVE SUMMARY

This document sets out a framework for the Institute for Scientific and Technological Cooperation's proposed program in Environmental Planning and Resource Management. Four problem areas, forestry, resource management and environmental planning, coastal zone management, and pollution are identified as priorities.

A major task of ISTC is to provide a sound scientific and technological research base for development planning in the developing countries. These nations face fundamental problems in producing food for their increasing populations, in finding sources of renewable energy for these same people, in managing environmental aspects of their burgeoning cities, and in integrating industrial needs with other demands on their resource base. In each of these major areas, there are important environmental and resource management components.

Given the comparatively limited funding and staffing proposed for the ISTC, it is clear that two principles should guide program development: the principle of coordination and shared support with other institutions; and the principle of careful selection of activities. These two principles apply to all ISTC program areas but are especially important for work in Environmental Planning and Resource Management. Environmental activities, by their very nature, are broad-based and liable to dispersion of effort. Thus, there is need to be precise in defining what should be undertaken as ISTC's environmental components. In choosing a role within Environmental Planning and Resource Management, ISTC should consider concentrating its limited energies on topics

which:

...address basic questions of ecosystem maintenance and productivity;

...include close attention to the problems of application and dissemination of results;

...are well suited for collaborative work among host country and United States institutions;

...involve cross-disciplinary approaches;

...can be applied in a 10 - 15 year time frame;

...use ISTC's funding as a catalyst for other support.

At the end of five years, it is anticipated that the ISTC will have contributed substantially to a better understanding of tropical ecosystem utilization, developed a good working relationship involving joint research programs and technical assistance with twenty to thirty host country institutions, and provided a focus for the activities of relevant United States institutions. The results of early studies will then already be feeding into applied development programs.

Detailed proposals for work in the sub-fields are set out in chapter IV, Program Elements. In this section and in the first four appendices, we review the state of knowledge in the four problem areas and outline some of the more important research findings, planning efforts, and recommended activities in these fields. The review indicates that in each of the problem areas, a start has hardly been made on the research agenda and that development programs suffer both from lack of appropriate

knowledge and from lack of a means of applying what is already known.

As a result of this review, it is proposed,that work in the forestry problem area begin almost immediately,as there have been a number of recent research activities, international conferences, and proposed plans of action, each contributing to the task of defining forestry priorities. In the other three areas (resource management and environmental planning, coastal zone management, and pollution control) although much is known about the broad issues, there have not been sufficient international reviews of priority topics and approaches to begin work immediately. In these three areas, we recommend a first year of activity which combines planning and consultation together with the beginning of research programs.

In preparing this study, we have recommended more activities than ISTC is likely to be able to undertake in the near future. This will allow choice to be made in light of discussions with developing country personnel and of the evolving shape of other parts of the ISTC program.

Nevertheless, we recommend that special priority be given in the four problem areas. The special priorities are:

1. In forestry, rural and community forestry which will make a substantial contribution to the understanding of community woodlot development in two or three major ecological systems.
2. In resource management and environmental planning, devise and strengthen information systems for managing,

monitoring, and utilizing resource data in developing countries, especially in making these data available for development project planning.

3. In coastal zone management, work cooperatively with other international agencies on one coastal zone plan for each continent or region, with each plan devoting special attention to issues of basic resource systems.
4. In pollution, initiate experimental work in non-chemical means of controlling pests, including experimentation with integrated pest management approaches.

II. INTRODUCTION

A. Environmental Planning and Natural Resource Management in the I.S.T.C.

The proposed Institute for Scientific and Technological Cooperation sets two basic goals:

> ...to strengthen capacities of developing countries to apply science and technology to meet their basic needs, especially through collaboration between specialists and organizations in developed and developing countries; and
>
> ...to focus increased scientific and technological research attention on the search for better ways to meet basic human needs and approach global problems.

Within these general goals, the Institute will concentrate its efforts on:

> ...problems which directly affect the poor;
>
> ...problems of shared interest between the United States and developing countries regarding better use of world resources(Presentation to Congress on I.S.T.C. February, 1979).

This document addresses one of two major problem area which ISTC has identified as fundamental in its efforts to move toward better use of world resources: "Environmental Planning and Natural Resource Management." ISTC's second major issue in its projected program on world resources is "Energy Planning and New Energy Supplies." This second and

closely related area is dealt with in a separate document, prepared on behalf of ISTC. However, environmental and natural resource management issues do not stand in isolation. They are an important component of many problem areas which deal with the world's poor. Therefore, recommendations in this report, although focussed primarily on the Institute's role in resource planning and management, go much beyond that topic. The recommendations also interlink resource issues with the several problem areas which ISTC has identified as its basic priorities. There are not tight compartments in the array of problems in ISTC's agenda. These resource strategies are therefore recommended in light of ISTC's current ten problem areas which are:

1. Increasing Agricultural Productivity and Income
2. Improving Health Conditions in Developing Areas
3. Improving Population Programs
4. Nutritional Improvement
5. Strengthening Indigenous Science and Technology Capacity
6. Improved Processes of Technological Cooperation
7. Communication and Information Systems
8. Energy Planning and New Energy Supplies
9. Environmental Protection and Natural Resource Management
10. Non-Agricultural Employment.

Of these ten issues, those related to (1) agricultural productivity, (2) health, (4) nutrition, and (8) energy planning and new energy supplies are most obviously interlinked with environmental concerns. A particular contribution that

ISTC can develop in this area is a strong interdisciplinary, cross-sectorial attack on development problems. In providing cross-disciplinary approaches which also entails collaboration between personnel and institutions in developing and developed countries, the ISTC will actively encourage such approaches in developing countries. Although this approach is important for all ten ISTC problem areas, it is especially important for Environmental Planning and Natural Resource Management.

There are several reasons for international focus on linkages between these several components. We live in a complicated world. Sometimes it is helpful to reduce that complexity by focussing on a single problem or aspect, for example, how to grow better maize in tropical, semi-arid lands. Our educational systems, governmental structures, and professional affiliations reflect this specialization. Most of the developing countries give a similar if not greater emphasis to specialization. Yet problems keep coming to the surface whose solution demands complementary approaches. ISTC's inclusion of a multi-sectorial problem area entitled Environmental Planning and Natural Resource Management insures that this integrated approach will occur. From this view, the authors see this problem item as more than one of ten problem areas. Instead, it is a focal point which will help to integrate many aspects of the Institute's work. The Institute and its cooperating partners have a number of unique potentials. None is more vital than helping to assure the continuing productivity of the earth's ecosystems by initiating and

improving strategies in the management and planning of environment and natural resources. To this end, this report identifies four sub-themes:

1. Forestry, including research on fast growing species, more efficient uses of wood for fuel, and reforestation program development;
2. Coastal Zone Protection, including initiation of programmatic links for developing countries with NOAA's program in this field, joint research with coastal neighbors such as Mexico, and aquaculture development in cooperation with universities and industry;
3. Resource Analysis and Environmental Planning, including expanded use of United States remote sensing capabilities, related data analysis and utilization techniques, collaborative training programs in data interpretation, integrated survey/management programs, and systematic monitoring programs;
4. Pollution, including problems of agricultural pollution such as soil conservation, pesticide and fertilizer usage, and water quality as well as urban/industrial problems such as air and water control.

The work proposed on forestry is obviously linked with initiatives in renewable energy resources and energy planning. It will necessarily incorporate perspectives relating to patterns and priorities in reforestation. Coastal zone management incorporates food production problems on land as

well as in the water. Natural resource analysis will provide information and insights useful to agriculture, health, and nutrition. Issues of pollution will need to include perspectives on a wide range of uses in the environment, cutting across all sectors.

B. Environmental Planning and Natural Resource Management in Relation to Other United States Activities

A new institution must consider carefully its fit and relationship with existing entities. ISTC is obviously planned to fill a large gap in US research activities as they relate to problems of developing countries. Equally obvious must be consideration of research programs already in place or planned.

The environmental planning and natural resource management field has a less well established research infrastructure than some other problem areas, for example, in agriculture. Yet a complex of government, university, and private sector activities are underway and should be considered in long range policy determinations. It is impossible to review them all here, but we do attempt to outline some of the most important institutional issues which may arise in planning a resource management program for ISTC's first few years. Planning should consider relationships with:

-- the US Agency for International Development and other US agencies,

-- the National Academy of Sciences,

-- Universities with international research programs,

-- US private sector industry,

-- US private assistance groups which work overseas (Africare, Oxfam, etc.)

US-AID has sponsored a range of research activities, many directly tied to particular project needs and a few less specifically oriented efforts. In Environmental Planning and Resource Management, US-AID has sponsored work in forestry, environmental planning, resource management, and in the health aspects of pollution. The Agency has prepared research type reports on pesticides, environmental problems in Eastern and Southern Africa, and most recently has presented a report to Congress on the state of the global environment. The Agency has also taken initiatives in exploring the use of remote sensing techniques for developing countries; these techniques are especially helpful in the resource management and environmental planning area. This work includes several resource assessment studies, programs on agricultural and environmental data collection, and a study of the use of remote sensing for estimating population change.

In planning for the ISTC, it has been anticipated that some activities which are both especially appropriate and in an early stage of development should be transferred from US-AID to ISTC. Two projects fall into this category, one on forestry, and one supporting the MAB program. The forestry project will fit neatly into the forestry priorities outlined in this document. The Man and the Biosphere program is a Unesco initiated international research approach to the problems in this field. The MAB support in US-AID is designated for cooperative international activities of the fourteen scientific sub-committees

within the U.S. and is clearly within the scope of ISTC activities.

US-AID's support of remote sensing training and applied research has been related to a number of different applied aims in international development. The technology has been used in environmental and natural resource planning in many Latin American countries and in some parts of Asia and Africa. Close coordination will be necessary between US-AID and ISTC in this area as US-AID will continue with a number of projects involving remote sensing technology, and ISTC will develop research relationships with developing countries on the use of this technology. The Environmental Planning and Resource Management problem area will be an appropriate place for the ISTC component of this co-operative relationship. US-AID will continue to support studies in direct support of AID programs while the ISTC develops a broadly supportive research role. Appreciation of the environment and resource management as a vital component of development is growing. With this increasing awareness there will be growing demands on the research program in this field to supply the appropriate perspective for the design and execution of projects in the field.

A number of other US agencies have important overseas links and programs important to Environmental Planning and Natural Resource Management. The US Geological Survey has in the past provided valuable assistance to developing countries in training, mapping, and research programs; the US Department of Agriculture has assisted countries in soil conservation techniques and soil resource mapping; the Corps of Engineers

has provided support and modeling research on water resources including coastal zone problems; NASA has provided support in remote sensing materials and technology; and the US Environmental Protection Agency has assisted countries with problems of pollution control and institutional development. Each of these agencies and others will have an interest in the development of ISTC programs in this field.

The National Academy of Sciences has long played an important international role, in its co-operative relationships with other scientific bodies, in its joint seminars and workshops with developing nations and in the marshalling of US expertise to address particular global problems. In recent years the Academy has reviewed and published reports on "More Water for Arid Lands", "Remote Sensing from Space," "Aquatic Weeds Management," all focussed on developing country needs. It has sponsored joint workshops in the Republic of Sudan on Aquatic Weed Control, in Indonesia on Natural Resources Planning, and in Korea, Brazil, Zaire and other countries. A seminar on firewood problems is being planned in co-operation with the Sahelian countries. BOSTID, the National Academy of Science Board on Science and Technology for International Development, is an appropriate contact point between ISTC and the NAS on these issues.

While the ISTC may develop programs in some of these areas which have been addressed by the National Academy of Sciences, it seems clear that the role the Academy has played in the past is a very important complement to the proposed ISTC program. A National Academy of Science workshop may focus expertise to review a field. Out of that study may emerge

items of research for the ISTC which may eventually assist in development projects funded by US-AID or other agencies. Such a well articulated set of relationships may well need considerable work but seems a rational and attainable objective. Little of the proposed program of the ISTC in Environmental Planning and Resource Management is currently on the agenda of the Academy.

Universities with International Research Programs in Environmental Planning and Resource Development include several with well developed programs in remote sensing, for example, South Dakota, Purdue and the University of California at Santa Barbara. Others carrying out cooperative work in environmental planning include Clark University, the University of North Carolina, the University of Arizona and the Southeast Consortium for International Development.
Natural resource management programs are important at Yale, Cornell, Washington University, the University of Michigan, Stanford,or research institutes such as the Cary Arboretum. In addition, foundations such as Resources for the Future, the Smithsonian, Ford and Rockefeller are all engaged in some activities which relate to this problem area of ISTC.

The ISTC needs to be aware of these and other programs in its early planning and be ready to use them where appropriate, as support elements in an embryonic institution. A small institution such as ISTC needs to see coordination as an important function. At present there is little coordination and shared knowledge between these diverse initiatives.

U.S. Private Sector Industry. Natural resource surveys, environmental studies, and impact statements have become important items of business in some large and small companies in the U.S. A major part of the current technology transfer probably takes place through this network receiving mixed reception in the developing countries. This sector will continue to be important and the ISTC will need to be aware of the most important sets of activities as they impact topics and countries where the ISTC is working. This review did not include an analysis of private sector activities but it is recommended that this be included in the early stages of first year activity.

U.S. Private Assistance Groups. As the research output of ISTC will serve the wider development community, it may be useful to point out the important role that PVO's play, especially in overseas rural development programs. The several PVO's should be considered as part of the network of users of ISTC output and as an aid in identification of important research issues in the developing countries. The PVO's may also prove to be important as data gathering sources for some kinds of co-operative activity. Their role needs to be defined in general but also in relation to specific project activities.

In summary, if the ISTC can provide a coordinative role with respect to US programs, it will already perform a useful function. If in its own programs with the developing countries it can act as a stimulus for new research supporting our understanding of the environment and natural resource development, that will indeed be success.

C. Environmental Planning and Natural Resource Development in Relation to Developing Countries: The Need for Environmental Planning.

The last decade has seen a dramatic increase in the awareness of environmental issues in Asia, Africa, and Latin America as well as in North America and Europe. The Stockholm Conference on World Environment, the formulation of the United Nations Environment Program and its location in a Third World country, and the trauma of the Sahelian drought have all played a part in heightening Third World awareness. The fact that the last decade has witnessed the addition of a billion more people to the world's ecosystem has been equally telling.

The substantial increase in awareness has only marginally been accompanied by an increase in environmental understanding. Action programs for environmental goals have been even more rare. However, a number of incipient crises have focused the attention of some governments on the need for effective environmental planning.

The firewood crisis, for example, plagues many developing countries. It is probably most critical in the densely populated Indian subcontinent and in the semi-arid regions of Sub-Saharan Africa. In Latin America, wood and charcoal scarcity is a major environmental concern in the Andean region, Central America, and much of the Caribbean. Introduction of alternative fuels and

environmental planning for programs such as tree planting require a thorough understanding of the details of the problem. They also entail technical assistance which includes intensive cooperation between state or central governments, technicians, and managers as well as with local community members who must understand and be involved in the planning and implementation process.

Another major environmental issue gaining attention is the declining production of rangeland and arable land in many areas. Many developing countries are now placing high priority on land-use planning and management, especially as these nations place greater emphasis on the poorer sectors of the rural population. Since these problems of productivity directly inhibit development of the rural areas, environmental planning and management need to be carefully focused to reach and serve these groups.

The increasing pressure on scarce water resources, pressures on coastal areas, and problems of pollution and health created by urban and industrial growth have all become important agenda items for developing countries. Again, this awareness is not always accompanied by good information. Environmental research and data analysis reflect the world imbalance of resources in that ninety percent of all research is related to the problems and needs of the industrial countries. Hence, knowledge and scientific understanding of the unique problems of the environment in developing

countries is in short supply.

Part of the remedy is at hand. An example of heightened awareness is the recent ASEAN Experts Meeting on the Environment held in Jakarta, Indonesia, from 18-20 December, 1978. This meeting emphasized that a concentration on (1) land-use planning, (2) environmental development planning, and (3) pilot projects on environmental management and development be given top priority. These recommendations would not have been put forward a few years ago.

For another example, the Southwest Watershed Research Center (USDA research service in the western region) has recently completed extensive research on infiltration control including (1) practices, (2) runoff and erosion control, (3) conservation land tillage, (4) revegetation of barren land areas, and (5) no-tillage implements and seeders. Emphasis on this broad base of land-use, environmental management, and planning would not have taken place, even as recently as ten years ago.

These and many other recent innovations in research are a modest yet solid beginnning which may be utilized to form a substantial technical base from which environmental management in developing countries could be launched. Yet there are still major gaps in basic data. Information systems are not in place to manage the data. Nor, are there yet good networks of like-minded professionals in different countries who can share and exchange their information. Thus, while there may be pockets of

progress in developing countries, there are not yet effective mechanisms for transfer or adaptation of information. Meanwhile, these environmental problems become more pressing and well-informed remedial action becomes more difficult to accomplish.

However, it is important to acknowledge that a core of significant work, as yet in its early stages, is underway among a number of agencies. UNESCO's Man and the Biosphere Program (MAB) including a United States component has dozens of national committees working in fourteen different topical areas; FAO and UNEP have set up sector reviews and have initiated modest investigatory approaches. The UNEP "Blue Plan" for the Mediterranean coastal zone and sea is an example of a highly successful coastal zone management approach involving major international cooperation.

Many governments have also initiated efforts to improve environmental planning. For example, the governments of Kenya, Zaire, Indonesia, Nigeria, the Philippines, Guyana, and Guatemala have created special environmental agencies and have begun explicit environmental planning programs. These are all important efforts. Yet, they work from uneven research and social scientific data bases in many fields and although early efforts have been laudable, they are little more than a beginning. Another widespread handicap to environmental planning and protection is the lack of trained and experienced personnel. Educational systems in many countries

give priority to specialized disciplinary training rather than system-wide and integrated approaches to environmental issues. In addition, a further dimension that requires special managerial efforts is that environmental issues cut across jurisdictions of two or more of the traditional government ministries or departments. As a result, planning, implementation and management require contributions from more personnel and approval by more agencies than most development activities.

There is also a lack of mature institutions able to deal with local and regional research and training needs. Among the few regional institutions with special experience in environmental management are: (1) The Environmental Training Program (ENDA) located in Dakar, Senegal, which engages in environmental training, research, and consultation; (2) The Pan-African Institute for Development (PAID) coordinated through its Geneva Office but actually managed and operated through its four regional offices in Cameroon (two), Upper Volta, and Zambia; (3) The East African Management Training Center at Arusha, Tanzania; (4) Institut du Sahel, the research and training arm of CILSS in Bamako, Mali; (5) ASEAN Sub-Regional Environmental Program (ASEP); and (6) The Asian Institute of Technology, Bankok, Thailand. The United States has considerable expertise in government, industry, and at universities. If the expertise of the several existing regional centers can be combined with the experience of those in the U.S.

in a cooperative framework, this know-how can make a major contribution to improving the capability of Third World countries in dealing with environmental problems.

III. PROGRAM RATIONALE

The ISTC has a wide ranging set of research objectives. The case for the inclusion of Environmental Planning and Natural Resource Assessment has been well made in the early planning documents. The problems are increasingly of concern to the developing world. The U.S. has a unique combination of resources and skills in this area. The co-operative framework of ISTC is ideal for an approach which will provide a sound scientific base to the resource and environmental aspect of development planning and programs.

The Need for Resource Management

Issues of resource management are closely linked with issues of environmental planning and protection. Most countries depend heavily on the direct production of land and water systems as the basis of their economy. Most people is these countries rely heavily on agricultural produce, woodland resources, and local water supply for their livelihood.

The doubling of the world's population in the last twenty to twenty-five years has meant that pressure on each of these resource systems has increased. FAO has estimated that 100,000 hectares of land are lost to the desert each year due to human activities in Algeria, Morocco, Libya and Tunisia. India is also losing farmlands and rangelands to desert; vast dry regions which stretch eastward from the Rajasthan Desert and comprise about one-fifth of the country, now present a nearly treeless landscape. Journeying out

to gather firewood and fodder in the once heavily forested Himalayan foothills of Nepal is now an entire day's work. One generation ago the same task required no more than an hour or two.

Tropical woodlands have been the focus of much international attention over the past few years. These resources in both humid and arid areas are important for the whole world. They are economically important as genetic resources, vital in nutrient cycling and maintenance, and significant in local and regional climates. Yet they are steadily disappearing. In the period from 1957-1976, Philippine forest area was reduced from 13.2 to 9 million hectares; fifty percent of Guatemalan forests have gone since 1950; major loss of forest lands has occurred in all parts of the tropical zone. It is clearly of global importance that we begin to manage these resources so that they are renewed rather than mined.

The soils in India, Bangladesh, Indonesia, much of Africa and parts of South America are losing productive capacity under current systems of management. Agroforestry programs are being implemented to domesticate and upgrade shifting agriculture in order to maximize sustained production on less fertile soils. More advanced irrigation and intensive cultivation, while resulting in some dramatic increases in yield, are also resulting in soil and water management problems. Partly as a result of development and urban growth, water systems which a few decades ago were thought inexhaustible (like the Nile waters) are now being used to near capacity.

In many developing countries the last few decades have been a time of change from individual management of family farms to regional and national management systems and technical expertise is woefully inadequate.

The U.S., with its twin strengths in information technology and management expertise, is in a unique position to assist, not by imposing our systems on others, but by working with other nations to find the best balance between local and outside capabilities which will blend with existing capacities of problem identification and policy implementation. This joint search may be the most vital and the most difficult task of technology transfer and technical cooperation.

A Rationale for Selecting Specific Themes

Equally, the Institute for Scientific and Technological Cooperation (ISTC) is facing a long agenda for action and many choices in environmental protection and resource management. In any new organization, choice of initial programs is partly dictated by concurrent initiatives elsewhere as well as the level of groundwork and preparedness in certain fields and the particular strengths that can be readily mobilized and brought to bear on problems. One of ISTC's responsibilities is to recognize existing institutional infrastructure in developing countries and attempt to complement current regional and international environmental management activity.

For example, the ASEAN programs in environment and natural resources are initiating mechanisms for environmental cooperation such as seeking bilateral and multilateral financial support for projects and undertaking other support activites as may be necessary. UNEP GEMS (Global Environmental Monitoring System) are preparing reports on the expansion of that program in the ASEAN region; the United Nations will sponsor a meeting in Malaysia on the development of appropriate pollution control technology which will focus on two industries which are widespread throughout the ASEAN region: mining and forest products. In making plans for activities in this area, the ISTC must obviously take all this current activity into account and endeavor to either (a) supply supporting skills and approaches or (b) complement ongoing activity by work in other sectors.

A review of the environmental planning and natural resource problem area has defined five major sub-topics which met the criteria of pressing need and for which U.S. expertise and ISTC resources could help:

a) forestry and land degradation

b) coastal zone protection and development

c) pollution

d) environmental planning

e) resource management

In this document we discuss these under four headings as the last two, environmental planning and resource management, are closely linked. In one of the areas, forestry, there have been very recent

reviews and syntheses on an international basis which have gone a long way toward establishing a list of priorities from which ISTC can proceed. In resource analysis and environmental planning there have been reviews of parts of the field including desertification and the general problems of arid areas and of the possibilities of the use of remote sensing for natural resource surveys. There is a basis here also from which some work can be initiated in some countries. A program in these topics can begin in fiscal year 1980 with combined action and planning on a sure footing. In the other two areas, coastal zone protection and pollution, there are equally important and pressing problems. New problems of coastal zone management have arisen in the gulf of Guinea, in the Caribbean, and in Indonesia, for example. It is important that ISTC respond in a timely fashion to these needs, but until a period of specific international analysis of these and other issues has elapsed it is premature to map out a working program.

Similarly in the field of pollution, great concern is voiced on the role of pesticides in developing countries, on issues of urban, air, and water pollution and the like. The UN Task Force on Human Environment has presented a project working paper on the Legal Aspects of Environmental Management in Malaysia. The Pesticides Act, 1974, sets out regulations for the application of pesticides as they are discharged, emitted, or deposited in the environment in a manner so as to cause alteration of the environment. However,

government regulatory agencies lack sufficient expertise with respect to pesticides to support an effective regulatory program. The issue of pollution is again seen as a vital aspect of development activity. But there has been no opportunity yet for an overview of these issues involving an international perspective and thus no ready way for setting precise priorities at the present.

Thus it is anticipated that fiscal year 1980 will be a year of active planning and preparatory work in the areas of coastal zone management and pollution. It will be a year of combined planning and program initiation for the areas of forestry and land degradation, environmental planning, and resource analysis.

Rationale for Working with Local Institutions

A important aspect of the ISTC program is the proposed style of operation. The plan is to work co-operatively with individuals and institutions in developing countries thus combining U.S. science and technology with local science and technology. The need for this kind of approach is particularly evident in environmental planning and resource management for these main reasons:

... the characteristics of tropical and sub-tropical ecosystems

... the importance of local knowledge of the systems involved

... the great need to build up local research and development institutions.

The Characteristics of Tropical and Sub-Tropical Ecosystems

Scientific knowledge of natural environment systems began in the west and comes implicitly with its assumptions which have been proved and tested in the tropical mid-latitude ecosystem. Of course many western scientists have contributed valuable work in the tropics and sub-tropics but conditions are different enough for the assumption about mid-latitude systems not to be valid. For example, our knowledge of soil losses from agricultural land is based very largely on information gathered in the U.S. and Western Europe. Tropical rainstorms have different intensities from those in mid-latitudes and tropical soils have different characteristics from those in Europe and North America. Thus, we cannot easily transfer soil erosion and conservation data and methods to the tropics.

Ecosystems such as the tropical rain forest are more complex in structure, composition, and replacement rates than temperate systems. The savannah ecosystem is fundamentally different from dryland systems in Europe and North America.

In the past, major mistakes have been made in attempting too casual a transfer of mid-latitude scientific principles to the tropics. In some areas, new principles need to be established for the tropical and sub-tropical systems. By working with local institutions and local personnel from these areas we have a better chance of insuring that a new and vital approach is made.

Importance of Local Knowledge of the System Involved

As well as the establishment of general principles through scientific study, there is also need for local application of these general principles. Such application needs detailed local knowledge not available to international institutions. For example, in East Africa, there is a considerable range of elevation and quite rapid localized change in conditions. A maize variety that does well in one locality, grows poorly ten miles away, tree species show a similar variable response. Environmental planning and resource management has to take such variation very much into account. Only local institutions have the on-ground capability of dealing with such specific applications of research findings. Any other approach than working through local people and institutions is clearly impractical.

Importance of Strengthening Local Institutions

The pattern of development of scientific research in environmental and resource issues, as in other science, has meant that early initiatives were made in Europe and North America. Some research institutions have long been established in the developing world in India, Pakistan, Sri Lanka, Bangladesh and in South America. Few of these have concentrated on environment and resource issues. The developing country institutions in these fields are typically newly established and modestly funded. Scientists interested in working in these institutions have commonly found few incentives.

Established lines of advancement or security of tenure are rare and most scientists work as cross appointments with university teaching posts. This has led to slow development of research strengths. On the other hand, because the institutions are new, governments have been slow to recognize their potential in advice and support. There is much to be done in the strengthening of developing country institutions in this field. This will be a major role for ISTC.

IV. Program Elements

A. Planning Activity

1. Environmental Planning and Resource Management

a. A Review of the Issues

(See Appendix I for a detailed discussion of previous work, conferences, institutions, and literature on environmental planning and resource management.)

Environmental planning is best thought of as balanced resource development to achieve two purposes: (1) maximum short run productivity; and (2) long-run and sustained yield from available resources. Maximum utilization of environmental resources calls for two sets of institutional structures:

1. Institutions for Information Systems

It is necessary to develop accurate yet succinct assessments of present resources in vegetation, land/land-use, geology, water (including surface and underground), and animals (doemstic and wildlife). Nations in Asia, Africa, and Latin America, with a few notable exceptions, do not yet have such information systems in place. To be of value to planners, the assessments should be organized in a dynamic way that will provide for periodic and systematic reassessments for monitoring of these resources. The time period and degree of specificity for monitoring will vary from situation to situation. Yet, the basic principle of information collection and updating is common to all situations. In dealing with nations in Asia, Africa, and Latin America,

it is especially important to keep the technologies of the information systems appropriate to national needs, and the amount of data to be collected in relation to the levels of analysis contemplated in national development programs.

As a second step, the information systems should be designed so that host country agencies are full and direct participants in the process. Care should also be taken to assure that the information systems can be run primarily with local personnel and that the system itself can be replicated in a number of countries once an experimental or trial stage is completed. In the past, such information flows have tended to be intermittent, carried out by short term consultants, and to be little used in the development process. A major challenge for the ISTC and its cooperating insitutions will be to devise systems which will dovetail with the essentially economic and political planning and decision making process.

2. Institutional Systems for Policy /Planning

As suggested, environmental and resource information will be of little value unless it is analyzed and used in the planning/policy process. The first step of analysis calls for an evaluation stage. Trends in environmental situations need to be studied and understood in terms of cause, severity, and possible means

of amelioration.

As a second stage, the analyses must carry sufficient importance to be included by planners and policy makers in decision-making priorities. This second stage will require a mechanism for the environmental resource information to be quickly available to decision-makers in appropriate forms and/or for the environmental managers to be included in the decision process. Most nations in Asia, Africa, and Latin America do not yet have smoothly functioning institutions capable of data analysis and policy planning for environmental management.

We suggest that these twin areas of analysis and planning are a logical and important step for ISTC to undertake in its first year of activity. Formal interactions could begin in two to three countries each in Asia, the Near East, Africa, and Latin America. Care will need to be taken to select nations where the infrastructure has already provided the beginning of resource analysis. Work in perhaps eight to ten countries would develop a series of possible approaches for resource analysis and planning which could be evaluated and adapted for implementation in other nations. In some cases, sector oriented resource surveys will have been completed for some sectors, and work in the initial stages

will be in devising proper frameworks for the coordination of work carried out by separate government and private agencies. In other countries very little current work will have been done and it might be appropriate to formulate experimental new approaches. It is clear that in no country has there been a serious attempt to come to grips with the full implications of the new technology on the one hand and the new needs on the other. ISTC, with access to U.S. Remote Sensing technology and information analysis capacity, together with developing country institutions that have an awareness of local systems and planning structures, is well placed to play an important and catalytic role.

There are a number of reasons why strengthening institutional capacities in information and planning is important:

(i) In the past four or five years, world attention has been focused on resource assessment and monitoring through a number of international conferences. These include the Stockholm Conference on the Environment held in 1972, the UN Water Conference of 1977, the Desertification Conference held in 1978, and the forthcoming UN Conference on Technology Transfer to be held in Vienna in 1979. More specialized meetings on topics such as forestry, energy, and food supply have all helped to

call international attention to the problem of resource management. The climate of world opinion is ready for next stages.

(ii) Technologies for assessment and monitoring are now available in combinations of remote sensing techniques, field study, and local investigations. Remote sensing capability includes LANDSAT satellite imagery with ground receiving stations either in place or under development in Asia, Africa, and Latin America. Other weather and related satellites which NOAA coordinates are also available and can be called upon as appropriate. Field studies and local investigations exist in varying degrees of availability, with some nations better equipped than others. It is safe to say that every nation has a basic meteorological system and a number have the infrastructure in place for basic assessment in agriculture, livestock, health, nutrition, and water. Yet, these different systems are not smoothly operating in most countries and in only the rare exception is there any coordination between and among the several systems.

(iii) Although some assessments in exploitable resources such as petroleum, diamonds, or copper, have been made in great detail, many countries still lack basic knowledge of their geology and mineral

resource endowments. Also, the developing nations have few examples of comprehensive assessments made in the sectors where environmental and resource needs are critical. In addition, even where sketchy assessments have been made, there are few examples of longitudinal or periodic reviews or updates of these assessments to determine trends in the resource situation.

(iv) Although there have been assessments of moist, tropical rain forests in countries such as Ivory Coast, Indonesia, or the Philippines, there are very few analyses available of the forest and vegetation situation in the semi-arid tropical nations.

(v) Fundamental to any policy or action in resource management is the question of awareness and commitment. Although the various world conferences have created a general awareness, it is less clear that the international concerns on issues such as water or energy have been translated into domestic policy. An important role which ISTC can play is bringing the precise nature of environmental trends and situations to the attention of planners and policy makers in the governments of the developing world.

(vi) A comprehensive examination of local institutional capabilities in Asia, Africa, and Latin America as

well as regional institutions suggest that the infrastructure is in place and is ready, on a pilot basis, to begin the work of collecting, analyzing, and acting upon resource information as it relates to long range environmental planning.

b. Activities

Research Activities

In addition to the recommended basic institutional work in resource planning and management, there are a number of priority research activities for ISTC to consider. These research efforts focus on aspects of water quality, land preservation and retention, and replanting of denuded areas. These research themes are of particular priorty because of the considerable degradation of land and water resources which has been underway in recent years. Moreover, the resources of land and water are the fundamental ingredients required in food production which, in the face of continued population expansion, must become one of ISTC's primary work areas. Proposed research activities fall into two basic categories: (1) soil erosion and vegetation control; and (2) resource deterioration.

1) Soil Erosion and Vegetation Control

Soil losses due to water or wind erosion are co-extensive with crop production on tilled land. Expanding market forces in industrialized countries have significantly increased the pressure on soils for food and livestock feed. Even more serious are the rapidly growing local food requirements of

Third World countries, many of which are now only marginally able to feed themselves. Simultaneous widespread crop shortfalls in these countries could result in calls for relief of unprecedented magnitude. The problem facing these countries is complex and serious in the face of weak technical, political, social, and economic foundations.

Research themes which particularly merit increased attention in an expanded soil erosion/vegetation control program are:

Forage Crop/ Tree-Crop Breeding and Management

a. Micropropagation to Assist Revegetation of Denuded Land

Many developing countries have significant land area which has been overstressed by grazing, cultivation, lumbering, erosion and other forces. Reestablishing plant cover on barren lands is a difficult task at best. Natural seed sources have been reduced if not eliminated. Those plants present may produce only a few seeds or produce them slowly, the probability for germination may be lowered, etc. Replanting as currently performed often involved the introduction of species such as pine or eucalyptus and, if the soil is still responsive, the result is large monocultures of plants foreign to the environment.

Micropropagation (sometimes called tissues culture or cloning) has potential for generating quantities of different native variety seedlings for revegetation. Numerous clones can be produced rapidly from a single plant. Thin slices of tissue are removed from a plant's

leaves, buds, roots or other parts and placed in vials on a sterile, nutrient-rich substrate and kept lighted. Plant slices will usually develop new plants by this process but root structure may be lacking. At an appropriate growth stage, enzymes are added to trigger root production. Ultimately the plants are removed to a greenhouse for conditioning prior to planting.

Research is needed to establish micropropagation techniques for plant species native to and of particular value for developing countries. Food, fodder, fuel and environmental repair are the potential benefits from such research and implementation.

b. Tropical Biogeochemical Cycles

Development in much of the humid tropics is taking place at the expense of the forest cover. Land is cleared temporarily or permanently for agriculture, grazing or lumbering and in so doing the bulk of nutrients are lost or dissipated. Increased development activity and population pressure act to decrease fallow periods that in the past have allowed some regeneration to occur. Soil in the humid tropics is highly weathered to depths of 100 feet or more and contain minerals rich in aluminum, silica, iron or water. Plant nutrients are tied up in the natural vegetative cover which when removed greatly minimizes the likelihood of regenerative growth.

Unanswered questions abound. What is the ultimate fate of nutrients when large tracts of tropical forest are burned? How long before additional soil weathering will release scant additional nutrients? What is the carrying capacity and natural regeneration cycle of these soils? Can tropical forest soils be made to recover in a period of time meaningful to people and their quest for food? Research is now underway in the wet forests of Venezuela under the auspices of the UN Man and the Biosphere program. Such activity needs acceleration and diversification to other topographic and climatic regimes.

c. Zeolite Research

Zeolites are fine grained minerals with porous, three dimensional structure which act as molecular sieves and perform ion exchange under natural conditions. These properties lead to important zeolite use in soil conditioning water purification, trapping of hazardous heavy metals, etc.

Zeolites are known to exist in various sedimentary rocks in developing countries. This could be a valuable resource but the areal extent is poorly known as are the specific crystalline attributes important to zeolite utilization. Reserach is needed to characterize zeolites in developing countries. Exploration is required to assess the distribution of zeolitic sedimentary rocks.

d. Primitive Agroforestry Systems

Over thousand of years man has evolved food production systems involving a mixture of food plants and trees which when planted together improve the productivity of the individual plants and the site itself. Modern agriculture emphasizes cultivation of single plant species with a variety of external and often energy intensive inputs such as fertilizer, pesticies, mechanical tillage, etc.

Research and study on the differing basic agroforestry systems which have developed worldwide could lead to better understanding of synergistic plant combinations. The relationship of food production to energy inputs and to environmental stress in traditional compared with modern system is also an important topic of study.

In addition to these rather specialized research efforts in soil erosion/vegetation control, there are also the more traditional approaches including conservation tillage of row crops and alternative uses of new crops developed such as new sources of energy.

2) Resource Deterioration

In order to preserve the environment at optimal levels of production, the inhabitants of the developed and developing nations need to focus attempts on the conservation of their resources, whether natural or man-made. The significant

environmental changes caused by developments in agriculture have two facets: (a) excessive production of harmful substances such as salt from waterlogged lands and smoke from engines; and (b) deterioration of resources without their proportionate regeneration, such as exploitation of forest reserves and intensive use of natural soil nutrients.

There are three broad categories in which environmental deterioration are underway. They are:

a. Deterioration of Soils

Soil erosion is a growing problem in many parts of the world. The resulting silt from rivers and canals has severe effects on the build up of the deltaic riverbeds and sedimentation in dams. Problems also arise from waterlogging, salinity, deforestation, and mismanagement of pasture lands.

b. Deterioration of Water Reserves

Water constitutes one of the most indispensible natural resources. Throughout the developing world there are many areas of water scarcity. The quality of water is inferior for drinking and irrigation. Consequently, there is a need for determining hydrological, topographical, and meteorological factors, and to locate and harness surface and underground water resources for the equitable distribution of clean and wholesome water in developing nations.

Under the canal irrigation system almost half of the water is lost in conveyance by evaporation, entry into non-agricultural lands, faulty farm management, and

spoilage with factory effluents.

c. Deterioration of Animal Quality

In many places, livestock, especially those with commercial potential (young stock, milkers, and pelt producers), are being slaughtered indiscriminately and without regard to optimum levels of basic herd structures necessary for further reproduction. This leads to a depletion in stock and their products. Wild game and other practices are extincting the rare species. Many animal products such as meat, milk and bones go to wasted as a result of defective marketing systems or because of a lack of technology necessary for converting raw products inot valuable articles of commerce.

There are six major categories, within the broad field of resource deterioration, which call for additional research and action. These include resource deterioration in relation to:

a. Agricultural and Land Use Development
b. River Basin Development
c. National Parks and Natural Reserves
d. Industrial Planning
e. Human Settlements Planning
f. Population and Demographic Planning

a. Agricultural and Land Use Development

(i) As soon as possible, surveys should be initiated to determine what effects pollution from agricultural development is having upon the environment and upon human health and to formulate short and long-term plans for reducing pollution.

(ii) Agricultural research data and technology from other nations should be made available to interested research institutions, through UN, the FAO (especially their documentation center) and also through bilateral arrangements.

(iii) In addition to studies on the specific environmental impact of agricultural development programs, national and regional studies should be undertaken on the effects of overall development programs on the potential productivity of natural ecosystems.

(iv) Research on the semi-arid and sub-humid regions which have special problems of shifting cultivation and overgrazing must be pursued and extended in the following areas: (a) knowledge of climate: studies of the general climate, climatic cycles, and the relationship between vegetation and local regional climates; (b) agro-pastoral research; (c) studies on ecosystem productivity and carrying capacity for wild and domesticated animals; (d) introduction of high value pasture plants and studies on the regeneration of local species; (e) studies of integrated agro-sylvo-pastoral management; and (f) studies on the effects

of rapid demographic growth on the utilization of marginal lands.

(v) The following should receive special emphasis in the education and training of personnel for land-use and its management:

(a) demonstration of effects of land-use practices on the environment;

(b) information on erosion, pollution, and degradation of land;

(c) the role of the land in the regulation of the function of the ecosystem;

(d) long-term effects of overgrazing, fire, shifting cultivation, and pastoralism on the lands;

(e) training in the use of remote sensing and other new techniques through "extension services" programs; and

(f) training in transfer of technology of a multi-disciplinary nature.

b. River Basin Development

River basins are developed in order to achieve certain objectives. Among them, winds, flood control, and the generation of water are the most important.

It is recommended that systematic studies be undertaken on the possible effects on the quality and quantity of water, the chemical, physical, and biological characteristics which regulate the dynamics of the system. Continuous monitoring systems should be introduced after the completion of the projects in order to anticipate undesirable secondary

effects, and to provide feedback for feasibility studies on future projects.

c. National Parks and Natural Reserves

Basic studies in ecology of national parks in arid and humid regions is necessary to gather information for education. Research should also be carried out on the feasibility of using wild animals as crops to determine the potential for producing sustained yields. This research will have important implications for areas outside parks. The effect on the total ecosystem involved should also be studied.

d. Industrial Planning

For industrial planning, countries in the Third World should be assisted in establishing a National Environmental Research Institute which will sponsor and coordinate the research activities of various disciplines related to environmentally oriented industrial planning. In order to translate effectively the results of research into practice, appropriate training programs should be organized for personnel in the field of environmentally oriented industrial planning.

e. Human Settlements Planning

The influx of population from rural to urban areas, and the process of rapid population growth taking place in all the developing countries has impact upon the qulaity of human settlements. Migration creates the multiplication of urban slums and squatter settlements and substandard housing conditions in rural areas. It is recommended that social adoption studies of rural-urban

migrants be undertaken including analysis of traditional and experimental building forms, materials, and techniques in terms of climatic modifications, measures of efficiency, the factors of initial and long-range cost. Moreover, the issue of urban health as it relates to the urban environment is of equal priority. This research should be directed towards the minimum standard of housing, settlements, and environment, to insure a basic level of the quality of life.

f. Population and Demographic Planning

With more than two-thirds of the world's population in Asia and other developing countries, the fundamental development issues of food, education, manpower training, urbanization and health still remain. Ways and means have to be traced whereby population planning on the one hand and education and training of manpower on the other hand work side by side. Research into the factors of population planning in most of the Third World countries is worth considering under the topic of resource management and planning.

IV. Program Elements

B. Planning Activity

2. Forestry

a. A Review of the Issues

(See Appendix II for a detailed discussion of previous work, conferences, institutions, and literature on forestry).

The world's forests are a critical source of raw material, a resource for protection of soils and nutrients, and a critical determinant of local and regional climatic patterns. Tropical and subtropical woodlands are especially valuable in these respects. They also include a large part of the total number of species of plants, insects, and animals on the globe. It is these woodlands and forests which are decreasing in area at an especially alarming rate. For example, Philippine forest area was reduced from 13.2 to 9 million hectares in the period from 1957-76; 50% of Guatemalan forests have disappeared since 1950. Forest land is being reduced annually by 5 to 10 million hectares in Latin America and as much as 2 million hectares in Africa, and 4 million in Asia. The world-wide annual removal of commercial/industrial forests and fuelwood is in the order of 900 million cubic meters per year with some 25 percent of this being consumed as fuel. The estimate is that most tropical forests will disappear in 25-50 years. Conservative estimates suggest that 20 million hectares of tropical forests are cut annually or over 5,000 hectares each day.

These woodlands which are so threatened have been the source of fuel for many people in the area and have been a national natural

resource of great potential for the future of many nations. The causes of forest and woodland resource depletion are quite varied, including unwise forestry practices, spread of cultivation, uncontrolled cutting by local people, and introduction of plantation-type production of cash crops. The solutions likewise call for varied responses. In many areas it may be appropriate for woodlands to be transformed into cultivation, and in many others not.

In brief, the response to deforestation in tropical areas need not always be reforestation but rather a re-examination of the need for forest and woodland products and of ways for meeting that need. In most cases there will be concern from scientists, development planners, and resource managers to meet three basic goals: (i) to maintain some areas of tropical woodland, (ii) to provide sustainable supplies of wood products for local fuel and local and international wood industries, and,(iii) to deal adequately with the land use and employment problems of the area concerned. The ISTC has a potential role with respect to all three of these goals. Proposals contained in this document address the first two most directly.

During the 1950's and 60's international agencies played a significant role in forestry management in developing countries. In the late 1960's and 70's, however, a tendency emerged to focus more directly in shorter term food production needs. Now in the later 1970's as the facts about rates of depletion of forest land are becoming better known, as fuelwood is becoming dramatically more difficult to obtain, and as many national and international meetings have addressed forestry needs, attention is once again returning to the problems of forests and woodlands.

These meetings have raised a host of issues and priority needs. They have spelled out approaches in particular fields such as management, inventory, conservation of forest resources, global, regional and local monitoring, assessment systems, establishment of centers for forestry research and land use planning. In order to facilitate a concise summary of these main issues and to outline a realistic state of activities in the field of forestry, for ISTC to consider, four main foci are identified as possible organizational principles:

(i) Rural Development Forestry

(ii) Institution Building Projects

(iii) Environmental Forestry

(iv) Industrial and Commercial Forest Projects

Specific issues are associated with each of these major foci. These are enumerated below.

(i) Rural and Community Development Forestry

The most important issue defined in this focal point is the need for community forestry programs whereby forestry and agriculture can be combined to raise nutrition and living standards among the rural poor. Local forest areas, if well managed, can provide important parts of the fuel supply of an area, can contribute to food supply in a small way (honey, fruits, animals), can provide an important resource for small scale industrial activity, and can provide a small-scale cash crop for the local people. In most parts of the world, such local sources are not now available. Instead, woodland resources which had previously been available are there no

longer. They have been depleted, not because villagers are unaware of the consequences, but because of shifting marketing and cropping patterns which have brought new forces to bear on local woodland supplies. At the heart of community forestry lies need for exploration into the nature of these external forces and ways that local woodlots can be organized to provide direct and reasonably short term return to villagers. We recommend such analysis as a high priority for ISTC rural forestry activity.

In addition to community woodlots, we recommend work in the areas of:

...developing better methods of reclamation of degraded lands;

...initiating cooperative research in tropical eco-zones in the field of water management;

...developing and evaluating new types of technology more suitable for reforestation works in arid zones.

(ii) Institution Building Projects

Although most countries have a Ministry of Forests and Wildlife or a Ministry of Natural Resources incorporating these divisions, forestry institutions in developing countries are not numerous or strong. With some noteable exceptions, for example The Republic of Korea and some countries in South America, the institutions currently available do not

have the capacity to deal with issues and needs of the coming twenty years. The ISTC will be in a key position to help identify priorities for local institutional growth and support the needed research on a cooperative basis which will enable local forestry institutions to perform more effectively

Primary activities under this category include:

...exploring means for more effective transfer of information and information systems between similar global climatic and ecozones;

...attending to resource needs of existing regional institutions and research centers;

...creating, where needed, regional and international centers for tropical and subtropical soil and water conservation;

...evaluating need to create a critical awareness of forestry economics with special reference to the possible implementation of a major forest policy on the national level.

(iii) Environmental Forestry

This focal point includes issues such as:

...the need for assistance in developing planning techniques for the suitable and sustainable use of living natural resources and for conservation

of ecosystem samples and genetic resources

...the development of models of multi-purpose use of forests;

...the creation of conservation guidelines and teaching materials available based on tropical experience;

...suitable field techniques for tropical zones;

...to stengthen research on species and sites for arid zones;

...to conduct thorough studies of the aerodynamics and relief development process in sands, both under laboratory and field conditions.

(iv) Industrial and Commerical Forest Projects

Two issues associated with this focal point are:

...assistance in studies in the areas of substituting wood fueld with alternative sources of energy and in technological research into alternatives to wood, e.g., use of bagasse and rice stalks for paper manufacturing and use of mud bricks for housing and construction in wood deficient countries;

...assistance in research on systemic repellents that can be absorbed by the roots of foliage of trees to protect plantation against gerbilles, hares, deer, birds and other animals.

b. Projected Activities in Forestry

Of the four main foci, Rural and Community Development Forestry and Institution Building Projects appear to be the most appropriate for immediate ISTC involvement. Beacuse there has been so much discussion of forestry issues recently it is difficult for this report to avoid the appearance of duplication. A number of national and international institutions have, for example, expressed interest in community forestry. But most of these expressions call for action programs, some with modest preliminary investigations. The research side of community forestry has not been a major focus. ISTC has a special role to plan in research and evaluation in support of community forestry. The basic questions of how community forestry can be fitted into rural development and at what regional and local levels are well within the scope of the projected ISTC program. A second set of questions calls for analysis of community forestry efforts in differing ecological, social, and economic settings. The more specialized questions of species, extinction methods, and the like are also important and should be considered. The possibility of several on-going Agency programs in community forestry and local woodlots increases the priority of this research agenda. ISTC could be well placed to address part of this need.

Another more general role for the ISTC in the forestry field

is in relation to building up institutional capabilities in the developing countries. This charge would include assistance in planning and developing appropriate institutional frameworks for community forestry, environmental forestry, and commercial and industrial forestry, especially as they apply to the development of rural communities. While agencies such as FAO and the International Development Research Center (IDRC, Canada) are already involved, a vast amount remains to be done. ISTC has a special role in linking the skills and expertise of US foresters in government and outside to the needs and priorities of the developing countries. Projected activities that emerge from the issues in these two riority areas are:

(i) Rural and Community Development Forestry

A primary goal of forestry development is raising living standards and, with that, nutrition levels. Therefore, programs initiating agroforestry techniques in the rural communities would clearly help to achieve these stated goals. Suggested activities as:

(a) analysis and evaluation of pilot or prototype community forestry strategies in a number of representative ecological, social, economic, and political settings;

(b) development of a "community" forestry network to

share and exchange information about the findings of these experiments;

(c) research activities in tropical ecozones which enhance the current knowledge of watershed management;

(d) assistance in creating new forms of technology designed to facilitate reforestation in arid and semi-arid zones under various geographic conditions (i.e. sloping grounds);

(e) provision of technical methods of reclamation of degraded lands, and questions of supply and demand relations in typical locations.

Some experimentation and project activity has already begun. Peace Corps and Vista have prepared a manual for reforestation and local woodlot programs. The Africa Bureau of AID has recently sent out an airgram inviting commentary and project design specifications on the need for increased local fuelwood production. A recent study on the fuel and energy situation in East Africa shows that the area will continue to rely on wood and charcoal as their principal sources of fuel and local construction materials (O'Keefe, 1978).

These project activities will focus on the analysis of technological, managerial, supply and demand, and other

issues related to the use of forestry and wood products as an important component of growth and diversification of the rural economy in humid and arid areas. Incumbent upon ISTC would be, not only a means of evaluating the effectiveness of these technical and managerial issues, but also a means by which these findings would be shared among appropriate institutions throughout the developing world as well as among donor nations. The need to disseminate such data calls for the work of analysis and evaluation to be undertaken in direct collaboration with local, host country institutions. Such collaboration requires that ISTC pay explicit attention to strengthening forestry institutional capabilities in host countries, hence second priority activity.

(ii) Institution Building Projects

Priority ISTC activities with respect to institution building should include the initiation of efficient information systems to effect a transfer of technology between and among similar global climatic and ecozones; to support financially as well as technically existing institutions and agencies in developing countries as a dual purpose of bolstering such centers as data and information banks as well as identifying focal points from which to coordinate research and to assist in developing appropriate training for conservation workers in developing countries. This projected

activity could result in the emergence of an international center or regional centers for subtropical forest development and soil and water conservation. Lastly, this projected activity could include training programs in forestry economics at the regional or international centers with special reference to developing forestry policy at the national level.

Ministries of natural resources, forestry, conservation, or agricultre are found in most governmental systems and in varying ways maintain responsibility for forestry. Faculties of forestry or forest training schools are found in a few developing countries. Effective forestry research and extension systems are rare indeed. While much of the basic research in forestry can be tackled at a few central institutions located in appropriate ecological zones, regional and local field trials and testing are important, especially to initiate research into the particular needs of localities.

At each level in this ideal infrastructural system, much needs to be done. There are not enough well staffed institutions and there are only inadequately developed field testing networks. This is particularly true of the arid and semi-arid zones of the tropics.

An important role of ISTC in the forestry area will be to work with other international agencies such as FAO, UNEP,

and MAB to reinforce the network of forestry institutions, especially by working with them on basic research questions and providing technical support.

There are also many national institutions in developing countries which provide a significant capacity for a cooperative framework. Examples of these institutions include:

The Brazilian Institute of Forestry Development

The Brazilian National Research Council

Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE), Coasta Rica

Instituto Venezuelano de Investigacion Scientificas (IVIC), Venequela

Forest Products Research Institute (FPRI), Ghana

Tropical Ecology Research Institute, Ivory Coast

Directorate of Nature Conservation and Wildlife Management, Indonesia

The Malaysian Environmental Protection Socity

The Royal Forest Department, Thailand

A fuller listing of the institutions and their capacity is found in Appendix I.

We also see that ISTC could explore longer range forestry work in Environmental Forestry (see section (iii) above) and in Industrial and Commerical Forestry Projects (see section (iv) above). For the immediate future and for the highest priority action, however, we recommend that the

bulk of ISTC's initial energies be invested in items (i) and (ii) above, Rural and Community Development Forestry and Institution Building.

To this end we provide a list of issues which should be considered in constructing ISTC's forestry plan of action:

1. Technical

   (a) What species are most appropriate for fuel, for house construction, and for local industry in the various tropical ecological settings in Asia, Africa, and Latin America?

   (b) What are the most effective techniques of charcoal production? Are there ways to encourage charcoal production for export to urban areas? At present, much firewood is taken into urban areas at a considerably greater transportation cost than if the firewood could be converted into charcoal. Are there ways to alter present cooking practices to use more energy efficient technology/techniques?

   (c) Using appropriate technology, what are the optimum distances and what are the best transportation systems to enable harvesting of wood/charcoal from wood surplus areas and transporting

them to wood deficient areas at a cost that poor farmers and peasants can afford?

2. Managerial

(a) What are traditional methods of allocating and preserving forests and woodlots? What changes in these practices have occured in the last few years? Are there possibilities of using traditional systems to aid in the development and protection of local woodlots?

(b) What is the actual rate of forest loss in rural areas? To what extent does this loss create problems:

(i) in loss of soil

(ii) in price of wood products

(iii) in production of oxygen

(iv) in water retention for agriculture.

(c) What kinds of local organizations and institutions are best suited to initiate local woodlots? How are the lots best managed? How can the production of woodlots be managed to maintain incentives to preserve the trees?

(d) What are the relationships between wood needs for local consumption and wood/fuel supplies

to be sent to urban areas? What are the relationships between priorities to use land for wood production and for growing of either local food crops or commercial crops? To what extent do policies of the central or national government encourage or discourage woodlot production?

IV. Program Elements

C. Planning Activity

3. Coastal Zone Protection and Development

a. A Review of the Issues

(See Appendix III for a detailed discussion of previous work, conferences, institutions, and literature on coastal zone management).

It has been estimated that upwards of three-quarters of the world's population live in or within reasonable proximity to a coastal zone region. The coastline, tributary river basins, and tidal areas are an important economic and food resource to most developing countries since coastal zones are among the biologically most productive regions on earth, particularly the estuaries.

Coastal zone management is generally recognized as one of the basic elements of national development planning. It is a recent concept. Its definition has emerged from expressed needs, primarily among industrial nations to (1) coordinate a number of sectors within the coastal region of one country and (2) build linkages between these coordinating agencies of two or more nations which share a common coastline. The integrated nature of the concept has been highly effective in a number of cooperative programs among primarily industrial nations, for example, in the Mediterranean Sea. It has been applied with somewhat less success among developing nations as, for example, along the coast of West Africa.

Unlike many aspects of development policy, coastal zone management is broad-based in concept and requires inputs from

many ministries and many disciplinary perspectives. These include components such as fishing, mining (including petroleum extraction), transport and shipping, foreign and domestic tourism, manufacturing, agriculture, forestry, and settlement. In addition conservation, waste disposal, waste supply, and scientific research also relate directly to many coastal zone questions.

As a result, coastal zone development and management are extremely complex in their conceptualization. They combine elements of physical and regional analysis on the one hand with environmental management on the other. Because of considerable population pressure in many of the world's coastal zones and because coastal zones produce large amounts of the world's food supply, careful management of the resource base is critical.

Often international management is necessary to deal with the problems. Our considerable knowledge of the characteristics of the coastal zone in mid-latitude, temperate countries is not at all matched by our insufficient understanding of tropical coastal systems. The United States, with its well established expertise in coastal zone management is uniquely suited to assist cooperatively in analyzing coastal zone problems in the developing world.

The main issues surrounding coastal zone management include:

(i) Interactions among users of the coast and complex inter-governmental and intra-governmental conflicts associated with these uses;

(ii) The destruction of or deleterious modification of valuable and productive environments such as wetlands, salt marshes, mangroves, rain forests, and coastal plains. There is always a strong pressure to develop these areas for commercial or residential purposes, sometimes conflicting with sound environmental policy;

(iii) The pollution of coastal and estuarine waters. Related to these direct problems of pollution are:

...national economic priorities,

...cultural differences in the importance of environmental quality,

...lack of awareness of potential interactions and long range impacts of varying coastal zone activities, and

...costs associated with coastal zone environmental protection which are sometimes perceived to outweigh at least the short-run benefit.

In developing countries where there is less industrial infrastructure, these issues become more complex by additional factors such as:

(i) low level of understanding of the dynamics of many tropical coastal zone environments;

(ii) lack of coordinated and effective planning or regulation of shoreline activities;

(iii) lack of trained staff and personnel;

(iv) lack of legislation conferring powers and authority to coastal zone agencies; and

(v) lack of adequate laboratory and training facilities to deal directly with questions of coastal zone management.

Thus, two major issues emerge as the foci for a projection of activity in the field of coastal zone management:

(i) The need for an integrated effort by scientists, social scientists, and government officials in a regional and global attack on understanding and dealing with problems relating to coastal zone protection and development; and

(ii) the lack of training, education, laboratory facilities, curriculum development, and coastal administration in developing countries.

b. Projected Activities

The two major issues listed above indicate a lack of coordination among four categories of possible program activity. These four activity areas are:

(i) renewable resources;

(ii) tourism and recreation;

(iii) transport and infrastructure; and

(iv) non-renewable resources.

The current isolation in cause and effect among these four areas places constraints upon the management of the affected coastal zone area. Given that these two major issues and the four proposed

activity areas are directly related to insitution building, it follows that ISTC could be instrumental in developing coordination among current coastal zone research efforts in developed countries and in effecting a transfer of this knowledge and integrated approach to major coastal zone areas of developing countries. Therefore, the ISTC could aid in the preparation of comprehensive coastal zone management programs. Such projected activities include:

(i) promoting research approaches that lead to a better understanding of the dynamics of the coastal zone;

(ii) assisting in cooperation and coordination among developing countries in research and exchange of information and the establishment of a suitable mechanism for these tasks;

(iii) establishing data bases and acquiring methods and techniques to formulate regulatory measures necessary for integrated coastal area resources development and management;

(iv) providing for appropriate environmental assessment programs;

(v) organizing a planning mechanism; and

(vi) protecting against coastal pollution, including river borne pollution carried to the coasts from inland sources.

While management of coastal areas and their resources represents a valid approach to the problems involved, it is still a new approach and further refinement is required. This can be achieved by an exchange of knowledge and by collective thinking, especially as recommended above in cooperation and coordination with institutions in the developing world. To avoid duplication of work already done, the first task of the ISTC should be to further assess the state of international effort in priority areas and to establish links with appropriate organizations to collect the relevant materials from the various countries, to analyze the techniques employed, and to establish certain guidelines for future action (see Appendix III for the list of UN organizations involved, either directly or indirectly with coastal zone management). However, it is clear that the number of coastal zone national institutions in the developing world is indeed small. It may be necessary to develop a limited number of new institutions, particularly in Africa. However, a sample listing of Asian institutions indicates a growing awareness and institutional infrastructure. A sample list of Asian institutions includes:

Center for Natural Resource Management and
Environmental Studies
Institute Pertanian Bogor
Jl. Raya Pajajaran, Bogor, Indonesia

Philippine Council for Agricultural and
Resources Research
Los Banos, Laguna
Philippines

Faculty of Resource Economics and
Agribusiness
Universiti Pertanian Malaysia
Serdang, Selangor, Malaysia

National Institute of Oceanology
P.O.Box 580/DAK
Jakarta Utara, Indonesia

International Center for Living
Aquatic Resources Management
MCC P.O. Box 1501
Makati, Metro Manila
Philippines

IV. Program Elements

D. Planning Activity

4. Pollution Control

a. A Review of the Issues

(See Appendix IV for a detailed discussion of previous work, conferences, institutions, and literature on pollution control.)

Rapid growth in urban centers is perhaps the most ubiquitous experience of countries in Asia, Africa, and Latin America. Growth rates of 10% per annum are not uncommon. Such growth has been much faster than the provision of urban services and many towns and cities have the dubious distinction of combining the environmental ills of industrialized economies -- water, air, and noise pollution -- with those of the non-industrial world -- lack of sanitation, ill health, and poverty. The cities of the Third World are a prime focus of urban pollution. We know many of the technological solutions to these problems but there is little experience in low cost solutions compatable with local resources and conditions. There is also a critical need for planning approaches and techniques which promote less hazardous urban growth.

In rural areas, modern pollution problems are mainly those connected with the unwise application

of pesticides and fertilizers. While these are important for crop production, there is widespread concern about the impacts on the health of people and animals and on the local water systems. Because many of these chemicals used in pest control are exported from industrial countries, to peoples who are unaccustomed to the proper procedures for their application, the issues are of a special priority.

Although the problems of urban and rural pollution are immediate and urgent, there has been little recent opportunity for an assessment for coordination of priorities either within the Third World or between Third World nations and industrial countries. For this reason, we propose that ISTC use fiscal 1980 mainly as a planning year in the area of pollution in order to organize a more coordinated plan of action for fiscal 1981 and beyond. The rationale for an initial planning year is strengthened by the fact that the Department of State will hold a major conference on pesticides and pollution in June, 1979. Recommendations from this conference will be an invaluable guide to ISTC policy.

1. Urban Environmental Concerns

The majority of people in developing nations continue to live in rural areas. However, cities are growing at unprecendented rates. As the cities go, so do problems of urban environments. The principal problems are caused by the disposal of industrial and human wastes. Those countries with the greatest industrial problems are those which have moved most directly into stages of industrial growth such as Brazil, Nigeria, India, or Egypt. For those countries, urban air pollution from internal combustion engines and factory emissions are beginning to cause difficulties in smog and other pollutants. Oxides of carbon, sulfur, and lead are generally the most critical. Although on a relative scale, these nations suffer from problems far less severe than in the industrial countries, problems of urban and industrial pollution should not be ignored.

Disposal of human waste in large cities in developing countries is also of great concern. In most cases, sanitation systems are antiquated and greatly overburdened. In many more cases, no sanitation systems have ever been installed and housing and residential areas of extremely dense concentration

exist with no formal waste disposal system. Haphazard and disorganized means of disposal result in serious health problems which have a particularly severe impact on children.

At present, government agencies such as those responsible for health, urban planning, industrial development, or urban affairs do not have adequate resources or sufficient numbers of trained manpower to deal with these problems. Nor is there any hope that the high percentage of urban migration and growth will ease these pressures in the next decade. It is therefore of especial importance that ISTC initiate linkages with institutions in the developing world which have special interest and expertise in developing local awareness and in providing local skills to assess and plan for policies related to urban pollution. It must be stressed that at present, the problems of urban pollution are of critical concern in only a few cities around the developing world. However, if present trends continue, the dilemmas will escalate in the coming decade and be of crisis proportions, especially in the area of human health in cities.

2. Rural Concerns

Pollution problems present a major dilemma for the rural regions of Asia, Africa, and Latin America. On the one hand, it is known that these areas must produce substantially greater quantities of food in the decades ahead, simply to keep pace with current nutrition levels. On the other hand, it is equally clear that if food production is to increase, use of fertilizers and pesticides (or some other means to control pests) are mandatory. One source (Dr. Robert Gardiner of the Ministry of Economic Planning in Ghana) estimates that by 1985, pesticide usage in developing countries will have increased five-fold over the levels used in 1965.

Pesticides, however, are a mixed blessing. Although in the short-run they may increase yield, in the long-run the effect may be much different. For example, a study in Central America recently determined that the average annual incidence of human pesticide poisoning was approximately 5,000. The same study further concluded that the use of pesticides, sustained for a prolonged period in the same area, resulted in substantially decreased effectiveness. In some cases, it was necessary to spray cotton fields

forty times in a single growing season, simply because of ineffectiveness of pesticide. As a result, pesticide use is increasing at alarming rates, worldwide.

A recent estimate finds that the world uses about four billion pounds of insect, mite, rat, and weed killer every year or roughly one pound for every person on earth. Industrialized nations produce 90 percent of this quantity and consume 80 percent of it. Though poor nations use relatively small amounts of pesticide, they are often applying it intensively and sometimes carelessly. For example, it has been estimated that half of the pesticide powder dropped from spray planes misses the target, and instead, lands on grazing lands, village fields, or villages themselves. When pesticides do hit their mark they are not always effective. UNEP estimates that more than 300 species of insects and mice are now resistent to chemicals that formerly destroyed them. For example, in Pakistan in 1961 there were an estimated seven million cases of malaria. A vigorous spray program was initiated and by 1967, the number of cases had been reduced to 9,500. However, the increased resistence of mosquitoes to DT,

as well as less vigorous spraying programs, resulted in an increase in cases of malaria. By 1974, Pakistan recorded ten million cases.

Use of pesticides also has an economic dimension. For instance, FAO has estimated that 35 percent of the total potential world production of wheat is lost to pests and diseases, that 40 percent of potatoe production is lost, 24 percent of sugar beets, 30 percent of apples, 60 percent of cotton, and 62 percent of tobacco. The food loss on the stalk to pests and diseases in developing nations has been estimated to be about one-third of the actual tonnage harvested. Storage losses of crops after harvest, due to pests and diseases, have been estimated to be as high as 40 percent. The value of world crop losses in a single year from pests and disease is estimated at about 100 billion.

Pesticides have reduced insect infestation and control of crop and livestock diseases. Yet the longer-run uncertainties, as indicated above, both in declining effectiveness and negative human impacts have caused serious reconsideration of pesticide policies. In recent years, the US Agency for International Development has adopted a program of Integrated Pest Management (IPM). IPM utilizes cultural, physical, and

mechanical control methods for pests to the maximum extent possible, and uses chemical pesticides only when absolutely necessary. IPM also uses, whenever possible, sex-attractants, anti-feeding compounds, juvenile hormones, and micro-organisms pathogenic to pests, and other biological-ecological methods.

b. Significant Themes and Possible Activities

A review of the literature, previous symposia, and recommendations suggests a broad-based approach to problems of pollution. Significant themes include:

1. The institutional base for both urban and rural pollution control is inadequate in most of the developing world. Shortage of trained manpower is a particular problem. In addition, emphasis needs to be placed on "training the trainers to train."

2. Generally throughout the developing world, there is not yet agreement on "safe practices" for the use of toxic materials or for the disposal of human and industrial wastes.

3. There is not yet reliable information on losses incurred either from inappropriate use of pesticides in rural areas or from inadequate disposal and maintenance methods in urban/industrial areas. A great deal of research is required to document precise losses, costs to change methods, and savings accumulated as a result. One of the few studies we were able to find noted that for cotton production in Central America, that techniques of integrated pest management resulted in an average increase of profits of 83 percent over previous uses of pesticides.

Experimentation and dissemination of such results are a vital part of the longer-range struggle to reduce pollution.

4. What little information that does exist at present tends to be more readily available in the commercial/cash crop sector than in the domestic food crop or small manufacturing sector. Profit returns are more easily calculated in commercial efforts. Yet a pressing need exists in developing nations to increase the production of food crops. Research and experimentation is long over due on alternatives to pesticide use for the production of local and food crops.

5. There are not now any well established environmental research and training centers focussing specifically on problems of rural or urban pollution anywhere in the developing world. A number of centers such as the Environmental Training Program in Dakar or the Asian Institute for Technology in Thailand work in related areas. But they are not specifically concerned with pollution. Consideration of establishing one or more such research and training centers should be of priority to ISTC.

6. The developing world is also without well-established local institutions for monitoring and assessing various forms of pollution. The capabilities of such institutions in developing countries need to be strengthened in terms of personnel, equipment, training programs, and capabilities to perform technical functions such as measuring residue build-up in food products.

7. Reasonable and enforceable standards for acceptable levels of pollution are not now in place in the developing world. Nor is it realistic to transfer standards developed in Europe or North America to developing nations. Research and planning need to be undertaken to develop guidelines for measures of acceptability in areas of air, water, and land standards. It may also be worthwhile to consider appropriate legislation to enforce these locally developed standards.

8. Information on the potential harm of toxic substances is not generally available to users in the developing world. Labeling of products is sometimes handled in hap-hazard ways. Toxicity to humans is not always stated nor is toxicity to other non-target species necessarily spelled out. Instructions for application, storage, disposal of containers, or procedures to follow in case of overdose are not always clearly described. Thus it seems appropriate to encourage ISTC to conduct experimentation and research on appropriate information to supply to users of potentially dangerous materials.

9. Restrictions on use of pesticides by AID are not yet clearly in place. Although the environmental impact statement (May, 1977) developed for pesticides recommended a number of restrictions, it is not clear that these restrictions have in fact been adopted as policy. For example, the EIS recommends that bulk quantities of pesticide be provided only to countries which have capabilities, resources, facilities, to repackage and distribute them in proper ways. Yet these limitations are not yet part of AID's pest management policy. Such policy clarifications require carefully detailed studies and research efforts which could easily come under the jurisdiction of ISTC.

10. For several years, EPA has conducted tests on the impact of pesticides. These data are now becoming available. However, they are not automatically transferrable to settings within developing nations. Differences in temperature, humidity, specie, and cultural practices require translation efforts. ISTC might explore ways in which these translations could be accomplished with minimal effort.

11. There is need to create pest and disease forecasting centers, both in terms of regional monitoring and in anticipating need for selective use of pesticides and insecticides to combat larger problems.

12. There is not now an agreed upon international strategy for pesticide use and management. FAO has worked on the problem for several years. Yet a global policy has not yet appeared. Issues such as the persistence, transportation, production, and exportation of pesticides in relation to global problems and international residue limits are of high priority. The State Department conference coming up in June will be one step toward this activity. However, ISTC may wish to explore ways in which a more active global effort might be undertaken.

13. There is not now any significant effort underway, either in the United States or overseas, to assess the impact of fertilizer use on the environment. ISTC should explore in more detail the need for such assessment, particularly in areas where fertilizers and chemical pesticides are used together.

14. A great deal of research is needed to explore simple, easily maintained, and safe applicator systems for pesticides. At present, most application equipment is designed for commercial and large scale uses. The needs of small farmers have not been considered. Research could prove of considerable benefit for production of local food products.

15. Integrated pest management needs more research and evaluation. Specific techniques have not been tried and tested in local areas. Adaptations, dependent upon local species, climate, vegetation, soils, etc. have not been examined in nearly the detail required. Nor have training and extension programs been undertaken to disseminate information about integrated pest management. ISTC should place high priority on research efforts which explore the appropriateness of non-chemical means to deal with pests.

It is recommended that such experimentation be undertaken in cooperation with local institutions, both to strengthen their research capabilities as well as to assure the appropriateness of the experiments. Experimentation might also take place in conjunction with the network of agricultural research institutions which are identified in Appendix I (Resource Management and Environmental Planning).

16. Finally, ISTC should consider launching a selected number of longitudinal studies in a representative sample of urban and rural settings throughout the developing world. Long-range data runs on questions of incidence of disease, problems of toxicity, residue build-up, water and air quality, and agricultural yield are simply not available. In the absence of such "representative" data, it is difficult to determine precisely the nature of trends nor is it possible to measure the precise impact of a new variable (for example, a new technique of spraying) into a local ecosystem. ISTC is well situated to undertake such longitudinal studies, in cooperation with local institutions. Moreover, ISTC should consider ways in which a continual monitoring of these longitudinal sites can provide data which will be used in longer-range policy planning and formulation.

c. Specific Action Recommendations

In an earlier section, we recommended that ISTC's work in pollution be largely planning for the first fiscal year. With this objective in mind, we recommend the following five activities, to begin as quickly as possible:

1. Review the basic issues as noted above and the large number of recommendations found in many reports and symposia, also as noted above, with regard to:

(a) Agricultural pollution, and

(b) Urban pollution problems.

2. Prepare a careful analysis of institutional capabilities in developing countries to deal with pollution problems in both rural and urban settings.

3. Consider work on pollution problems of selected countries to evaluate and elaborate methodologies under different "typical" situations, giving high priority to:

   (a) Rural approaches which emphasize integrated pest management;

   (b) Urban approaches which pay particular attention to low cost technologies for human and solid waste disposal.

4. Explore possibilities to implement and evaluate prototype, low-cost monitoring systems to maintain surveillance on pollution levels.

5. Contact State Department personnel responsible for the International Conference on the Impact of Pesticides on the Global Environment (June, 1979) in order to assure discussions and recommendations of the Conference will be organized in forms which ISTC can use to formulate policies on pollution activities.

   Because the State Department Conference is particularly timely, we append to this summary statement a list of six critical issues which the Conference will address. It is significant to note that our list of issues, particularly for rural pollution, coincides almost completely with the list which the Conference organizers have drafted. The coincidence suggests that the State Department Conference can be of great value in assisting ISTC to formulate policy. The critical issues follow:

U.S. POLICY OPTIONS FOR REDUCING THE IMPACT OF PESTICIDES ON THE GLOBAL ENVIRONMENT

An International Conference Sponsored by the Department of State
in Cooperation with the U.S. National Committee
for Man and the Biosphere

Washington, D.C.
June 7-8, 1979

LIST OF CRITICAL ISSUES

1. Magnitude of the Problem

   a. What are the major health and environmental global impacts created by current U.S. pest management policies?

   b. Which impacts are the most serious and which merit highest priority by the U.S. Government, other developed and developing countries, and international organizations?

   c. What are the most significant political, legal, institutional, and economic constraints to mitigating these impacts?

2. General Approach

   a. How should principal responsibilities for reducing the enumerated impacts be apportioned among developed nations, LDCs, and international organizations?

   b. What are the most appropriate generic approaches to reducing the identified impacts – an elaborate regulatory framework in developed nations, transfer of regulatory expertise to LDCs, transfer of technical information (including IPM)?

3. Global Impacts of U.S. Pesticide Regulations

   a. What are the principal impacts within LDCs of U.S. domestic pesticide regulations? How could positive impacts be enhanced and undesirable impacts be minimized?

   b. How effective are U.S. procedures for notifying LDCs of domestic pesticide registration, suspension, and cancellation actions? How could these procedures be improved?

   c. What type of instructions with respect to packaging, labeling, storage, usage, and disposal are most useful to foreign governments purchasing U.S. pesticides? How could dissemination of this information be improved?

   d. What type of risk/benefit information would be useful to nations importing U.S. pesticides?

   e. What are the impacts on the pesticide manufacturing industry of regulations which circumscribe international trade in pesticides? To what extent should these impacts be considered, along with potential environmental benefits, in designing a regulatory framework?

   f. Should major financial institutions incorporate an environmental impact or risk/benefit criterion into pesticide-related assistance programs?

4. International Exchange of Regulatory Expertise

   a. What are the problems associated with complex pesticide regulation in LDCs?

   b. To what extent is it appropriate to exchange with LDCs the mechanisms of a pesticide regulatory framework (registration, suspension, RPAR, etc.)?

   c. What types of programs should be developed to accomplish this exchange?

5. Global Impacts of U.S. Pesticide Assistance and Training Programs

   a. To what extent should AID-funded pesticide assistance programs take into account the environmental impacts of pesticides provided to LDCs? (For example, is it appropriate for the U.S. to provide LDCs with pesticides banned in the U.S.?)

   b. How effective are current AID programs which train personnel and monitor pesticide handling and application in recipient nations? Should these programs be modified or expanded?

   c. What types of technical information on the environmental and health hazards associated with specific pesticides would be useful to LDCs? How could this information transfer best be accomplished?

6. Transfer of IPM to LDCs

   a. How large a role should the U.S. take in the international dissemination of IPM information and expertise? How can the multitude of ongoing global IPM programs best be coordinated?

   b. How effective are current U.S. programs aimed at transfer of IPM to LDCs?

   c. What specific types of additional programs -- research, training, and demonstrations -- are now most urgently needed? How should these programs be designed?

   d. What are the major technical, legal, institutional, political, social, and economic barriers to widespread dissemination of IPM? What could be done to mitigate these obstacles?

   e. What types of organizations should be encouraged to promote or sell IPM?

IV. Program Elements

E. Long Range Goals and Objectives for Program Elements

In general, the task of ISTC is to provide a sound research base for development planning in the developing countries. These nations face fundamental problems in producing food for their increasing populations, in finding sources of renewable energy for these same people, in managing environmental aspects of their burgeoning cities, and in integrating industrial needs with other demands on their resource base. In each of these major areas, there are important environmental and resource management components.

Given the comparatively limited funding and staffing proposed for the ISTC, it is clear that two principles should guide program development: the principle of coordination and shared support with other activities and institutions; and the principle of careful selection of activities. These two principles apply to all ISTC program areas but are especially important for work in Environmental Planning and Resource Management. Environmental activities, by their very nature, are broad-based and liable to dispersion of effort. Thus, there is need to be precise in defining what should be undertaken as ISTC's environmental components. If the four fields proposed in this document do become ISTC's major environmental thrust, the goals and objectives within these fields need precise definitions and continuing revision.

The research agenda that flows from these propositions is enormous, though, thankfully, one of increasing visibility as more and more agencies around the world are providing support in the area. In choosing a role within Environmental Planning and

Resource Management, ISTC should consider concentrating its limited energies on topics which:

... include close attention to the problems of application and dissemination of results;

... are well suited for collaborative work among host country and United States institutions;

... involve cross-disciplinary approaches;

... address basic questions of ecosystem maintenance and productivity;

... can be applied in a 10-15 year time frame;

... use ISTC's funding as a catalyst for other support.

Five Year Goals and Objectives

The following are proposed as the overall goals for the first five year of the ISTC.

1. A better understanding of tropical ecosystem utilization, especially
   (a) the tropical rainforests;
   (b) semi-arid tropical areas;
   (c) coastal and aquatic systems in the tropics;
   (d) methods of applications of scientific knowledge to development problems.
2. A cooperative working relationship with institutions in the developing world including joint research programs and technical assistance involving as many as 20-30 institutions after five years.
3. Divising a mechanism for focusing the work of more institutions in the United States on problems of developing countries.

4. Providing the United States international agencies with better information and insights into resource and environmental aspects of their programs.

Within Groups

Specific goals and objectives within groups are:

Forestry

1. Make a substantial contribution to the understanding of community woodlot development in two or three major ecosystems. Very high priority areas include African semi-arid regions and Asian monsoonal areas.
2. Assist other international agencies in the strengthening of rural institutions in the field of community and rural forestry including capabilities in evaluation, implementation, project revision, and integrated project management.
3. Achieve a major review of possible world initiatives in forestry for local fuel and industry for the 1981 projected world rural renewable energy conference.

Resource Management and Environmental Planning

1. Devise and strengthen information systems for managing and utilizing resource data in developing countries, especially in making these data available for development project planning.
2. Assist developing countries in designing appropriate institutional structures for testing and evaluating research and development problems, especially in relation to humid tropical, semi-arid, and coastal zone ecosystems.

3. Begin work on the environmental dimensions of rapid urban expansion in developing countries.
4. Experiment with low cost, cooperative systems to monitor a limited number of critical indicators for key environmental trends.

Coastal Zone Management

1. Complete review of key global issues in coastal zone management.
2. Work cooperatively with other international agencies on one coastal zone plan for each continent or region with each plan devoting special attention to issues of basic resource system viability.
3. Assist in researching and organizing institutional responsibilities in developing countries for integrated coastal zone management.

Pollution

1. Review basic issues with regard to
   (a) agricultural pollution, and
   (b) urban pollution problems.
2. Work on pollution problems of selected countries to evaluate and elaborate methodologies under different "typical" situations, giving high priority to:
   (a) rural approaches which emphasize integrated pest management;
   (b) urban approaches which pay particular attention to low-cost technologies for human and solid waste disposal.

3. Implement prototype, low-cost monitoring systems to maintain surveillance on pollution levels.

V. The Program, 1980 - 1985

A. Major Potential Program Elements

Earlier sections in this report have documented the reasons for selection of programs during the first few years of ISTC's activity. The central part of the work will focus on issues in environmental planning and resource management. Specialized work in forestry, coastal zone management, and pollution, will complement this central thrust. The reasons for the emphasis on planning and management are clear. Without an overview of the basic planning and resource management strategy, much of the rest will not fit into place and the interaction between and among other areas will be much more difficult.

Because resource management and environmental planning are the unifying principles for long range work, we recommend that they constitute the core of the work with the other three program areas organized in a complementary mode. However, because much work has already been accomplished in forestry, we recommend that ISTC activities begin first in forestry.

Thus, our long-run program goals in Environmental Planning and Resource Management are:

1. Information Systems/Monitoring
2. Institution Building
3. Research and Action Programs
    a. Soil Erosion and Vegetation Control
    b. Resource Deterioration in Relation to:
        i. Agricultural and Land Use Development
        ii. River Basin Development

iii. National Parks and Natural Reserves

iv. Industrial Planning

v. Human Settlements Planning

vi. Population and Demographic Planning

This basic effort will be complemented by work in the three other environmental fields. In forestry, the major program activities fall into four areas with the first two receiving much higher priority than the second two. The four Forestry areas recommended for activity are:

1. Rural and Community Development Forestry
2. Institution Building Projects
3. Environmental Forestry
4. Industrial and Commercial Forest Projects

In Coastal Zone Management, the proposed activities call for emphasis on integrating the work of scientists, social scientists, and government officials in regional efforts, including administration, research, monitoring, policy formulation, training, curriculum design, and development of laboratory facilities. Projected activities include:

1. Promoting research approaches that lead to a better understanding of the dynamics of the coastal zone;
2. Assisting in cooperation and coordination among developing countries in research and exchange of information and the establishment of a suitable mechanism for these tasks;
3. Establishing data bases, acquiring methods and techniques, and formulating regulatory measures necessary for integrated coastal area resources development and

management;

4. Providing for appropriate environmental assessment programs;
5. Organizing a planning mechanism; and
6. Protecting against coastal pollution, including river borne pollution carried to the coasts from inland sources.

For Pollution, the recommendations call for an initial planning stage to further refine projected activities, with special importance being attached to the forthcoming State Department Conference on Pollution and Pesticides (June 7-8, 1979). Possible activities in the area of pollution include:

1. Review basic issues with regard to:
   a. agricultural pollution, and
   b. urban pollution problems.
2. Work on pollution problems of selected countries to evaluate and elaborate methodologies under different "typical" situations, giving high priority to:
   a. rural approaches which emphasize integrated pest management;
   b. urban approaches which pay particular attention to low-cost technologies for human and solid waste disposal.
3. Implement prototype, low-cost monitoring systems to maintain surveillance on pollution levels.

B. Budget Priorities

Figures are offered below which suggest ratios or approximations for ISTC effort. They are based on a number assumptions. First, the figures assume a modest annual increase in funding. The recommendations consciously urge that ISTC organize its activities in ways that will grow slowly but steadily. Establishing close working relationships with regional and national institutions takes time. To do it properly requires that very small initial activities slowly lead into more ambitious work.

Second, the figures assume that work in forestry can begin in FY 1980. Hence, forty percent of the proposed new money is recommended for forestry activities. The other three program areas will use the remainder for planning and initial organizational work, with perhaps one or two major conferences undertaken in each area.

As the ISTC matures, the funding cycle suggests that increased emphasis should go to the theme of environmental planning and resource management. This area has been identified as the core theme to which the other three areas will relate. It is logical for it to emerge as the largest single receiver of funds. If anything, our projections for planning and management funding may be too modest.

Third, we assume that ISTC will not be acting alone in these four important areas. The MAB program, for example, works in a like coordination with committees from many other countries. In manner, ISTC should seek out ways that assure some activities being jointly supported, if not directly through AID, then in

cooperation with other organizations. We do not envision ISTC as an institution with large budgets or as an organization contributing core funding to major projects. Rather, we hope that ISTC will experiment with and evalute pilot activities, engage in research efforts, support programs in cooperation with regional and local institutions, and set precedents for larger projects to follow. ISTC should be an exploratory institution, not a main-line support group. To this end, we recognize that the modest resources recommended in our five year budget projection are intended to plant seeds, not to purchase fully ripened crops.

Our budget projections follow.

Program	Fiscal 1980	1981	1982	1983	1984
Transferred Programs:					
MAB	1.35	1.5	1.5	1.5	1.5*
Forestry Projects	0.75	1.0	1.0**		
New Programs					
Forestry	1.0	1.5	2.0	2.5	2.5
Environmental Planning and Resource Management		1.5	2.0	2.5	3.5
Coastal Zone Management	1.4	1.0	1.5	2.0	2.5
Pollution		1.0	1.5	2.0	2.0
	4.50	7.5	9.5	10.5	12.0

*It may be that MAB funding will require expansion over these years. However, for this discussion, it is assumed that any additional funding will not come from the ISTC budget.

**It is assumed here that forestry activity will be consolidated into new program activity after Fiscal Year 1982.

VI. THE GLOBAL NETWORK

Most developing countries have government and institutional structures modeled on the western institutions. Many have changed little from the recent colonial past. Unfortunately, two persistent patterns result: governments with rather rigidly segregated ministerial structures and universities and research institutions with rather rigidly structured subject areas and departments. These institutional legacies create inappropriate separation of responsibilities in areas of resource management and planning.

In both university and government, this structure emphasizes the traditional--ministries of water, power, agriculture, forests, wildlife; departments of economics, physics, botany, zoology--and leaves little room for coordinated approaches to environment and natural resources. It has been difficult for environmental issues to find a secure institutional home, at least not until the past five to ten years. Even now, only a handful of countries in the developing world have instituted coordinating or integrative agencies for environmental planning and natural resource management.

This is not to suggest that environmental and natural resource issues were not previously studied and taught. Rather, they were most often studied and taught as discrete componenents in quite separate institutions. This separation persists although

increasingly the barriers are being bridged by new arrangements or reduced by new institutions.

The global network of institutions with which ISTC will have to deal is made up of:

(i) International Institutions:

UN related institutions

Other multilateral institutions

Foundations

(ii) National and Regional Institutions

Coordinating institutions

Single purpose institutions

Cooperative institutions

(i) International Institutions

The United Nations family of institutions has major programs in the field of environmental planning and resource management, the most important being FAO, UNESCO, UNEP, WHO, WMO, and UNDP. Each has a particular and sometimes overlapping role. FAO and UNESCO have long had a range of programs. In the 1950's and 1960's, FAO developed extensive forestry and wildlife conservation programs and carried out resource surveys of many areas, frequently on a river basin basis. Forestry activity was greatly reduced in the last ten to fifteen years in the face of pressure from the demands

of the food production sector and conservation suffered heavily in the cutbacks of the same period. Natural resource surveys were found to be an unproductive way of project development and were similarly phased down. In the last two years, forestry has again become a more important focus.

UNESCO has played a continuous and vital role, sponsoring, among others, the arid lands studies of the 1950's and early 1960's, the International Hydrological Decade, the International Biological Program, and more recently, the Man and the Biosphere program. The last three have been especially important in that each has encouraged the setting up of national committees in participating countries. The IHD, IBP, and MAB committees have performed a valuable interministerial and interdisciplinary scientific meeting ground for many developing and developed countries alike. The MAB program, with its fourteen substantive committees provides a current coordinating framework for some aspects of environmental planning and natural resource management research. Some ninety-one countries have active MAB programs including twenty-one in Africa, twenty-two in Asia, and fourteen in Latin America.

The United Nations Environment Program, located in Nairobi, has played a more direct environmental role. In its relatively short life (since 1972), it has initiated

a significant number of research and monitoring activities. It was of course the sponsoring institution for the UN Conference on Desertification and continues to promote work in this field. For more information on specific capabilities of the UN agencies, see Appendix IV, Resource Management and Environmental Planning.

There are many other multinational institutions which have an interest in these issues, perhaps the most directly relevant being the Scientific Committee on the Problems of the Environment. SCOPE has among other activities sponsored the publication of a number of reviews of environmental and natural resource issues.

Other Multilateral Organizations

Beyond the global UN grid of institutions, there are sets of regional organizations which can be worked into an environmental management network. For example, in Africa, three regional research and training institutions function effectively with local and national level policy organizations. One is ENDA, The Environmental Training Program, in Dakar. The second is PAID, the Pan-African Institute for Development, in Cameroon. The third is the Institut du Sahel in Mali which is the research and training arm of CILSS.

For Asia, organizations such as the Asian Institute of Technology in Bangkok or the International Center for Living Aquatic Resources Management in the Philippines would be good regional linkages. In Latin America and the Caribbean, possible institutions include the Central America Research Institute for Industry, UNEP's regional office for Latin America in Mexico City, the Pan American Center for Sanitary Engineering and Atomospheric Sciences, Lima, Peru (REDPANAIRE), or UNEP/ECLA's Caribbean Environmental Project.

Foundations

A number of foundations have programs in environmentally related areas. The Ford Foundation and the Rockefeller Foundation have a particularly outstanding history in institution building and research in the environment. They have supported many of the agricultural and food systems institutes mentioned in Appendix IV. They have also supported training and local instituional efforts in a number of countries.

Related to these efforts are agencies supported by other donor countries. For example, the Ministry of Overseas Development (ODM) in Great Britain, through the Centre of Overseas Pest Research, supports an East African regional research and dissemination center for pest control.

(ii) National and Regional Institutions

The readiness of national institutions to deal with resource management and environmental planning issues naturally varies widely from country to country. There have not been sufficient resources and time available to complete a full survey for this study. However, we attempt in this section to provide examples of the kinds of institutional framework currently in place.

Africa

Most African countries now have a considerable awareness of the importance of environmental and natural resource issues. Most governments now include references to these topics in official plans and public statements. However, many countries do not yet have government structures to deal with the issues. Yet the picture is changing rapidly. Nearly all countries have a ministry dealing directly with natural resources, and several governments including Kenya, Ghana, Ivory Coast, and Nigeria have specially designated national environmental bodies.

Research institutes directly responsible for environmental planning and natural resource management are still small in scale. Yet they are growing quickly.

Examples include:

The Center for Environmental Studies
University of Khartoum

Bureau of Resource and Land Use Planning
Dar es Salaam, Tanzania

Center for Ecological Studies
Cameroon

Centers and departments in several Nigerian universities

Center of Environmental Studies
University of Zaire

Institute of Rural Economy
Mali

Institute of Development Research
Ethiopia

Asia

Asia's infrastructure of environmental institutions is marked by some old and well established organizations in those countries with a long university tradition; and by some newer and expanding organizations in countries where university training has only recently been implemented. In virtually every Asian nation, a commitment exists to establish an environmental ministry by 1979. This combination of many organizations and a commitment to environmental policy and action makes Asia an appropriate place of ISTC to develop regional affiliations.

Research institutions in Asia include:

Institute for Tropical Biology
Bogor, Indonesia

University of Malaya Ecology Unit

University of Philippines

Kasetsart University School of Forestry
Thailand

Regional Center for Environmental Planning
Malaysia

Central Arid Zone Research Institute
Jodhpur, India

Bangladesh Environmental Institute

Pakistan Council of Scientific and
Industrial Research

Latin America

In the Caribbean and Latin America, institutional responses to environmental needs vary from Mexico's autonomous Environmental Protection Agency, with jurisdiction similar to that of the U.S. EPA, to Brazil's environmental secretariat which is housed within the Ministry of Interior. As in other regions of the developing world, the institutions are in a formative stage with actual authority to enforce legislation severely limited and access to environmental information, at best, uneven. Yet the good beginning serves as a solid infrastructure upon which ISTC can build.

Examples of Latin American organizations with potential for collaboration include:

Institute for Development of Renewable Natural Resources and Environmental Protection, Colombia

Office for the Evaluation of Natural Resources, Peru

Interagency Committee for Environmental Affairs, Guatemala

Agency for Prevention and Control of Environmental Pollution, Ecuador

In preparing recommendations for ISTC activities, we see a two-fold level for collaborative work.

Level 1--with the UN family of institutions, we recommend an interchange of plans, goals, activities, and information in order to coordinate and complement related action.

Level 2--with host country national and regional institutions, we recommend, on a selective basis, direct collaboration in the four subject fields proposed in this report. Particular emphasis should be placed on relationships which will strengthen long-range capabilities of these organizations to manage their own resources and which will increase contact and exchange of information between and among these institutions.

We also see an important goal of ISTC to build an identity among this global network of institutions which will carry forward on its own. Ideally, ISTC will be able to strengthen bonds between like-minded scientific institutions in many developing nations which will ensure sustained exchange of scientific information and experience over and above resources which ISTC can make available. The ultimate solution to problems of environmental management lies in strong local organizations which themselves will plan and allocate the use of local environments.

VI. THE GLOBAL NETWORK

ADDENDUM

MAB Project Areas and National Committees

MAB has fourteen project areas, several of which relate directly to semi-arid and arid regions. The fourteen MAB areas are:

1. Ecological effects of increasing human activities on tropical and subtropical forest ecosystems;

2. Ecological effects of different land uses and management practicies on temperate and mediterranean forest landscapes;

3. Impact of human activities and land use practices on grazing lands: savanna and grassland (from temperate to arid areas);

4. Impact of human activities on the dynamics of arid and semi-arid zones ecosystems, with particular attentions to the effects of irrigation;

5. Ecological effects of human activities on the value and resources of lakes, marshes, rivers, deltas, estuaries, and coastal zones;

6. Impact of human activities on mountain and tundra ecosystems;

7. Ecology and rational use of island ecosystems;

8. Conservation of natural areas and of the genetic material they contain;

9. Ecological assessment of pest management and fertilizer use on terrestrial and aquatic ecosystems;

10. Effects on Man and his environment of major engineering works;

11. Ecological aspects of urban systems with particular emphasis on energy utilization;

12. Interactions between environmental transformations and the adaptive, demographic, and genetic structure of human populations;

13. Perception of environmental quality;

14. Research on environmental pollution and its effects on the biosphere.

List of MAB National Committees

Afghanistan
Algeria
Argentina
Australia
Austria
Belgium
Popular Republic of Benin
Bolivia
Brazil
Bulgaria
Burma
Burma
Byelorussion Soviet Socialist Republic
Canada
Chile
Colombia
Costa Rica
Cuba
Czechoslovakia
Dominican Republic
Denmark
Ecuador
Arab Republic of Egypt
Finland
France
German Democratic Republic
Federal Republic of Germany
Greece
Hungary
Iceland
Malaysia
Mali
Malta
Mauritius
Mexico
Morocco
Nepal
Netherlands
New Zealand
Nigeria
Norway
Pakistan
Papua New Guinea
Peru
Philippines
Poland
Portugal
Rumania
Senegal
Republic of Singapore
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syrian Arab Republic
Tanzania
Thailand
Tunisia
Turkey
Uganda

MAB National Committees, cont.

India
Indonesia
Iran
Iraq
Ireland
Italy
Ivory Coast
Japan
Jordan
Kenya
Republic of Korea
Kuwait
Democratic Republic of Madagascar
Ukrainian Soviet Socialist Republic
Union of Soviet Socialist Republics
United Arab Emirates
United Kingdom
United States of America
Uruguay
Uganda
Venezuela
Yugoslavia
Zaire

CHAPTER VII

BIBLIOGRAPHY

Environmental Planning and Natural Resource Management

BIBLIOGRAPHY

A. ENVIRONMENTAL MANAGEMENT AND NATURAL RESOURCE ANALYSIS

Adams, Victor W., Geological Survey Circular 712 "Earth Science Data in Urban and Regional Information Systems - A Review," U.S. Geological Survey, Virginia 1975.

Allaby, Michael and Poore, Duncan (1978) Sourcebook for a World Conservation Strategy: International Union for Conservation of Nature and Natural Resources, General Assembly paper GA. 78/10 Add. 1-5, second draft.

Anderson, James R., Ernest E. Hardy, John T. Roach and Richard E. Witmer Geological Survey Professional Paper 9U4, "A Land Use and Land Cover Classification System for Use with Remote Sensor Data," United States Government Printing Office, Washington 1976.

Arminger, W.H., Jones, J.N. and Bennett, O.L., "Revegetation of Land Disturbed by Strip Mining of Coal in Appalachia," U.S. Department of Agriculture, Agricultural Research Service, August 1976.

Asian Regional Workshop on Environmental Training of Practising Civil Engineer. Faculty of Engineering, University of Malaya, Kuala Lumpur, 12-23 May 1975. Final Report UNESCO, 1975.

Aviation Week and Space Technology October 17, 1977, Vol 107, No. 16 McGraw-Hill, Incorporated, New York 1977.

Bergquist, Wenonah E., Ralph L. Miller, Anne Lucas Falk and Jane A. Tyskowki Geological Survey Circular 771 "Worldwide Directory of National Earthsciences Agencies," U.S. Geological Survey, Virginia 1978.

Berry, E., Hays, C., Scott, E., "Workshops in Environmental Investigation: Techniques and Procedures for Project Development Case Study No. 2 "Onchocerciasis Clearance in West Africa with Special Reference to Upper Volta." Program for International Development, Clark University, Worcester, Massachusetts February, 1978.

Berry, L., Ford, R., Katz, C., Renwick, H. "Workshops in Environmental Investigation: Techniques and Procedures for Project Development. Overview No. 1. African Overview." Program for International Development, Clark University, Worcester, Massachusetts February 1978.

Bhuiyan, S.I., A.C. Early, R.W. Herdt, J.C. Flinn "Irrigation Water Management," Annual Program Review January 26, 1979.

Brew, David A. Geological Survey Circular 695 "Environmental Impact Analysis: The Example of the Proposed Trans-Alaska Pipeline," U.S. Geological Survey, Virginia, 1974.

Busterud, J. IIASA and the Policy Maker: Integrating the Research Function into Decision Making. Resolve, Palo Alto, California, July 1977.

Castro, Ruby Uy, "IRRI Research Paper Series No. 9 Zinc Deficiency in Rice: A Review of Research at the International Rice Research Institute," The International Rice Research Institute, Philippines August 1977.

Dames and Moore Engineering Bulletin, Remote Sensing Environmental and Geotechnical Applications, Robert M. Perry (ed.) Executive Offices Suite, Los Angeles, California August 1974.

"The Environmental Context of Development: An Analysis of National Environmental Situations and Persistent Problems in Eastern and Southern African Nations." Program for International Development, Clark University, Worcester, Massachusetts 1977.

"The Environmental Context of Development in Tanzania: A Map of Environmental Pressure Points." Program for International Development, Clark University, Worcester, Massachusetts February 1977.

"The EROS Data Center," U.S. Department of the Interior/Geological Survey U.S. Government Printing Office, 1978. 261-226/39.

"The EROS Program," U.S. Department of the Interior/Geological Survey, U.S. Government Printing Office, 1978. 261-226/54.

"Final Report of the 208 Islandwide Project, A Water Quality Management Plan for the Island of Puerto Rico." October 1978 (draft) Environmental Quality Board, Commonwealth of Puerto Rico.

First Session of the Interdisciplinary Working Group on Environmental Aspects of Engineering and Training. Paris, 1-5 September, 1975. Final Report, Paris, Unesco, December 5, 1975.

Forrester, Frank, "Satellite Image Map of Yemen Published," Department of the Interior News Release, January 10, 1979.

Geological Survey Professional Paper 1050 "Geological Survey Research 1977," United States Government Printing Office, Washington, D.C. 1977.

"Geological Survey Professional Paper 929 ERTS-1 A New Window on Our Planet," U.S. Government Printing Office, 1976. 211-345/93.

Golley, Frank B., and Medina, Ernesto Tropical Ecological Systems-Trends in Terrestrial and Aquatic Research, Ecological Studies, Vol 11, New York: Springer-Verlag, 1975.

Hanson, Arthur J., Case Studies on Environmental Assessment of Foreign Donor-Supported Projects in Indonesia, paper prepared for the Planning Workshop on Environmental Dimensions of Development Financing, (Hawaii: East-West Environment and Policy Institute, May 1978).

Hanson, Arthur J., "Transmigration for Marginal Land Development," paper to be published in G. Hansen (ed.) Agricultural and Rural Changes in Indonesia.

Hays, Charles W., Berry, Leonard, Ford, Richard. "Recommendations on Procedures for Environmental Assessment of Malaria Control Programs with Special Reference to Pakistan." Clark University, Worcester, Massachusetts 1978.

Health Overview. Program for International Development, Clark University, Worcester, Massachusetts January 1979.

Hilliker, C., Ford, R., Berry, L., Roever, C., "Workshops in Environmental Investigation: Techniques and Procedures for Project Development. Resource Paper No. 1 Resource Materials and Information Systems for Assessment of Local Environmental Impact." Program for International Development, Clark University, Worcester, Massachusetts February 1978.

Holdcroft, Lane E., "The Rise and Fall of Community Development in Developing Countries, 1950-65: A Critical Analysis and an Annotated Bibliography," MSU Rural Development Paper No. 2 ibid.

Interim and Report. "Workshop on Techniques of Environmental Assessment." 19 February-3 March 1978. Worcester, Massachusetts: Clark University - Program for International Development, April 1978.

Inquiry Form: Geographic Computer Search, U.S. Department of the Interior/Geological Survey. Form 9-1936, January 1977.

International Conference on the Education and Training of Engineers and Higher Technicians. New Delhi, 20-26 April, 1976. Final Report, Paris, Unesco.

"12th and 13th International Remote Sensing Workshops," U.S. Department of the Interior/Geological Survey, EROS Data Center, Sioux Falls, South Dakota 1979.

"IRRI Research Paper Series No. 3 Biological Nitrogen Fixation in Paddyfield Studied by Insitu Acetylene-Reduction Assays" I. Wantanabe, K.K. Lee, B.V. Alimagno, M. Sato, D.C. del Rosario, G.M.R. de Guzman, The International Rice Research Institute, Philippines January 1977. (xerox)

Investments in Large Scale Infrastructure: In Search of Policy. Preliminary draft, Seminar Discussion Paper, Stanford, California: Food Research Institute, August 23, 1978.

Johnson, D., O'Keefe, P. "Workshops in Environmental Investigation: Techniques and Procedures for Project Development. Overview No. 3. Overview of Physical and Socio-economic Environmental Situations in North Africa." Program for International Development, Clark University, Worcester, Massachusetts February 1978.

Kajosaari, Professor Eero. Improving Environmental Awareness and Competence of Engineers. Second Session of the International Multidisciplinary Working Group of Environmental Education and Training of Engineers, Caracus, Venezuela, 19-23 September, 1977. Paris: Unesco/Unep, September 1977.

Khan, Akhter Hameed. "Ten Decades of Rural Development: Lessons from India," MSU Rural Development Paper No. 1 Michigan State University, East Lansing, Michigan 1978.

Khush, Gurdev, S., "Breeding for Resistance in Rice," Reprinted from Annals of the New York Academy of Sciences, Vol 287, pages 296-308, February 25, 1977.

Kuswata Karrawinata, Andrew P. Vayda, R. Sambas Wirakusumah. "East Kalimantian and the Man and Biosphere Program" (unpublished manuscript).

Lewis, L., Amundsen, M., Townshend, J., "Workshops in Environmental Investigations: Techniques and Procedures for Project Development. Case Study No. 1. Feeder Roads in the Caribbean: A Case Study from Belize." Program for International Development, Clark University, Worcester, Massachusetts May 1978.

Lins, Dr. J.T., "International Trade Aspects of Environmental Management" (Delivered at the Environmental Economics Symposium, Yeravan, U.S.S.R., October 16-October 24, 1977).

Lees, Martin. The United Nations Conference on Science and Technology for Development in the Wider Perspective of North-South Relations. A paper prepared for those concerned with the preparation for the 1979 U.N. Conference on Science and Technology for Development, 1978.

Leopold, Luna B., Frank E. Clarke. Bruce B. Hanshaw, and James R. Balsley. Geological Survey Circular 645 "A Procedure for Evaluating Environmental Impact," U.S. Geological Survey, Virginia 1971.

Livermore, D., Boyd, J., McNamara, K., Roosevelt, A. Rare II Methodology Report. Resolve: Palo Alto, California, 1978.

MacCuaig, R.D., Radiometric Estimation of Blood Cholinesterase Levels in Domestic Animals. Technical Report No. 63, Addis Ababa, Ethiopia: Desert Locust Control Organization for Eastern Africa, April, 1975.

Management of Natural Resources in Africa: traditional strategies and modern decision-making. MAB Technical Notes 9, prepared in cooperation with UNEP Paris: UNESCO, 1978.

Meeting of Experts on Environmental Aspects of Engineering Education and Training. Paris, 17-21 June 1974. Final Report. Paris: Unesco, October, 1974.

National Research Council. Paper on "International Environmental Program Committee." Commission on Natural Resources, Environmental Studies Board, Washington: NAS, June 1976.

Natural Resource and Environmental Assessment for Development Planning and Assistance - Project Status Report. East-West Environment and Policy Institute, Honolulu: The East-West Center, January 1979.

Office of Technology Assessment. OTA Priorities: 1979. With Brief Descriptions of Priorities and of Assessments in Progress, OTA/Congress of the United States, Washington, D.C. 1979.

O'Keefe, Philip.,"Woodfuel and Energy in Eastern Africa" Program for International Development, Clark University, Worcester, Massachusetts, 1978.

"An Open/Environmental University for Spanish Speaking Nations," Atmospheric Environment, Vol 12, pages 1577-1580. Henry Woalers. (xerox)

Ponnamperuma, F.N. "IRRI Research Paper Series No. 2 Specific Soil Chemical Characteristics for Rice Production in Asia" The International Rice Research Institute: Philippines December, 1976.

Ponnamperuma, F.N. "IRRI Research Paper Series No. 6 Screening Rice for Tolerance to Mineral Stresses, The International Rice Research Institute: Philippines March 1977.

Ponnamperuma, F.N. "IRRI Research Paper Series No. 8 Behavior of Minor Elements in Paddy Soils," The International Rice Research Institute: Philippines May 1977.

"Recommendations for a System to Monitor Critical Indicators in Areas Prone to Desertification." Program for International Development, Clark University, Worcester, Massachusetts 1977.

"Remote Sensing and Advanced Techniques." Reprinted from Geological Survey Professional Paper 1050 "Geological Survey Research 1977."

Report of the Aseaa Experts Meeting on the Environment. Jakarta, 18-20 December, 1978.

The Sahel Development Program - Progress and Constraints. General Accounting Office, Government Printing Office, Washington, D.C. March 1978.

Science and Technology for Resources Development in Indonesia (1979/1980 - 1983/1984) Jakarta: Indonesian Institute of Sciences, October 7, 1977.

Scientific Committee on Problems of the Environment. SCOPE 5 Paris: International Council of Scientific Unions, July 1977.

Scientific Committee on Problems of the Environment SCOPE Newsletter No. 3 Paris: ICSU, 1978.

Second Draft of a World Conservation Strategy. General Assembly Paper GA. 78/9 Morges, Switzerland: IUCN-UNEP-WWF, July 1978.

Second Session of the International Multidisciplinary Working Group of Environmental Education and Training of Engineers, - Caracas, Venezuela, 19-23 September, 1977. Final Report, Paris: Unesco, March 30, 1976.

Shane, Jeffrey N., "Coastal Management Legislation in Sri Lanka," UNEP, Bangkok, Thailand 1978.

Shane, Jeffrey N., "Environmental Law and Technical Cooperation: Agenda for Asia and the Pacific," ESCAP/UNEP: Bangkok, Thailand 1977.

Shane, J.N. Environmental Law in Thailand. Project Working paper. Thailand: U.N. Task Force on Human Environment, November, 1977.

Shane, Jeffrey N., "Legal Aspects of Environmental Management in Malaysia," United Nations Task Force on Human Environment: Bangkok, Thailand, January 1977.

Steinlin, Dr. H.J. (1977) "Outline of a Global UNEP Programme: United Nations Environment Programme," Division 2/Consultants/2, Na. 77-1245.

"Studying the Earth from Space," U.S. Department of the Interior/Geological Survey, U.S. Government Printing Office 1977. 0-236-460

"Summary Report (Agronomic Result with Economic Analysis) on The First and Second International Trials on Nitrogen Fertilizer Efficiency in Rice (1975-1977)," The International Rice Research Institute: Philippines April 1978. (revised June 1978)

Survey of the Natural Resources, Vieques 1972, Commonwealth of Puerto Rico/Office of the Governor, Environmental Quality Board.

Townshend, J. "Workshops in Environmental Investigation: Techniques and Procedures for Project Development. Resource Paper No. 2 The Use of Remote Sensing Methods in the Assessment of Environmental Impact." Program for International Development, Clark University, Worcester, Massachusetts May 1978.

Townshend, Jan, Townshend, John. "Workshops in Environmental Investigation: Techniques and Procedures for Project Development." Overview No. 2 Overview of Physical and Socio-economic Environmental Situations in Latin America." Program for International Development, Clark University, Worcester, Massachusetts January 1978.

U.S. Department of the Interior Fish and Wildlife Service, Publications of the Biological Services Program (Washington: Government Printing Office, October 1978).

"United States Geological Survey Yearbook Fiscal Year 1977," U.S. Government Printing Office, Washington, D.C. 1977.

"U.S.-Mexico Consultation on Desertification -- Saltillo, Mexico, December 11-15, 1978," Bureau of Oceans and International Environmental Scientific Affairs, Department of State: Washington, D.C. December 1978.

Unpublished Research Abstracts October-December 1978, U.S. Department of the Interior, Geological Survey January 17, 1979.

The Uses of Mediation for International Environmental Disputes: A Program of Study and Implementation by Environmental Mediation International. Washington: Environmental Mediation International, 1978.

Valera, A. and T. Wickman "Management of Traditional and Improved Irrigation Systems: Some Findings from the Philippines," Paper presented in Choices in Irrigation Management Workshop sponsored by the Agricultural Administrative Unit of the Overseas Development Institute, Kent, Canterbury, England, September 27-October 1, 1976.

Watanabe, I., C.R. Espinas, N.S. Berja, B.V. Alimagno. "IRRI Research Paper Series No. 11 - Utilization of the Azolla-Anabaena Complex as a Nitrogen Fertilizer for Rice," The International Rice Research Institute: Philippines November 1977.

White, G.F. (ed.) "Environmental Effects of Arid Land Irrigation in Developing Countries," MAB Technical Notes 8, UNESCO: Paris 1978.

B. FORESTRY

"Announcement of a Conference on Forest Land Assessment and Management for Sustainable Uses," June 11-20, 1979 Honolulu, Hawaii, USA: Center for Cultural and Technical Interchange between East and West. (xerox)

"A Review of Forest and Rangeland Research Policies in the United States," The Renewable Natural Resources Foundation Washington, D.C. September 1977.

Arnold, J.E.M., Wood Energy and Rural Communities, paper prepared for the Eighth World Forestry Congress, Jakarta, Indonesia, 16-28 October 1978.

Bene, J.G., Beall, H.W., and Côté, A. (1977) Trees, Food and People: Land Management in the Tropics, International Development Research Center, Ottawa, Canada.

Clawson, Marion (1974), Forestry Policy for the Future - Conflict/Compromise/Consensus, Resources for the Future, Inc. Washington, D.C.

Description, functioning and evolution of tropical forest ecosystems: "Inventory and survey: international activities." pgs. 17-32.

Donaldson, Graham (1978) Forestry - Sector Policy Paper, World Bank, Washington, D.C.

Eckholm, Erik, The Other Energy Crisis: Firewood, Worldwatch Paper I, September 1975.

Eighth World Forestry Congress: Forestry Support for Agriculture through Watershed Management, Windbreaks and other Conservation Actions, Jakarta, Indonesia, 16-28 October 1978.

International Council for Research in Agroforestry (ICRAF): Background, Formation, and Progress to Date, Progress Report, June 5, 1978.

Kunkle, Samuel H., Forestry Support for Agriculture through Watershed Management, Windbreaks, and other Conservation Actions, paper prepared for 8th World Forestry Congress, Jakarta, Indonesia, 16-28 October 1978.

McGuire, John R. (1978) More from Our Forested Resources - 1977 Research Accomplishments, Forest Service U.S. Department of Agriculture.

Myers, Norman, New Scientist: "Forests for People" 21-28 December 1978.

"National Program of Research for Forests and Associated Rangelands," A Joint Task Force of U.S. Department of Agriculture and National Association of State Universities and Land Grant Colleges, August 1978.

Ibid. Proceedings of a National Working Conference, January 17-19, 1978 Washington, D.C.

NRDC Tropical Moist Forests Conservation Bulletin. Cynthia Mackie, editor. Issued by: International Project Natural Resources Defense Council, Washington, D.C., Number 1, May 1978.

Parham, Walter, Forests for People, paper prepared for the 8th World Forestry Congress, Jakarta, Indonesia, 16-28 October 1978.

Poore, Duncan and Allaby, Michael, Tropical Rain Forests and Moist Deciduous Forests, paper for IUCN.

"Program for Research for Forests and Associated Rangelands," Southern Region, A Joint Task Force of U.S. Department of Agriculture and National Association of State Universities and Land Grant Colleges, General Technical Report 50-19.

Ibid. General Technical Report NE-42.

Ibid. North Central Region.

Ibid. Western Region.

Proceeding of Conference on Improved Utilization of Tropical Forests. Issued by: Forest Products Laboratory/Forest Service, U.S. Department of Agriculture. Washington: Government Printing Office, 1978.

Shane, Douglas R (1978) Tropical Deforestation, U.S. Department of State, Washington, D.C.

Sinden, J.A., Evaluation and Analysis of the Environmental Impacts of Forestry, position paper, Agenda Item 25, Jakarta, Indonesia, 16-28 October 1978, prepared for the Eighth World Forestry Congress.

Teller, H.L., Guidelines for Watershed Management: Environmental Impact Analysis and Forestry Activities, Rome, 1977.

Tropical Forest Ecosystems. A State-of-Knowledge report prepared by Unesco/UNEP/FAO, Paris 2 United Nations Educational, Scientific and Cultural Organization, 1978.

Viewpoints July-August 1978 "Managing the Forest Resource," International Paper Company.

Weber, Fred R. (1977) Reforestation in Arid Lands, VITA/ACTION, Washington, D.C.

C. COASTAL ZONE MANAGEMENT

"A Conceptual Scheme for Marine and Coastal Environment Studies," Maura Geens Tyrrell and Robert W. Stegner, Coastal/Oceanic Awareness Studies, University of Delaware.

Agency for International Development, "PID: Approved Utilization and Management of LDC Coastal Zone Resources," PS/DT RDA 20: 1979.

"A Report for the Year 1977," The Conservation Foundation: Washington, D.C. 1977.

A Water Quality Management Plan for the Island of Puerto Rico. Final Report of the 208 Islandwide Project. Issued by Environmental Quality Board/Commonwealth of Puerto Rico, October 1978.

Barber, Carlos M. Jiménez, Estado Libre Asociado de Puerto Rico Oficina del Gobernador Junta de Calidad Ambiental: "Efectos del Control de la Calidad Ambiental Sobre el Desarrollo Económico," 30 de enero de 1974.

C.B.C.E.S. Report of the Chesapeake Bay Center for Environmental Studies, July 1, 1975 through September 30, 1976. From Smithsonian Year, 1976.

C.B.C.E.S. Report of the Chesapeake Bay Center for Environmental Studies, October 1, 1976 through September 30, 1977. From Smithsonian Year, 1977.

"Chesapeake Bay Center for Environmental Studies," Smithsonian Institute (Pamphlet).

Clark, John, "Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone." Washington: The Conservation Foundation, 1974.

Coastal Facility Guidelines Working paper by the National Oceanic and Atmospheric Administration, Office of Coastal Zone Management. Washington: U.S. Department of Commerce, August 1976.

Coastal Management Aspects of OCS Oil and Gas Developments. A technical information paper by the National Oceanic and Atmospheric Administration's Office of Coastal Zone Management. Rockville: U.S. Department of Commerce, 1975.

"Coast and Bay Bylines" Maryland's Coastal Resources Management Publication, Annapolis, Maryland: December-January 1977-78.

Correll, David L. Estuarine Productivity. Chesapeake Bay Center for Environmental Studies, Smithsonian Institution. Edge Water, Maryland: American Institute of Biological Sciences, 1978.

Correll, David L., Pierce, Jack W. and Wu, Tung L. "Herbicides and Submerged Plants in Chesapeake Bay." Proc. Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone Management. San Francisco: ASCE, March 14-16, 1978.

Correll, David L., Pierce, Jack W. and Wu, Tung L. "Studies of the Transport of Atrazine and Alachlor from Minimum Till Corn Fields into Chesapeake Bay Tidal Waters" Proc. Northeastern U.S. Weed Science Society Conference. New York City, January 1978.

Current Focus "Coastal Zone Management Program." Washington: League of Women Voters Education Fund, April 1975.

"Engineering and Construction Guidelines for Applicants," Federal Register, Department of Commerce, National Oceanic and Atmospheric Administration, Coastal Energy Impact Program, Part III, (December 1977).

"Environmental Comment." Coastal Zone Management, the Urban Land Institute: Washington, D.C. November 1976.

Evans, Edward D. Jr. Legal Aspects of Tidal Boundaries of the Coastal Zone, Office of General Counsel, NOAA. Rockville, Maryland: Department of Commerce, May 1975.

Field, Ralph M. and Associates, Inc. "Coastal Zone Planning for Ocean Islands," Westport, Connecticut: June 1976.

Field, Ralph M. and Associates, Inc. "Some Potential Problems of American Samoa's Participation in the Coastal Zone Management Program." Prepared for U.S. Department of Commerce, NOAA Office of Coastal Zone Management. Westport, Connecticut 1978.

Gillman, Katherine. A report by the Council on Environmental Quality, "Oil and Gas in Coastal Lands and Waters," (April 1977).

Goldsmith, Victor and Abraham Golik, The Israeli Wave Climate and Longshore Sediment Transport Model, Geological Department Report No. 78/1, Israel Oceanographic and Limnological Research: Haifa, Israel, June 1978.

Hanson, Arthur J. and Koesoebiono, Settling Coastal Swamplands in Sumatra: A Case Study for Integrated Resource Management, (Indonesia Bogor Agricultural University, 1977).

Hull, Wesley V. and Thurlow, Carroll I., Tidal Datums and Mapping Tidal Boundaries, National Ocean Survey, NOAA. Rockville, Maryland: Department of Commerce, April 1975.

Inland Boundaries of a State's Coastal Zone, Office of Coastal Zone Management, NOAA, Rockville, Maryland: Department of Commerce, May 1975.

Living Coastal Resources - A Coastal Zone Management Technical Assistance Document prepared by: U.S. Department of Commerce: NOAA - National Marine Fisheries Service and U.S. Department of Interior: U.S. Fish and Wildlife Service. Washington: U.S. Department of Commerce: NOAA - Office of Coastal Zone Management, July 1976.

Managing the Coastal Zone. Publications from The Conservation Foundation, Washington, D.C. 1978.

"Marine Social Studies Project" University of Hawaii at Manoa, Cirriculum Research and Development Group, Honolulu, Hawaii.

Mediterranean Action Plan. Mediterranean Action Plan and the Final Act of the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea, United Nations Environment Programme, New York, 1978.

"Proceedings: A Citizen's Workshop on Coastal Management," October 9-12, 1977 Twin Bridges Marriott, Washington, D.C. Sierra Club: 1977.

"Proceedings of the Conference on Organizing and Managing the Coastal Zone," June 13-14, 1973, U.S. Naval Academy, Annapolis, Maryland, Council of State Governments, Office of State-Federal Relations, Washington, D.C.

Project Coast. University of Delaware, College of Marine Studies and College of Education, (July 1, 1977).

"Public Law 94-370," (The Coastal Zone Management Act). 94th Congress, S.586, July 26, 1976.

Puerto Rico Coastal Management Program and Final Environmental Impact Statement, A report prepared by NOAA: Office of Coastal Zone Management and Commonwealth of Puerto Rico: Department of Natural Resources/Puerto Rico Planning Board. Washington: U.S. Department of Commerce, 1978.

Ray, G. Carleton, "A Preliminary Classification of Coastal and Marine Environments," *International Union for Conservation of Nature and Natural Resources: Morges, Switzerland, 1975. *IUCN Occasional Paper No. 14.

Ray, G. Carleton, "Session 2: Working Paper No. 1: Critical Marine Habitats," The John Hopkins University: Baltimore, Maryland, 1975.

Realisation du Ministere de la Qualite de la Vie. "10 Points to the Blue Plan," In Collaboration avec le Programme des Nations-Unies Pour L'environnement. France, 1976.

Regional Seas Programme Activity Center, UNEP, "The Siren," No. 1, June 1978, UNEP, Switzerland.

Sea Grant. A listing of Sea Grant Projects by Institution as of October 1, 1978. U.S. Department of Commerce, NOAA.

"State Coastal Management Programs" Development and Approval, Part II Department of Commerce, National Oceanic and Atmospheric Administration (March 8, 1978).

Szekielda, Karl-Heinz and Breuer, Bernd. (1976) Development and Management of Resources of Coastal Areas, United Nations/German Foundation for International Development, New York.

United Nations Economic and Social Council. Progress Report of the Secretary-General: "Coastal Area Development and Management and Marine and Coastal Technology," UN, New York, 1977.

United Nations Environment Programme. "Regional Seas Programme Documents," UNEP, Switzerland, 1978.

U.S. Department of Commerce, NOAA. Report to the Congress on Coastal Zone Management: July 1974 through June 1975. Public Law 92-583, Washington: Government Printing Office, 1976.

D. POLLUTION

Adkisson, P., Gutierrez, A., Harris, F., Reynolds, H., Smith, R., Watson, T., "A Special Report on Pest Management and Pesticide Management in the Arab Republic of Egypt," The University of California at Berkeley, California, October 1975.

"The Agromedical Approach to Pesticide Management," UC/AID Pest Management and Related Environmental Protection Project: Berkeley, California, January 1976.

Annex to the Report of the Director Quadrennial, 1974-77 Annual 1977 Project Activities, Official Document No. 158-A, WHO: Washington, D.C. 1978.

Boxer, B., "Mediterranean Action Plan: An Interim Evaluation," Science Vol. 202, 10 November 1978.

Caltagirone, L., Allen, M., Kaiser, N., Orsenigo, J., "The Crop Protection Situation in Guatemala, Honduras, Nicaragua, Costa Rica, Panama, and Guyana," University of California at Berkeley,; California October-November 1972.

Cavin, A., "Crop Protection in the Mediterranean Basin," The University of California at Berkeley; California September-October 1972.

Chaney, R.L., Brnick, S.B., and Simon P.W., "Heavy Metal Relationships During Land Utilization of Sewage Sludge in the Northeast," U.S. Department of Agriculture, Beltsville, Maryland.

Clean Air for Puerto Rico. Issued by the Commonwealth of Puerto Rico/Office of the Governor, Environmental Quality Board, January 197 .

Colacicco, D., Derr, D. and Kasper, V., "Major Cost Factors in Composting Sewage Sludge in Aerated Piles," U.S. Department of Agriculture, Beltsville, Maryland.

"A Cost Comparison of Sludge Composting with the Aerated Pile and Windrow Methods," from the 1977 National Conference on Composting of Municipal Residues and Sludges, August 23-25, 1977.

Davies, John. "International Survey on Pesticide Use," University of California at Berkeley; California, 1972.

Davies, J.E., Smith, R.F. and Freed, V. (1978) Agromedical Approach to Pesticide Management: Ann. Rev. Entomol., Vol 23, pp. 353-366.

Day, Boysie, "Pest Management and the Efficient Use and Safe Handling of Pesticides in South Vietnam," University of California at Berkeley; California, February-March, 1974.

Echandi, E., "Crop Protection in Brazil, Uruguay, Bolivia, Ecuador, and Dominican Republic," University of California at Berkeley, North Carolina State University at Raleigh; California, 1972.

"An Environmental and Economic Study of the Consequences of Pesticide Use in Central American Cotton Production." United Nations Environment Programme, Central American Research Institute for Industry Guatemala, March 1975.

Environmental Considerations for the Industrial Development Sector, World Bank, Washington, D.C. August 1978.

Epstein, Elliot., "Composting Sewage Sludge at Beltsville, Maryland, "Proceedings of the Conference on Land Application of Residual Materials, Easton, Maryland, September 26-October 1, 1976.

Epstein, E., Willson, G.B., Burge, W.D., Mullen, D.C., and Enkiri, N.K., "A Forced Aeration System for Composting Wastewater Sludge," Journal Water Pollution Control, Vol 48, No 4, April 1976.

Epstein, E. and Willson, G.B., "Composting Sewage Sludge," Proceeding of the National Conference on Municipal Sludge Management June 11-13, 1974.

Farvar, M., Milton, J. (eds.) "The Unforeseen International Ecologic Boomerang: The Ecological Aspects of International Development Programs," Natural History Special Supplement, Warrenton, Virginia, 1968.

Glass, E. "Plant Protection Problems in Southeast Asia," The University of California at Berkeley; California October-November, 1971.

"Implications of Pesticide Use for Tropical Freshwater and Terrestrial Ecosystems." Center for Overseas Pest Research February 1975.

"Industrial Production and Formulation on Pesticides in Developing Countries." Vol I United Nations Industrial Development Organization, Vienna, 1972.

"Infiltration Control Research," U.S. Department of Agriculture, Southwest Watershed Research Center, Arizona 1979 (update).

Informal Dialogue on Pesticides. Industry Cooperative Programme, FAO, Rome October, 1977.

Khush, Gurdev S., Tropical Agriculture Research Series No. 11 "Breeding Methods and Procedures Employed at IRRI for Developing Rice Germ Plasm with Multiple Resistance to Diseases and Insects," Tropical Agriculture Research Center, Ministry of Agriculture and Forestry, Japan March, 1978.

Koehler, C., Wilcoxson, R., Mai, W., Zimdahl, R. "Plant Protection in Turkey, Iran, Afghanistan, and Pakistan," University of California at Berkeley; California September-October, 1972.

Lehr, Lewis W., (1977) Pollution Prevention Pays, 3M Company, St. Paul, Minnesota.

Ling, Dr. J.T., "Non-Waste Technology, The 3M Case," (Paper delivered at the International Environmental Management Seminar, St. Paul, Minnesota, January 30-February 10, 1978).

"Management of Pesticides and Protection of the Environment: A Report on the Seminar," University of California at Berkeley; California 1973.

Oregon State University, Environmental Health Sciences Center. An annual progress report prepared by the National Institute of Environmental Health Sciences Grants. October 1, 1978.

Parr, J.F., Epstein, E. and Willson, G.B., "Composting Sewage Sludge for Land Application," Agriculture and Environment Vol 4, 1978, Elseview Scientific Publishing Company, Amsterdam.

Parr, J.F., Willson, G.B., Chaney, R.L., Sikora, L.J. and Tester, C.F., "Effect of Certain Chemical and Physical Factors on the Composting Process and Product Quality," Science and Education Administration, U.S. Department of Agriculture 1978.

Pesticide Manual. Rumker, R. Von, Horay, F., Department of State, U.S. Agency for International Development, Washington, D.C. August 1972.

"Pesticides in the Modern World," A Symposium prepared by members of the Cooperative Programme of Agro-Allied Industries, FAO, and other United Nations Organizations, 1972.

"Pesticide Poisoning 'Alarming' says FAO," Christian Science Monitor, February 1978.

"Policy Issues on Appropriate Pesticide Technology." Penna, Frank, The Policy Sciences Center, Inc., New York March 1978.

"Proceedings of the UC/AID - University of Alexandria, A.R.E. Seminar/Workshop in Pesticide Management" University of California/AID Pest Management and Related Environmental Protection Project, California September 1977.

Proposed Solid Waste Management Authority. Prepared by the Environmental Quality Board of the Commonwealth of Puerto Rico.

"Report of the Ad Hoc Government Consultation on Pesticides in Agriculture and Public Health," FAO, Rome 1975.

"Report of the Sahel Crop Pest Management Conference," Ray F. Smith and David E. Schlegel, Rapporteurs, University of California at Berkeley, California 1974.

"A Report on Seminar and Workshop in Pesticide Management," University of California at Berkeley, California 1975.

"Restrictions on Using More Fertilizer for Food Crops in Developing Countries." General Accounting Office, Government Printing Office, Washington, D.C. July 1977.

Rybczynski, W., Polprasert, C., McGarry, M., International Development Research Center, Ottawa, Canada 1978.

Series on Water Pollution Control: No. 8, "Aerated-Pile Composting: a Promising New Alternative for Disposing of Sewage Sludge," Civil Engineering-ASCE, September 1978.

Comprehensive Solid Waste Management Plan for Puerto Rico. Prepared by Environmental Quality Board and the Department of Health of the Commonwealth of Puerto Rico.

Ten Year Construction Program for Waste Water Treatment Facilities. Issued by the Commonwealth of Puerto Rico, Office of the Governor, Environmental Quality Board, April 30, 1971.

U.S. Department of Agriculture, "From Waste to Resource: Composting Sewage Sludge," Agricultural Research Service, March, 1976.

Wilcoxson, R., Ali Niazee, M., Dresner, E., Hedlund, G., Maxwell, R. "Plant Protection in Bangladesh," The University of California at Berkeley, California October-November 1975.

Willson, G.B., Epstein, E., and Parr, J.P., "Recent Advances in Compost Technology," Proceeding of 3rd National Conference on Sludge Management and Disposal Utilization December 1979.

"WHO Offset Publication No. 41 Air Quality in Selected Urban Areas 1975-1978," World Health Organization, Geneva 1978.

"World Food, Pest Losses, and the Environment" David Pimentel, (ed.), Westview Press, Incorporated, USA 1978.

Yates, W., Maxwell, R., David, J. "Analysis of Pesticide Use in Pakistan," The University of California at Berkeley, California July-August 1974.

"Weed Science in the Developing Countries of the World," University of California at Berkeley for the US-AID, California 1973.

APPENDIX I

ENVIRONMENTAL PLANNING AND RESOURCE MANAGEMENT

OUTLINE

A. Institutions

B. Conferences

C. Review of Recent Research

APPENDIX I

ENVIRONMENTAL PLANNING AND RESOURCE MANAGEMENT

A Review of previous work, conferences, and institutions

A. Institutions

Our search for institutions working in the area of environmental planning and resource analysis determined that very few national or international institutions work directly on this topic. However, a large number of organizations, both within developing country governments and in the United Nations and other international networks, work in areas which are directly related both to planning and resource analysis. The first cluster are those institutions concerned with agricultural research, monitoring, planning, and analysis. These centers include:

1. IRRI (International Rice Research Institute), Los Banos, Philippines. Rice under irrigation; multiple cropping systems; upland rice.

2. CIMMYT (International Center for the Improvement of Maize and Wheat), El Batan, Mexico. Wheat and maize research.

3. CIAT (International Center for Tropical Agriculture), Palmira, Colombia. Beef, cassava, field beans, farming systems, and other livestock.

4. IITA (International Institute of Tropical Agriculture), Ibadan, Nigeria. Research on farming systems, cereals, grain, legumes, and tubers.

5. CIP (International Potato Center), Lima, Peru. Potatoe research.

6. ICRISAT (International Crops Research Institute for Semi-Arid Tropics), Hyderabad, India. Research in sorghum, millet, peas, and farming systems.

7. ILRAD (International Laboratory for Research on Animal Disease), Nairobi, Kenya. Detailed research on trypanosomiasis.

8. ILCA (International Livestock Center for Africa), Addis Ababa, Ethiopia. Research in livestock production systems.

9. IBPGR (International Board for Plant Genetic Resources), FAO, Rome, Italy. Conservation of plant genetic material with special reference to cereals.

10. WARDA (West African Rice Development Association), Monrovia, Liberia. Regional cooperative activities for adaptation of rice growing methods.

11. ICARDA (International Center for Agricultural Research in Dry Areas), Lebanon. Concerned with dissemination of farming and resource management techniques.

A second group of institutions are supported by the United Nations or UN affiliate organizations and are concerned with larger resource questions. These include:

1. Man and the Biosphere (MAB)

   UNESCO
   Paris, France

   In co-operation with UNEP, MAB has prepared a document entitled: Management of Natural Resources in Africa: Traditional Strategies and Modern Decision-Making. (MAB Technical Notes 9, 1978, published by UNESCO). This document contains three topics of research: 1) Sudan-Sahel Zone; 2) Sudan African Zone; and 3) Forest and Pre-Forest Zone. It provides a study of specific cultural values which each society associates with its survival. It also identifies the relative independence of man with respect to the natural environment as a crucial factor to be taken into account by decision-makers.

2. Scientific Committee on Problems of the Environment (SCOPE)

   SCOPE's mandate is to assemble, review, and assess the information available on man-made environmental changes and the effects if these changes on man; to assess and evaluate the methodologies of measurement of environmental parameters; to provide an intelligence service on current research; and by the recruitment of the best available scientific information and constructive thinking to establish itself as a corpus of informed advice

for the benefit of centres of fundamental research and of organizations and agencies operationally engaged in studies of the environment.

3. United Nations Environment Program (UNEP)

Nairobi, Kenya

Created as a result of the World Environmental Conference in Stockholm (1972), UNEP serves to coordinate all United Nations environmental planning and resource management activities. Of particular interest within UNEP is GEMS (Global Environmental Monitoring System) which is responsible for coordination of all monitoring activities. Additional monitoring institutions are listed below.

In addition, two United States-based institutions of special note are:

1. International Environmental Programs Committee (IEPC)

IEPC is a Committee of the Environmental Studies Board of the United States Commission on Natural Resources. It was established in 1969 and provides interdisciplinary advice regarding appropriate solutions for international environmental problems and assistance in formulating US initiatives at international conferences. IEPC has completed studies which comprise the following reports: Institutional Arrangements for International Environmental Cooperation (submitted to the Department of State, 1972, National Academy of Sciences, Washington, D.C.); Man, Materials and the Environment, (submitted to the National Commission on Materials Policy, 1973, MIT Press, Cambridge, MA.; and Early Action on the Global Environmental Monitoring System, (1976, National Academy of Sciences, Washington, D.C. Other IPEC activities include the following: Biogeochemical Cycles Research, Dynamic Changes and Evolution of Ecosystems, Environmental Aspects of Human Settlements, and Ecotoxicology.

2. Environmental Mediation International: The Uses of Mediation for International Environmental Disputes - A Program of Study and Implementation. (EMI)

Washington, D.C.

Environmental Mediation International is a newly formed organization which undertakes an examination of basic principles of conduct by nations, companies, and groups as part of the increasing awareness of the impact of many environmental problems.

Special mention should also be made of resources which exist within individual countries. Nearly every nation has a ministry or at least agency responsible for mapping and surveys. These organizations, in varying degrees of completeness, have undertaken geological mapping, land use mapping, topographic mapping, and suitability mapping for various resource uses. These materials are available and are of fundamental need for any resource planning and monitoring system. In addition, those countries with particular resources in minerals, timber, or related products of commercial value are usually well supplied with detailed maps of those products. Moreover, many private corporations have conducted surveys which are sometimes available to the government.

In addition to these several institutional sources, a number of organizations assist in monitoring the resource base. In addition to UNEP's GEMS system, other regional and international monitoring systems include:

1. World Weather Watch

   Coordinated by the World Meteorological Organization in Geneva (WMO) WWW consists of three sub-components which are (a) global observing system; (b) global telecommunications system, and (c) global data processing system. These three components collect and analyze data on weather and weather-related information through a world-wide network.

2. Weekly Weather/Crop Assessment

   The Environmental Data Service (EDS) of the United States National Oceanic and Atmospheric Administration (NOAA) publishes a weekly assessment of crop and weather information for the entire world. The information is compiled by the Center for Climatic and Environmental Assessment and is available to anyone who writes in.

3. Food and Agricultural Organization (FAO) Global Information and Early Warning System.

   During the food shortage of 1972/73 FAO implemented a food watch system. Weekly reports are sent to FAO

in Rome which then processes the data for regular monthly reports to participating countries. The system pays particular attention to issues of food shortages but also looks at special crop reports to anticipate possible short-fall in production.

4. Monitoring and Assessment Research Center (MARC)

Based in London, MARC is an international organization which works with UNEP to monitor environmental variables, worldwide. Recently completed studies have analyzed problems of desertification, climate stability, air-borne dust, and desert boundary movements.

5. National Environmental Satellite Service (NESS)

Organized by the U.S. National Oceanic and Atmospheric Administration (NOAA), NESS provides daily observations, world-wide, for cloud cover, vertical temperature, and humidity profiles. The service also anticipates storms and makes such information available to potentially affected countries.

6. Sahel Agrometeorology and Hydrology Network (AGRHYMET)

The Sahelian drought precipitated many programs and projects to provide better resource management. One of these, known as AGRHYMET, is designed to upgrade the regions weather and crop information systems in order to provide farmers and herdsmen with better information on when to plant, which crops to plant, when to cultivate, and when to harvest. Jointly sponsored by WMO, UNDP, and CILSS, the project is upgrading capabilities of 75 monitoring stations throughout the Sahel.

7. Kenya Rangeland Ecological Monitoring Unit (KREMU)

Jointly staffed by the Kenyan Ministry of Tourism and the Ministry of Agriculture, KREMU has devised systems to monitor arid and semi-arid rangeland conditions and resource situations in Kenya. Observations of rainfall, water availability, soil moisture, biomass, and rangeland condition are included in the network.

8. LANDSAT Network

Another important monitoring system for resource planning and management is remotely sensed imagery. The most comprehensive network is that of LANDSAT which has ground receiving capabilities throughout the developed world as well as stations either operational or in preparation in Brazil, Chile, Kenya,

Zaire, Upper Volta, and Iran (no recent information on the current situation in Iran).

B. Conferences

As with institutions, there have been few conferences which speak directly to the question of resource management and environmental planning. However, a number of meetings have worked on related themes. These include:

1. The basic Stockholm Conference on Problems of the Environment (1972).

2. 12th and 13th International Remote Sensing Workshops, Earth Resources Observation Systems Program (EROS), U.S. Department of the Interior Geological Survey, to be held April 30 - May 25, and September 10 - October 5, 1979. The use of remote sensing technology for Earth resources inventory and assessment is a valuable instrument for monitoring environmental problems such as desertification in the developing countries. Such techniques can provide information for land-use planning, gaging the environmental impact of construction, and for inventorying and managing natural resources.

3. United Nations Conference on Desertification, August-September, 1977.

   Held in Nairobi, the conference brought together representatives from roughly 100 nations concerned with the problem of desertification. A plan of action made a number of recommendations which included specific points for resource management, monitoring, and assessment. UNEP is coordinating the implementation of the plan of action.

4. Report of the ASEAN Experts Meeting on the Environment, Jakarta, 18-20 December, 1978. The purpose of the ASEAN meeting was to consider the proposed ASEAN Sub-regional Environment Program (ASEP) as well as other areas of cooperation among the ASEAN member countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand). Six working groups were set up at the meeting to discuss the following subjects: (1) Habitat, rural and urban development; (2) Environmental education; (3) Environmental planning and development; (4) Marine environment; (5) Social aspects of environmental development; and (6) Nature conservation. Important outcomes of the meeting are recommendations

made by each working group, and discussions of an appropriate mechanism for ASEAN environmental co-operation. The outcome of these discussions was an agreement to recommend the creation of a Sub-Committee on Environment under the ASEAN Committee on Science and Technology. A UNEP representative was also present at the meeting to discuss institutional cooperation.

5. United Nations Conference on Science and Technology for the Development in the Wider Perspective of North-South Relations.

   A conference is planned for August, 1979 in Vienna on the subject of transfer of science and technology. The immediate reference above is a paper written by Martin Lees in preparation for the meeting. Lees perceives two lines of development in order to strengthen and reorient research and development capacities in developing countries: (1) strengthen and reorient where necessary existing research and development centers and, (2) to improve cooperation between and among these centers.

C. Review of Recent Research

1. Irrigation Water Management Program, conducted by the International Rice Research Institute, Annual Program Review, 26 January 1979. This Program sets out the need for research in order to ascertain why existing irrigation systems are performing at a low level of efficiency and how this pattern could be changed. The research is basicly aimed at providing useful information on specific effects on yield of various water stress conditions in the farmer's field at the different inputs management levels, relationship of stress day concept used for quantifying water deficit conditions to measured soil moisture status, and the effect of different degrees of water stress on the seepage and percolation requirements in the field.

2. Project Status Report: Natural Resource and Environmental Assessment for Development Planning and Assistance. East-West Center, East-West Environment and Policy Institute, January, 1979. The Project deals with three elements: (1) policies and planning for economic development; (2) development activities that depend largely on natural systems; and (3) information about natural resources and the environment. As a result of the 1977 amendments to the U.S. Foreign Assistance Act which added

"environment and natural resources" to the list of factors for bilateral aid, more emphasis is on the formalization, intensification and extension of environmental assessments of the consequences of development projects. Among the first year project activities were: (i) planning workshop, May 1978; (ii) visiting fellows; (iii) study on sustained yield forestry and (iv) research papers on environmental aspects of energy sector development.

3. The Rise and Fall of Community Development in Developing Countries, 1950-65; A Critical Analysis and an Annotated Bibliography, by Lane E. Holdcroft, Department of Agricultural Economics, Michigan State University, 1978. This paper traces the rise and fall of community development within this time period and draws lessons for developing countries and donors interested in aiding the rural poor. Many of these lessons may be applied to environmental planning within a community/rural structure.

4. Ten Decades of Rural Development: Lessons from India, by Akhter Hameed Khan, Department of Agricultural Economics, Michigan State University. Professor Khan examines four major rural problems (famine, abuses of land tenure, peasant indebtedness, and rural disaffection and its remedy) and traces in an historical context models of rural development.

5. U.S. - Mexico Consultation on Desertification -- Saltillo, Mexico, December 11-15, 1978. This document emphasizes the environmental problem of desertification as presenting a threat to the economic and social well-being of large sectors of the population, in the United States and in Mexico. It stresses the need for policy development and program implementation so that desertification may be controlled effectively. Recommendations call for the formulation of National Plans to combat desertification, an expansion of cooperation in five major areas: (1) Soil and Water Conservation; (2) Watershed Management; (3) Management and Utilization of Native Flora and Fauna; (4) Desertification Indicators; and (5) Legislation on Utilization of Natural Resources.

6. Legal Aspects of Environmental Management in Malaysia, by Jeffrey N. Shane, Attorney, UN Task Force on Human Environment, January, 1977.
The author examines the constitutional basis for environmental management, discusses the gaps in Malaysia's current legal framework and the need for a legally enforceable environmental impact assessment requirement.

7. Science and Technology for Resources Development in Indonesia (1979/1980 - 1983/1984), prepared by Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences), Jakarta, October, 1977.
This paper consists of priority programmes dealing with the application of science and technology for resources development of Indonesia: (1) Inventory and evaluation of resources; (2) Earth Sciences; (3) Energy; (4) Ecosystem; (5) Food processing; (6) Materials processing; (7) Industrial components; and (8) Appropriate technology.

8. Second Draft of A World Conservation Strategy. Prepared by the International Union for Conservation of Nature and Natural Resources (IUCN), Switzerland, July, 1978.

9. A World Conservation Strategy, commissioned by the United Nations Environment Programme (UNEP), and also financially supported by the World Wildlife Fund (WWF), is intended to be read and implemented by governments, intergovernmental organizations both non-commercial and commercial. The goal of the Strategy is to achieve the conservation of the living natural resources on which human survival and well-being depend. Organizations such as UNEP, FAO, UNESCO and others may derive programmes from the Strategy which: 1) consist of high priority projects; 2) do not duplicate the programmes of other organizations; and 3) can be implemented in the context of complementary activities by other bodies. This complete study provides a framework for environmental assessment and management.

10. A Review of the Natural Resources of the African Continent, UNESCO, 1963.
This book describes the situation of scientific research into the environment and the natural resources of Africa.
Expertise was provided for the book from the following fields: topography and maps, geology and mineral resources, seismicity, climate and meteorology, hydrology and water resources, soils, flora, fauna, entomology, fresh water biology, and marine biology.

11. Natural Resources of Humid Tropical Asia, UNESCO, Paris, 1974.
This study was an outgrowth of the previous review completed by UNESCO of the natural resources of Africa. It is based on the premise that as the countries in humid tropical Asia develop and their needs expand, they will continue to be faced with problems relating to the rational utilization of natural resources. Thus, this study examines those natural resources,

provides a detailed inventory and summary of present knowledge. The book is complemented by bibliographies and lists of institutions, research centres and other sources of additional information. It also attempts to bring out the gaps in this knowledge with an insight to furthering economic and social development.

12. Institute of Current World Affairs: (1) Forestry developments in the Philippines; (2) Travels and Impressions of the Tropical Far East; and (3) A Visit to the International Timber Company Indonesia. Fall, 1978.
These three summary reports outline current developments within the developing countries of the Philippines, Indonesia, Malaysia, and Singapore. An interesting note is that the government of the Philippines initiated the Program for Forest Ecosystem Management (ProFEM) in July, 1976.

13. Environmental Law in Thailand by Jeffrey N. Shane, UN Task Force on Human Environment, November, 1977.
This project working paper details Thailand's environmental legislation and its interest in strengthening current government regulations.

14. Recommendations for a System to Monitor Critical Indicators in Areas Prone to Desertification, L. Berry and R. Ford, June, 1977.
A report prepared for the United States delegation to the UN Desertification Conference recommending a system of resource management and monitoring in semi-arid areas. The report contained recommendations for monitoring at local, regional, and international levels.

15. The Environmental Context of Development: An Analysis of National Environmental Situations and Persistent Problems in Eastern and Southern African Nations, Program for International Development, Clark University.
An analysis of environmental trends in seven countries in Eastern and Southern Africa, prepared by local institutions in those countries in collaboration with the International Development Program at Clark University. The report discusses environmental trends in these countries and addresses institutional means to work with amelioration of these trends.

16. Workshops in Environmental Investigation: Techniques and Procedures for Project Development, Program for International Development, Clark University, 1978.
Seven documents prepared as training materials to assist development project officers in techniques of sound environmental design for development planning.

17. Environmental and Natural Resource Management in Developing Countries: A Report to Congress, February, 1979. A comprehensive document describing the state of environmental issues and trends for Africa, Asia, Latin America, and the Near East. Information is included on specific problems as well as on institutional capabilities to deal with the issues. The report is intended to assist the Congress in formulation of longer range development policy vis a vis environmental issues.

18. Woodwell, G. M. et al. "The Biota and the World Carbon Budget," Science, January, 1978, Bol. 199, pp. 141-145. An important summary study which illustrates the significance of the terrestrial biomass in the carbon-dioxide budget and the importance of further intensified research on the global carbon cycle.

19. Adrien, P. M., and M. F. Baumgardner. "Landsat, Computers, and Development Projects," Science, November, 1977, Vol. 198, pp. 466-470. Summarizes the then current activity in the use of Landsat for development projects. The Inter-American Development Bank is supporting a resources inventory of five countries in Central America, involving interpretation of thrity-three Landsat images. The role of the data gathered in improving natural resource management is discussed.

20. Hemlin, C. L., and W. H. Goodenough. "Archiving Remotely Sensed Data," Science, editorial, October, 1978, Vol. 202, p. 9. Discusses issues of handling remotely sensed data and of declassifying valuable information.

21. Train, R. E. "The Environment Today," Science, July, 1978, Vol. 201, pp. 320-324. Summary emphasizes the inadequacy of scientific knowledge about environmental matters, even in the United States, but especially in the developing world. The author calls for a massive effort to redress the imbalance.

22. Brink, R. A., J. W. Densmore, and G. A. Hill. "Soil Deterioration and the Growing World Demand for Food," Science, August, 1977, Vol. 197, pp. 625-629. A study of five watersheds in Wisconsin that points to a general trend in the United States. In 70% of the sections sampled, soil losses were estimated to be more than twice the amount considered compatible with permanent agriculture. This article illustrates the nature of soil erosion, world-wide.

23. "Remote Sensing: I. Landsat takes hold in South America. II. Brazil explores its Amazon wilderness. III. The tools continue to improve." Science, April, 1977, Vol. 196, pp. 511-516. The three articles summarize the use of remote sensing for natural resource work in South America. They also analyze institutional problems and outline future prospects for the technology.

24. "Soil Erosion: The Problem Persists Despite the Billions Spent on it," Science, Vol. 196, pp. 409-411. Deals with United States conditions but illustrates the magnitude of the problem and the kind of new approaches which might be attempted. It is a useful piece for beginning to think about similar problems in the developing world.

25. National Academy of Science, Resource Sensing From Space: Prospects for Developing Countries, 1977. In this report, the matter of resource information and its use in developing countries is discussed. The report details the new technologies for earth resource sensing from space. Subsequent chapters test the usability of satellite data in various sectors of application and the improvements anticipated from from future technological advances. The prospects and problems of utilization of such data in developing countries is considered and the report concludes with recommendations that address certain policy issues and technical cooperation initiatives.

APPENDIX II

FORESTRY

A REVIEW OF PREVIOUS WORK, CONFERENCES AND INSTITUTIONS

OUTLINE

A. Institutions
   1. International
      a. United Nations Family
      b. Other
   2. Bilateral and National Programs and Institutions
      a. Developed World
      b. Latin America
      c. Africa
      d. Asia
   3. United States Universities

B. Conferences

C. Review of Recent Research

D. Example of Questions Which Have Not Received a Full and Detailed Analysis
   1. Technical
   2. Managerial

APPENDIX II

FORESTRY

A. Institutions

There are a number of multilateral and bilateral institutions that are directly or indirectly involved in forestry and land degradation analysis. These institutions fall into two main categories: (1) International; and (2) Bilateral and National. Many of the institutions assist in technical expertise, forestry management, and inventories as well as research and training programs. While some of the institutions have initiated collaborative work (i.e. The Brazilian Institute of Forestry Development is executing programs in cooperation with UNDP and FAO), there remains a large body of technological information which does not benefit from such international coordination and for which effective implementation and technology transfer is not achieved.

The purpose of this Appendix is to summarize the current institutional and state of research knowledge situation in world forestry. Given the short time available to prepare this report, the summary is obviously incomplete. However, we have attempted to review the major bilateral and multilateral institutions, important conferences, and published and unpublished reports. Moreover, the recently published, Tropical Forest Ecosystems: A State of Knowledge Report Prepared by UNESCO/UNEP/FAO, (1978) provides an excellent and comprehensive review of these issues.

1. International Institutions

a. United Nations Family

UNDP (United Nations Development Program)

FAO (Food and Agricultural Organization)

a. United Nations Family (continued)

UNESCO (United Nations Educational, Social and Cultural Organization)

UNEP (United Nations Environment Programme)

b. Other

IUCN/WWF (International Union for the Conservation of Nature and Natural Resources/ World Wildlife Fund)

ICSU (International Council for Scientific Unions)

ICRAF (International Council for Research in Agro-Forestry)

OAS/IIAS (Organization of American Studies/ Inter-American Institute of Agricultural Sciences)

ECNAMP (Eastern Caribbean Natural Area Management Program)

EAAFRO (East African Agriculture and Forestry Research Organization)

IUFRO (International Union of Forest Research Organizations)

World Bank

a. United Nations Family

(i) UNDP - United Nations Development Programme

UNDP is assisting the developing countries in technical expertise and expects to disburse $2.5 billion in technical aid in a period of four years (1977-81). Almost all of the forestry projects assisted by UNDP in the tropics are executed by the Food and Agricultural Organization.

(ii) FAO - Food and Agricultural Organization

FAO provides technical assistance and conducts applied research in several areas which contribute to sound management and conservation of tropical moist

forest, including the following:

(a) inventory and assessment of national forests, including satellite image interpretation;

(b) assistance and development and strengthening forest services and related institutions;

(c) research and development of village-level forestry schemes such as fuel wood plantation, agrosilviculture, and reforestation.

A new FAO policy is leading to more village-level schemes and attention to forestry. The following projects of FAO are of global interest:

(a) Forestry for Community Development;

(b) Tropical Forest Cover Monitoring Project;

(c) Regional Project for Latin America: Wildlife Management and Environmental Conservation. A UNDP/FAO Project.

Some of FAO's work in areas such as agro-forestry, parks, and reserves, has been important in the development of current thinking. But current levels of funding are much lower than that of 5-10 years ago.

(iii) UNESCO - United Nations Educational, Social, and Cultural Organization

While FAO is devoted primarily to development activities, UNESCO supports research and education worldwide.

UNESCO's Man and Biosphere Program (MAB) is an important relatively new program with components in the forestry field including: - Ecological effects of increasing human activities and sub-tropical forest ecosystems; and - Conservation of natural areas and the genetic material they contain.

In addition, UNESCO's State of knowledge report on tropical forest ecosystems (cited above) is published and describes the ecological processes and evolution of tropical rain forests.

Unfortunately, UNESCO programs to establish forest preserves are reported to be seriously underfunded and badly in need of national support (source: Tropical Deforestation, Proceedings of the U.S. Strategy Conference, June, 1978 (page 28)).

(iv) UNEP - United Nations Environment Programme

UNEP acts as a coordinating agency for all environmental activities undertaken by United Nations agencies. The important UNEP programs that will contribute to the understanding of deforestation rates and ecological processes on tropical moist forest are GEMS (Global Environmental Monitoring System), IRS (Information Retrieval System), and components of the Earth Watch Program.

As a coordinating agency, UNEP supports projects launched by sister agencies (UNDP, FAO, UNESCO).

b. Non-United Nations International Organizations

(i) IUCN/WWF - International Union for the Conservation of Nature and Natural Resources/World Wildlife Fund

IUCN is an independent, international organzation. The purpose of IUCN is to promote the conservation of wildlife species and their habitats. An exclusive network of scientists and other professionals is organized into six commissions.

WWF is an international charitable organization which works along with IUCN, to support efforts in habitat and endangered species protection, ecological research, and land acquisition. Among the efforts undertaken by IUCN and WWF on global scale are the following:

(a) World conservation strategy;

(b) Conservation priorities: IUCN and WWF have undertaken regional surveys of conservation needs to protect ecosystems and species in tropical regions;

(c) Research on dipterocarp (a species of genetic forest resources) and a conservation task force.

(ii) ICSU - International Council of Scientific Unions

The International Council of Scientific Unions coordinates and encourages activities in the sciences by its worldwide membership through various committees. Of these committees the following is most relevant for work in forestry and the environment:

(a) Special Committee on Problems of the Environment (SCOPE); Monitoring and Assessment Research Center (MARC) is one of the major programs supported by SCOPE.

(iii) ICRAF - International Council for Research in Agro-Forestry

ICRAF will serve as a catalyst and information clearing house for agro-forectry research and field projects. It is organized as an autonomous international council governed by a board of trustees and assisted by a small team of experts and consultants.

ICRAF has already taken steps to provide information and documentation services and to identify possible studies in agro-forestry in need of financial support.

(iv) OAS/IIAS - Organization of American States/ Inter-American Institute of Agricultural Sciences

IIAS is a sub-group of OAS and supports research, training, and education programs among its 20 member sovereign states. IIAS is also the mother institution of the Tropical Agricultural Center for Research and Training in Turrialba, Costa Rica, one of the most important centers for tropical forestry in Matin America.

(v) ECNAMP - Eastern Caribbean Natural Area Management Program

The first phase of this program was launched in 1977 in Dominica, with the cooperative efforts of the University of Michigan's School of Natural Resources, the Caribbean Conservation Association, IUCN, and Dominica's Forestry Division.

(vi) EAAFRO - East African Agriculture and Forestry Research Organization

This organization was founded in 1948 and governed by members from government of Kenya, Tanzania, and Uganda. EAAFRO supports international research in applied sciences, including forestry and wildlife. We are no. sure of its current activity as the parent East African community is now in a temporary state of uncertainty.

(vii) IUFRO - International Union of Forest Research Organizations

In 1967 IUFRO funded a subject group on tropical silviculture with the intention of facilitating contact and communication between researchers active in this area.

IUFRO has established sub-groups in the following:

(a) Structure of closed tropical forests;

(b) Natural regeneration of closed moist tropical forests;

(c) Enrichment of tropical forests;

(d) Agrosilvicultural systems for the regeneration of closed, moist-tropical forests;

(e) Conservation of tropical forests; and

(f) Mangrove silviculture.

(viii) World Bank

The World Bank is actively involved in the forestry sector. Many of the Bank's projects in forestry and related areas have well defined policies, related to the Bank's new policy towards forestry lending. The policy was announced in a recent sector paper on forestry (March, 1978) and plans to lend US $500 million in the next five years to forestry efforts. Included in these efforts are afforestation, watershed protection, agrosilviculture, and fuelwood plantations. Recognizing the rapid disappearance of forests in developing countries, the Bank has targeted 60% of these loans for rural and environmental forestry projects.

The Bank has already many forestry projects scheduled, particularly in tropical forests. For example, the Bank works in close cooperation with FAO in three major projects to alleviate the fuel and building material shortage in Mali and Niger.

The Bank has assisted several innovative projects. In the Philippines, credit to 1300 small holder

farmers was provided to establish Albizzia Falcata (a botanical term for a specific tree species) pulpwood plantations during a three year pilot project funded in 1974. This is now being expanded to include combination cropping regimes of fast-growing fodder trees. Part of a rural infrastructure project in Korea was devoted to a nationwide fuelwood planning program.

In summary, it appears that among international agencies, there is much vocal concern as well as considerable activity in the area of forestry work and the problems of deforestation in less developed countries. What seems to be urgently needed is an integrated strategy, involving all of the agencies, national as well as international, about what should be done to preserve and develop forests. One conference recommended that AID, the Department of State, and the World Bank should assume leadership in coordination to undertake the most urgent task of preserving the vital resource. (State Department Forestry Conference, June, 1978). Others suggest that UNEP take such initiatives.

2. Bilateral and National Programs and Institutions:*

a. Developed World

(i) Canada

*NRDC's Bulletin on "Tropical Moist Forest Conservation," May, 1978, is of great help in this.

Canadian International Development Agency (CIDA) recognizes forestry as an integral part of rural development. As of March 31, 1977, CIDA supports seventy-two ongoing forestry projects totalling over $51 million in annual CIDA expenditures. CIDA also supports and gives technical assistance to Malaysian Pertanien University to establish a forestry faculty.

Canada's International Development Research Center (IDRC) has several research and evaluation programs underway in reforestation. Among the IDRC initiatives related to forestry are assistance to local institutions in Ghana for an agrosilviculture research project, afforestation projects in Bolivia and Peru, support for the development of agroforestry cropping systems in Nigeria. In 1975, IDRC launched a project to identify research needs in tropical forestry.

(ii) Federal Republic of Germany

The Federal Research Center for Forestry and Forest Products. The Institute conducts research in forestry management, forestry economics, forest ecology, inventory, soil science analysis, and related fields. Recently, the Institute sponsored a workshop on Tropical Rainforest Ecosystems Research.

(iii) France

(a) The Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM) maintains research centers in France and French-speaking countries in the developing world. As a part of MAB Project I, ORSTOM has participated

in research and training programs in the tropical forests of Africa and Latin America. ORSTOM is involved with projects in the Central African Empire, Ivory Coast, and Colombia.

(b) Centre Technique Forestier Tropical (CTFT: Technical Center for Tropical Forestry). The Center assists in the development of forestry resources in Africa. Under a contract from FAO, CTFT conducts field surveys of national forests for preliminary investment data and mapping purposes.

(iv) Sweden

Swedish International Development Authority (SIDA) provides assistance for several multilateral programs which promote the conservation and wise use of tropical moist forests. One of the most notable is SIDA's support of the advisory panel for Forestry for Community Development, a unit within FAO.

(v) United Kingdom

(1) Ministry for Overseas Development, Land Resources Division, provides support for institutions and projects related to tropical forestry, particularly in the Southeast Asia region.

(2) University of Aberdeen, Department of Botany, is the center for breeding populations of trees in tropical forest ecosystems and studying their degree of genetic variability.

(vi) United States: Federal Activities

(a) United States Agency for International Development (US-AID) is giving increased attention to

natural resource management in response to a Congressional directive to provide assistance in environmental protection to developing countries. This has spurred AID to give higher priority to tropical forest management and restoration activities since 1976.

Among the new projects AID has proposed for FY 1979, is an agroforestation project in the Philippines which would develop combined agriculture/forestry methods for hillside farmers who now practice an environmentally unsound form of shifting cultivation. AID has also proposed reforestation projects in the Gambia and Panama. Some of AID's proposed integrated rural development schemes will have forest conservation and management components, including fuelwood plantations, watershed protection, afforestation, and similar activities.

(b) U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs (OES) has recently taken steps to initiate an internationally coordinated program to further the protection, management, and rehabilitation of the world's forest resources. OES sponsored a major forestry symposium, the findings of which are available in Proceedings of the U.S. Strategy Conference on Tropical Deforestation, June, 1978.

(c) Council on Environmental Quality (CEQ) has prepared a Global Year 2000 study at the President's request, containing a section on forestry.

(d) U.S. Fish and Wildlife Service within the Department of Interior provides technical consultants when requested by Latin American countries.

(e) U.S. Forest Service (in USDA) program coordinates U.S. technical assistance in forestry research and training projects overseas. Consultants are recruited to participate in projects initiated by international agencies (e.g., FAO, UNDP) and national institutions.

(f) The Institute of Tropical Forestry (in USDA) has three major functions: a) providing information on tropical forests and forestry; b) generating new knowledge on these subjects; and c) promoting the application of forestry knowledge in Puerto Rico, the U.S. Virgin Islands, and other areas of the Caribbean. The Institute contains the most complete library on tropical forestry in the Western Hemisphere.

(g) Smithsonian-Peace Corps Environmental Program provides training and technical support to other organizations involved with conservation activities. Peace Corps also publishes manuals and handbooks on low technology approaches to forestry work.

(h) National Science Foundation (NSF) initiates and supports a large portion of the basic research in tropical biology conducted by U.S. scientists.

(i) National Academy of Sciences/National Research Council (NAS/NRC). The NAS/NRC committees are presently engaged in research concerning tropical moist forests. For example, the Committee on Research Priorities in Tropical Biology is a current National Academy of Sciences

study group, working under an NSF Task Order and will complete its assessment of research priorities in world tropics by FY 1980. This report is awaited for further guidance in developing this emphasis that currently is highlighted by a cooperative study with Brazil on the vegetational diversity of the Amazon Basin. NAS also coordinates research on exotic and fast growing species.

(j) Smithsonian Tropical Research Institute, Balboa, Canal Zone conducts research on the unique problems of forestry management in tropical ecosystems.

(vii) United States: Private Organizations

(a) Natural Resources Defense Council (NRDC). Since 1976, NRDC has been studying ways of protecting tropical moist forests and working toward legislative implementation of such programs.

(b) Nature Conservance is dedicated to the preservation of natural lands. The establishment of the Corcovado Park Forest Service on the Osa Peninsula of southwestern Costa Rica was the result of Nature Conservancy initiatives in cooperation with Costa Rican agencies. The same program has assisted in Dominica (West Indies).

(c) The Sierra Club Tropical Forests Program promotes an integrated, multi-disciplinary approach to tropical forest conservation. The program seeks to coordinate and assist efforts in tropical countries to devise resource management schemes which are ecologically

sound while enhancing economic development. Among the initiatives taken by the program is a comprehensive study of the problems of deforestation in Venezuela. A similar project for the management and protection of the mangroves in the Caribbean is now being proposed.

(d) World Watch Institute analyzes issues of global significance within the context of ecological, economic, and social systems, including the social and economic implications of the world wide loss of forests.

(e) The Ford Foundation. The Foundation assists many institutions in the tropical zone in the broad area of water management, which includes activities related to tropical forest conservation and management.

(f) Rockefeller Brothers Fund (RBF) has supported many programs which have a tropical forest conservation and management component. These include research and training projects in the Caribbean, Latin America, and Africa.

b. Developing Nations: Latin America

(i) Brazil

(a) Institute Brasileiro de Desenvolvimento Florestal (IBDF: Brazilian Institute of Forestry Development).

IBDF has joined in programs of conservation and management of wildlife in cooperation with UNDP/FAO/ Forestry Development and Research Project. Topajos National Forest Project of IBDF/FAO has recently been completed.

(b) Conselho Nacional de Pesquisas da Amazonia (CNPQ: The Brazilian National Research Council) is the umbrella organization for a host of research institutions in Brazil. One of its research arms, the National Institute of Amazonian Research (INPA) is well staffed and is conducting research in the Amazon.

(c) Empresa Brazileira de Pesquisa Agro Pecuaria (EMBRAPA: Brazilian Agricultural Research Corporation). The agency supports research conducted in Manaus by INPA, in Porto Seguro, and in Belem.

(ii) Costa Rica

(a) Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE) under the direction of Dr. Santiago Fonseca Martinez is a very competent research organization which deals with regional forestry issues in Central America. Its research projects suffer from a lack of financial support.

(b) Tropical Science Center (TSC) is a consulting firm which conducts surveys, inventories, and identification of species for government, FAO, and OAS projects.

(iii) Ecuador

The Institute of Food and Agricultural Sciences International Program is conducting research in designing small scale farming systems based on a mixture of crops, animals, and forest production.

(iv) Guyana

Office de la Recherche Scientifique et Technique Outre-mer (ORSTOM: Office of Overseas Scientific and Technical Research). Centre de Cayenne has participated in MAB Project I activities in Guyana.

(v) Mexico

(a) Centro de Ecodesarrolla (CECODES: The Eco-development Center). The Center is involved in several development schemes in the tropical forest regions of Mexico. CECODES receives support from the Mexican governmental and private institutes, and from UNEP.

(b) Conselho Nacional de Ciencia y Tecnologia (CONAYCIT) is an umbrella organization with expertise in such fields as ecology and marine biology.

(c) Instituto de Ecologia, A.C. conducts research in the field of forest ecology.

(vi) Nicaragua

The University of Tennessee/Republic of Nicaragua Program, University of Tennessee, Knoxville. The University currently advises the Nicaraguan Department of Agriculture on resource management matters. An institute financed by the government is conducting research in agriculture and forestry.

(vii) Venezuela

(a) Conseji Nacional de Investigaciones Cientificas y Tecnologicas (CONICIT), under the direction of Ernesto Medina, conducts ecological research and projects, and is one of the major institutions in Latin America.

(b) The Venezuelan Institute for Scientific Research (IVIC), This Institute is a research arm of CONICIT. As a part of a MAB Project for Latin America, the Amazon Project includes studies of vegetation, soils and water with the cooperation of the University of Georgia, the Maxplanck Institute of Limnology (Federal Republic of Germany) and the World Institute of Forestry in Reinbeck, Federal Republic of Germany. Baseline studies of nutrient cycling, forest ecology, and productivity, and soils are part of the first phase of the project which is now underway.

c. Africa:

(i) Ghana

Forest Products Research Institute (FPRI). With the support of IDRC, a FPRI project is examining the technical, ecological, and economic viability of introducing agrosilviculture methods to shifting cultivators.

(ii) Ivory Coast

Ecology Research Institute. The Tai Forest, one of the last remaining patches of primary forests in West Africa, is the site of an international research effort as part of the MAB Project I since 1975. The French Research Institute is the participating agency.

(iii) Nigeria

Department of Forest Resources Management, University of Ibadan, the International Institute of Tropical Agriculture, and the Forestry Research Institute of Nigeria conduct research in tropical ecology and appropri-

ate cultivation systems for the local forest environment.

The University, with the support of IDRC is developing farming systems which combine food and tree crops in upland forested areas.

d. Asia:

(i) Indonesia

(a) Directorate-General of Forestry Perlindungan dan Pengawetan Alam (PPA: Directorate of Nature Conservation and Wildlife Management). PPA has been assisted by the World Wildlife Fund Indonesia Program and by UNDP/FAO National Parks and Wildlife Management Project.

(b) Center for Natural Resource Management and Environmental Studies is meeting the training and research needs in integrated resource management. The Ford Foundation provides financial and technical support for the Center's activities.

(c) University of Mulawarman is offering undergraduate and graduate programs in forestry management and economics. As a participant in MAB Project I activities in Indonesia, the University is developing capabilities in tropical forest ecology, including an integrated program in rural ecology.

(ii) Malaysia

Persatuan Perlindungan Alam Sekitar Malaysia (The Malaysian Environmental Protection Society). The Society is working for the protection of forestry from the destructive nature of the logging activities.

(iii) Sri Lanka

The Department of Botany, University of Sri Lanka, is conducting a three year study of the rainforest. The proposed study will generate basic information concerning the flora and fauna, including endangered species.

(iv) Thailand

The Royal Forest Department. In January 1978, an IUCN/UNEP mission began preparation of a nature conservation plan for Thailand, with the cooperation of Thailand's National Environmental Board, the Royal Thai Forest Department, and FAO.

3. United States Universities

a. John Beuter, Department of Forest Management, School of Forestry, Oregon State University, Corvallis, Oregon.

b. William Burch, School of Forestry and Environment Studies, Yale University, New Haven, Connecticut.

c. Frank Convery, Natural Resources Economics, School of Forestry, Duke University, Durham, North Carolina.

d. Paul Ellefson and Hans Gregersen, College of Forestry, University of Minnesota, St. Paul, Minnesota.

e. Norman Johnson, College of Natural Resources, Utah State University, Logan, Utah.

f. Stephen Spurr, Center for Natural Resources and Environment, University of Texas, Austin, Texas.

g. Thomas Waggener, College of Forestry, University of Washington, Seattle, Washington.

h. John Zivnuska, Department of Forestry and Conservation, University of California, Berkeley, California.

B. Conferences

There have been a number of recent forestry conferences which have discussed problem areas and put forward recommendations to develop solutions. They have also identified particular issues in which there is a need for international cooperation with regard to forestry. Recent meetings, in addition to the 1972 UN Stockholm Conference on the Human Environment include:

1. Eighth World Forestry Conference at Jakarta, Indonesia, October, 1978.
2. U.S. State Department Strategy Conference on Tropical Deforestation held in June, 1978, Washington, D.C.
3. Conference on Improved Utilization of Tropical Forests, May 21-26, 1978, Madison, Wisconsin.
4. Resources for the Future Symposium on "Research in Forest Economics and Forest Policy," January, 1977.
5. CENTO Conference on Forestry Development Policy, Ankara, Turkey, June, 1970.

SUMMARY OF RECOMMENDATIONS OF CONFERENCES: (Forestry)

1. The Eighth World Forestry Congress singled out the following ways to make forest development contribute more to the greater well-being of the more deprived sections of population.

   i. forests must make a greater contribution to the economic development of more underdeveloped parts of the world, without detriment to the needs of future generations;

   ii. international cooperation must be strengthened in the field of inventory, management, and conservation of forest resources, especially in the developing countries;

   iii. forest productivity must be raised, as to allow the alienation of more land to agriculture;

iv. the maximum amount of employment must be afforded in rural areas.

2. The U.S. Strategy Conference on Tropical Deforestation emphasized

i. the broad based integrated and coordinated programs and approaches to designated and implemented within an overall economic development context;

ii. high priority to be given by governments and international organizations to accelerating land use, survey inventory and classification activities, as well as land use planning at the national and local levels;

iii. global, regional and local monitoring and assessment systems be established with regional centers of excellence for forestry research in the major forest zones of the world;

iv. training of forest personnel within nation states should be expanded with the help of international assistance. Support should be expanded for:

a. environmental research;
b. biological research;
c. socio-economic research; and
d. research and development to find some alternative to traditional practices.

3. Proceedings of Conference on Improved Utilization of Tropical Forests, Forest Service, USDA, 1978

This report of the conference proceedings deals with the utilization of tropical forests in the commercial sector. It provides some assistance in developing national self-sufficiency in wood and pulp products through local and appropriate technologies. It concentrates on species work, fast-growing variety research and technologies of manufacturing. Among the recommendations for action are: -

i. US-AID, in conjunction with other large technical assistance agencies, should develop common, environmentally sound guidelines for assistance in achieving long-term benefits from tropical forest lands.

ii. US-AID should coordinate research on an international basis in the following areas:

a. the need for natural forest reserves;
b. impacts of existing tropical forest uses and their significance to future environmental values;
c. potentials of agroforestry;
d. intermediate technology for harvesting that has social and economic balance.

iii. FAO should lead in promoting world-wide inventory of areas and monitoring global markets for forest products.

4. Symposium of Resources for the Future on Research in Forest Economics and Forest Policy suggested research needs in:

i. characteristics of demand and supply for forestry products;

ii. measurement of the instability stemming from forces external to forestry;

iii. labor requirements and labor welfare in forest sector;

iv. in the effect of trade barriers in international trade of forestry goods and products;

v. in effects and the effectiveness as agents of change of direct US involvements in forestry and forest products in other nations, etc.

5. The CENTO Conference recommended that forest land-use development achieve the greatest economic and sociological returns to the people commensurate with scientific forest-management principles.

C. Review of Recent Research

A number of research and position papers were presented at the conferences cited above. Other works on problems of forestry are also included. The recent literature includes:

1. "The Nature of the Deforestation Problem--Trends and Policy Implications" by Gerald Barney, Staff Director "Global 2000" study, Presidents Council on Environmental Quality. The work presents estimates of world forest resources, 1978 and 2000 and other data and assessment of implication of the high rate of deforestation.

2. "Deforestation--Death to the Panama Canal" by Dr. Frank Wadsworth, Director, Institute of Tropical Forestry, US Department of Agriculture, Rio Piedres, Puerto Rico. The paper reviews the implication of removal of about 35 percent of tree cover for cultivation and pasture land. It has been pointed out if invasion by shifting cultivators continues, the canal may turn into a worthless ditch.

3. "Co_2. Deforestation Relationships" by Dr. George Woodwell, Marine Biology Laboratory, Woods Hole, Massachusetts. Dr. Woodwell reviews the scientific and technological state of the art by establishing the relationship between the world's forests and atmospheric problems associated with carbon dioxide (CO_2).

4. "Biological Research" by Dr. S.H. Sohmer, National Science Foundation. Dr. Sohmer examines the basic biological research that is being conducted, in the areas of biology, ecology, ecosystem, etc. related with tropical forests.

5. "Monitoring and Assessment" by Michael Calabrese, Resource Observation Division, National Aeronautics and Space Administration (NASA). This paper discusses capabilities of remote sensing capabilities, particularly of the ERTS Landsat Satellite System, as a tool in the monitoring and assessment of forestry activities in the tropical area.

6. Two papers on Commercial Forestry and Agroforestry by Mr. Gordon Fox and Dr. Louis Huguet review the implication of commercial logging operations in the third world and problems of shifting cultivators and views of developing the associations of agriculture forestry to produce food and protect environment.

7. "Energy Alternatives"--by Alan Jacobs--US-AID. The paper discusses the position of fuelwood in developing countries and possibilities of alternatives.

8. "Revegetation Using Selected Species" by Dr. Noel Vietmeyer, Board on Science and Technology for International Development, National Academy of Science, Washington. The paper reviews the successful development of species which have enormous promise to become crops of the future.

9. "Tropical Rain Forests and Moist Deciduous Forest" and "A World Conservation Strategy by IUCN." The two papers review the magnitude and importance of tropical forests and the causes of their destruction. The papers offer some solutions.

10. "The Other Energy Crisis--Firewood," a World Watch Institute paper, reviews the importance of fuelwood and the implication of shortages of wood. Problems treated include increased burning of manure which denies use of manure as fertilizer.

11. Sector Policy Paper on Forestry, World Bank, 1978. The paper discusses role of forestry in development and scope and prospects for forest development and role of the Bank.

12. "Forestry for Rural Communities." FAO paper.

13. "The Economics of National Forest Management and Decision Making in Timber Production, Harvest and Marketing." Resources for the Future.

14. "Research on Reforestation in Arid Zone" 1970, R.N. Kaul. This is an extensive work of research on the forestry in arid zones of the Southern fringe of Europe, Northern Africa, The Near East, The Indian subcontinent, Central Aurasia, The American continent and Australia.

15. "U.S. Investment in the Forest-Based Sector in Latin America: Problems and Potentials" by Hans M. Grengerser and Anoldo Contreves. The book analyses the foreign investment processes and experience in a renewable resource, sector, and obstacle to expand foreign investment in Latin America.

16. "Forestry and Economic Development" by Peter Sartorius 1968. The book is a bit out of date but provides a good theoretical perspective to forestry and economics.

17. "Forestry Support for Agriculture through Watershed Management and other Conservation Actions" by Samuel H. Kunkle 1978. The paper reviews the role of forestry in supplementing agriculture, watershed management, desertification problems in arid zones and research and training for tropical countries.

18. "Forests for People" 8th World Congress paper, discusses the role of forestry community and importance of research.

19. "Forestry for Rural Communities" FAO. The paper reviews the aim and role of forestry for community development. The problems of land degradation.

20. "Wood, Energy and Rural Communities" by J.E.M. Arnold, FAO. The paper discusses why forests are important, and what are the impacts on developing other sources of energy.

21. Ecosystem Conservation IUCN. It covers land degradation problems and causes.

22. Forests for Whom and for What by Marion Clawson 1975. The book discusses pressing policy issues in forestry and provides a good framework of analysis for forestry.

23. A Review of the Natural Resources of the African Continent, UNESCO 1963. This book describes the situation of scientific research into the environment and the natural resources of Africa. Expertise was provided for the book from the following fields: Topography and maps, geology and mineral resources, seismicity, climate and meteorology, hydrology and water resources, soils, flora, fauna, entomology, fresh water biology, and marine biology.

24. Natural Resources of Humid Tropical Asia, UNESCO, Paris 1974. This study was an outgrowth of the previous review completed by UNESCO of the natural resources of Africa. It is based on the premise that as the countries in humid tropical Asia develop and their needs expand, they will continue to be faced with problems relating to the rational utilization of natural resources. Thus, this study examines those natural resources and provides a detailed inventory and summary of present knowledge. The book is complemented by bibliographies and lists of institutions, research centers and other sources of additional information. It also attempts to bring out the gaps in this knowledge with an insight to furthering economic and social development.

25. Tropical Forest Ecosystems: A-State-of-Knowledge Report prepared by UNESCO/FAO, 1978. This report is an extensive work which consists of three principal parts. Part I, "Description, Functioning, and Evolution of Tropical Forest Ecosystems" includes the research results of biologists and other natural scientists. Part II, is concerned with biological behavior and social-cultural aspects of the human population living in and around tropical forest ecosystems and with their patterns of use and management. Lastly, Part III consists of eight regional case studies which illustrate the type and orientation of research through a description of specific tropical forest ecosystems.

26. Reforestation in Arid Lands by Fred R. Weber, ACTION/Peace Corps, and Volunteer in Technical Assistance (VITA), 1977. This is the third manual in a series of publications being prepared by the US Peace Corps and VITA. This manual presents some current, state-of-the-art examples of forestry programs in West Africa, however, it focuses on the broad subject of project implementation, presents methods and planning guides useful outside the West African context. Its extended appendices include:

    a. a directory of 165 tree species found in West Africa;

b. an expanded look at 30 of the trees highlighted in Appendix A;
c. maps and charts explaining climate and rainfall, soil, vegetation, and characteristics of sub-Saharan Africa;
d. a guide to writing funding proposals for reforestation projects;
e. a listing of other information sources and of bibliographic material.

27. Forest Resources of Africa: An Approach to International Forest Resource Appraisals, Part I: Country Descriptions by Reidar Persson, Royal College of Forestry, Stockholm, Nr. 18, 1975. This report provides information which describes the forest resources of all African countries. The country descriptions contain information about natural vegetation, closed forests, man-made forests, and inventories. Special forestry maps have been prepared for most countries. This document gives a more detailed analysis than the earlier report, World Forest Resources.

28. World Forest Resources, A Review of the World's Forest Resources in the early 1970's. Reidar Persson, Royal College of Forestry, Stockholm, Nr. 17, 1974. This report is a continuation of the World Forest Inventories (WFI) which was begun by FAO. It provides a description of the forest resources in nearly all countries of Africa, Asia, Latin America and the Pacific. The country descriptions include information about natural forest land, man-made forest and inventories. This information gives the areas of closed forest world wide as 2,800 million ha or 22 percent of land area while the area of open woodlands of different types is more than 1,000 million ha. The area of coniferous forest is estimated as 1,140 million ha or 40 percent of the total forest area. The area of man-made forests in Africa, Asia (excluding China and Japan) the Pacific and Latin America is estimated at 12 million ha. A global figure is approximately 100 million ha.

29. Outline of a Global UNEP Program on Trees by Professor H.J. Steinlin, Senior Consultant, UNEP, March 1977. This document provides a format for a potential global tree program emphasizing an integrated approach of biological, ecological, economical, and soci-economical factors. It also includes estimated critical areas and priorities for a tree program, development of a strategy, and a plan of action.

30. Tropical Ecological Systems: Trends in Terrestrial and Aquatic Research ed. Golley, Frank B.; Medina Ernesto. Springer-Verlag NY Inc. 1975. This book includes papers written by participants at meetings of the International Society of Tropical Ecology and the International Association for Ecology on topics

such as physiological ecology, populations, tropical savannas, rivers, estuaries, and island ecosystems. These papers among others illustrate trends of research in tropical ecology and have served to stimulate interaction between tropical ecologists. Contributed papers relevant to forestry include:

4. Hartshorn, Gary S.: A Matrix Model of Tree Population Dynamics.
5. Knight, Dennis H.: An Analysis of Late Secondary Succession in Species-Rich Tropical Forest.
9. Klinge, H., W.A. Rodrigues, E. Brung and E.J. Fitikau: Biomass and Structure in a Central Amazonian Rain Forest.
10. Huttel, Charles: Root Distribution and Biomass in Three Ivory Coast Rain Forest Plots.
11. Garg, R.K. and L.N. Vyas: Litter Production in Deciduous Forest near Udaipur (South Rajasthan), India.
12. Malaisse, F., R. Freson, G. Goffinet, and M. Malaisse-Mousset: Litter Fall and Litter Breakdown in Miombo.
13. Bernhard-Reversat, France: Nutrients in Throughfall and Their Quantitative Importance in Rain Forest Mineral Cycles.
14. Karr, James R.: Production, Energy Pathways, and Community Diversity in Forest Birds.

31. Trees, Food and People: Land Management in the Tropics by J.G. Bene, H.W. Beall, and A. Cote, IDRC, 1977. This book stresses forest management as the critical necessity in rehabilitating tropical forests. It cites the lack of research efforts to improve the utilization of non-wood products i.e. gums, bark, spices and fruit. The authors believe that research could identify products that have significant economic and social benefit as well as a systematic approach on how to manage trees, harvesting process and distribution. As knowledge of the extent and nature of any resource is a basic requirement for the sound management of that resource, the authors continue to stress the importance of other research efforts as well. These are:

(a) information needed regarding forest influences on, and interactions with all other elements of tropical ecosystems, both in the disturbed natural and managed states;
(b) how to monitor what happens when tropical forests are cut or interfered with in other ways, including effects on human socio-cultural and behavioral characteristics; and
(c) studies of the forest's potential for repairing damage already done to tropical ecosystems, e.g. dune fixation, especially with respect to stopping the spread of arid and desert areas.

32. Planting for the Future: Forestry for Human Needs, E. Eckholm, 1979.

D. Example of Questions Which Have Not Received a Full and Detailed Analysis

Examples of questions which have been raised in the various reports and have not yet received a full and detailed analysis but which bear directly on rural forestry are:

1. Technical

(a) What species are most appropriate for fuel, for house construction, and for local industry in the various tropical ecological settings in Asia, Africa, and Latin America?

(b) What are the most effective techniques of charcoal production? Are there ways to encourage charcoal production for export to urban areas? At present, much firewood is taken into urban areas at a considerably greater transportation cost than if the firewood could be converted into charcoal. Are there ways to alter present cooking practices to use more energy efficient technology/techniques?

(c) Using appropriate technology, what are the optimum distances and what are the best transportation systems to enable harvesting of wood/charcoal from wood surplus areas and transporting them to wood deficient areas at a cost that poor farmers and peasants can afford?

2. Managerial

(a) What are traditional methods of allocating and preserving forests and woodlots? What changes in these practices have occured in the last few years? Are there possibilities of using traditional systems to and in the development and protection of local woodlots?

(b) What is the actual rate of forest loss in rural areas. To what extent does this loss create problems:

(i) in loss of soil

(ii) in price of wood products

(iii) in production of oxygen

(iv) in water retention for agriculture.

(c) What kinds of local organizations and institutions are best suited to initiate local woodlots? How are the lots best managed? How can the production of woodlots be managed to maintain incentives to preserve the trees?

(d) What are the relationships between wood needs for local consumption and wood/fuel supplies to be sent to urban areas? What are the relationships between priorities to use land for wood production and for growing of either local food crops or commercial crops. To what extent to policies of the central or national government encourage or discourage woodlot production?

APPENDIX III

COASTAL ZONE MANAGEMENT

A REVIEW OF PREVIOUS WORK,

CONFERENCES AND INSTITUTIONS

OUTLINE

A. Institutions

1. Lead Organizations

2. Other Institutions and Individuals

3. National Sea Grant College Program

B. Conferences

1. Inter-regional Seminar on Development and Management of Resources of Coastal Areas, Berlin (West), 31 May - 14 June 1976

2. Seminar on Inter-regional Program on Resource Use and Management in the Coastal Zones of the Asian Humid Tropics

C. Review of Recent Research

APPENDIX III

COASTAL ZONE MANAGEMENT

A. Institutions

1. Lead Organizations

Coastal zone management is a relatively new field. Thus the literature and institutional activity is not as large as in other areas. Its complex programs are intertwined with many other disciplines. There are only a few national governments and international organizations which look at coastal management as a separate and distinct entity. The United States is one of these few. The United Nation's specialized agencies are among the other leading institutions which are active in the newly emerging field. These include:

a. Food and Agricultural Organization (FAO) which provides financial and technical assistance in fisheries, other living resources, and fish processing. Recently it has prepared a major environmental law assistance project for Indonesia, and is rendering advice in various other aspects.

b. United Nations Environment Program (UNEP) has a division which specializes in marine and coastal

pollution. UNEP's Action Plan and Blue Plan are interesting and rather successful examples in coastal management as it relates to an enclosed body of water, the Mediterranean Sea.

The Action Plan comprises political, legal, scientific, and economic measures, and brings together all of the nations fronting the Mediterranean Sea into a series of accords. The Barcelona Convention of 1975 was one of the first of these agreements.

The Blue Plan instituted a series of priority action plans focusing on protection of soil, management of water resources, living marine resources, human settlements, tourism, and the development of soft technologies for energy, including solar energy.

Through its Regional Office for Asia and the Pacific, UNEP has prepared reports on coastal management legislation in Sri Lanka and "Environment Law and Technical Cooperation: Agenda for Asia and the Pacific.

UNEP is also carrying forward a prefeasibility study on the Persian Gulf, and an exploratory mission to study marine pollution problems in the West African coastal countries of the Gulf of Guinea.

c. United Nations Development Program (UNDP) is providing financial assistance to support the establishment of laboratory facilities, training, curriculum development, and administration.

d. UNESCO. In marine science, UNESCO's Man and the Biosphere Program is currently working towards the compilation and review of existing socio-economic literature on coastal zones.

e. United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) concentrates on four substantive areas as a strategy on environmental activities, one of which is: "Protection of the marine environment and related ecosystems." Technical and legislative guidelines on the protection of the marine environment and related ecosystems will be developed with the financial assistance of the Swedish government in cooperation with UNEP and the Inter-governmental Maritime Consultative Organization (IMCO). Their specific activities will include national seminars in a number of countries of the region having predominant problems of marine environment, followed by a regional seminar at ESCAP Headquarters in Bankok and a study tour in Sweden.

f. United Nations Conference on Trade and Development (UNCTAD) is examining shipping, port, and harbor development, including dredging.

g. United Nations Industrial Development Organization (UNIDO) works with industries located in coastal areas and offers programs to limit industrial pollution.

h. Intergovernmental Maritime Consultative Organization (IMCO) is concerned with shipping safety and navigation.

i. World Meteorological Organization (WMO) offers programs in marine meteorology.

j. World Health Organization (WHO) is responsible for activity in sanitary engineering, environmental health, and water quality.

k. International Atomic Energy Agency (IAEA) concerns itself with problems of disposal of radioactive wastes.

l. International Transport Union (ITU) oversees marine and coast telecommunications.

All these organizations deal with particular scientific and technical aspects of many fields, including coastal zones. At present, they are not

coordinated nor are they related specifically to coastal management or to the general development planning process in coastal zones. Two which are working directly in coastal zones and development are:

m. US-AID which participates actively in programs and projects to improve utilization and management of the coastal zone environment and its marine resources in developing countries by supporting U.S. and LDC marine science institutions. It is helping in research and development in the least developed countries' problems through training and through coordinating research and development with U.S. remote sensing efforts.

n. International Union for the Conservation of Nature and Natural Resources (IUCN) has undertaken the major task of classification of coastal and marine environments. IUCN is also launching a marine program which deals with coast conservation.

2. Other Institutions and Individuals

A number of intergovernmental bodies, professional societies, nongovernmental organizations, universities, and scientific expert groups are carrying out work in the field of coastal management. Among these:

a. The Institute of Biology of the Federal University of Bahia (Salvador, Brazil) held an international symposium on coastal problems of planning, pollution, and productivity in December 1976.

b. The International Federation of Landscape Architechts, at its fifteenth congress, held at Instanbul in September 1976, discussed the role of the landscape architect in coastal development.

c. The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) has recently established a working group on the pollution implications of sea-bed exploitation and coastal development.

d. Ralph M. Field Associates, Inc., Westport, Conn., 06990, is involved in coastal zone management and, more generally, with natural resource management.

e. D. G. Carleton Ray, of Johns Hopkins University, undertook studies on "conservation of critical marine habitat" which involved the identification and description of such marine habitat needing plans for conservation. The work is being carried out by IUCN under a grant from the World Wildlife Fund, with additional support from UNESCO and UNEP. As a part of this study, Dr. Ray has prepared a

tentative classification of marine ecosystems.

f. The Institute of Marine Affairs located in Trinidad and Tobago, conducts two major activities in the field of coastal zone management:

(i) Data Acquisition Program - This program is currently gathering baseline data on the physical, chemical and biological characteristics of the Gulf of Paria. They will be extending the activities of this program next year to the northeastern and southern coasts of Trinidad. The data obtained will be used to establish criteria and standards for pollution control activities.

(ii) Coastal Zone Management Program - This program is intended to produce a series of guidelines for the siting of industry, preservation of critical areas, and identification of potential residential and recreational areas for the eastern coast of Trinidad. Its activities will eventually expand to include all of the coastline of Trinidad and of the Tobago coastline.

g. Chesapeake Bay Center for Environmental Studies - Smithsonian Institute - Under the direction of J. Kevin Sullivan, the Center conducts two major

programs: environmental research, and an education program. The Scientific Research Program is designed to study the dynamics of an estuarine-watershed ecosystem and to clarify the effects of past and present human activities on this system. The research is divided into three major sub-programs: Upland Ecology, Watershed Studies, and Estuarine Ecology. The basic theme of these research efforts is the relationship of land-use to water quality and the relationship between historical land-use changes and the status of contemporary communities. Most of their research focuses on estuaries and their watersheds. The Center's information transfer under the Education Program allows for dissemination through special publications, fact sheets, news releases, workshops, and a monthly newsletter; and attempts to facilitate the inclusion of scientific findings in resource management decisions.

h. The Conservation Foundation - This is a very old environmental institution, founded as early as 1948, to publicize the fact that the earth's most basic resources - air, water, energy, and land,

and the animal and plant life nourished by these resources - are not inexhaustible, but severely limited. The early role of the Foundation was that of a prophet, alerting the world to future environmental crises which are all too familiar to us today. Presently the Foundation is involved in long-range planning to help resolve resource conflicts on our public and private lands, and to ease the problems of implementing environmental laws.

Foundation efforts have helped form many other organizations, including Resources for the Future, The International Untion for the Conservation of Nature and Natural Resources, the Environmental Defense Fund, etc. The Foundation also helped to publish The Careless Technology following a national conference. The book has helped bring to public attention the need for regular technolcgy assessment. Among the major programs of the Foundation are: Land Use and Urban Growth, Rural Land Market Project, International Land Use Project, and Urban Conservation Project.

i. Office of Technology Assessment (OTA) - was created in 1972 to provide Congress with early indications of the broad range impacts of technological

applications on the society. Those impacts include the beneficial and the adverse, the physical, biological, economic, social and political. OTA is also required to bring a long-term global and comprehensive perspective to bear and to provide an independent and even-handed assessment on the basis of five criteria:

(i) the general impact of technology,

(ii) the interest of the Congress,

(iii) the significant impact on human needs and quality of life,

(iv) the positive foresight, if any, provided by assessment, and

(v) the capacity and capability of OTA to undertake the assessment.

As many as 1,530 topics were received by OTA from the general public and about 3,000 items were extracted from published literature. Of these, 30 items were listed for assessment for 1979.

j. Office of Coastal Zone Management (OCZM), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce - This is the U.S. government's major agency in coastal zone issues.

It is involved in the development and implementation of state coastal zone management programs under the Coastal Zone Management Act of 1972.

Under this act, the activities involved include management of many coastal activities such as industry, commerce, residential development, recreation, and the harvest of living resources. The act provides a very comprehensive approach to the coastal zone activities, but a replica of this law cannot easily be applied to Third World countries, as the land-use problems in the developing countries and the legislation needed differs from those in the advanced countries.

In addition to preserving, protecting, developing, restoring, and enhancing the resources of the nation's coastal zone, NOAA and OCZM are involved in other projects which lead to extensive research and study programs. One such activity is the National Sea Grants College Program noted below.

Under the July 26, 1976 amendment, authorization was extended to OCZM to provide assistance and encouragement to coastal states to develop and

implement national programs for managing their coastal zones. The Federal Act provides for planning and management funds and for extension of Federal consistency standards and activity to Puerto Rico. The Puerto Rico coastal zone management program was approved in April, 1977. NOAA provided a program and a final environmental impact statement in July, 1978. The EIS recommends policies and responses of the program for final review. As of this writing, the Puerto Rican project is getting underway.

The education program of NOAA is noteworthy, and its publications are serving as a good guide for the general public and for those in the coastal zone management field.

3. National Sea Grant College Program

The Sea Grant Program is administered by the National Oceanic and Atmospheric Administration (NOAA), and currently involves thirteen United States universities. The Sea Grant Colleges as of this date are:

Institution	Year Begun
Oregon State University	1971
Texas A & M University	1971
University of Washington	1971
University of Rhode Island	1971

Institution	Year Begun
University of Hawaii	1972
University of Wisconsin	1972
University of California	1973
State University System of New York	1975
University of Delaware	1976
State University System of Florida	1976
University of North Carolina	1976
Massachusetts Institute of Technology	1977
Louisiana State University	1978

The Program emphasizes research in marine sciences and aquaculture. The projects and activities undertaken can be divided into four major groups:

		Number of Projects
a.	International efforts;	5
b.	Educational and management programs, including socio-political studies and marine economics;	300
c.	Marine biology and species and other scientific research and studies; and	300
d.	Physical programs including coastal zone management and infrastructures.	270

The international projects which are relevant to this study are the following:

a. Oceanic Institute, Hawaii
   Engineering--Aquaculture
   Title: Aquaculture in tropical Oceans
   Date of Inception: 6 March 1978

b. University of Virginia
Ocean Law--International
Title: The Law of the Sea Negotiations: A Comprehensive Commentary on the Treaty Articles
Date of Inception: 1 October 1978

c. University of Washington
Ocean Law--International
Title: Research in Ocean Law Enforcement
Date of Inception: 1 January 1978

d. University of Washington
Environmental Models--Biological
Title: NorFish II - A Joint Sea Grant - National Marine Fisheries Services Project in Aid of Regional Fisheries Management in the Northeast Pacific
Date of Inception: 1 September 1978

e. University of Wisconsin
Ocean Law--International
Title: Ocean Policy and Natural Resource Strategy
Date of Inception: 1 September 1978

B. Conferences

Two recent seminars and symposia have been held on coastal zone management. Their proceedings are available. These are:

1. Inter-regional Seminar on "Development and Management of Resources of Coastal Areas," sponsored by the United Nations and the German Foundation for International Development in Berlin (West), 31 May - 14 June 1976.

2. Seminar on "Inter-regional Program on Resource Use and Management in the Coastal Zones of the Asian Humid Tropics," December, 1978, Bankok, by the Agricultural Development Council (ADC).

Brief Summary of Seminar Proceedings

1. At the Inter-regional Seminar in West Berlin, it was recognized that:

   a. In view of the central importance of an integrated approach to coastal area development, there is need for an appropriate institutional and legislative action of global scope;

   b. It is necessary to prepare guidelines to assist governments in developing the institutional and legislative infrastructure, in the context of their needs in developing their coastal areas within an integrated planning effort;

c. It is necessary to establish marine coast technology information systems (MACTIS) to facilitate communication between consumers and suppliers of specific coastal technologies;

d. In regard to the training and education in the field of coastal area development, it was observed that a number of measures have already been taken which include: (i) the preparation of a world register of courses and training programs; and (ii) planning of a two month training course for selected participants from developing countries. Nevertheless, the seminar emphasized that much is still undone in the field.

In view of these observations, it was recommended that a national level emphasis be laid upon:

a. an integrated approach to coastal and development planning;

b. training scientific and technical personnel on all levels, and increasing the technological capability for comprehensive coastal area research, planning, management, and control;

c. taking into account all ecological factors when designing coastal activities to insure compatibility and suitability of proposed uses.

At the international level, through the United Nations' system, recommendations were:

a. to assist developing countries in establishing data bases, acquire methods and technics, and formulate regulatory measures necessary for integrated coastal area resources development and management;

b. to assist developing countries to focus on national and regional coastal area development, and to increase their human resources through training courses, program development, and institution building;

c. to promote cooperation and coordination among developing countries in research and the exchange of information and the establishment of suitable mechanisms for these tasks.

Together with these general recommendations, some specific tasks were pointed out for future action by the UN and its specialized agencies. These areas for future action included:

a. regional seminars to focus on specific problems of common interest to coastal zone states where regional cooperation is most likely to prove feasible;

b. training seminars or workshops to be organized by the UN's Ocean Economics and Technology Office in

cooperation with UN specialized agencies. Seminars would be concerned with:

(i) the methodology of assessing socio-economic and environmental impacts of development within coastal areas;

(ii) the methodology for compiling an integrated inventory of data required;

(iii) the UN Ocean Economics and Technology Office (OETO) developing means of accommodating the possible requests from member states in the development and management of their area programs;

(iv) helping member states of the developing world to acquire the capability to gather environmental data and information needed for coastal development and management, using, where appropriate, the assistance of the competent agencies of the UN and other bodies.

2. Seminar on "Inter-regional Program on Resource Use and Management in the Coastal Zones of the Asian Humid Tropics." The comprehensive report of the seminar is due in March, 1979. In the memoranda to the participants, the following issues were emphasized with regard to coastal area activities.

a. The coastal zone is the most significant geographic unit for developing multiple use resources strategies.

b. In the three areas of coastal zone activities, i.e., delta and coastal plain areas, smaller islands, and swamplands and related estuarine waters, the process of degradation is taking place through single purpose (non-integrated) development because of:

(i) deforestation and its impact on soil hydrology and microclimates;

(ii) dam construction and irrigation upstream;

(iii) non-renewable resource exploitation;

(iv) land-use practices, especially forest removal, in the areas of upland watersheds;

(v) harbor improvements;

(vi) swampland reclamation projects;

(vii) excessive fishing pressures;

(viii) increased salinity levels owing to change in water flows;

(ix) thermal changes;

(x) changing levels of naturally occuring compounds; and

(xi) alien pollutants (heavy metals, oils, and pesticides).

In view of these complex issues, it was recognized that the main purpose of the "Program on Resource Use and Management in the Coastal Zones of the Asian Humid Tropics" is to make development experts, policy makers, and administrators in national governments and international organizations more aware of both the potential productivity and the fragility of the coastal zone.

The recommendations of the seminar are awaited.

From the proceedings of the seminars and from other sources, it is clear that coastal zone protection and development can be divided into two major areas:

1. coastal zone development and management in the context of economic activities;
2. coastal zone development and management related to environmental issues of conservation, waste disposal, and scientific research.

1. In the economic sphere, there are varied activities which include: food production, production of other materials such as minerals, transport, tourism, and settlement. These activities are directly relevant to the growth of national incomes and community development.

2. From an environmental perspective, the coastal zones are divided into three areas:

a. deltas and coastal plains;

b. smaller islands including some in The Philippines, Indonesia, and Pacific Island groups; and

c. swamp lands and related estuarine waters.

Each of these three zones has its own socio-economic environment and requires different management inputs for enhanced utilization of the resource base.

These sub-areas call for a different approach in tropical and temperate coastal ecosystems. The temperate coastal areas which are most important in the developed countries have more problems related to environmental pollution issues, whereas in tropical zones, these issues of degradation of land and water units may, in some places, be secondary to the problems associated with poverty and overpopulation.

To provide adequate supplies of food and sufficient employment for the expanding population, in Asia and other parts of the developing world, the development efforts may be geared towards the intensified use of the combination of resources on which local villages depend. These resources include:

a. wood and other forestry products;

b. fisheries;

c. acquaculture;

d. animal husbandry; and

e. other dry season food crop production.

Since coastal zones are recognized as the most significant geographic units for developing multiple use resources strategies, it would therefore follow that priority might be given to the areas of highest population densities of Southeast Asia, where the majority of people are found in delta and coastal plain areas. There is need for programs to develop acquaculture as well as year round agriculture in these areas, including development of fisheries and timber resources.

In the overall global context, coastal zone resources have to be carefully analyzed, managed, and monitored. Human use and misues must be evaluated in terms of the entire ecosystem. Environmental management is particularly important in the coastal area as estuaries and coastal zones are among the biologically most productive areas on earth.

C. Review of Recent Research

1. The Proceedings of the Inter-regional Seminar on Development and Management (May - June, 1976, West Berlin) contains a number of position papers presented by country representatives, resource specialists, and the United Nations' specialized agencies.

The country position papers include Barbados, Benin, Ecuador, El Salvador, Haiti, Honduras, India, Indonesia, Iran, Israel, Jamaica, Kenya, Kuwait, Mexico, Monaco, Nigeria, Republica Dominicana, Spain, Thailand, Togo, and the United Republic of Tanzania.

The papers presented by specialists cover the subjects of:

a. coastal resources management and economic development;

b. mineral resources in coastal areas;

c. socio-economic data;

d. management techniques;

e. raw materials potential and the geodynamics of the coastal zones;

f. marine meteorological services to coastal activities;

g. the functions of international fishery organizations;

h. labor intensive construction of shore erosion control;

i. the integrated surveys for the coastal area development;

j. legislative approaches to coastal area and resource management;

k. interactions and conflicts in coastal areas;

l. coastal mapping from satellite altitude;

m. fisheries in coastal area development: conflicts and possibilities;

n. safety of navigation in coastal areas; and

o. establishment of scientific guidelines.

These papers cited problems in the area of coastal zone management. The problems and conclusions appeared in the recommendations of the seminar as listed above in Section B.

Beside these papers, additional references pertinent to the conference include:

a. "Business Prospects Under Coastal Zone Management," prepared by the Real Estate Research Corporation, Chicago, Illinois, under contract to the US Department of Commerce, March, 1976;

b. "The Effect of Increasing Multiple Use of Ocean Space and Resources on World Fishery Productivity and Extraction." A paper presented for 8th ACMRR Working Paper No. 4, National Marine Fisheries Services, Northwest Center, by Mcgreavy, 1975.

c. "Coastal Zone Management: The Process of Programmed Development." Published by CZMI, Sandwich, Massachusetts, USA, 1974.

2. United Nations Economic and Social Council: Report of the General Secretary on Coastal Area Development and Management and Marine and Coastal Technology, 1977.

The report has three parts: the first is concerned with a "Manual on Coastal Area Development" which seeks to provide planners and decision makers with detailed guidelines for establishing a national program of coastal management. The second part consists of a brief review of several other activities undertaken by the UN in the field of coastal area development and management. The last section focuses on measures to insure a better and wider application of marine and coastal technology, and includes a classification of the elements of a work program in this field.

3. Two papers prepared for the U.S. Department of Commerce, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration (NOAA), by Ralph M. Field Associates, Inc., Westport, Connecticut, June 1976, and August 1978.

a. The first report is Coastal Zone Planning for Ocean Islands. It discusses the socio-cultural

factors of the ocean islands; it briefly examines the problems of ocean islands in conducting and implementing coastal zone management planning; it suggests various areas for further investigation.

b. The second report is on Some Potentials of the American Samoa's Participation in the Coastal Zone Management Program. It is a review of the land tenure and institutional factors in Samoa, and considers some problems of legal authority that could affect the participation of American Samoa in the federal coastal zone management program.

4. A paper: "Environmental Law and Technological Cooperation: Agenda for Asia and the Pacific." Presented at ESCAP/UNEP Expert Group Meeting on Environmental Legislation, December, 1977, by Jeffrey N. Shane.

The paper review the pros and cons of environmental law and technical cooperation and points out the many problem areas in the modern legal mechanisms. It strongly suggests the administrative and legal mechanisms which maximize the likelihood that:

a. environmental concerns will be promptly included in the development planning calculus, and

b. conduct inconsistent with sound environmental management will be promptly identified and contained.

5. A report on a UNEP mission on "Coast Management Legislation in Sri Lanka," February, 1978, by Jeffrey N. Shane.

The report documents the problems and state of affairs in Sri Lanka which are typical of such problems in most of the least developed countries with similar conditions.

6. IUCN occasional paper on "A Preliminary Classification of Coast and Marine Environments," by Dr. G. Carleton Ray, 1975.

The paper classifies the marine ecosystems into different regions by coastal biotic provinces and habitat. This system serves the purpose of defining and classifying natural regions for purposes of conservation.

7. Another paper by Dr. Ray is entitled, "Critical Marine Habitats." This paper identifies problems of critical marine habitats and describes such areas and the preparation of plans for their conservation. One of the objectives of this study is to provide criteria for the selection of areas to be set aside as marine parks or

reserves and to prepare guidelines for their management.

8. US-AID Project Identifiaction Documents (PID) include:

   a. "Improved Utilization and Management of LDC Coastal Zone Resource;" and

   b. "Man and the Biosphere Program, Phase II."

9. A technical paper on "The Israeli Wave Climate and Longshore Sediment Transport Model," written by Victor Goldsmith and Abraham Golik, 1978.

10. Monographs on "The Blue Plan" and "The Medieterranean Action Plan" by UNEP.

11. Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone. John Clark, The Conservation Foundation, 1974. The book presents basic ecological and management principles which are very useful in approaching coastal zone management in developing countries. The author states that environmental management of coastal waters and shorelands has as one of its fundamental goals "the maintenance of coastal ecosystems in their best condition, or at the level of 'best achieveable ecosystem function.'" As any form of environmental management must encompass whole ecosystems, Dr. Clark deems it necessary to conduct a professional analysis of each coastal ecosystem through an

examination of the important biota and major physical factors and the effect of each on the functioning of the ecosystem, how these factors interact, and how in comination they affect the life of the system. The four chapters of the book are: Ecologic Considerations; Environmental Distrubance; Resource Evaluation and Protection; and Constraints on Specific Uses. The book provides a model from which to launch a research project of specific coastal zones in developing countries.

12. Final Report of the 208 Islandwide Project: A Water Quality Management Plan for the Island of Puerto Rico. (Draft.) Environmental Quality Board, Commonwealth of Puerto Rico, October 1978.

This case project provides a study which examines through an integrated approach, a potential ccastal zone management plan for Puerto Rico. The project has included studies such as water supply, water quality assessment, residual wastes and a problem assessment of the following elements: agriculture, construction, mining, urban runoff, rural communities.

An additonal note is necessary on coastal zone management research. In a field as broad and comprehensive as coastal zone, there are an infinite number of studies

which deal with individual themes that function within coastal zones, i.e., fisheries development, forestry, tourism, water pollution. For purposes of this literature review, we have consciously excluded works on individual themes and instead included references only to works which integrate several thems under the heading of Coastal Zone Management.

Appendix IV

Pollution

A. Institutions

B. Conferences, Seminars, and Symposia

C. Review of Recent Research and Literature

A. Institutions:

Among the UN family of international institutions, FAO, WHO, UNDP, UNIDO, and UNEP are the leading organizations. Among others, the important ones are the World Bank, United States Environmental Protection Agency (EPA), and United States Agency for International Development (AID). Canadian International Development Agency (CIDA), Centre for Overseas Pest Research of the Overseas Development Ministry (COPR), Institut de Recherches Agronomiques Tropicales et des Cultures, Paris (IRAT), Scientific Committee on the Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU), the World Food Council, the International Fund for Agricultural Development and some universities.

1. FAO

The Director-General of FAO in July, 1963 established a working party of experts on the official control of pesticides and reviewed the existing pesticide control schemes in approximately 25 countries. The report of the Working Party included recommendations for provisions which should be incorporated in comprehensive pesticide legislation of any country. Since then, these guidelines have been reviewed and brought into conformity with WHO standards.

The FAO Committee on Pesticides issued a report in 1963 dealing with 37 pesticides and suggested acceptable daily intakes for 15 of them. The same substances were reviewed in 1965, and in addition other pesticides were evaluated. The sub-committee on

Pesticide Residues is active in recommending tolerances and appropriate methods of analysis for certain pesticides used on cereals.

The main sphere of activities of FAO in Pesticides is to:

a. determine the availability of residue data and the collection of these data;

b. evaluate data and propose pesticide residue tolerances;

c. evaluate analytical methods and recommendations of acceptable methods of analysis;

d. recommend to initiate, stimulate, and coordinate the necessary research as indicated by their studies.

There are a number of problems in establishing this coordination which include the specific interest of the donors, limitations in the FAO system, and the research orientation for the consultative group.

A new international program is being proposed by FAO to coordinate and strengthen national pesticide programs, to strengthen regional structures, and to develop information exchange.

FAO is also promoting increased and more efficient use of fertilizer. In 1975, the FAO Task Force on Fertilizers was established to exchange information and coordinate activities both within FAO and with other organizations. Possible fertilizer pollution is a portion of this program. The program has developed into a more comprehensive approach based on five points:

a. project appraisal of present fertilizer use and source of supply;

b. fertilizer research, including the effect of environmental factors;

c. fertilizer extension services, including demonstrations for cash or credit;

d. training of personnel through publications and seminars;

e. coordination of fertilizers use development at the regional, national, and international levels.

The FAO Fertilizer Program is financed by trust funds contributed by donor groups. Annual contributions in cash and in kind now average more than two million dollars.

2. WHO

The WHO Expert Committee on Pesticide Residues is responsible for advising on all matters related to pesticides and pesticide residues with particular reference to:

a. review of toxicological and related data on certain pesticide residues;

b. proposal of, where possible, acceptable daily intakes for man for those pesticide residues that have been reviewed;

c. recommendations designed to initiate, stimulate and coordinate necessary research.

3. UNDP

UNDP works with the national governments in programming their national plans and helps them construct their own program. For instance, UNDP/FAO Quelea bird project headquartered in Dakar, Senegal and UNDP/FAO Project on training in crop protection, conducted in the Sudano-Sahelian Zone, are the examples of UNDP activities.

In the area of fertilizers, UNDP works jointly with the United Nations Industrial Development Organization (UNIDO) and is helping

developing countries overcome technical problems in their fertilizer industry as well as environmental impact. UNDP finances most of UNIDO's fertilizer projects as well as research on potential fertilizer impact.

4. UNEP

United Nations Environment Program is the single most important agency concerned with regional cooperation in the field of environment, including problems of pollution. UNEP emerged in response to expressed needs of the developing countries, based on the premise that environmental problems stem from both physical circumstances and the existence of underdevelopment and poverty. In working on questions of pollution, UNEP is the principle coordinating agency for United Nations institutions.

An early UNEP effort was a symposium, coordinated jointly with the SCOPE Program. The symposium underlined many problems related to pollution that were unique to developing countries. See item 6 in "Review of Recent Research" in this appendix for details of the SCOPE Symposium.

UNEP work on pollution includes its Mediterranean Action Plan, a regional environmental program which involves 17 states and nearly a dozen international organizations and research bodies. Pollution is a prominent part of the program. Other activities consist of pollution monitoring (through GEMS) and pollution research.

5. EPA

EPA coordinates pesticide and other pollution problems in the United States as well as working jointly with international bodies such as the World Health Organization to determine environmental impacts and pollution problems in other parts of the world. The domestic pesticide program has been underway for several years. It has been a huge effort and has analyzed hundreds and perhaps even thousands of different pesticides and chemical substances. Until recently, information from these analyses was classified material. However, recent court rulings have made it possible for the information to be made available to the public. EPA is about to begin releasing it. Once the EPA test results are publicly available, portions of them may be of use in developing countries. Although the environmental impact of pesticides is not automatically transferable, with modest adaptation, the results may be applicable. Additional testing would be in order in this area.

EPA has also made modest beginnings in the area of integrated pest management but it is too early to suggest that IPM is a major activity of EPA.

EPA is also working jointly with specialists from Great Britain, the Netherlands, Yugoslavia, Egypt, India, and the United States to develop methods for monitoring pesticides and other environmental pollutants.

6. AID

AID works actively in pesticide and other pollution areas.

Under a contract with the University of California, AID has conducted a large number of studies and training programs dealing with crop protection, pesticide management, and environmental impact in Asia, Africa, and Latin America.

AID representatives at the Sahel Crop Pest Management Conference propose a regional pest management project for Central West Africa which would be implemented through the USDA. Plans for this project are currently under discussion. Aid has also published a number of documents related to pollution and pesticide management. These include a pesticide manual (1972), an environmental impact statement on pesticides (1977-78), a manual for water and environmental health procedures, an engineering guide for environmental standards, and large numbers of documents and reports based on a number of the pesticide training and research efforts.

AID has also sponsored training programs in industrial pollution. The School of Public Health at the University of North Carolina has offered several seminars, both in the United States and overseas, over the last five years on the topic of industrial pollution.

AID also supports major programs in fertilizer assistance but has not yet undertaken any major efforts to assess the environmental impact of fertilizer usage or the relationship between fertilizer use in cooperation with various pesticide or other chemical sprays.

7. CIDA

Canadian International Development Agency is assisting in establishing plant quarantine and plant protection programs in Niger and Upper Volta and anticipates including a plant protection element in a cereal grain project in Mali.

8. COPR

Centre for Overseas Pest Research of the Overseas Development Ministry, United Kingdom works closely with regional and national organizations and have projects on birds, grasshoppers, termites, and locust in several parts of the developing world.

9. IRAT

Institut de Recherches Agronomiques Tropicale, based in France, maintains laboratories in Senegal, Niger, Mali, and elsewhere in the Sudano-Sahelian region. It undertakes research on agriculturally related topics including pesticide use, fertilizer application, and other agricultural environmental issues.

10. SCOPE

Scientific Committee on the Problems of Environment of the International Council of Scientific Unions (ICSU) undertakes review and assessment of the information available on man-made environmental changes and the effects of these changes on man. SCOPE's activities emphasize improvement of the scientific procedures of assessment of long-term changes in the environment.

11. IGU (International Geographic Union)

The IGU has recently initiated a committee of experts to work on the problem of pesticide pollution. Members include representative of industry, government agencies, and research institutions throughout the world. They hope to initiate a small number of pilot projects to develop a series of case studies on the impact of pesticide.

12. World Bank

The World Bank has been a major source of financing for projects to construct fertilizer production and to improve the output of existing capacity in developing countries. Because the Bank has been working in the area of fertilizer usage for many years, it is also concerned with the environmental impact of these chemicals.

13. World Food Council

The World Food Council was established as a high level body concerned with food problems. Its primary purpose is to review reports from all organizations in the United Nations family concerned with food and agriculture. The Council then considers what actions may be necessary to advance their efforts. For example, the Council recently recommended that:

a. bilateral and multilateral institutions increase their assistance, both in cash and kind, to assist developing countries to obtain their fertilizer requirements;

b. stress the importance of making more realistic forecasts of the developing country's fertilizer supply and demand.

To date, the World Food Council has not taken a stand on the issue of fertilizer impact.

14. Universities

Among United States universities concerned with pollution and other detrimental environmental impacts are the University of California at Berkeley which has conducted over two dozen studies and training programs on pest management and pesticides in Asia, Africa, and Latin America. The University of North Carolina, North Carolina State, the University of Arizona, Arizona State University are among those that have participated in multi-disciplinary study and training efforts in Latin America. The University of Miami and Washington University have participated in multi-disciplinary efforts to analyze the impact of pesticides in Pakistan. The University of Arizona has special expertise in semi-arid land agriculture and its environmental problems.

B. Conferences, Seminars, and Symposia:

There have been a number of recent seminars and conferences which have documented the current issues and identified particular areas of national and international concern in the area of pollution. These conferences include:

1. Sahel Crop Pest Management Conference, Washington, D.C., U.S.A., December, 1974.

2. Seminar and Workshop in Pesticide Management, Manila, Philippines, 1975.

3. Seminar on Management of Pesticides and Protection of the Environment, San Salvador, El Salvador, 1973.

4. Seminar/Workshop in Pesticide Management, Alexandria, Republic of Egypt, 1977.

5. A Report on "Plant Protection Problems in South-East Asia" by East Asian Management Study Team, Cornell University, 1971.

6. A Multi-Disciplinary Study Team Report on "Crop Protection in the Mediterranean Basin," by University of California at Berkeley, 1972.

Summary of Recommendations of these Six Seminars

1. Sahel Crop Pest Management Conference held at the invitation of AID, U.S. Department of State, Washington, D.C., on December 11-12, 1974. The report suggests that the increased emergency assistance to the Sudano-Sahelian Zone, after the devastating drought, may be neutralized in its efforts to increase crop production, by crop pests. Consequently, the conference objectives were:

a. to establish a technical understanding of the problem;

b. to develop a technical consensus from the stand point of professional pest control management;

c. to help create a forum or network for continued exchange of information bearing on the problem; and

d. to gain some indication of the kind of assistance donors might provide.

The conference conclusions were:

a. while most of the Sudano-Sahelian states have a rudimentary plant protection service, they do not have the institutional capabilities to maintain surveillance of the pest problems, to develop appropriate attacks on the pests, or to react quickly and effectively when a pest outbreak occurs;

b. with the exception of very few, the pest problems are intra-country, rather than regional or international problems;

c. the nature of terrain and transport systems in the Sahelian Zone makes surveillance extremely difficult;

d. the 1974 outbreaks have left the region seriously depleted of available supplies of equipment and pesticides;

e. training and retraining of technical and non-professional levels of crop protection workers is seriously needed. This training should stress field operations and ecological aspects of plant protection.

In the light of these observations, it was recommended that:

a. national programs should be strengthened;

b. at the regional level, a comprehensive manpower training be observed, and emergency control operations strengthened;

c. exchange of information, adaptive research, and the development of coordinated policy and planning undertaken.

2. Seminar and Workshop in Pesticide Management held with participation of University of California and US-AID on February 10-15, 1975, at Manila. The seminar reviewed the situation in the areas of pesticide industry, safe use, exposure of human and other non-target organisms, relation of agriculture and health and the use of pesticides and pollution control. Recommendations include:

a. Pesticide Industry:

i. There should be a more scientific and accurate assessment of pollution to be implemented by an authorized agency,

ii. Pesticides industry should cooperate with local authorities in disseminating information to farmers, government, technicians, and the public,

iii. The pesticide companies should continue to publish compatibility charts to guide extension and research people as well as farmers in the mixing of pesticides,

iv. The chemical companies should also make available the antidote recommended for pesticide intoxication,

v. Companies should market the protective clothing and devices for use by farmers or whoever may apply pesticides,

vi. The companies should pool their technical staff, which will assist in the training of technicians and their extension men, on the utilization of different pesticides.

b. Safe Use

i. Field practices be improved to reduce contamination,

ii. Methods of pesticide application should be thoroughly studied and modified for the safer use,

iii. Proper formulation undertaken, corrective measures applied to assure the farmers and applicators apply the effective minimum dosage,

iv. Disposal of surplus pesticides after field operations be ensured.

c. Exposure

i. Proper handling by transporters, shippers, etc., and storage,

ii. Disposal of used containers,

iii. To study and establish monitoring systems.

d. Agriculture and Health

i. Coordinate and cooperate in establishing research studies in:

(a) Pesticides residue analysis,

(b) Establishing pesticide tolerance limits,

(c) Conducting bio-assay and susceptability tests; studying tolerance/resistence of target pests or insect vectors.

ii. To provide confirmatory or referral system or specific pesticides research studies of common interest.

e. Pollution Control

i. Pesticide Industries: Depending on the character of effluents, the following should be observed by pesticide industries before discharging waste:

(a) Plant control - control loss of raw materials, solvents, and products to reduce the volume of waste water and concentration of pollutants to be treated,

(b) Chemical treatment and chemical residue analysis,

(c) Physical treatment such as carbon absorption, sedimentation, filtration, heating, dilution, evaporation, etc.

(d) Biological treatment - such as trickling, filters, activated sludge, lagoons, stabilization ponds, etc.

ii. Protection of Environment: to protect the environment from pollution, the following were recommended:

(a) Develop, promote and place into gradual application, the integrated control approach to pest management in agriculture and health,

(b) To consider the following specific measures to minimize environmental pollution:

- utilizing alternative non-chemical and environmental modification methods to disease and pest control;

- utilizing bio-degradable pesticides and gradually phasing out the use of pesticides with high pollution potentials.

3. Seminar on Management of Pesticides and Protection of the Environment; sponsored by Ministry of Agriculture, El Salvador and USAID and University of California, held at El Salvador, December 3-7, 1973. The seminar pointed to the problem of skills in pesticide management for integrated pest-control in three areas:

a. human pesticide poisoning;

b. pesticide contamination; and

c. resistence problems, affecting both agricultural pests and mosquito vector of malaria.

The Seminar recommended:

a. a long-term inter-country program to be established; and

b. the training courses to be continuously held at University levels and updating of laboratory personnel, technical back-up, and supporting roles.

4. Seminar/Workshop in Pesticide Management; sponsored jointly by Plant Protection Department, University of Alexandria, Egypt, Ministry of Agriculture, and University of California/AID. In cooperation with FAO, WHO and ALESCO.

The Seminar pointed to the dilemma in integrated pest management which requires careful ecological analysis of many variables in pest problems as they exist in the field. Research for the development of integrated pest management must be related to the full complexity of these field problems. The Seminar identified problems of limited facilities, unskilled manpower, and other shortages of resources as it made the following recommendations:

a. Conservation of natural enemies, parasites, predators, and pathogenes of pests;

b. Development of reliable pest prediction methodologies;

c. The determination of accurate economic thresh-hold infestation levels for each pest;

d. Application of an integrated research program;

e. Proper registration of pesticide imports and registration of new pesticides;

f. Establishment of an agro-medical program at the national government level and local levels, integrating the skills and resources of the disciplines of agriculture and medicine;

g. Establishment of appropriate courses and training programs for agro-medical workers in the colleges and schools of agriculture, public health, medicine, and in the relevant ministries;

h. Monitoring of pesticides residues and establishment of laboratory facilities at university levels, along with training facilities for analysts from Middle East and Africa;

i. Training for all those who use, supervise, sell, and conduct the business of pesticides.

5. Report on Plant Protection Problems in Southeast Asia; prepared by East Asian Management Study Team in 1971 covered the countries of the Philippines, Thailand, Malaysia, Taiwan, Hong Kong, Singapore, and Japan.

The meeting identified nine general deficiencies in crop protection:

a. Inadequate information on losses due to pests;

b. Economic thresh hold for pests are not established;

c. Applied research is inadequate on food crops, in most countries;

d. Extension activities are inadequate;

e. Pesticide regulations are out of date or insufficient;

f. There is almost no monitoring of pesticide residues on edible crops;

g. Post harvest losses are seldom being studied or controlled;

h. There is serious lack of trained manpower for crop protection activities; and

i. Information gap and deficiencies of libraries and books.

6. Crop Protection in the Mediterranean Basin, by USAID and the University of California, 1972. This is a report based on meetings and visits to the region. It showed concern over the desert locust and other pests and the neglect of side effects on the individual safety of users in the use of pesticides. The Mediterranean Basin countries are experiencing reduced availability of farm labor and higher labor costs due to migration of laborers to urban areas and to attractions of wage employment in industrialized European countries.

The report therefore recommended:

a. development of a directory of plant protection workers in the Mediterranean Basin;

b. provision of facilities and support for more inter-regional meetings on general plant protection with subsections from the various disciplines;

c. development of a library service with facilities for duplication and translation;

d. encouragement and assistance for those governments where no agricultural college now exists in the university system, or where inadequate commitment to agricultural sciences exists, to develop or strengthen the curriculum in crop protection;

e. establishment of facilities for conducting pesticide residue analysis on crops produced for export, local consumption, or feed and on crops and animal products being imported from other countries;

f. strengthening regional approaches in the protection disciplines, comparable with the impetus which entomology has received through FAO activities on the desert locust and the AID/USDA Regional Insect Control Project.

C. Review of Recent Research and Literature:

A number of studies and reports on rural and urban pollution, crop protection, pesticides, and the environment have appeared in recent years. A limited selection of some of the more important include:

1. Environmental Consideration for Industrial Development, 1978. A World Bank document deals with the sources and effects of industrial pollution, governmental structures for environmental management, sampling and analytical procedures and treatment technology. The paper also covers the economic, sociological, planning and political aspects of industrial pollution.

2. Report to the Congress, by the Comptroller General of the United States, on "Restriction on Using More Fertilizer for Food Crops in Developing Countries," 1977. The report deals with various aspects of food problems and the fertilizer demand, and identifies the bottlenecks in the production and distribution of fertilizers. It suggests ways and means to work with host country governments (less developed countries receiving fertilizer aid) to review policies which act as constraints in the enhancement of the use of fertilizers.

3. A briefing paper on "Policy Issues on Appropriate Pesticide Technology," by The Policy Sciences Center, Inc., 1978. The paper provides background information about appropriate pesticide technology and the institutions involved in producing and delivering it. The paper reviews the role of the international chemical industry and identifies the areas which need further research and development. It also stresses the role of trans-national corporations and the cooperation between less developed and more developed countries.

4. FAO Paper on "Informal Dialogue on Pesticides," 1977. The dialogue concentrates on two aspects of pesticide usage: the constraints on increased usage by the farmer and how to remove them; and the scope for greater participation on the part of developing countries in repacking from bulk, local formulation, and where appropriate and feasible, the local manufacture of active ingredients.

5. **Final report by Central American Research Institute for Industry, 1975 on "An Environmental and Economic Study of the Consequences of Pesticide Use in Central American Cotton Production."** This was a UNEP Project intended to develop a systems management program to reduce the environmental effects of pesticide use in Central American cotton production. The report points to the critical problem that 4,000 to 5,000 human pesticide poisonings occur in the area annually.

6. "Environment and Development," collected papers, summary reports, and recommendations of SCOPE/UNEP Symposium on Environmental Aspects of Agricultural Development in Asia and Africa, with Detailed coverage of environmental Aspects in Land Use, Pest Control, Rivu Basin Development, National Parks and Natural Reserves, Industrial Planning, and Human Settlements.
The report also contains papers on population and demographic problems, education, and training. National and regional institutional arrangements are considered and recommendations offered.

7. A Report of Economic and Social Commission for Asia and the Pacific, on the need for more effective environmental pollution control, 1977 from Jeffrey N. Shane, Attorney, Task Force on Human Environment. The report deals with the problems of pollution arising from marine and industrial sources, and from motor vehicles. It suggests recommendations in each of these areas.

8. A report by Agricultural Research Service of the United States Department of Agriculture on "Infiltration Control Research," directed to increased and staple crop production through more efficient use of soil, water, and vegetation resources. This research has produced over 30 papers and abstracts which have been published in professional journals, symposia proceedings, and technical magazines.

9. Research articles on "Pesticides Use in Less Developed Countries," by S. Ghotak and R.K. Turner, published in Food Policy, May, 1978. The paper examines the use of pesticides in agriculture of less developed countries. It outlines in general terms both the benefits and the costs of any pesticide programs and the difficulties involved in quantification of cost functions.

10. Implications of Pesticide Use for Tropical Fresh Water and Terrestrial Ecosystems. Papers presented at an informal workshop meeting held at the Center for Overseas Pest Research, February, 1975. Pertinent papers included:

    a. "The Fate and Significance of Chemical Pesticides," F.P. Winteringham, IAEA.

    b. "Disruption of Aquatic and Terrestrial Ecosystems by Pesticides in Developing Countries," by M. Taghr Farvar, Centre for Development Studies, Iran and Wasif Ahmed, Department of Environmental Conservation, Iran.

    c. "Implications of Pesticide Use for Man as a Consumer," by G.B. Pikkering, Tropical Products Institute.

11. "A Consequence of Insecticides: Pests follow the chemicals in the cocoa of Malaysia," a paper by Gordon R. Conway. Conway suggests that the most serious outbreaks of pests often occur immediately following, and as a direct consequence of, the application of contact-acting insecticides.

12. "Pesticides and the Environment," a paper presented at Pesticides in the World Symposium prepared by members of the Cooperative Programme of Agro-Allied Industries with FAO and other United Nations Organizations, 1972.

13. "Mediterranean Action Plan: An Interim Evaluation," article published in Science, Volume 202, 10 November, 1978 by Baruch Boxer.
    The Mediterranean Action plan is an extensive program of regional environmental cooperation on technical and institutional approaches to pollution, monitoring, environmental assessment, and policy making. The simultaneous development of a regional monitoring network and legal instruments to protect the Mediterranean from pollution is an important achievement which provides a firm basis for continuing cooperative efforts.

14. "World Food, Pest Losses, and the Environment," edited by David Pimentel, 1978. A selected symposium by the American Association for the Advancement of Sciences (AAAS).

15. Country Reports prepared for the Agency for International Development (AID), by the University of California. The reports included:

    a. Pakistan: "Analysis of Pesticide Use in Pakistan," 1974.

    b. South Vietnam: "Pest Management and the Efficient Use and Safe Handling of Pesticides," 1974.

    c. Brazil, Uruguay, Bolivia, Ecuador and Dominican Republic: "Crop Protection in These Countries," 1972.

    d. Arab Republic of Egypt: "Pest Management and Pesticide Management," 1976.

    e. Guatemala, Honduras, Nicargua, Costa Rica, Panama, and Guyana: "The Crop Protection Situation," 1972.

    f. Bangladesh: "Plant Protection," 1975.

    g. Turkey, Iran Afghanistan, and Pakistan, "Plant Protection," 1972.

16. A report on "Weed Science in the Developing Countries of the World," by participants from University of Nebraska, Michigan State, Florida, Oregon State, and Colorado State, and USDA, 1973.

17. Department of State, Agency for International Development, "Pesticide Manual," Part 1: Safe Handling and Use of Pesticides, Part II : Basic Information on Thirty-five Pesticide Chemicals, 1972.

18. The Agro Medical Approach to Pesticide Management, by the University of California Pesticide Project, 1976. The report covers pesticide use for (a) assisting in increased food production, (b) better protection of human health from vector born diseases, (c) prevention of human poisoning, (d) prevention of environmental pollution, and (e) evidence of pest resistence.

19. International Survey on Pesticide Use, conducted by the Panel on Pesticide, AID/University of California Project. The report finds eight principal concerns in pesticide use. They are:

    a. that construction of storage containers and actual storage of pesticides is a major problem in many developing countries;

    b. that both technical personnel and equipment for monitoring of pesticide problems are in short supply;

    c. that facilities for analyzing residues of pesticides are inadequate when attempting to identify specific residue problems in agricultural commodities;

    d. that contamination of spray men and other pesticide personnel was a consistent problem and was intensified by a shortage of doctors and other trained medical staff to diagnose problems of human pesticide poisoning;

    e. that the three most persistent problems involved with pesticide formulation were quality, availability, and safety. Many countries in the developing world do not observe quality control in the process of pesticide formulation;

    f. that much research is needed to develop more suitable containers for pesticide transportation and storage in the tropics;

g. that research was needed to develop more suitable application equipment for use of pesticide teams in developing countries;

h. that AID should encourage research on the biological and ecological characteristics of insect pests.

20. "Recommendations on Procedures for Environmental Assessment of Malaria Control Programs with Special Reference to Pakistan," April, 1978. A report prepared by the Program for International Development at Clark University, Charles W. Hays, Leonard Berry, Richard B. Ford.
The document considered the possibility of a blanket or overall environmental assessment which would be applicable to any malaria control project using malathion. The report determined that although some portions of malaria control programs would be common to any project, other aspects, particularly the cultural and social dimensions of a project, would not be transferrable and therefore a blanket environmental assessment would not be possible.
The principal recommendations of the report were to recognize:

a. environmental uniqueness - that every environment has qualities which are particular to it;

b transferability - that some projects would have elements common to other projects and therefore some universality;

c. monitoring - that the concept of continual monitoring of any project was as important if not more important than the formulation of a good environmental assessment. Moreover, that the information on pesticide use and incidence should be fed back [illegible] continual redesign of the project was funda-

21. "Policy Issues on Appropriate Pesticide Technology: A Briefing Paper," March, 1978. Prepared by Frank Penna, Policy Science Center, New York, New York.
This paper is an inquiry into the appropriateness of pesticide usage for small farms. It concludes that research is required to devise technologies and methods of application which will be uniquely suited to small holders. The paper considers thirteen issues pertinent to the question, including environmental impact and toxicity of the pesticides used. The paper also considers possibilities of integrated pest management.

22. Environmental Impact Statement on the AID Pest Management Program (two volumes), May, 1977.
This major effort by AID came in response to a court ordered inquiry into the appropriateness of AID pesiticide policy. The report is an extremely thorough analysis of previous programs and explores several options. It recommends that AID pursue integrated pest management as its long-range solution to pest problems. On the other hand, it recognizes the need to use pesticides on a selected basis. The report carries detailed information about the composition, application, and impact of pesticides commonly used overseas.

23. Low-Cost Technology Options for Sanitation: A State-of-the Art Review and Annotated Bibliography, Witold Rybczynski,

Chongrck Polprasert, and Michael McGarry, 1978.
A concise review of technologies for low-cost sanitation as well as an excellent bibliography. Included are brief descriptions of waste-disposal systems, options for hot climates, and alternatives for reusing human waste.

APPENDIX V

LIST OF PEOPLE AND INSTITUTIONS ASSISTING IN REPORT

APPENDIX V

LIST OF PEOPLE AND INSTITUTIONS ASSISTING IN REPORT

Yusuf Ahmed
Deputy Assistant Executive Director
Programme Bureau
UNEP
P.O. Box 30552
Nairobi, Kenya

Arthur Alexion
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
US Department of Commerce
Rockville, Maryland 20852

Fred Arnold
Pesticide Office
US Environmental Protection Agency
Washington, D.C.

Dr. Whitman Bassow
Executive Director
Center for International Environment
Information
300 East 42nd Street
New York, New York 10017

Paul Berthoud
Director
Division for Programme Support Services
UNCTAD
Palais des Nations
CH-1211 Geneva 10
Switzerland

Janet M. Bonner
Assistant to James Digger Jones
US Department of the Interior
Geological Survey
Reston, Virginia 22092

Dr. David R. Bouldin
Department of Agronomy
Cornell University
Ithaca, New York 14853

Robert W. Brandt
Director of International Forestry
US Forest Service
US Department of Agriculture

John Busterud
President
RESOLVE
360 Bryant Street
Palo Alto, California 94301

Frank Butrico
Director of Environmental Health
Pan American Health Organization
525 23rd Street, N.W.
Washington, D.C. 20037

John R. Clark
Senior Associate
The Conservation Foundation
1717 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Phillip A. Clark
American Petroleum Institute
2101 L Street, N.W.
Washington, D.C. 20037

David Conn
Professor, Department of Architecture and
Urban Planning
University of California
Los Angeles, California 90024

Diana Crowley
University of Virginia
Box 237
Keswick, Virginia 22947

Michael McDonald Dow
BOSTID
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Harold Elkin
Director, Environmental Affairs/Energy Conservation
Sun Company
1608 Walnut Street
Philadelphia, Pennsylvania 19103

Rachel Elkins
University of California
UC/AID Pest Management Project
2288 Fulton Street
Suite 310
Berkeley, California 94704

Dr. Virgil H. Freed
Environmental Health Sciences Center
Oregon State University
Corvallis, Oregon 97331

Pedro Gelabert
President, Environmental Quality Board
Office of the Governor
Commonwealth of Puerto Rico
Santurce, Puerto Rico 00910

Norman Gilroy
Institute for Human Environment
World Affairs Center
312 Sutter Street
San Francisco, California 94108

Christine Gosselin
Assistant to Mr. J.G. Bene
International Development Research Centre
Box 8500
Ottawa, Canada K1G 3H9

D.J. Greenland
Deputy Director General
International Rice Research Institute
P.O. Box 933
Manila, Philippines

Ernest Grennwald
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
US Department of Commerce
Rockville, Maryland 20852

Arthur J. Hanson
Director
Institute for Environmental Studies
Dalhousie University
Halifax, Nova Scotia

Richard Helmer
Deputy Director
Regional Seas Programme Activity Centre
UNEP Geneva Office
Palais des Nations
CH-1211 Geneva 10
Switzerland

Allan Hirsch
Chief
Office of Biological Services
US Department of the Interior

Lois Hobson
Conference Planning Office
Department of State
Washington, D.C. 20520

Larry Johnston
Ralph Field Associates, Inc.
68 Church Lane
Westport, Connecticut 06880

George Kinter
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
US Department of Commerce
Rockville, Maryland 20852

Robert Knecht
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
US Department of Commerce
Beltsville, Maryland 20852

Dr. H.W. de Koning
Environmental Health Technology and Support
Division of Environmental Health
WHO
1211 Geneva 27
Switzerland

Janet Kozera
Chief, Reference Unit
Bureau for Programme Policy and
Evaluation
United Nations Development Programme
One United Nations Plaza
New York, New York 10017

Samuel Kunkle
Conservation Specialist
Office of Programming and
Training Coordination
Peace Corps
806 Connecticut Avenue, N.W.
Washington, D.C. 20525

Molly Kux
Bureau for Development Support
US Agency for International Development
Department of State
Washington, D.C. 20520

Dr. David Lieberman
School of Engineering
University of Illinois
Urbana, Illinois 61801

William Long
Deputy Director
Office of Environmental Affairs
Department of State
Washington, D.C. 20520

Cynthia Mackie
Assistant to Dr. Vayda
Cook College
Rutgers University
P.O. Box 231
New Brunswick, New Jersey 08903

Bernadette V. Marasco
Assistant to Dr. Oscar Traczewitz
International Paper Company
Tuxedo Park, New York 10987

Cruz A. Matos
Director
Institute of Marine Affairs
P.O. Bag 135
Saint James, Trinidad

Robert Milne
National Park Service
Department of the Interior
1100 L Street, N.W.
Washington, D.C. 20005

George B. Morgan
Director, US Environmental Protection Agency
Office of Research and Development
Environmental Monitoring and Support Laboratory
P.O. Box 15027
Las Vegas, Nevada 89114

Philip Ndegwa
Economic Adviser
Office of the President
P.O. Box 30510
Nairobi, Kenya

Lawrence Neuman
Ocean Economics and Technology Office
United Nations
One United Nations Plaza
New York, New York 10017

John B. Noble
Suite 1000
1100 17th Street, N.W.
Washington, D.C. 20036

Francis O'Kelly
Chief, Publishing Programme
UNEP
P.O. Box 30552
Nairobi, Kenya

Daniel Okun
Professor,
School of Public Health
University of North Carolina
Chapel Hill, North Carolina 27514

Kenneth Osborne
Bureau for Development Support/Agriculture
US Agency for International Development
Department of State
Washington, D.C. 20520

Henry G. Owen
Assistant to Dr. J.T. Ling
3M Corporation
3M Center
Saint Paul, Minnesota 55101

Dr. Walter Parham
Office of Technology Assessment
United States Congress
Washington, D.C. 20510

James F. Parr, Chief
Biological Waste Management and
Organic Resources Laboratory
Agricultural Environmental Quality Institute
Beltsville Agricultural Research Center
US Department of Agriculture
Beltsville, Maryland 20705

E.W. Pearcey
Department of Industry
Ashdown House
123 Victoria Street
London SW1E 6RB
England

N.K. Pham
Chief, Environmental Co-ordinating Unit
Office of the Executive Secretary
United Nations Economic and Social Commission for Asia
and the Pacific
UN Building
Rajadamnern Avenue
Bangkok 2, Thailand

Victor Rabinovich
BOSTID
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Dr. G. Carleton Ray
Department of Pathobiology
School of Hygiene and Public Health
Johns Hopkins University
615 North Wolfe Street
Baltimore, Maryland 21205

Bill Roseborough
Bureau of Development Support
US Agency for International Development
Department of State
Washington, D.C. 20520

Basil A. Rossi
President
Rossi-Nayve Consultancy Services, Inc.
P.O. Box 5111
J.P. Rizal Street
Manila, Philippines

Flavia Rutkosky
Office of Programming and
Training Coordination
Peace Corps
806 Connecticut Avenue, N.W.
Washington, D.C. 20525

Dr. Saiz
Organization of American States
Department of Scientific Affairs
1735 I Street, N.W.
Washington, D.C. 20006

Dr. Albert Sasson
Division of Ecological Sciences
Man and the Biosphere Programme
Unesco
7, Place de Fontenoy
75700 Paris
France

Jacob Scherr
Natural Resources Defense Council
917 15th Street, N.W.
Washington, D.C. 20005

Scientific Committee on Problems of the Environment
51, Bld. de Montmorency
75016 Paris

Leslie Sederlund
Assistant to Michaela Walsh
Office of Technology Assessment
United States Congress
Washington, D.C. 20510

Jeffrey Shane, Esq.
Environmental Attorney
Washington, D.C.

Dr. Small
Department of Commerce
Washington, D.C.

Raymond Stanton
US Department of Agriculture
Office of Pesticides
500 12th Street, S.W.
Washington, D.C. 20024

Kevin Sullivan, Ph.D.
Director
Chesapeake Bay Center for
Environmental Studies
Smithsonian Institution
P.O. Box 28
Edgewater, Maryland 21037

Dr. James Talbot
Staff Officer
National Research Council
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

H.L. Teller
Unesco
7, Place de Fontenoy
75700 Paris
France

William M. Upholt, Ph.D.
525 East Indian Spring Drive
Silver Spring, Maryland 20901

Andre Valeiras
Braualo Orejas Miranda
Organization of American States
Department of Scientific Affairs
1735 I Street, N.W.
Washington, D.C. 20006

Dr. A.P. Vayda
The Environment and Policy Institute
The East-West Center
1777 East-West Road
Honolulu, Hawaii 96848

Gilbert White
Institute of Behavioral Sciences
University of Colorado
Boulder, Colorado

Dr. F.W. Whittemore
Office of Agriculture
US Agency for International Development
Department of State
Washington, D.C. 20520

Henry C. Wohlers
36381 Row River Road
Cottage Grove, Oregon 97424

Dr. G.M. Woodwell
The Ecosystems Center
Marine Biological Laboratory
Woods Hole, Massachusetts 02543

Tomio Yoshida
Professor, University of
Tsukuba
Graduate School of Environmental Science
IBARAKI-KEN, 300-31
Japan

APPENDIX VI

INSTITUTIONS CONCERNED WITH ENVIRONMENTAL MANAGEMENT AND ANALYSIS

A. African Institutions

B. Latin American Institutions

C. Asian Institutions

A. African Institutions

1. Algeria

a. Centre de Recherche sur les Ressources
Biologiques Terrestres,
4 Route des 4 Canons
B.P. 812,
Alger

2. Botswana

a. Botswana Geological Survey
Private Bag 14
Lobatse

3. Cairo

a. Cairo University
Department of Botany
University of Cairo Post Office,
Giza

b. Desert Institute
El Mataria

c. Institute of African Research Studies
33 Misaha Street
Dokki, Giza

4. Central African Republic

a. Office de la Recherche Scientifique et
Technique Outre-Mer
B.P. 893
Banqui

5. Ethiopia

a. Desert Locust Control Organization
for Eastern Africa

P.O. Box 4255
Addis Ababa

6. Gabon

a. Laboratoire de Primatologie et d'Ecologie
des Fôrets Equatoriales
(C.N.R.S.)
B.P. 18
Mokokou

7. Ghana

a. Ghana Academy of Arts and Sciences
P.O.B. M, 32
Accra

b. Institute of Aquatic Biology
P.O.B. 38
Achimota

c. Council for Scientific and Industrial Research (CSIR)
P.O.B. M, 32
Accra

8. Ivory Coast

a. Ministère de la Recherche Scientifique
B.P. 2599
Abidjan

b. Directeur de l'Environnement
Ministère de la Protection de la Nature
Abidjan

c. Directeur Adjoint de l'Institut Universitaire
d'Ecologie Tropicale
Abidjan

d. Institut de Géographie Tropicale
Abidjan

e. Coordinateur Scientifique du Projet TAI,
l'Institut Universitaire d'Ecologie Tropicale

f. Institut de Recherches Agronomiques Tropicales
et des Cultures Vivrières (IRAT)
B.P. 635
Bouake

g. Centre de Recherche Océanographique d'Abidjan
B.P. V18
Abidjan

9. **Kenya**

a. **Institute of Development Studies**
University of Nairobi
Nairobi

b. National Environment Secretariat
Office of the President
P.O. Box 30510
Nairobi

c. Kenya Rangelands Ecological Monitoring Unit
P.O. Box 47146
Nairobi

d. East African Agriculture and Forestry
Research Organization
P.O. Box 30148
Nairobi

e. International Centre for Insect Physiology and Ecology
(ICIPE)
Kenya

f. Kenya Soil Survey
National Agricultural Laboratory
P.O. Box 14733
Nairobi

10. Libyan Arab Republic

a. Agricultural Research Centre
P.O. Box 2480
Sidi El-Masri,
Tripoli

11. Malawi

a. Fisheries Research Unit
P.O.B. 27
Monkey Bay

b. Forest Resource Institut
Private Bag 6
Dedza

c. Chancellor College
University of Malawi
Zomba

12. Mali

a. Directeur de l'Institut d'Economie Rurale,
Bamako

b. Centre National de Recherches Zootechniques,
B.P. 262
Bamako

13. Mocambique

a. Instituto de Investigacao Cientifia
Mocambique
Caixa Pestal 1780
Maputo

14. Morocco

a. Universite Mohammed V
Faculté des Sciences/ Institut
Scientifique Chérifien
Avenue Moulay
Chérif, Rabat

15. Niger

a. CNRSH - IFAN
B.P. 318
Niamey

16. Nigeria

a. School of Biological Sciences,
University of Lagos
Yaba

b. Department of Agricultural Biology,
University of Ibadan
Ibadan

c. Institute of Agriculture,
Ahmadu Bello University
Zaria

d. School of Biological Sciences,
University of Benin
Benin City

e. Forestry Research Institute
P.M.B. 5054
Ibadan

17. **Senegal**

a. Ministère de l'Industrie et de l'Environnement,
Dakar

b. Centre Technique Forestier Tropicale
Division des Recherches
Piscicoles Résidence Faidherbe
B.P. 28
Richard-Toll

c. Centre de Recherche Océanographique de Dakar
Thiaroye (CRODT)
B.P. 2241
Dakar

d. Office de la Recherche Scientifique et Technique
Outre-Mer Centre ORSTOM de Dakar,
Route des Pères Maristes,
B.P. 1386
Dakar

e. Office de la Recherche Scientifique et Technique
Outre-Mer (ORSTOM)
Station Ecologique de Richard-Toll
B.P. 20

f. Institut de Physique Météorologique
Dakar-Fann

g. Université de Dakar,
Faculté des Lettres et Sciences Humaines,
Département de Geographie
Dakar-Fann

18. Sierra Leone

a. Institute of Marine Biology and Oceanography
Fourah Bay College
University of Sierra Leone
Freetown

19. Sudan

a. University of Gézirah
P.O. Box 2667
Khartoum

b. University of Khartoum
P.O. Box 102
Khartoum

c. Geological and Mineral Resources Department
P.O. Box 410
Khartoum

20. Tanzania

a. National Scientific and Research Council

b. Bureau of Resource Assessment and Land Use Planning

c. University of Dar es Salaam, United Republic of Tanzania

21. Tunisia

a. Institut National Scientifique et Technique d'Océanographique et de Pêche (INSTOP), Salammbo

b. Institut des Régions Arides de Tunisie

22. Uganda

a. East African Freshwater Fisheries
Research Organization
P.O.B. 343
Jinja

23. Upper Volta

a. Comité Inter-Africain D'Etudes Hydrauliques (CIEH)
Secrétariat
B.P. 369
Ouagadougou

b. Centre Voltaïque de Recherche Scientifique
Ouagadougou

24. Zaire

a. Commissaire d'Etat à l'Environnement
Conservation de la Nature et Tourisme
B.P. 12348
Kinshasa 1

b. l'Institut Zairois pour la Conservation de la Nature
B.P. 4019
Kinshasa 2

c. Département de l'Environnement
B.P. 4019
Kinshasa

B. Latin American Institutions

1. Argentina

a. National Committee for SCOPE
CONICET,
Rivadavia 1917,
1033 Buenos Aires

b. Coordinador del Programa Forestal INTA
Secretaría de Agricultura y Ganaderia Argentina
Castelar - Provincia de Buenos Aires

c. Instituto Argentino de Investigaciones de las Zonas Aridas (IADIZA)
Casilla de Correos 507,
5500 Mendoza

d. Instituto Nacional de Tecnologia Agropecuaria (INTA)
Rivadavia 1439
Buenos Aires

e. Centro de Investigaciones de Recursos Naturales (INTA)
Castelar

f. Universidad de Buenos Aires
Avenida San Martín 4453,
Buenos Aires

2. Barbados

a. Caribbean Conservation Association

3. Bermuda

a. Bermuda Biological Station for Research

4. **Bolivia**

a. Office de la Recherche Scientifique et Technique
Outre-Mer (ORSTOM)
Cajon Postal 8714

b. Centro Nacional de Documentación Cientifica y
Technológica
(Bolivian National Scientific and Technological Documentation Centre)
P.O.B. 3383

5. **Brazil**

a. Conselho Nacional de De Senvolvimento
Cientifico e Tecnologico

b. Instituto Brasileiro de Geografia e Estadistic a
(I.B.G.E.)
Avenida Beira Mar 436, Centro
Rio de Janeiro 20,000

c. Departamento de Conservacão Ambiental
(Department of Environmental Conservation)
C.P. 3545-ZC-00
Rio de Janeiro

d. Estacâo Experimental de Biologia e Pisciciltura
(Experimental Station for Biology and Pisciculture)
Bairro Cachoeira Emas,
Pirassununga, S.P.

e. Instituto de Biologia e Pesquisas Tecnológicas
(Institute of Biology and Technological Research)
Rua dos Funcianarios,
Juvevê, PR

f. Academia Brasileira de Ciências
(Brazilian Academy of Sciences)
Caixa Postal 229, ZC - 00
Rio de Janeiro

g. Instituto de Pesquisas Agropecuár do Norte
Caixa Postal 48
Belem, Para 66000

h. Secretario Especial de Meio Ambiente
Ministerio do Interior
Brasilia

6. Chile

a. Instituto de Investigacion de Recursos Naturales (IREN)
Manuel Montt 1164
(Casilla 14995)
Santiago

b. Universidad Catolica de Valparaiso
Casilla 4059
Ave. Brasil 2950
Valparaíso

c. Universidad de Chile
Sensores Remotos y Recursos Naturales (SERREN)
Sede Occidente
Casilla 5027
Santiago

7. **Colombia**

a. **Instituto de Desarrollo de los Recursos Naturales (INDERENA)**
Carrera 14 - No. 25A-66,
Oficina 201
Bogotá

b. Comisión Colombiana de Oceanografía

c. Comite Colombiano para la Información del Medio Ambiente

d. Instituto de Ciencias Naturales
Apdo. Postal 7495

e. Instituto de Desarrollo de los Recursos Naturales Renovables
Dirección General de Bosques
Avenida Caracas No. 25 A-66
Bogotá

8. Costa Rica

a. Presidente del Consejo Nacional de
Investigaciones Cientificas y Tecnologicas (CONICIT)
Miembro de la Facultad de Microbiologia
Universidad de Costa Rica
Apartado 10318
San Jose

b. Seccion de Ecologia
Escuela de Biologia
Universidad de Costa Rica
San Jose

c. Facultad Ciencias Exactas y Naturales
Universidad Nacional
Heredia

d. Organization for Tropical Studies,
University of Costa Rica,
Ciudad Universitaria
San Jose

e. Tropical Science Centre,
Apartado 8-3870
San Jose

f. Tropical Science Center
Apto. 2595
San Jose

g. Forestry Sciences Department
Centro Agronomico Tropical de
Investigacion y Ensenanza
Turrialba

h. Asesor Presidencial en Recursos Natural
Servicios de Parques Nacionales
Ministerio de Agricultura y Ganaderia
San Jose

9. **Cuba**

a. Centro de Investigaciones Pesqueras
(Fisheries Research Centre)
Av. 1 y 26,
Miramar, Marianao
Havana

b. Centro Nacional de Investigaciones Cientificas - CNIC
Ave. 25, Calle 158,
Deparo Cubanacán

10. Dominican Republic

a. Encargado de Programación de la Dirección
General de Foresta
Santo Domingo

b. Director, Proyecto Sierra
Coordinador Técnico Sub-Secretaria de
Recursos Naturales y de Protección Ambiental
Secretaría de Estado de Agricultura
Santo Domingo

11. **Ecuador**

a. Ing. Naval,
Autoridad Portuaria de Guayquil
P.O. Box 5739
Guayaquil

12. El Salvador

a. Recursos Naturales Renovables
Ministerio de Agricultura y Ganaderia,
Boulevard de los Héroes,
Edif. Latinoamericano
San Salvador

b. Jefe, Unidad de Paraques Nacionales y Vida Silvestres
Servicio Forestal y de Fauna
Direccion General de Recursos Naturales Renovables
Ministerio de Agricultura y Ganad.
Canton El Matasano, Soyapango

13. Guatemala

a. Instituto de Nutrición de Centro América y Panamá - INCAP
Carretera Roosevelt, Zona 11,
Guatemala City

14. Guyana

a. Guyana Ecological Society
Vice-President
Caribbean Conservation Association
Georgetown

b. National Science Research Council
Georgetown

15. Haiti

a. Département d'Agriculture
Ressources Naturelles
Développement Rural
Port-au-Prince

b. Conseil National Des Recherches Scientifiques
(National Council for Scientific Research)
Département de la Santé Publique et de la Population
Port-au-Prince

16. Honduras

a. Ministerio de Recursos Naturales
11-12 Calle 8 Av. Edif. Jiménez Talavera
Comayagüela

17. Jamaica

a. Ministry of Mining and Natural Resources
Government of Jamaica
4 Musgrave Avenue
Kingston 10

b. Caribbean Food and Nutrition Institute (CFNI)
Jamaica Centre
P.O. Box 140
Mona, Kingston

c. Scientific Research Council
P.O.B. 350
Kingston

18. Mexico

a. Institito de Investigacions Sobre Recursos
Bióticos (INIREB)
Heroico Colegio Militar No. 7,
Apartado Postal No. 63,
Jalapa - Veracruz

b. Sede Museo de Historia Natural de la Ciudad de México
Nuevo Bosque de Chapuktepec,
Apartado Postal 18-845,
México 18, D.F.

c. Instituto Mexicano de Recursos Naturales Renovables,
Avenida Dr. Vertiz No. 724,
México 12, D.F.

d. Sociedad de Estudios Biologicos:
Balderas 94

e. Instituto Mexicano de Recursos
Naturales Renovables, A.C.
Dr. Vertiz 724
Mexico 12, D.F.

f. Instituto de Geografia
Ciudad Universitaria
México 20, DF.

g. Instituto de Investigacion de las Zonas Deserticas
Plaza de Fundadores,
San Luis Potosí, S.L.P.

h. Presidente del Comite del MAB Mexicano
Heroico Colegio Militar No. 7
Apartado Postal No. 63
Jalapa

19. **Panama**

a. Consejo Nacional de Ciencia (National Science Council):
Apt. 3277
Panama City

b. Academia Nacional de Ciencias de Panama;
Apdo. 4570

c. Director del Servicio Forestal
RENARD
MIDA
Apartado 5390
Panama

20. Paraguay

a. Instituto Nacional de Investigaciones Cientificas
P.O.B. 1141

21. **Peru**

a. **Instituto del Mar del Perú**
(Peruvian Marine Institute)
Gral. Valle y Gamarra
Callao, Apdo. 22

b. Oficina Nacional de Evaluacion de Recursos Naturales
(ONERN)
Calle 17 No. 355,
Urb. El Palomar,
San Isidro, Lima

22. Puerto Rico

a. Institute of Tropical Forestry
U.S.D.A. Forest Service
P.O.B. AQ
Rio Piedras, 00928

23. Surinam

a. Stichting voor Wetenschappelijk onderzoek de Tropen
(WOTRO)
(Netherlands Foundation for the Advancement of
Tropical Research)
P.O.B. 1914
Paramaribo

24. Venezuela

a. Instituto Venezolano de Investigaciones
Científicas (IVIC),
Apartado 1827,
Caracas 101

b. Ing. Jefe de la Division des Investigaciones sobre,
Contaminacion Ambiental (CISCA),
El Hastillo,
Apartado 62131,
Caracas 106

c. Consejo Nacional de Investigaciones Cientificas y
Tecnológicas (CONICIT)
Apartado 70617 Los Ruices
Caracas

d. Instituto Venezolano de Investifaciones Cientificas
(IVIC)
(Scientific Research Institute)
Apdo. 1827
Caracas

e. Depto. de Ecologio
I.V.I.C.
Apartado 1827
Caracas

C. Asian Institutions

1. Bangladesh

a. Centre for Integrated Environmental Studies for Development Planning

b. University of Dacca

c. University of Rajshahi

d. University of Chittagong

e. Forest Research Institute

2. Burma

a. Burma Research Society;
Universities' Central Library,
University Post Office
Rangoon

3. India

a. National Committee on Environmental Planning
and Coordination
Department of Science and Technology
New Mehrauli Road
New Delhi - 110029

b. Forest Research Institute and Colleges
Dehradun

c. International Crop Research Institute for
Semi-arid Tropics
Hyderabad
Andhra Pradesh

d. The Executive Secretary
Indian National Science Academy
Bahadurshah Zafar Marg,
New Delhi 110001

e. International Commission on Irrigation and
Drainage

f. International Crops Research Institute for the Semi-
Arid Tropics

g. India Institute of Hygiene and Public Health,
Calcutta

h. National Environmental Engineering Research Institute,
Nagpur

i. S.V. Regional College of Engineering and Technology,
Surat

j. Indian Institute of Science, Bangalore

k. Soil and Water Conservation Engineering
College of Agricultural Engineering,
Tamil Nadu Agricultural University,
Combatore

l. Central Inland Fisheries Research Institute,
Barraukpore, West Bengal

m. University of Jodhpur

3. India (continued)

n. Indian Biophysical Society
Saha Institute of Nuclear Physics
92 Acharya Prafulla Chandra Road
Calcutta

o. Indian Association of Biological Sciences;
Life Science Centre,
Calcutta Univeristy
Calcutta, 19

p. International Society for Tropical Ecology

q. Central Arid Zone Research Institute
Jodhpur, Rajasthan

r. Forest Research Institute and Colleges
P.O. New Forest
Dehra Dun
(Uttar Pradesh)

s. Geological Survey of India
27 Jawaharial Nehru Road
Calcutta 13

t. International Commission on Irrigation
and Drainage
Central Secretariat
48 Nyaya Marg,
Chanakyapuri,
New Delhi - 110021

u. International Crops Research Institute for the
Semi-Arid Tropics
Begumpet, Hyderabad 500016, A.P.

v. University of Jodhpur
Centre of Desert Studies
Jodhpur, Rajasthan 342001

4. **Indonesia**

a. Indonesian Institute of Sciences,
Director, Botanical Garden,
Djl. Teuku Ditiro No. 43,
Jakarta

b. Institute of Oceanology,
P.O. Box 580/DAK,
Sunda Kalapa,
Jakarta

c. National Biological Institute,
Indonesian Institute of Sciences,
Jl. Ir. H. Juanda 11,
Bogor

d. Directorate of Land Use,
Ministry of Home Affairs,
Jl, Singamangaradja 2,
Kebayoran Baru,
Jakarta

e. Urban and Environmental Research Centre
Jl. Imam Bonjol 13,
Jakarta

f. Director, National Institute of Oceanology
Akuarium, Sundakelapa
P.O. Box 580
Jakarta Barat

g. Center for Natural Resource Management and Environmental Studies,
Bogor Agricultural University

h. Indonesian Institute of Sciences

i. National Institute of Geology and Mining

j. National Biological Institute

k. Project Leader, Environmental Study Group,
Lemigas, Cipulir, Kabayoran Lama,
Jakarta Saltan, W. Java

4. Indonesia (continued)

l. Indonesian Institute of Sciences
Jalan Teuku Tjhik Ditiro 43,
Jakarta

m. Lembaga Biologi Nasional
(National Biological Institute)
Jl. Ir. H. Juanda 11
POB 110
Bogor

n. Lembaga Oseanologi Nasional
(National Institute of Oceanology)
Jl. Akuarium, Pasar Ikan
P.O.B. 580
Jakarta

o. Executive Secretary
National Committee on the Environment
Jalan Raden Saleh 43
P.O. Box 250
Jakarta

5. Iran

a. Marine Geologist,
The Geological Survey of Israel
30, Malkhei Israel Street
Jerusalem

b. Department of the Environment (D.E.)

c. The Plan and Budget Organization

d. Arid Lands Ecology Bureau
P.O. Box 1430
Tehran

e. Environmental Sciences and Ecodevelopment Cluster
P.O. Box 12/1645
Tehran

f. Soil Institute
North Amirabad Avenue
Tehran

6. Iraq

a. Institute for Applied Research on Natural Resources
P.O. Box 10094
Jadiriyah, Baghdad

7. **Israel**

a. Agricultural Research Organization
Forestry Division
Ilanot, Doar Na Lev Hasharon

b. Center for Environmental Studies
Hebrew University
Mount Scopus Campus
Education Building
Jerusalem

c. Israel Soil Conservation and Drainage Division
Soil Erosion Research Station
P.O. Ruppin Institute of Agriculture
Emek Hefer

8. Malaysia

a. Malaysian Centre for Development Studies,
ENE Building,
2nd Floor,
Jalan Pudu,
Kuala Lumpur

b. Department of Environment
Oriental Plaza,
Jalan Parry,
Kuala Lumpur

c. National University
Kuala Lumpur

d. University of Malaya
Kuala Lumpur

e. Environmental Protection Society Selangor

f. Freshwater Fisheries Research Station
Batu Berendam
Malacca

g. Forest Research Institute
Kepong, Selangor

h. Malaysian Scientific Association
c/o Rubber Research Institute of Malaysia
P.O.B. 150,
Kuala Lumpur

9. Nepal

a. Department of Irrigation, Hydrology and Meteorology, HMG
Pani Pokhari
Kathmandu

b. Tribhuvan University,
Kirtipur Campus,
Kathmandu

10. Nicaragua

a. Ministerio de Economia,
Industria y Comercio
Dirección General Riquezas Naturales
Apartado 8,
Managua

11. **Pakistan**

a. Pakistan Science Foundation
P.O. Box 1121
Islamabad

b. Department of Geography
University of Peshawar

c. Pakistan Forest Institute

d. University of Agriculture (Lyallpur)
Lyallpur

12. **Philippines**

a. National Institute of Science and Technology

b. National Science Development Board,
Bicutan,
Taguig
Rizal

c. University of Philippines at Los Banos

d. Commissioner, National Pollution Control Commission,
772, Pedro Gill Street
Ermita, Manila

e. National Research Council of the Philippines
University of the Philippines
Diliman, Rizar

f. National Science Development Board
P.O.B. 3596
Manila

g. National Institute of Science and Technology
727 Pedro Gill Street
P.O.B. 774
Manila

13. Sri Lanka

a. University of Sri Lanka
Colombo Campus,
Colombo

b. National Science Council of Sri Lanka
47/5 Maitland Place,
Colombo 7.

14. Thailand

a. Department of Marine Science
Faculty of Science
Chulalongkorn University
Payathai Road,
Bangkok

b. Faculty of Natural Resources
Prince of Songkhla University
Songkhla Province

c. Ecology and Environment Research Institute
Applied Scientific Research Corporation of Thailand
Bangkhen, Bangkok 9

d. Faculty of Forestry
Kasetsart University
Bangkhen, Bangkok 9

e. Project Director,
Environment Education and Research Project
Mahidol University

f. Environmental Research Institute
Chulalongkorn University,
Payathai Road,
Bangkok

g. Director of Brackish Water Fisheries
Department of Fisheries
Bangkok

h. Asian Institute of Technology (AIT)
Bangkok

i. Director, The Institute of Environmental Research,
Chulalongkorn University
Bangkok

j. Applied Scientific Research Corporation of Thailand
196 Plagonyothin Road
Bangkhen, Bangkok

k. Marine Biology Centre, Marine Fisheries Division
89/1 Sapanpla,
Yanawa, Bangkok

14. Thailand (continued)

l. Science Society of Thailand
Library Building
Faculty of Science
Chukalongkorn University
Phya Thai Road
Bangkok

m. Secretary-General
National Environment Board
260 Suriyothin Building
Phaholyothin Road
Bangkok