REPORT

Rome,
Italy,
30 November-
3 December
1993

Integrating environmental and sustainable development themes into agricultural education and extension programmes

Expert Consultation

Food
and
Agriculture
Organization
of
the
United
Nations

REPORT OF THE EXPERT CONSULTATION ON INTEGRATING ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT THEMES INTO AGRICULTURAL EDUCATION AND EXTENSION PROGRAMMES

Rome, Italy, 30 November to 3 December 1993

Prepared by the
Agricultural Education and Extension Service (ESHE)
Human Resources, Institutions and Agrarian Reform Division

Compiled by
Michael Stocking
with the editorial assistance of
Scott Perkin

Food and Agriculture Organization of the United Nations
Rome, 1994

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Foreword

The need to improve the role of agricultural education and extension systems in promoting sustainable agricultural and rural development has recently been recognized as an urgent international priority. The World Commission on Environment and Development (the "Bruntland Commission"), the UN's *Environment Perspective for the Year 2000 and Beyond*, the FAO/Netherlands Conference on Agriculture and the Environment (1991), and the United Nations Conference on Environment and Development (UNCED, in 1992) have all highlighted the importance of appropriate agricultural education and extension. Long before UNCED, however, FAO had been promoting the adoption of environmentally sound agricultural practices, through its technical assistance programmes in agricultural education, extension, training and information exchange. However, the measures and scope for increasing the environmental content of agricultural programmes have not been widely disseminated, in either the developed or the developing countries; the extent to which environmental and sustainable development themes have been successfully integrated into agricultural programmes has also remained uncertain.

This Expert Consultation on the Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes represents one of FAO's responses to these important issues. Today, virtually every country in the world has an agricultural education programme, and most countries have an agricultural extension system as well. The world's trained agricultural staff are the product of agricultural education institutions. These staff include the agricultural extension workers, teachers, managers and researchers who will be expected to provide technical and professional services to the world's growing agricultural population; by the year 2000, the number of people economically active in agriculture is estimated to reach 1,130 million.

Twenty experts in agricultural education and extension and two consultants participated in this Expert Consultation, together with more than 40 FAO professional staff. The Consultation, which included plenary and small workshops, was enriched by five background documents: a keynote address presented by the Deputy Director-General of FAO; a paper on FAO's environmental policies and activities, presented by the Assistant Director-General for Environment and Sustainable Development; a paper on women and the environment; and two synthesis reports, each based on a review of ten, specially commissioned, case studies. One synthesis report examined the integration of environment and sustainable development themes into agricultural education programmes, while the second report reviewed the status of environmental themes in agricultural extension programmes.

This report summarizes the findings and recommendations of the Expert Consultation, and also incorporates the five original background documents in a series of annexes. It addresses a wide variety of topics, including institutional capacities, roles and functions, policies and mandates, target groups, faculty training, and funding and resource allocation. As such, the report is intended as a reference document on the current status and approaches to integrating environmental themes into agricultural programmes.

The contributions of all participants are acknowledged with appreciation. Special gratitude is extended to those who undertook the case studies and prepared the Consultation papers, and to the FAO Education and Extension Service, which organized the Consultation and the preparation of this report. It is my hope that the report will lead to an increased contribution on the part of agricultural education and extension programmes to global sustainable development.

H.W. Hjort
Deputy Director-General

TABLE OF CONTENTS

Annexes to the Consultation Report

EXECUTIVE SUMMARY

An Expert Consultation on Integrating Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes was held at FAO Headquarters in Rome from 30 November to 3 December 1993. Twenty international experts, influential in agricultural education and extension as deans and professors in universities and colleges or as high-level government officials, met together with two resource persons and 46 FAO staff to consider the role of agricultural education and extension in promoting sustainable agriculture and rural development (SARD) and how environmental issues could be incorporated in the diversity of agricultural education and extension systems world-wide. FAO has long been attentive to environmental matters in its programmes, but only comparatively recently, through such international forums as the Earth Summit (UNCED) in 1992, has SARD come to the fore as a global expression of the importance of protecting the natural resource base for present and future generations.

The objectives of the Consultation called for an examination of the nature and scope of current involvement in SARD by agricultural education and extension organizations; roles, strategies and appropriate approaches through which institutions could contribute to the implementation of UNCED recommendations; and policies and lines of action to improve the role and contribution of agricultural education and extension organizations to SARD. The Consultation's output is intended to guide planners and policy makers at regional, national and international levels on the integration of SARD into agricultural education institutions and extension programmes.

Five main papers (annexed to this report) were presented and discussed in plenary session. The Keynote Address stressed the importance attached by FAO to the Consultation in view of the recommendations of UNCED and the imperative to integrate environmental issues in policy and practice. The Opening Address by the FAO Assistant Director-General responsible for environment and sustainable development asked participants to pay special attention to policies and actions for the environment that could accommodate the urgency to intensify agriculture, provide gainful employment to populations and deal with global environmental threats. The importance of a gender analysis perspective to environmental issues was highlighted in a special theme paper. Two reviews, based on ten case studies each, were then presented. These studies had been commissioned by FAO to provide a systematic review of the extent to which environmental and SARD themes have been integrated into agricultural education and extension work in 20 countries.

Following these formal presentations, participants to the Consultation met in plenary and small group sessions to consider (a) the lessons learned from the case studies and other experiences; (b) strategies for incorporating environmental concerns; (c) policy implications and proposed implementation actions; and (d) specific suggestions for improving the capability of agricultural education and extension to support environment and SARD.

Rationale for Integration and Change

Participants examined the rationale for integrating environment and sustainable development themes into agricultural education and extension programmes. They noted the importance of maintaining a productive resource base through policies and actions which not only relate to current concerns about population growth and gender inequalities but also promote sustainable development. The challenge was seen as how to integrate environmental issues in their broad social, cultural, political, economic and physical aspects with technical knowledge of natural resource use through programmes of agricultural education and extension.

Participants discussed the adequacy of various approaches, including the top-down delivery of messages to students and extension audiences. An 'inputs model' of education and extension where passive 'target groups' are told what they are doing wrong and then shown how to correct their ways was debated during the Consultation, especially with regard to its ability and effectiveness to deal with the complexity of the issues and to enlist the active participation of all client groups. The Consultation suggested that probably one of the more effective means of protecting the environment and agricultural resources is to empower local people and others directly involved in the management of natural resources to make their own analysis and own decisions on what should be done. A participatory model of agricultural education and extension may need to be developed in which participant groups would discuss their priority issues and implement solutions. Inevitably, environment and sustainable development themes would permeate such discussions. The role of educators and extension agents would be to facilitate the process and provide access to technical advice and financial resources if these should be needed and demanded. The exact balance between providing advice and facilitating local participation will depend on the culture of the country, the current nature of the institutions and the rapidity by which innovative methods of analysis and learning can be promoted. However, participants were by no means unanimous in the degree to which it was possible to empower students and farmers to deal with environmental and sustainable development questions.

Three issues affect the challenge of integrating environmental and sustainable development themes into agricultural education and extension programmes. First, SARD concerns are complex and diverse. They involve social, cultural, political and economic aspects as well as technical and scientific information. No blueprint solutions are available for all situations. Hence, an interdisciplinary approach is essential. Secondly, agricultural education and extension organizations are not always structured to deal with the complexity of these issues. Substantial institutional reorientation may be necessary. Thirdly, new paradigms of learning and knowing which incorporate the knowledge of local people and students are necessary as alternatives to top-down approaches. The Consultation, therefore, while fully endorsing the rationale for integration where agricultural education and extension is placed firmly in the context of SARD, recognized the difficult challenges ahead of achieving a better approach to the substantial problems of environmental protection.

Current Practice

The Consultation examined the nature and scope of current involvement and activities in environmental issues. Developed countries have for some time been including environmental concerns in their teaching curricula, research activities and outreach extension programmes. For example, agro-ecology, farming systems research and extension, and safe use of chemicals have been part of curricula in most agricultural education programmes for more than a decade. However, this integration of environmental aspects has been almost exclusively concerned with production agriculture. Developing country institutions have also included some environmental aspects of production agriculture and in recent years have been using a farming systems focus in education and extension. Some of the critical threats to tropical and small-farm agriculture, such as soil erosion, input supply and water provision, have also been addressed. Therefore, there is in place a generalized appreciation for SARD and a willingness to include it in current programmes in both industrialized and less developed countries.

Current practice does not, however, demonstrate widespread integration of environmental and sustainable agriculture themes into programmes. Rather, these themes are adding to existing demands. A need for substantial change in attitudes, leadership and organization is indicated. In particular, an open-mindedness and willingness to innovate should be fostered with attention paid to bringing in all participant groups (students, farmers, agri-business, research, youth, women and others) at all relevant levels (local, regional, national and international). Cooperation, coordination and liaison between different organizations and interest groups are currently inadequate and should be improved.

Setting a Course for the Future

Using examples of good practice and of the development of new paradigms of learning, participants made a large number of suggestions and recommendations. These are grouped under eight issues in which improvement could be effected.

Issue 1: Roles and Functions

Primary amongst the many roles and functions of agricultural education and extension institutions is the fostering of a climate of partnership and self-action amongst all participants in SARD - students, professionals, field workers, farmers, consumers and other groups in society. The classical approach of technology generation and transfer of 'correct' messages has, in the complex context of SARD, to be reconsidered in favour of more empowerment of local communities to solve their own problems. Because there are compelling reasons why environmental issues shoud be integrated into overall programmes, the Consultation called for explicit reappraisal of the challenge.

Issue 2: Policy and Mandate

Environmental mandates are drawn from many sources, and the Consultation noted the confusion that still reigns as to what constitutes 'sustainable development'. Unless sustainability can be perceived by the majority of people at all levels as essential to their personal welfare, then short-term expediency and crises will dominate working practice to the detriment of long-term environmental protection. For these reasons, the support of clear policies is needed with unambiguous institutional mandates to promote sustainable development at all levels in all agricultural education, training and extension.

Issue 3: Institutional Capacity

The Consultation recognized that many institutions neither have the capacity to take on additional burdens nor the flexibility to restructure in order to accomplish integration. The resource provision for education is often inadequate. There is a lack of appropriately trained faculty members to teach environmental issues with sufficient breadth and depth at university level. Many extension systems similarly have few trained personnel and are dangerously overloaded. Cooperation with other organizations that have an interest in environment and development - such as women's groups and NGOs at local level - is frequently poor. Therefore, as an appropriate way of building national institutional capacity, the Consultation recommended much closer liaison and integration of programmes between agricultural institutions and with other organizations.

Issue 4: Target Groups and Coverage

The Consultation advised that education and extension must be designed for specific audiences, taking into account their needs, knowledge and experience. Curricula may provide for some specialist courses, but because sustainable development is a fundamental goal for all agriculture, participants preferred that environmental issues permeate all formal and non-formal education and extension. In the greater awareness of the needs of different groups, special attention should be paid to the disadvantaged in society because it is generally they who suffer most from environmental degradation. Regional workshops, using materials similar to those developed for this Expert Consultation, are suggested as a means of discussing specific approaches of incorporating environmental issues into education programmes.

Issue 5: Environmental Content and Extension Topics

An impressive array of environmental topics is covered by various institutions. While issues surrounding commercial agriculture are generally provided for, an inadequacy was identified in the coverage of some topics of less immediate relevance to economic efficiency of production systems. A wider appreciation of global environmental issues is needed in extension. Aspects such as environmental impacts on small-farming systems, desertification and biodiversity require new means of expression and the development of appropriate educational and training materials. The Consultation was especially concerned that some materials appear to ascribe blame for unsustainable agriculture only on the land users. The environmental content must present a balanced analysis of the reasons why farmers sometimes degrade their land and how solutions do not necessarily lie only with on-farm

techniques; they may rest with changes in policy, market prices, incentives and subsidies, or indeed with industry and patterns of consumption. At all levels, the Consultation urged a thorough re-examination of the content and nature of environmental messages in agricultural education and extension. In this reappraisal, students, extension trainees and farmers should be actively involved in drawing up an agenda of appropriate topics. The term 'critical conversations' was used by the Consultation to describe the needed interactions and networking between institutions and with all strata of society.

Issue 6: Integration Approaches and Methodologies

The Consultation highlighted the strategic importance of how environmental topics are integrated. Although a difficult challenge, integration approaches should provide an alternative to traditional top-down ways of learning. An ultimate aim should be to make environmental issues inseparable from the production goals of farmers, the objectives of industry and manufacturing and the needs of society for a safe and secure environment. Participants suggested a variety of teaching techniques such as role play, field projects and distance learning via television and radio, and a number of technologies which may be useful such as multi-media, computer games, software and electronic mail for networking.

Issue 7: Training and Reorientation

Consultation participants recognized the need for substantial change in many education and extension systems. Properly trained personnel with a sufficient breadth of experience will be vital. At national level, a professional responsibility for environmental matters should be engendered through foundation courses, in-service training and multi-disciplinary team approaches to problem solving. New models of analysis which accommodate gender issues, global perspectives and socio-economic considerations are required.

Issue 8: Funding and Resource Allocation

Some new resources may be required, especially in the case of developing countries. However, the expectation of substantially increased resources in order to take on the mandate is unrealistic. The Consultation's suggestions emphasized reappraisal, reorganization and reorientation. Additional budget may be needed for coordination, staff retraining and new materials, but better integration of environmental issues and liaison between institutions at all levels could achieve cost savings, thus freeing resources for field projects and programmes.

Role of FAO

The Consultation addressed the key role that FAO has taken and will continue to take in promoting SARD. The Organization is in a lead position to clarify basic principles, act as a catalyst in encouraging change and facilitate networking and communication among all relevant institutions.

In particular, the Consultation suggested that FAO assist with developing and testing new models in agricultural education and extension; with the exchange of examples of appropriate practice; with the creation of international and regional forums for the discussion and development of policy and institutional mandates; with assistance in institutional analysis for the enhancement of capacity in environmental matters; with training techniques and with the dissemination of educational and training materials with particular emphasis on reaching the more marginal target groups such as rural women and the illiterate. Participants encouraged FAO to further its already substantial work in these directions by combining the promotion of sustained agricultural production with the maximum effort to conserve natural resources.

1

ORGANIZATION AND OVERVIEW OF THE EXPERT CONSULTATION ON INTEGRATING ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT THEMES INTO AGRICULTURAL EDUCATION AND EXTENSION PROGRAMMES

Background

Agriculture is the activity most essential for human survival: it feeds people, produces basic commodities for society, and provides gainful employment for the majority. Yet, with rapid population growth in many parts of the world, agriculture is not fulfilling its vital function. In many parts of the world, demand for agricultural products outstrips supply with the result that natural resources are being depleted through deforestation, soil degradation, pollution, loss of biological diversity and other processes.

Three main challenges have been identified by FAO[1]:

- By the year 2025, an additional three billion people will have to be fed from a finite resource base. Already, more than 600 million are undernourished and some 50 million are threatened by food shortages and famine in developing countries. The needed intensification of agriculture, however, poses further problems: pollution, waste disposal, loss in biodiversity. With many current methods of high-intensity agriculture, environment, human health and the natural resources themselves are at risk;

[1] See FAO (1992). *Sustainable Development and the Environment: FAO Policies and Actions, Stockholm 1972 - Rio 1992*. UN Food and Agriculture Organization, Rome. This review of FAO's involvement in sustainable development and environmental protection provides guiding principles for a broad programme of international cooperation towards the elimination of hunger and poverty for present and future generations.

- Agriculture often fails to provide sufficient employment opportunities. Disparities in living conditions between rural and urban populations are increasing. Coping strategies of farming populations in the face of poverty or the vagaries of uncertain climates or difficult market conditions often further threaten the integrity of the natural environment;

- The search for sustainable forms of agriculture and rural development is related to the need to find land use approaches which do not deplete natural resources, or promote climatic change, water and air pollution, deforestation and loss of biological diversity. Is agriculture the culprit or the victim? Are land users to be blamed for land degradation or assisted to reverse it? Society itself has to develop a coherent view of sustainability and the responsibility for its promotion. A precautionary approach is called for, which places constraints on the agricultural sector while looking to consumers, especially in affluent societies, to change their patterns of consumption.

Herein lies the environmental imperative. Unless the natural resource base can be protected, growing populations will not be fed, inequalities between rich and poor, rural and urban, men and women, will continue to widen, and the conflict between nature and society will intensify. How do we plan in order to avoid these eventualities?

At the **local level**, rural households will struggle to meet their short-term needs; their very survival may be in jeopardy. Poverty inevitably leads to land degradation. Desperate people have no choice but to exploit their environment, endangering the sustainability of resources needed for their children and their children's children.

At the **national level**, economic and environmental policy may deteriorate as governments face the dilemma of a declining productive resource base combined with population increase. Desperate people will desert the countryside, demand land and tenancy reforms, migrate to urban slums, and possibly foment social instability. Amidst short-term crises, national governments will be unable to address the long-term challenge of sustainable development.

At the **international level**, relationships between rich and poor countries, aid donors and recipients, and natural resource users and providers will be under further strain. The burden of international debt, which seriously impeded growth for many developing countries in the 1980s, will affect differentially how major geo-political groupings perceive the need for environmentally-acceptable use of natural resources and energy-efficient and pollution-free technologies. Migration and cross-border disputes based on alleged environmental impacts of one country affecting another could well intensify.

To a degree, some of these problems are manifest today. One of the messages of the Earth Summit at Rio de Janeiro in 1992 was that there is still time to forestall the major environmental and social disasters - provided that action is taken urgently. This Expert Consultation was one of a number of international efforts to address the key issues of delivering guidelines, policies and actions that will protect the environment and natural resource base for the future. It sought to clarify the role of agricultural education and

agricultural extension in relieving the pressures on natural resources and in providing for greater but more sustainable productive output for the security of rural households, national economies and international relationships.

FAO's Commitment to Environmental and Sustainable Development Issues

FAO has long been concerned with the numerous and interrelated components of what is now called sustainable development. In the preamble to FAO's Constitution, the various sub-programmes of FAO's overall Programme of Work contain objectives such as "raising levels of nutrition and standards of living", "securing improvements in the efficiency of the production and distribution of all food and agricultural products" and "improving the conditions of all rural populations". Some early milestones in FAO's involvement in environmental issues include:

- In 1961, FAO established its Fertilizer Programme "to improve crop production and farmers' incomes through the efficient use of fertilizers". With its emphasis on increased production, the programme only indirectly addressed environmental questions;

- Also in 1961, FAO with Unesco commenced preparation of the Soil Map of the World, a project which 20 years later led to the publication of a global inventory of soil resources and a methodology to calculate the capability of the lands of the developing world to feed the populations who live on them;

- In 1965, FAO launched the Indicative World Plan for Agriculture with the view to countries progressively adjusting the allocation of their agricultural resources to conform to long-term coordinated production plans for the best use of these resources;

- FAO played a major role in the United Nations Conference on the Human Environment in Stockholm in 1972. Thirty-six of the 108 substantive recommendations were addressed in whole or part to FAO in such areas as habitat and resource conservation, waste disposal and recycling technologies, and the monitoring of environmental problems associated with the use of pesticides and fertilizers;

- In 1977, FAO published its review of the State of Food and Agriculture, examining among other things the environmental threats to forests and agriculture, the impact of soil degradation, depletion of wildlife and fish stocks and genetic diversity;

- FAO's Conference of 1981 adopted the World Soil Charter, which recommends that decisions about land use and management be made for long-term advantage rather than short-term expediency;

- In 1982, FAO published the first comprehensive survey of tropical forest resources, including an analysis of the rates of depletion and degradation, leading in 1985 to the Tropical Forestry Action Plan which gives an overall framework for investment planning in forestry and support to national development.

However, the term 'sustainable development' did not come into common usage until less than ten years ago. Presented to the United Nations General Assembly in 1987, the report of the World Commission on Environment and Development alerted the international community to the need for long-term environmental strategies for sustainable development. FAO is playing a leading role in addressing the challenge of sustainable development on a world-wide basis.

In FAO's Conference of 1989, it was decided that the Organization should intensify its interdisciplinary work to ensure the integration of environmental considerations in all FAO activities; give higher priority to the prevention of environmental degradation; strengthen collaboration with other UN organizations in these fields; and prepare for the 1992 United Nations Conference on Environment and Development (UNCED).

As part of the preparatory work for UNCED, FAO with the support of the Government of the Netherlands organized a Conference on Agriculture and the Environment in 's-Hertogenbosch in 1991. Various strategies and tools for sustainable agricultural development in the developing world were reviewed by participants from 119 countries, 17 intergovernmental organizations and 20 non-governmental organizations. A noteworthy aspect of the conference was the interaction between planners, administrators, researchers, farmers' leaders, and representatives of women's associations, consumer unions, pesticide and fertilizer industries and development agencies. The results of the Conference, synthesized in the Den Bosch Declaration and Agenda for Action on Sustainable Agriculture and Rural Development, formed major inputs to *Agenda 21* of UNCED.

FAO took the lead in developing a consistent strategic framework for sustainable growth as one of its contributions for UNCED in Rio de Janeiro, June 1992. In particular, FAO took responsibility for a number of chapters of *Agenda 21* which contain proposals for a wide range of technical and institutional changes essential for longer-term development. In response to *Agenda 21*, FAO has brought together 12 Special Action Programmes within an international cooperative framework for sustainable agriculture and rural development. These Programmes fall into four broad categories:

- policy advice and planning assistance;
- nutrition and welfare of rural peoples;
- sustainable management of natural resources;
- sound use of agricultural inputs.

This Consultation addresses the first category because, as *Agriculture: Towards 2010* (prepared for the 27th FAO Conference, November 1993) notes: "What matters for development, more than natural resources and man-made physical capital, is the capability of people to be effective and productive economic agents." For the agricultural sector, that capability is developed and mobilized through institutional arrangements of agricultural

education and extension. Within those arrangements, environmental and sustainable development themes now need to imbue all aspects of agricultural education and extension. There is an urgent need to: (a) understand and improve the role of agricultural education and extension institutions in the sound management of the natural environment at farm and community levels; and (b) measure the scope and extent of integration of environmental and sustainable development themes into agricultural education and extension programmes.

Today, practically all countries have formal education programmes in agriculture and most have agricultural extension systems. Trained men and women in agriculture are products of these educational programmes. Amongst them are thousands of teachers at various levels, some 600,000 (1989 estimates) agricultural extension workers and 140,000 (in 1985) researchers, who provide technical and professional support to what are projected to be 1,130 million persons economically active in agriculture in the year 2000.

Objectives of the Consultation

The following objectives were set for the Expert Consultation on the Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension:

- Examine the nature and scope of involvement of agricultural education and extension institutions in environmental and sustainable development;

- Identify roles, strategies and appropriate approaches through which agricultural education and agricultural extension institutions could contribute to the implementation of *Agenda 21* of UNCED;

- Identify and discuss issues and suggest policy and lines of action to improve the role and contribution of agricultural education, training and extension institutions in environmental management and sustainable agricultural and rural development.

The output of the Consultation, in the form of this report, associated papers and case study reviews presented in the annexes, is intended to provide guidance to planners and policy makers on the development of agricultural education and extension institutions at national, regional and local levels. In particular, the output is aimed at academic leaders and administrators in universities and colleges (especially agricultural institutions, educational training organizations and agricultural research stations involved in postgraduate and post-doctoral programmes), extension service organizers and programme managers in government ministries and departments (for example, agriculture, environment and natural resources, forestry, rural development, education and culture, higher education and research, economic affairs and finance). Other potential beneficiaries of the deliberations of this Consultation will include teachers, researchers and student leaders in various faculties and institutions who are concerned about the development of their subject to address environmental issues. Further, it is anticipated that the Consultation's analysis of the current situation, the determination of appropriate strategies and the suggestion of policies and lines of action will be of value to FAO, other international organizations, donor agencies, voluntary groups, and

individuals engaged at all levels in promoting environmentally sustainable forms of land use and agricultural development.

Consultation Methodology

This Expert Consultation was part of the Regular Programme of Work and Budget of FAO's Human Resources, Institutions and Agrarian Reform Division. The Agricultural Education and Extension Service (ESHE) was responsible for organising and servicing the Consultation.

Preparatory work for the Consultation commenced in February 1993, with the contracting of persons from a range of backgrounds related to agricultural education and extension to carry out a series of twenty case studies. Ten country case studies were commissioned under the heading: "The Integration of Environment and Sustainable Development Themes into Agricultural Education Programmes" - from Chile, Columbia, Lebanon, Malaysia, Morocco, Nigeria, Thailand, United Kingdom, USA, and Zimbabwe. Faculties of agriculture in each country were analyzed to determine the extent to which environmental and sustainable development themes have been included in all aspects of their operations and teaching programmes. Similarly, ten case studies were commissioned to examine agricultural extension systems in countries or individual states within countries - from Brazil (Parana), Burkina Faso, Egypt, India (Andhra Pradesh), Indonesia (Java), Ireland, Malawi, Mexico, Syria, and USA (Nebraska). Most of the case study authors were invited in their personal capacity to participate in the Expert Consultation, thus giving a spread of experiences from all major regions of the world, developing and developed countries, small and large states, affluent countries and poor. The similarities and contrasts between the evidence from the various case studies contributed to a rich store of experiences, enabling the Consultation to consider a large number of options for the promotion of environmentally-sound development of agricultural education and extension.

When the case studies were completed, two consultants were commissioned to write review papers, one each for agricultural education and agricultural extension. These reviews were intended to examine the case study results, prepare a background justification for the involvement of agricultural education and extension services in environmental and sustainable development themes, and derive specific lessons on good practice which may be of wider interest. These papers (included in this report at Annexes 4 and 5) formed two of the principal documents for the Expert Consultation meeting in Rome; their findings laid the groundwork for much of the subsequent deliberations.

Finally, in preparation for the Consultation, FAO staff of the Human Resources, Institutions and Agrarian Reform Division wrote three further papers: a Keynote Paper (see below for a summary; Annex 1 for the full paper); a paper on FAO's environmental and sustainable development policies and activities (Annex 2); and a paper addressing gender issues in environment and sustainable agricultural development (Annex 3). All five core papers were provided to participants immediately before the Consultation; their main findings were also presented in plenary session to the Consultation.

Twenty experts, representing experience as deans, heads and professors in subjects related to agricultural education and extension in universities and colleges, directors of government institutions, a president of a professional agricultural association, a high-level government official and a programme manager in a Ministry of Agriculture, constituted the core group of the Expert Consultation. The two review paper authors acted as Resource Persons, while some 46 FAO staff from various technical and administrative divisions were participant observers for all or part of the deliberations. The list of experts and other participants appears in this report at Annex 7.

The Consultation met for four days. The first one and a half days consisted of plenary sessions to hear formal presentations of the five main papers, followed by a short analysis of the material from lead respondents and then open discussion. An assigned Rapporteur for each session, with the assistance of a Chairperson and a Secretariat Liaison Officer drawn from FAO staff, made a written record of major findings for subsequent use by small group sessions and final report preparation. On the afternoon of Day 2, the programme consisted of a mix of small groups to consider separately the requirements of agricultural education and agricultural extension, and a report back in plenary discussion.

The agenda dealt successively with:

- Lessons learned from the experiences of integrating environmental and sustainable development themes into agricultural education and extension programmes;
- Strategies and approaches for incorporating environment concerns: the role of agricultural education institutions and agricultural extension services;
- Policy implications and proposed implementation actions for integrating environment and sustainable development in agricultural education and extension
- Specific suggestions for improving the capabilities of agricultural education and extension to support environment and sustainable agricultural and rural development.

On the last day, a number of Consultation Report drafting groups involving nearly all participants met to record major conclusions and inputs for this report. These groups presented their findings in plenary session and the Consultation was concluded with a verbal Summary Consultation Report to FAO by the General Rapporteur of the Consultation. The meeting was closed with short expressions of gratitude to the participants by the Officer-in-Charge of the Human Resources, Institutions and Agrarian Reform (ESH) Division of FAO, and the Chief of the Agricultural Education and Extension Service (ESHE). A representative of the invited experts expressed appreciation for the fine professional, administrative and secretarial support accorded to the Consultation by FAO staff.

The agenda of the Expert Consultation is contained in Annex 6.

Highlights of Welcome, Keynote and Opening Addresses

The Expert Consultation on the Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension programmes was officially opened by Mr. H. Meliczek, Officer-in-Charge of ESH, who set the background for the Consultation. Participants were welcomed to FAO and were told that the subject of their deliberations was a potentially critical influence on the livelihoods of present and future farmers throughout the world. He emphasized the importance of this Consultation to the work of FAO and his Division in the implementation of the recommendations of *Agenda 21* of UNCED. It is necessary, he urged, to investigate how integration of environmental issues can be achieved in practical and action-oriented programmes.

The Keynote Address was delivered by Mr. H.W. Hjort, Deputy Director-General of FAO. He reminded participants of the urgent need for sustainable development, FAO's key role in its promotion, and the need to know the capacity of institutions worldwide in environment and sustainable development. The increase in world population - currently 93 million persons per year - is unprecedented and rising with 7.2 billion projected for 2010 and 8.5 billion by 2025. Levels of calorie intake are under threat, and sub-Saharan Africa in particular is unable to meet its food demand. This puts a tremendous but variable pressure on the quality of natural resources. He isolated a number of important questions for the Expert Consultation. Can institutions which lag behind in environmental matters be encouraged through the development of policy and mandates? From where will the necessary quantity and quality of professionals to carry out appropriate agricultural education and extension come? How can the status of women in agriculture and their access to education be enhanced? Mr. Hjort's Keynote Address is presented in edited form for this report at Annex 1.

An Opening Address was then delivered by Mr P.J. Mahler, Special Adviser to the Director-General of FAO, and Assistant Director-General with responsibilities for environment and sustainable development. He saw the theme of the Consultation not just as how environmental issues could be integrated into agriculture, but also how agricultural education and extension could be integrated into sustainable development. Such development is nothing new, but poverty and affluence have in various ways led people to neglect the important concerns of future generations. Because of the diversity of agriculture, policies and actions for the environment will be very different in different places and in different subject areas. Three main challenges arise: agriculture must intensify and this may pose both an opportunity and a threat to the environment; agriculture must achieve gainful employment for rural populations; global environmental threats call for a precautionary approach which may necessitate changes in consumption patterns, especially in affluent societies. These challenges dictate a number of high-priority options in improving efficiency of agricultural systems, increasing resilience and minimising risks, and promoting diversity. There is, therefore, a need for technological changes, an adjustment in the relationship between people and their natural resources, and international cooperation to promote sustainable agriculture and rural development (SARD). He concluded with some critical components of SARD, the design of SARD strategies, and their inclusion in agricultural education and extension for policy-makers, planners and managers. An edited text of Mr. Mahler's paper is presented at Annex 2.

The opening sessions of the first day finished with an introductory presentation by Mr. T.E. Contado, Chief of ESHE and Secretary to the Consultation. He described the objectives for the Consultation and asked participants to use their expertise in making a technical analysis of the present situation in agricultural education and extension and providing advice as to how improvements in integration of environmental concerns could be made. What might be the most appropriate roles, strategies and programmes of agricultural education and extension systems in promoting sustainable development? He asked participants to address the main issues at several levels: local, regional, national, international and institutional.

The Expert Consultation participants appreciated the direction and tone given to their deliberations by the Welcome, Keynote and Opening Addresses, as well as the advice given by the Secretary to the Consultation. In particular, they welcomed the clear objectives set by FAO, the commissioning of twenty case studies to provide a basis upon which to assess current practice, and the provision of two review papers of the case studies which gave analytical evidence of comparative approaches of integrating environmental and sustainable development themes into agricultural education and extension.

2

RESULTS OF THE CONSULTATION'S DELIBERATIONS

Rationale for Integrating Environmental and Sustainable Development Themes into Agricultural Education and Extension

At the outset, participants recognized the importance for the future of world agriculture of the maintenance of a productive resource base supported by environmentally- sound policies and actions which promote sustainable development. FAO's working definition of sustainable development which emphasizes equally environmental, technological, economic and social aspects of sustainability was accepted:

> Sustainable development is the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable. (FAO Council, 1989, *Review of the State of Food and Agriculture*)

Arising from the Den Bosch Declaration and the Earth Summit at Rio de Janeiro in 1992, it was further recognized that there is now a strong political consensus on the crucial need for sustainable agriculture and rural development. Our understanding of environment and sustainability questions in agriculture and rural development is now seen to be inextricably linked with other high-profile issues, such as food security, trade, rural poverty, the role of women in society, and rapid population growth.

The Consultation recognized the importance of including the last two aspects: gender issues and population growth. Chapter 24 of *Agenda 21* stresses the urgency for global action for women towards sustainable and equitable development. Women are major resource users and managers. Their knowledge and experience are vital in achieving

sustainability. They are generally the poorest group in society and have often been neglected in the past. Their welfare is most severely affected by environmental degradation. As exemplified in a case study from Honduras presented by Ms .P. Howard-Borjas of ESHW, changes in international trade can have major consequences for land use and farming strategies which in turn affect rural employment, women's incomes and the conservation of land resources. Insecurity of land tenure, the occupation of marginal lands, decreasing of yields, malnutrition and environmental degradation are often interlinked. Agricultural education and extension systems that are gender-sensitive could play a major role in sustainable development. In similar fashion, population issues pose multiple threats to food security, environment and land use. The world population is projected to grow to 7.2 billion by year 2010, up from 5.3 billion in 1990, an increase of 1.9 billion or 36 percent in 20 years (see *Agriculture: Towards 2010* [FAO, 1993] for an analysis of population growth trends and their implications for agriculture). Developing countries in particular are on a high demographic growth path with sub-Saharan Africa especially vulnerable in terms of the highest number of persons who are chronically undernourished.

Agricultural education encompasses many levels (field, technical, intermediate and higher) and can be formal or informal. For the purposes of this Consultation, participants defined education in agriculture to be formal post-secondary school education at universities and colleges and intermediate agricultural education for diplomas and certificates. Also included within the scope of education were teaching, research and public service/outreach programmes in so far as they encompass environmental concerns, sustainable agricultural production and rural development. Similarly, agricultural extension was taken to mean the educational process of advising and assisting farmers, and by implication the means of disseminating knowledge and allocating resources better to accomplish agricultural strategies. Both agricultural education and extension have in more recent times taken on stronger informal roles whereby professional staff act in a developmental capacity, assisting land users in achieving their own objectives and learning from farmers' own experiences. The concept of the farmer as an expert in his/her own right and as a partner in development now imbues current definitions of agricultural education and extension. It follows, therefore, that agricultural education and extension are a primary means of achieving sustainable development concepts to various participant groups in society: planners, professionals, academics, project workers, farmers, urban dwellers, women and youth. They are also the means of disseminating existing good practice by farmers and on-farm experience of technical innovations to various groups including other land users and professionals.

The challenge now is to integrate the two sets of issues: environment, sustainable agriculture and rural development on the one hand; and the wealth of knowledge of individual resources, inputs and techniques held by professionals and land users alike on the other hand. Programmes of agricultural education and extension need to deliver to society a balanced and integrated appreciation of these issues drawn from the needs, understanding, experience and research of all sectors of society. The word 'empowerment' was used by many in the Consultation to describe the process whereby responsibility for the environment and for sustainable development is transferred to all participant groups in agricultural education and extension. Students and local people especially should be assisted to analyze, prioritize and take action on their own situation. Most participants felt that such empowerment and the development of innovative local models of 'self-action' are the most

effective means of assuring SARD. This is a substantially different emphasis from the classical top-down delivery of science and technology to students and farmers. Integration of environmental and sustainable development themes into agricultural education and extension would mean not just multi-disciplinary efforts to achieve the right message but also the active participation of all groups in society in the development of the message and the implementation of solutions.

In such a model of agricultural education and extension, the role of educators and extension agents would evolve to that of being facilitators and partners with students and farmers. A difficult balance would have to be achieved between providing advice and acting as partners. For any individual country and agricultural institution, this balance will depend upon the prevailing culture, the current nature of the institutions, the willingness to change and the rapidity with which innovative methods of analysis and learning can be promoted. Participants coming from an educational background generally saw the process of change to be achievable within a reasonable time-span. Those from agricultural extension organizations were less certain that the traditional extension advisory approach could be quickly replaced by dialogue and partnership. A full partnership including students and farmers to deal with environmental and sustainable development questions may be less feasible in some cultures. Nevertheless, the Consultation recognized the desirability of fostering a new approach more widely and intensively than hitherto.

The Consultation identified three general issues common to both agricultural education and extension that might affect the challenge of integration.

First, *the complexity of the problem* was acknowledged. There is an intrinsic complexity in environmental issues as a result of the interplay of natural, social, economic and political forces. Sustainable development involves both the bio-physical and the socio-cultural environments. There are no blueprint solutions: different countries face different problems and have different capabilities to solve their environmental problems. Elements of the diversity include natural resource availability, economic resources, institutional capacities and legal frameworks. Diversity often leads to inequality which in turn gives rise to conflict. Such conflicts may in turn deplete the natural resource base and damage the ability of governments to address long term sustainable development.

It was also noted that the traditional approach of disaggregating complexity in environmental and sustainable development issues into a number of single factors is inadequate. A multi-disciplinary approach is called for. Sustainable improvements demand multi-factor analyses across technical sectors with especial emphasis on the impact on socio-economic, gender and cultural aspects of farming communities.

Secondly, it was recognized that there is often a *mismatch between the nature of the institutions involved in agricultural education and extension and the character of environmental problems.* In developed countries, institutions involved in agriculture have for historical reasons devoted their resources to 'production agriculture'. This has involved research, education and training emphases on single commodities, high-input techniques and maximizing yield outputs. While not completely missing, the integration of non-agricultural issues for rural development purposes was not usually stressed. When universities and

extension services were set up in developing countries, the developed country model was transferred. 'Production agriculture' maintained its prominence. The complexity and lack of understanding of socio-cultural systems made integration of developmental issues into agriculture even more problematic in developing country environments than they had been in developed countries. Now, with scarce financial resources, developing countries will need substantial assistance to address the complicated challenges of environmental and sustainable development within their programmes of agricultural education and extension. FAO was advised to take a leading role in setting the new agenda, providing policy assistance and soliciting international funding.

Thirdly, there is a pedagogic challenge in current debates about environment and sustainable development which involves *'ways of learning'* and *'ways of knowing'*. Through these terms, the Consultation strongly recommended the development of new paradigms as alternatives to traditional top-down approaches. Learning from farmers' experiences, participatory planning, the use of indigenous technical knowledge and open learning systems are approaches which should be given greater attention by agricultural education and extension programmes. Youth in particular are a priority target audience in formal and non-formal education programmes for new ways of developing understanding and knowledge. The imposition of rigid technical solutions, however well-meaning and well-researched, is unlikely to assure sustainable development. Rather than be provided with fixed answers, students and land users would be better equipped if they had the skills and knowledge of problem-solving techniques. Consultation participants supported the idea that what is needed today is more dialogue with farmers' and a better development of 'conversational networks' of organizations, communities and individuals.

The pressing need for integration of environmental and sustainable development themes into agricultural education and extension was fully endorsed. Participants recognized, however, that such integration holds major challenges and may involve a substantial change to current procedures and actions as well as some additional funding. Different institutions may be needed which actively promote the new paradigms and are able to respond flexibly to the substantial demands of integration. Agricultural education and extension needs to be placed firmly back into the context of sustainable development; merely seeking the integration of a handful of environmental themes into agriculture will not be sufficient.

Nature and Scope of Current Involvement and Activities

The Consultation endorsed the principal findings of the two review papers which analyzed the current status of agricultural education (Annex 4) and agricultural extension (Annex 5) through two sets of specially-commissioned case studies. It was generally confirmed that, while developed country institutions have for some time been including environmental concerns into their curricula and programmes, this has usually been only partial and often in the context of 'production agriculture'. For developing country institutions, prior to 1990 little attention had been paid to environmental themes. However, in very recent years a number of innovative programmes have been developed which have the potential for forming a basis of 'good practice' and, with international cooperation and suitable funding, being

transferable to other countries. FAO's role as a catalyst and as an information network was stressed as being especially important.

Deriving from small group discussions followed by a plenary session, the Consultation identified a number of principal lessons from current practice in both agricultural education and agricultural extension. An immediate task is to appraise all technologies in their suitability for sustainable agriculture. This calls for better research-extension-training linkages and the participation of farmers, professionals in government departments and academics in higher agricultural education institutions. The need for interdisciplinary research, which places a demand on educational institutions to adapt their structures to accommodate work across traditional departmental boundaries, was reiterated.

Participants emphasized that current practice demonstrated that there needs to be a change in attitudes, approaches, leadership and funding in order to accomplish SARD through agricultural education and extension programmes. Present conflicts between environmentalists and land users need to be mitigated by appropriate education, training and extension activities to both parties. Committed leadership is essential. Open-mindedness, a willingness to accommodate the special interests of different groups (e.g. women) and attitudinal changes will be necessary in what will be often protracted negotiations between industrialists, land users, professionals and governments over changes to current practice. National level legislation is essential to give an underpinning to policy, and environmental programmes are generally strongest where education and extension institutions have an explicit environmental mandate. Inter-regional and international cooperation may help, as well as clear direction and financial resources from international bodies such as FAO, UNDP and the World Bank.

For agricultural education specifically, the current situation suggested to the Consultation that agricultural curricula should be adapted or restructured to address issues related to the conservation of natural resources and the protection of the environment. Both specialized and broad-based education will be required in order to sensitize students to environmental and sustainable development issues, depending on educational level and the specific environmental problems of the areas in which the graduates will work. In order to achieve such changes, the training and redeployment of teachers may be needed along with the greater involvement of students and younger staff in the design of new curricula. There was a recognized need for strengthened university research programmes and better linkages with national agricultural research stations. With universities being the training grounds for research scientists, it is imperative that faculty members be well trained and prepared to deal with issues related to SARD. There is also scope for cooperation between agriculture and allied departments, and with the community, in dealing with environment and natural resource subjects.

For agricultural extension, it was recognized that many extension organizations have difficulty in adapting to and addressing environmental and sustainable development issues. Environmental materials produced are often too general, there is little quantitative assessment of the impact of extension materials (even though their quality is sometimes good) and there appears to be a discrepancy in the provision of materials between what farmers perceive as high priority and what extension actually provides. Much of the environmental message

deals with agricultural practices, land stewardship and legal obligations rather than with developing a wider appreciation of environmental issues. Some aspects, such as biodiversity and global impacts, are usually by-passed entirely, being seen as of little consequence to local issues. Notwithstanding the availability of much good educational and training material, the lack of inputs to extension from environmental agencies and other non-agricultural bodies was noted with concern. In the particular situations where non-governmental organizations, women's groups and youth were involved in extension, there was better scope for an understanding of sustainable development. A wide range of groups should be involved in extension messages, including rural and urban populations, input suppliers and credit organizations.

Improving the Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension

The main deliberations of the Consultation were focussed on the role of education and extension in matters related to sustainable agriculture and rural development (SARD) and how this role should be expanded to meet the needs of farmers, students, consumers and the public in general. Some examples of 'good practice' were noted in the case studies, but it was recognized that, because the environmental imperative is still comparatively new for many institutions and agencies, current policies and actions tend to lag behind the development of thinking at international meetings such as the Earth Summit or amongst experts as represented by the Consultation group. Most improvements must necessarily emanate from implied deficiencies in current practice as evidenced from the case study reviews and from participants' direct experience.

Many recommendations were made throughout the course of the Expert Consultation. Valuable suggestions were made for improving the integration of environmental issues in agricultural education and extension in informal discussions and as a by-product of the analysis of the current situation. Many of the recommendations came from the working groups on the role of agricultural education and extension and on specific suggestions for improvement. Some suggestions arose during the work of report drafting groups. The many proposals are captured in this report from the written summaries of the various session rapporteurs and the notes of the General Rapporteur. For convenience and to assist the practical implementation of the recommendations, suggestions for improvement of integration are grouped under eight 'issues':

Issue 1: Roles and Functions

The case studies commissioned for this Expert Consultation revealed a large variety of roles and functions in agricultural education and extension systems. In the context of the Consultation, a primary role of an educational or extension institution must be to articulate the concerns and assist the learning of its clients - students, education and extension staff, other professionals, field workers, farmers, the general population. Teaching as merely the delivery of messages should give way to joint action and planning by all participants. The

goal of this learning process is to ensure the sustainability of the use of agricultural resources. Existing commitments of providing education and advice on such matters as production agriculture, specific techniques and crop recommendations must not be jeopardized, but rather be integrated with the overall theme of SARD.

The Consultation recognized that these multi-purpose roles and functions are extraordinarily challenging to achieve, but that, unless some improvement were made on the current situation world-wide, the goal of SARD is unlikely to be realized. Some educational institutions have managed to develop new programmes with new ways of learning that encourage the broad vision needed to include the diversity of issues in sustainable agriculture. Other institutions have simply cobbled together existing courses, hoping that the necessary integration would spontaneously occur. Participants felt that integration is probably already achieved by the best and most innovative students but that only through planned programmes of integration involving all parties would a wider coverage be accomplished. A reluctance has been noted in some teaching faculty to discuss SARD issues in depth and in a participatory manner with farmers and students. For some institutions, a complete reorientation and re-design of courses may be needed, including induction courses in field methods and communication skills, retraining of teaching staff and the development of new learning techniques.

Similarly, agricultural extension agencies have had difficulty in identifying and adapting to new roles and functions. One of their principal problems has been the loading of agencies with additional, demanding tasks. In many countries, extension organizations are treated as the frontline for interaction with farmers and rural dwellers, dealing not only with transfer of technology but also legislation, subsidies and input supplies. Clearly, it is not feasible to create yet another burden for these hard-pressed extension agents. The challenge is how to re-address the imperative of environmental protection with existing messages and how to re-emphasize the participatory nature of the development and delivery of extension messages. This requires that extensionists learn to promote true dialogue with their many clients - farmers, researchers, educators and others. A reappraisal is called for to assess the scope of roles and functions of extension systems to promote SARD. It has, for example, been feasible in some countries to privatize certain functions such as advice on inputs to commercial organizations while retaining functions of advice on matters such as conservation and reforestation which have wider societal implications. In other countries, NGOs may be better placed for close liaison with local communities on conservation matters.

At a **national level**, the Consultation called for a clarification of roles and functions of all agencies dealing with environment and sustainable development. There is potential for very considerable confusion between the roles of different departments in universities and colleges, and different ministries and agencies dealing with environmental matters. It is not necessarily best to set up specific departments and agencies to handle environmental concerns. Good practice in many countries shows that SARD may be better achieved by coordination of existing departments and the shouldering of the responsibility for the promotion of integration by all professionals in education and extension. The specific solution for any one country or institution will depend on the culture and accepted practice. However, the Consultation urged that the best way to accommodate the necessary roles and

functions be explicitly considered by all institutions with the view to building on present opportunities and avoiding current weaknesses.

At the **international level**, FAO is in a position to accelerate the examination of roles and functions. It could, for example, assist with the preparation of documentation on the possible options for integration of environmental and sustainable development themes into agricultural education and extension. It is in a unique position of authority and trust amongst both member governments and professional workers to offer unbiased, professional guidance in these matters designed for the specific conditions of each country and institution.

Issue 2: Policy and Mandate

Educational institutions and extension organizations draw their environmental mandates from a variety of sources ranging from the individual initiative of a teacher or professor, through departmental instructions, accepted professional practice, to national level decrees and legislation. At times, environmental issues may be mandated by donor agencies where it is felt that insufficient attention would be paid by local institutions. The Consultation emphasized the importance of developing clear policies on environment and sustainable development, and written mandates for all relevant institutions.

Without a persuasive, effective and unambiguous set of directives for good working practice, articulated in the form of high-level policy and agency mandate, the current *ad hoc* approach to environmental matters will likely continue. In some places and some subject areas, SARD will be promoted but more through the diligence of informed individuals; in other places, environmental matters will be ignored because of institutional inertia.

At **all levels** (local, national and international), the Consultation recommended a clarification of the terms 'sustainability', 'sustainable agriculture' and 'sustainable development'. While there are many definitions, including that of FAO's, there is for many people, particularly amongst field workers and extension agents, a lack of understanding of the broad scope of environmental issues. This, of course, has wide-ranging implications for the content of programmes (see Issue 5 below), but the problem has its basis in a lack of clear policy directions. All too often, short-term expediency and crises dominate working practice to the detriment of long-term sustainability issues. Well-trained workers need the backing of clear mandates and policies in order to prioritize their day-to-day activities. Similarly, students and educators need the support of policies on the environment which can be translated to changes in curricula and subject matter at all levels. Support and advice should be given by national and international bodies on the development of appropriate policies and mandates for the integration of environmental and sustainable development themes; these will vary according to the level and nature of the organization, and the degree and scope of the potential environmental problems.

At the **national level**, the Consultation called for the development of better linkages between policy and action. While recognizing that most countries do have policies on environmental matters and at least rhetorical backing from national leaders on the importance of SARD, participants felt that this is too rarely translated into institutional mandates which

give guidance as to the practice of sustainable development. National conservation strategies and similar documents are a good start, as is the creation of environmental secretariats, but there is an urgent need for policies which encourage liaison between various departments with responsibility for development and environment. Coordination is required to ensure complete coverage. A similar challenge is posed in educational institutions where policies and mandates rarely encourage cross-departmental teaching or multi-disciplinary courses. It follows that pre-service and in-service training should be guaranteed for inclusion in all programmes. It should be the responsibility of each country and national-level institution to articulate appropriate policies to effect the needed changes to current practice.

At the **international level**, the Consultation recognized the central leadership role of FAO and other international organizations in creating international forums for the discussion and development of policy and in the setting of mandates. While recognizing that FAO is necessarily restricted by the wishes of its member governments, the Consultation felt that more could be achieved in assisting national institutions in developing policies. FAO has a particular role in helping with the development of policy on global environmental impacts and assisting with the amelioration of potential cross-border issues such as soil erosion and flooding. A greater proactive role in these matters, further developing the policies of *Agenda 21* and other international agreements, would be helpful in creating the right international political climate for the international promotion of SARD.

Issue 3: Institutional Capacity

Any introduction of new ideas into an organizational system requires a willingness to accommodate the ideas and an ability to adapt the institution to enact the new policy and actions. Environmental and sustainable development issues cut across traditional academic subject and departmental boundaries. They demand an appreciation and working knowledge of technical and economic skills, and of scientific and social analysis. These are rare combinations within a single agency or institution. Where they do occur, individual specialists are not accustomed to working together. Traditional science has tended to move towards increasing specialization within a discipline - the very opposite to what is required in the analysis of sustainable development criteria. Social scientists often have inadequate capacity to handle the results of ecology, soil science, agronomy, forestry and the like in an integrative manner with their own specialisms. For individual professionals, these difficulties will be addressed further in Issue 7 below. Cross-disciplinary and team approaches can only occur in the right institutional environment, with motivated people in a reward system that recognizes the complexity of sustainable development.

Virtually every country has a system of higher education in agriculture that encompasses teaching, training, research and advice to government and the farming community. Resources for education have often not been commensurate with the importance of agriculture in the national economy, and many such institutions, especially in developing countries, find themselves starved of funds and incapable of performing more than their most basic function of teaching. The Consultation emphasized that environmental matters should not just be an added burden on institutions. What is often needed is flexibility within the institution and a willingness to change current curricula. The Consultation recognized that

the academic world might be difficult to change, and therefore stressed the requirements of leadership and scholarship on how best to promote SARD. Related to the academic inertia found in many educational institutions is the vital need to develop innovative and more participatory methods of analysis and learning. Willingness to cooperate with other organizations, especially at the local level with women's groups and NGOs, should be fostered. The tendency to try to accommodate all aspects of sustainable development expertise wholly within one organization should be resisted. Inter-departmental working groups and special action committees have assisted institutional collaboration in some places. University research programmes have in some cases had positive influences on the content of teaching curricula.

Similarly, agricultural extension organizations need to change. It is clear that in nearly all cases, the institutions do not have the capacity to take on any further major responsibilities such as environmental monitoring or specialist support for rural development. Already, the spread of Subject Matter Specialists (SMS) along with more general extensionists and field workers is dangerously thin. For a few organizations that have devolved many extension functions to other agencies, it may be rational to appoint environmental SMSs; an SMS with the job of integrating SARD into extension programmes could be useful. But to expect the typical multi-function extension organization to take on a cadre of SMSs in environmental matters is unrealistic on two counts: first, it treats environmental and sustainable development issues as yet another discrete topic; secondly, it transfers responsibility for considering environmental matters to a few persons, inviting others to ignore potential environmental problems. Both tendencies would be extremely risky. Instead, an enhancement of capacity within agencies is called for by restructuring and retraining (see Issue 7) which would not necessarily require additional budgetary provision except initially. A change of attitude and a willingness to broaden horizons and a consideration of doing things differently may be necessary. Certain functions could be given to agri-business field advisers and NGOs, and the extension agency itself could take more of a coordinating role (see Issue 1 above). Institutional support to farmer and community groups is often an effective way of reaching more people particularly in environmental matters. These structural and attitudinal changes could enhance the total capacity to integrate environmental and sustainable development themes into extension without necessarily increasing the total size of the organization. Indeed, in at least one of the case studies, an agency had become smaller and more focussed on its environmental mandate as a result of restructuring. This may not be applicable in all cases, but it does demonstrate that innovative ways of increasing institutional capacity can be designed for specific circumstances and these may not increase the total burden on government resources.

At the **national level**, the Consultation recommended much closer liaison, integration and cooperation between agricultural institutions and other organizations. There is much duplication of effort locally. A rationalization of functions would increase total institutional capacity. A promotion of leadership within communities would also decrease the burden on formal government agencies, thus allowing them the spare capacity to take on wider societal functions such as promotion of sustainable development. In educational institutions, courses and modules could be drawn from elsewhere. In extension agencies, the Consultation resolved to redefine the institutional responsibility as "helping local people make informed choices about their own welfare". National institutions involved in agricultural education and

extension must adjust their capacity to achieve this redefinition and should evaluate their capabilities for an expanded environmental emphasis. Within all institutions, the presence of appropriate intellectual capability and the capacity to undertake in-service training must be assessed.

At the **international level,** FAO can play an expanded leadership role in developing institutional capacity. Not only can it lead by example in the type of analysis it provides to member governments, but also it can act as the catalyst for change and restructuring. The Consultation urged FAO to identify possible institutional options that might promote SARD and then to assist governments to evaluate the capabilities and capacities of their own institutions to carry out the required actions to achieve the desired institutional capacity. The integration of environmental and sustainable development themes also demands coordination, facilitation and consolidation of efforts. While no single model of integration is appropriate to all circumstances, repositories of information on good practice and successful experience should be available. FAO is ideally placed to be such a repository. It could also encourage pilot activities where programmes and approaches can be developed and field tested as the first steps in developing regional centres of excellence in the promotion of SARD.

Issue 4: Target Groups and Coverage

Generalized approaches conveying uniform messages and advice are unlikely to be sufficient to achieve integration of environmental issues into agricultural education and extension. At its different levels, education should be designed specifically for the current knowledge, background and experience of students. The environmental content in any curriculum may be provided as single specialist courses dealing with such aspects as environmental impact assessment or it may permeate all courses. Because SARD is such a fundamental part of all work in agriculture, the Consultation felt that the latter approach is to be preferred, but it recognized also the need to develop multidisciplinary skills through specialist courses in ecology and sustainable development. Agricultural extension also has to have its various messages targeted to specific groups. To reach all land users with appropriate environmental messages demands specific targeting of groups with appropriate materials and through accessible media. Beginning with young persons, formal and non-formal education should concentrate upon an early and life-long appreciation of the necessity of SARD. Because the ratio of farmers to extension workers is very high in some developing countries, use should be made of a variety of communications technologies (see Issue 6 below)

Evidence presented to the Consultation through case studies suggests that extension workers tend to engage certain groups more than others - typically men and the affluent, leaving aside the poorest, women and youth. In many countries, there are at least as many women farmers as men. They are likely to suffer most from environmental degradation. A special effort should be made to reach them using women's groups, NGOs and female extension staff. In agricultural education, most case studies reported the development of specific materials for different target groups, but there has been little evaluation of the effectiveness or appropriateness of such targeting. Many people have an inadequate understanding of what sustainability is, how it might affect them and the differential impact of environmental problems between men and women, old and young, and rich and poor. A

more targeted approach to the integration of environmental issues into SARD is clearly necessary.

At the **national level**, the Consultation recommended the development of a greater awareness of the needs of different groups in society in regard both to their potential threat to the environment (e.g. the marginalized poor farming steep slopes) and to opportunities afforded by their skills, local knowledge and understanding of farming in often hazardous environments. This awareness has to start at an early stage in education, but it should also be included in training and reorientation of current educators and extension staff. Curricula need revision and new instructional material should be developed and evaluated. Agricultural education has to serve the whole community, consisting of producers, consumers, manufacturers, rural and urban people and so on. The only feasible means of achieving full coverage and reaching each group is by targeting appropriate material. An especially challenging target group is the illiterate: in some places, these are the majority of the population.

At the **international level,** organizations such as FAO should continue to develop educational and training materials which both emphasize the different needs of various groups and provide practical suggestions for reaching the more elusive groups. International cooperation is warranted in the development of materials specifically for groups such as extension workers, resource-poor farmers and minorities. Such materials could include new curricula, instruction manuals on problem-solving techniques, and multi-media extension support devices. FAO has a particular role in creating a climate of professionalism where interdisciplinary work and developmental approaches are no longer thought by many subject matter specialists to be inferior to narrow specialization. The targeting of in-country professionals is recommended through a number of regional and sub-regional workshops using materials similar to those developed for this Expert Consultation.

Issue 5: Environmental Content and Extension Topics

The environmental message and requirements for social and economic development vary from country to country depending on the nature of the physical environment and the level of human development. A prior condition for all environmental messages is that they must be prepared in such a way as to foster dialogue and discussion. Educators, extensionists and their clients must immediately perceive the rationality of the environmental message both for themselves and society in general. Strident lecturing as to the necessity of environmental protection and sustainable development without discussing the reasons for such care is insufficient and may even be counter-productive.

The Consultation noted the extraordinarily wide range and scope of environmental messages. An impressive array of topics is currently addressed by various institutions, though there is a need to improve coverage of some topics such as biodiversity, low-input agriculture and global impacts. A disparity was noted between topics covered in developed and developing countries. In the former, issues such as waste management and pollution control feature, while in the latter, erosion control, forest development and farm inputs are regularly mentioned.

In line with the desirability of demonstrating the benefit of an environmental perspective to agriculture, the Consultation discussed current content of educational curricula and extension messages. Participants found that environmental issues related to commercial agriculture feature most strongly. For example, the safe use of pesticides and efficient application of fertilizers appear on most agendas; these have cost-benefit as well as environmental implications. Such 'tagging' of environmental issues to cost-efficiency is a viable way of integrating the right message. However, the Consultation recognized that there are many aspects which cannot immediately be related to production increases, in which investment into environmentally-friendly techniques now would only have long term returns. These particular aspects require new means of expression and the support of additional research.

The Consultation was especially concerned about the nature of some environmental messages that tend to brand the land user as villain. A recognition needs to be imparted to all strata of society that it is often the political, social and economic climate that forces land users to carry out detrimental practices. The spread of negative messages about the actions of land users and the attribution of blame for harmful impacts should be avoided. Otherwise, negative responses will be invited from the very land users which society demands to be the guardians of natural resources. The proper analysis of the causes and consequences of environmental degradation would most appropriately feature in basic and advanced education as well as in the training of extension workers. Reaching youth with an introduction to environmental issues in an agricultural context is vital.

At **all levels**, the Consultation suggested a re-examination and reappraisal of the content and nature of environmental and sustainable development messages in agricultural education and extension. In accord with new ways of learning (see Issue 6 below), the Consultation recommended that multi-disciplinary and multi-agency approaches be used in the design of environmental messages. Faculty and students, as well as extension trainees and farmers, should be directly involved in drawing up the agenda of environment and sustainable development issues; they should also be participants in developing solutions. The aim should be to develop integrated course modules which more accurately reflect the interdependent nature of the 'real world' and the causes of environmental problems. The Consultation did not recommend a minimum number of environmentally essential topics: such prescription would stultify the development of new curricula and negate the importance of the participatory approach which is felt to be critical if real progress is to be made. Through core and foundation courses, a menu of possible options might, however, be prepared in order to guide educators and trainers in the range of topics and the ways they could be integrated with other aspects of environmental education and extension.

At the **national level**, the Consultation urged governments to insist that their own institutions develop appropriate curricula with environmental messages that support the government's own development priorities. National conservation strategies (see Issue 2 above) could assist in the setting of priorities and the formulation of effective methods of integrating environmental messages.

At an **international level**, scope exists to foster the development of environmental materials that will assist national progress towards effective agricultural education and

extension systems. Through further development of educational and training materials and the organization of regional workshops, FAO and other agencies could make a substantial contribution. While both technical and problem-solving skills are required, the specific content of the environmental message in training materials needs to be coupled with the encouragement of students to think and to analyze their own situation. There are a number of subject areas and problem solving appraoches where FAO should continue to set the lead: for example, gender issues in environment and sustainable development; biodiversity; desertification; global warming and climatic change.

Issue 6: Integration Approaches and Methodologies

Following from Issue 5, the Consultation highlighted the strategic importance of how the environmental message could be integrated and how it could be delivered along with mainstream agricultural education and advice. This is seen as perhaps the most difficult of all the challenges because it involves the interaction of teachers with their students and extension agents with their clients. If this interaction is ineffective or if it recreates top-down delivery of environmental imperatives, then the goal of integration is unlikely to be achieved. Participants wished to stress that 'preaching' about the importance of environmental matters is less effective than encouraging students and farmers to discover the importance for themselves and identify potential solutions. It follows, therefore, that integration approaches and methodologies must to an extent be innovative and challenging to traditional agricultural education and extension systems.

The interactive discussion of environmental issues was recognized as one of the areas where present educational and extension institutions are often deficient. Environment and sustainable development have usually been seen as yet another module or course, or another extension message to communicate. True integration in all sectors of land use - crops, livestock, fisheries, forests, wildlife, tourism - has probably not been achieved anywhere. In a few programmes, environmental concerns have been reasonably well integrated, but the number of issues addressed is small. In other programmes, an environmental education module or additional burden of extension responsibility has merely been added. The process of integration must be accelerated with the ultimate aim of making environmental issues inseparable from the production goals of farmers and the needs of society for a safe and secure environment.

At **all levels**, local, national and international, the Consultation recognized the need for coordinated development of communication technologies and new systems of delivery of integrated environmental messages that are more effective than at present for the various target audiences (see Issue 4). Integration could be better achieved through multi-media technologies. Some suggestions included role play, computer games and software, small group discussions, case studies and field projects, participatory research, on-farm demonstration, learning-by-doing, distance learning via television, radio and satellite, electronic-mail conversations and conferences between academics, farmers' networks, special interest groups and so on.

At the **national level,** there is a need to seek collaboration among the various agencies responsible for agriculture, environment and development. This would include agriculture faculty, planners and government field workers, as well as NGO staff. Each bring with them different approaches and perspectives which would enrich the whole process of achieving integration. Respect for the skills of others at different levels is important. The Consultation noted with concern that mutual suspicion sometimes occurs between agencies and between different specialists. Governments, by their authoritative lead in such matters, can greatly enhance the effective integration and delivery of environmental messages.

At an **international level**, there is scope for considerable cross-fertilization of ideas and approaches between countries. Innovations in how students and farmers acquire knowledge and in how they develop an ability to analyze their own environmental situation require careful assessment through the examination of comparative experience. Dissemination of ideas and discussion of alternatives is essential. FAO could accelerate the process through organizing regional workshops as already suggested for Issue 5. International organizations could also be effective in developing multi-media techniques applicable to a range of target audiences and circumstances through programmes of technical cooperation among the more industrialized and less developed countries.

Issue 7: Training and Reorientation

The Consultation identified the need for substantial change in many agricultural education and extension systems in order to encompass environmental concerns. Not only should the roles, functions, policies and mandates be clarified, but also a restructuring of institutions may be needed and the content and messages in education and extension may have to be redefined. This will take properly trained personnel with a sufficient breadth of expertise. It will also take persons who are willing and able to go beyond the narrow confines of their specialist discipline.

The extent of needed change is variable. Some educational institutions and extension agencies have scarcely changed from their established departmental lines with rigid demarcations among specialists. Others have taken on a far more proactive developmental role, working with other institutions and adopting more participatory approaches at local level and taking on coordinating functions at provincial and national levels. For existing staff, such changes may demand alterations in attitudes and activities. Many may have to 'unlearn' old ways - for example, yield maximization through high inputs - and integrate into their teaching, a capability for analysis, research and advice to farmers on alternative ways of achieving a livelihood without jeopardizing others in society and future generations. In these new 'ways of learning', educators and extension agents are helpers and facilitators, rather than suppliers of knowledge. Because these can be difficult changes to make, training and reorientation, carried out in an understanding but positive manner, will be essential.

At the **national level,** planning for progressive staff education and reorientation is needed. Through initial courses, in-service training and team approaches, a new approach to learning can be promoted. Professional responsibility for environmental matters needs to be engendered, through professional associations (such as teaching unions and agricultural

societies) and through better provision of staff development services within the institution. Many organizations have staff development and training officers with responsibility for enhancing internal capability of staff to achieve new goals. National governments should set the lead in this regard. Educational institutions themselves, ideally at the vanguard of developing new skills in communication, should promote the new 'ways of learning' and interdisciplinary capacity in staff and students. At the same time, new modes of analysis are required which account for gender issues, inequities in society and cost-benefit considerations and which are accessible to technical specialists, social scientists, students and farmers.

At the **international level**, while recognizing the limited role of organizations such as FAO in directly conducting training for local and national staff, the Consultation recommended a more sustained effort by the international community in striking the balance between disciplinarity and integration. This would mean, for example, wider dissemination of key recent documents such as *Agriculture: Towards 2010*, *Women in Agricultural Development: FAO's Plan of Action* and *Harvesting Nature's Diversity* in a variety of formats and in sufficient quantities to reach field workers, professionals and academics. International organizations have a particular responsibility for dissemination of information about global environmental impacts and the less tangible threats to sustainable development, such as loss of biodiversity and climatic change. Through the production of appropriate teaching and learning materials, the reorientation of extension practitioners and educators could be accomplished in cost-effective form. In other words, the Consultation felt that FAO should be more active in helping to set the agenda for pre-service and in-service training.

Issue 8: Funding and Resource Allocation

New developments usually require additional resources. The Consultation recognized the severe constraints on funding for agricultural education and extension. In some countries, structural adjustment programmes have frozen replacement and additional recruitment of personnel. In other countries, agricultural services are being privatized and educational budgets cut. The expectation of substantially increased resources is unrealistic. Nevertheless, participants in the Consultation from developing countries repeatedly stressed underfunding in the agricultural sector as one of the principal constraints. Additionally, low salary and reward levels for government fieldworkers and some professionals in developing countries contribute to poor morale and lack of willingness to take new initiatives.

It can be seen from the Consultation's recommendations on institutional capacity (Issue 3), environmental content (Issue 5) and integration approaches (Issue 6) that the broad thrust of the meeting's suggestions are related to restructuring, reorganization and reorientation, rather than additional courses and responsibilities. True integration involves incorporating environmental messages into all components; it does not involve another tier of responsibility requiring commensurate additional funding. Integration may, however, need an additional staff member in each organization with specific responsibility for the development and promotion of environmental messages.

The process of adaptation to the new imperatives will, however, need funding. Retraining requires the provision of workshops and seminars. The development of new

methods of analysis and ways of learning may be expensive: for example, in field projects. The direct participation of farmers may, however, be more cost-effective in the longer term. Additional budget will be needed to produce support and training materials. In part, resources could be sought from banks, agri-business, commodity associations and farmers' groups. Core funding will likely have to remain with government. Political will, the level of importance attached to SARD and competing demands will inevitably determine the level of funding and hence the overall scale of operation of agricultural education and extension.

At the **national level**, it is stressed that environmental matters and SARD should not be an added burden on institutions (see Issue 3) and on overall funding. Nevertheless, the Consultation recommended that the investment of additional educational and training funds into reorientation about environmental issues will repay large dividends to society in the medium term. At the same time, resource allocations should be examined to find areas where mutual interests between organizations in environmental matters could be exploited more efficiently to use available funds. Redeployment of staff or the creation of coordinating institutions and departments could achieve both cost savings and better integration, thus freeing resources for implementation projects and programmes of direct assistance to farmers. Again, political will is important.

At an **international level,** FAO and other agencies can assist the process of reallocation and re-examination of priorities. Studies of member government's whole provision for environment and sustainable development would provide baseline information for the determination of actual funding levels. FAO has the skills and expertise to provide independent and impartial advice. At the same time, international agencies are urged to seek resource provision for studies of structural changes to institutions and the reorientation of formal and non-formal educational programmes.

Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes

Keynote Address

Presented by Mr. H.W. Hjort,
Deputy Director-General
and Assistant Director-General a.i.,
Economic and Social Policy Department
30 November 1993, FAO, Rome

ANNEX 1

Introduction

It is my pleasure to welcome you, on behalf of the Director-General of FAO, to this Expert Consultation on the Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes. We are most appreciative of your interest and willingness to participate, and look forward to your insights and guidelines for action on this important topic.

The 1992 UN Conference on Environment and Development (UNCED) stressed the urgent need to promote sustainable agriculture and rural development in order to satisfy the growing demand for food and other agricultural commodities. The report of UNCED, titled *Agenda 21*, recognizes that one of the main tools for achieving sustainable agricultural production and rural development is **human resource development**. And it is the world's agricultural education and extension institutions which have the primary responsibility for educating and training the human resources that will be needed to attain sustainable agriculture and rural development.

In order for FAO to perform its advisory and technical assistance roles, it must have a clear understanding of the concept of sustainable agriculture and rural development (SARD); it must also have a clear understanding of the capacity of the global agricultural education and extension system to provide leadership in integrating environmental considerations into the SARD process. It is in this context that this Expert Consultation has been asked to:

- examine the involvement of agricultural education and extension institutions in environmental and sustainable development;
- identify the roles, strategies and approaches of agricultural education and extension that could contribute to the effective implementation of *Agenda 21* of UNCED;
- identify issues, policies and lines of action to improve the role and contribution of agricultural education, training and extension institutions in environmental management and sustainable agriculture and rural development.

Sustainable Development: Critical Issues and Challenges

This Consultation takes place at a time when there is widespread concern about our collective ability to ensure that all people have access to the food they need for an active and healthy life; at the same time, there is concern that producers of food should meet this challenge by using methods that will maintain or improve the quality of the natural resource base. To do so, we will require sound nutritional, environmental, agricultural and rural development policies, environmentally friendly food production technologies, more appropriate use of natural resources, and the development of human resources.

The Population Factor

Although the rate of population growth for the world as a whole reached its peak and began to decline more than two decades ago, the actual increase in population is unprecedented and

still rising. During the current decade, the annual average increase is expected to be in excess of 93 million people.

In 1990, the earth's population reached 5.3 billion. It is expected to be 6.2 billion by the year 2000, come close to 7.2 billion by 2010 and climb to nearly 8.5 billion by 2025. The high population growth areas are Africa and the Near East, but the largest annual increases are still taking place in South and East Asia. Between 90 and 95 per cent of the increase in world population will be in the so-called developing countries.

Food Production

Although the rate of growth in food production has also declined, it has exceeded the rate of growth in population. According to our recent study of prospects towards 2010, growth in food production will continue to slow, but will still exceed growth in population.

However, progress has been - and will continue to be - uneven. The region of primary concern is Sub-Saharan Africa, which has been unable to maintain per capita production. In general, increased reliance will have to be placed in the future on the relatively few countries that have the capacity to produce more than they can use. By 2010, the developing countries as a group are likely to turn from being net agricultural exporters to net importers.

Nutritional Status

Nutritional status has improved, and both the percentage and the number of persons seriously undernourished have declined from earlier peaks. Today, there are on average some 2,700 kilocalories available per person per day (around 3,400 in the developed countries and 2,500 in the developing countries). The only region to have made no progress in improving food supplies is Sub-Saharan Africa. Although considerable progress has been made in South Asia, availability remains low by world standards.

Despite this progress, a significant proportion of the world's people lacks sufficient food to lead a healthy and productive life. Our latest assessment reviewed nutritional status in 93 developing countries, and estimated that, in 1989, some 781 million people (20 per cent) were seriously undernourished. Although nutritional status in these countries is expected to improve (rising to about 2,700 kilocalories per person per day), some 650 million people are still expected to be undernourished in the year 2010.

Natural Resources

The natural resources needed to produce food and other agricultural products are used with varying intensity. Some could be used more intensively; others are being used in accord with sustainability criteria; and some in a manner that is unsustainable.

Overall, the productivity of those natural resources used to produce food is higher than ever before. However, a significant proportion of these resources is being used in a non-sustainable manner, and their availability or quality is declining. In some places, ground

water is being used faster than it can be replaced; in other places, water is being used inappropriately, and the quality of the soil is being adversely affected. In some places, the land is too fragile or steep to permit continued intensive use; in other places, the land is being used in an extensive manner, and could stand to be used more intensively.

The critical task is to identify those areas in which natural resources can be used more intensively, as well as those in which their present use cannot be sustained. Unfortunately, the latter areas are often those in which population pressure is the greatest, poverty is the most severe, and pressure on the natural resource base is most intense.

Although it is possible to increase agricultural efficiency without environmental degradation - through better research, more effective education and training, improved access to markets and more ecologically suitable farming practices - such improvements face stubborn geographic, economic and social obstacles.

Issues and Challenges for this Consultation

The task of confronting and eventually reversing the ominous demographic, environmental and agricultural production trends that threaten our common future requires courage and intelligence from men and women who can lead their societies through the difficulties ahead. You are those men and women, as are the hundreds of thousands of agricultural teachers, extension workers, researchers and technicians worldwide.

The Role of Agricultural Education and Extension Institutions in SARD

We have, therefore, asked you to join with us to discuss and analyze the roles, responsibilities and problems of agricultural education and extension in achieving the local and global goals of sustainable agriculture and rural development. We hope that your discussions will lead to recommendations on policies and strategies to promote the integration of environmental themes into agricultural extension and education programmes.

There are a number of important issues and challenges for this Expert Consultation to address. Progress has been made in integrating environmental and sustainable development themes into the programmes of some agricultural education and extension institutions, but others lag behind. The reasons for this slow progress may be the lack of national and institutional policies and mandates, as well as insufficient human and financial resources.

Policy Frameworks for Integrating Environmental Education in Agricultural Schools and Extension Services

In many developing countries, environmental policies and legislation to help guide the integration process have only recently been introduced, and there is intense debate over the ways in which the demands for economic development can be balanced with the protection of diminishing natural resources. Where policies and strategies for environmental education

and training do exist, government commitment and funding may be inadequate. Agricultural education and extension institutions themselves may lack specific environmental mandates and policies, while those that do have such mandates may not have the institutional capability to implement them fully. What can agricultural education and extension institutions do to create the political will and government support, as well as private-sector linkages, needed for them to become active agents in environmental protection and sustainable agriculture?

Human Capital Requirements for Environmental Education and SARD

The adequacy of the current levels of human capital in agriculture is a major question, both in terms of quantity and quality. Are there enough agricultural extensionists, educators and researchers? And if there are, do they possess the knowledge, attitudes and skills required to transfer and apply practices that are environmentally sound, as well as to carry out the research required to produce new technologies for the future?

It is estimated that there are some 600,000 extension workers worldwide, two-thirds of whom are based in the developing countries. These workers constitute a potentially powerful force for training farmers and other rural inhabitants, but most extension agencies are already over-stretched and lack the resources and experience to deal with new topics in sustainable agriculture or natural resource management. For example, in Asia, the extension/farmer ratio is one per 2,500, while in Latin America, it is one per 2,900.

According to the FAO study *Agriculture: Towards 2010*, 2.11 million trained extension agents will be needed by the turn of the century. The institutional capacity to produce trained agricultural personnel has improved in the developing countries, but there are still considerable shortages, especially in certain fields.

Institutional Requirements for Environmental Education in Agriculture

Virtually every country now has a network of agricultural schools, colleges and universities that could be tapped for formal environmental education. However, these schools tend to emphasize production-oriented agriculture, and often give little attention to technical subjects on the environment and even less time to the social, economic and political aspects of the problem. This Expert Consultation is expected to explore and recommend ways in which environmental and sustainable development topics can be integrated into the curricula of these educational institutions as well as into their teaching, research and outreach functions.

Institutions of higher learning, with their scientific and professional credibility, have a leadership role to play in sensitizing the public to environmental problems, including policy and decision makers. Often, however, they are steeped in tradition, removed from real-world agricultural problems and poorly linked with research and extension institutions. Can they meet the challenge of educating present and future generations of agricultural technicians and professionals?

The Relevance and Effectiveness of Education in Agriculture

Both formal and non-formal education programmes, implemented by agricultural education and extension institutions, are indispensable for promoting attitudes, skills and behaviours consistent with sustainable agriculture and rural development. Capacity-building with the full participation of local communities, non-governmental organizations (NGOs) and farmer organizations is essential if local communities are to assume responsibility for the sustainable management and protection of natural resources.

There is an important need for community-based education to empower local people, especially women and youth. It is estimated that by the year 2000, there will be over one billion youth between the ages of 15 to 24. In many developing countries, youth and children comprise 45-55 per cent of the population. Rural education often fails to provide youth the skills to find productive employment in their communities, and many, feeling the effects of rural poverty, drop out of school and migrate to urban centres. As our greatest human resource for sustainable development, it is essential that the world's youth be instructed in environmental issues and the care of natural resources, through both formal and informal educational programmes.

The Gender Issue in Education and Development

Nowhere are the linkages among population, environment, development and education more clear than in the case of the status of women and their access to education. In country after country, studies have shown a strong inverse correlation between the adult female literacy rate and the total fertility rate. When education is widely available to women, average family size drops sharply. In general, women in developing countries with more than seven years of education marry approximately four years later than less educated women. These more educated women have higher rates of contraceptive use and smaller families. Changing the educational status of women in developing countries could significantly reduce population growth. Furthermore, since women play a major role in farming, the integration of environmental education with health education could generate environmentally sound practices on the farm and in the household.

Concluding Statement

These are but a few of the issues which I hope will be addressed during this Expert Consultation. Various consultation documents have been prepared to aid your deliberations: one on FAO's policies and experiences in sustainable development; another on women and the environment; and various country case studies on the integration of environmental and sustainable development themes into agricultural education and extension programmes.

We in FAO look forward to benefitting from your collective wisdom in this important area. We also hope that you will be able to learn from each other about possible actions to be adopted in your respective countries. I wish you success as you ponder these issues, and look forward to hearing your views, experiences and recommendations.

FAO's Policies and Actions Related to Environment and Sustainable Development

An FAO paper presented by P.J. Mahler,
Special Assistant to the Director-General/
Assistant Director-General for Environment
and Sustainable Development

ANNEX 2

Introduction

When FAO was founded, almost 50 years ago, the terms "environment" and "sustainable development" were not in common usage, nor were they among the primary concerns of the international community. The mandate given to FAO was essentially focused on raising production and improving nutritional standards. However, the conservation of natural resources was mentioned among the objectives set out in the FAO Constitution, in recognition of the fact that agriculture, forestry and fisheries are all dependent upon the maintenance of the productive capacity of the earth's renewable resources.

The concerns of the international community, as initially couched in the Basic Texts of the Organization in 1945, have evolved over time, becoming more complex and taking on new dimensions as the demands of a growing population and the impact of new technologies have placed increased pressure on the natural resource base. FAO's policies and actions have evolved concurrently.

Brief Review of Past FAO Activities Related to Environment and Sustainable Development

FAO has a triple role: that of a policy forum for member governments; that of a world centre for information on food and agriculture; and that of an agency for technical assistance to developing countries. In performing these functions, the Organization does not have a separate structure or programme for environment and sustainable development. Rather, FAO policy is that these aspects should be incorporated within all the relevant activities of each sector and sub-sector: agriculture, forestry, fisheries and nutrition. It soon became apparent, however, that many environmental problems occur at the interface between sectors and sub-sectors and therefore required an integrated and coordinated approach.

As early as 1969, FAO established an Interdepartmental Working Group on Natural Resources and Environment. This Group was charged with, *inter alia*, the coordination of inter-sectoral activities, the formulation of several policy papers (on such topics as the conservation of natural resources, pesticides and the environment, fertilizers and the environment, etc.) and the preparations for the first UN Conference on the Human Environment, held in Stockholm in 1972. As a result of its work, more than 50 per cent of the recommendations of the Stockholm Conference were addressed to FAO (solely or with other UN agencies).

The follow-up of the Stockholm Conference by FAO led to a number of new activities, including projects in cooperation with UNEP, but the impact of this conference was limited by a series of oil and food crises which focused the attention of the world community on short-term demands rather than on the long-term aspects of sustainable development. Nevertheless, during the intervening period between this first world conference on environment and the Rio Summit in 1992, a number of important activities took place:

First, FAO organized a series of major policy consultations among member governments, including:

- the World Conference on Agrarian Reform and Rural Development (1979);
- the World Conference on Fisheries Management and Development (1984);
- the International Year of the Forest (1985) and three World Forestry Congresses, in Djakarta (1978), Mexico (1985) and Paris (1991);
- the FAO/Netherlands Conference on Agriculture and the Environment in 's-Hertogenbosch ("den Bosch"), Netherlands. This conference formulated a Declaration and Plan of Action which enabled agriculture to be included in the agenda of UNCED and provided the essential elements for Chapter 14 of *Agenda 21*;
- the International Conference on Nutrition (1992, in cooperation with WHO), which dealt in particular with sustainability and environmental aspects related to food security and nutrition.

Secondly, FAO carried out several major studies related to the environment and sustainable development, in particular:

- Potential Population-supporting Capacities of Lands in the Developing World (1982, in cooperation with UNFPA and UNEP);
- World Agriculture: Horizon 2000 (1989) and World Agriculture: Horizon 2010 (1993).

In addition, some 200 specialized technical publications were issued on the subjects of sustainable development and environment, including inventories of natural resources for agriculture, forests, fisheries and food security studies.

Thirdly, during this period, the FAO member countries adopted several important international agreements, in particular:

- the World Soil Charter (1981);
- the International Undertaking on Plant Genetic Resources, including the establishment of an FAO Commission on the subject (1983);
- the International Code of Conduct on the Distribution and Use of Pesticides (1985);
- the World Food Security Compact (1986);
- an International Declaration on Responsible Fishing (Cancún, 1992), laying the basis for an international code of conduct.

In addition, numerous guidelines were published on food contamination within the framework of the FAO/WHO *Codex Alimentarius*.

Lastly, FAO launched several international programmes to promote the rational use of natural resources and protection of the environment, notably:

- the Global System for Conservation of Plant Genetic Resources (1983);
- the Tropical Forests Action Programme (1985). This programme has mobilized US$ 2,300 million to date; more than 90 countries participate;
- the Programme for Conservation and Rehabilitation of African Lands (1989);
- the Programme for Conservation and Use of Animal Genetic Resources (1992);
- the International Cooperative Programme Framework for Sustainable Agriculture and Rural Development (1991). Twelve Special Action Programmes are included in this framework, grouping the above programmes with others concerning agricultural policies, people's participation in rural development, farming systems, integrated plant protection and nutrition systems, responsible fishing, control of food contamination, and nutrition.

The experience gained from these diverse activities enabled FAO to formulate a comprehensive set of strategies for sustainable agriculture and rural development (SARD) during the preparatory procedures for the UN Conference on Environment and Development. In the follow-up to UNCED, FAO was designated as Task Manager to promote action and cooperation within the UN system on the implementation of the UNCED Action Plan (*Agenda 21*) in the field of agriculture. (For a more detailed review of past activities, please refer to the FAO publication *Sustainable Development and the Environment: FAO Policies and Actions, Stockholm 1972-Rio 1992.*)

Strategies for Achieving SARD

Definitions, Challenges and Objectives

Agriculture was not explicitly identified as an UNCED agenda item when the UN General Assembly first decided to convene the Conference in 1989. Although UNCED was called in an attempt to reconcile development imperatives with those of environmental protection, the topics to be addressed initially included deforestation, loss of biodiversity, land degradation, desertification, climate change and pollution, but not agriculture, rural poverty, or food insecurity - issues which are among the root causes of environmental problems. An essential first step for FAO was to seek a consensus among its member governments on the meaning of sustainable development in the food, agriculture, forestry and fisheries sectors. On the occasion of its review of the State of Food and Agriculture in 1989, the FAO Council adopted the following definition:

> Sustainable development is the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

This definition has the merit of giving equal emphasis to the environmental, technological, economic and social aspects of sustainability, whereas many other definitions emphasize solely ecological sustainability. Its breadth, however, is also its weakness. The definition's multiple goals can be accorded different priorities under different circumstances, with the risk, therefore, that a wide range of SARD policies and strategies may result.

A number of basic strategies for achieving sustainable agriculture and rural development (SARD) were identified at the "den Bosch" conference in April, 1991. Participants included senior agricultural policy makers and planners from 119 countries, and representatives from 20 NGOs, 17 intergovernmental organizations, women's associations, consumer unions, and pesticide and fertilizer industries. Some 20 case studies examining SARD policies and strategies were discussed, including differences between regions, implications for each sector, and potential enabling actions. Since then, our understanding of SARD and its implications for different parts of the world has deepened, as a result of numerous studies, experiences from the field, and several national and international conferences.

The principles enunciated in the den Bosch Declaration and the thrusts of its Plan of Action provided the basis for a political consensus on SARD which was relatively easily reached by governments, both in the FAO governing bodies and at the Rio Summit. In particular, these principles formed the essential elements of the chapters on SARD and on the role of farmers which were ultimately included in the 500-page blueprint for action called *Agenda 21* which was agreed, world-wide, at Rio.

Strategies for sustainable agriculture and rural development should address three main challenges, which can be briefly summarized as follows:

Intensification of Agriculture: By the year 2025, an additional three billion people will have to be fed from a resource base which is shrinking as a result of many different forms of degradation. At present, there are more than 700 million undernourished people in the world, and some 50 million are threatened by food shortages and famine in developing countries. Further intensification of agriculture is therefore imperative to meet present and future demands and to avoid further encroachment on marginal lands and fragile ecosystems. However, intensification as practised at present, particularly in developed countries, carries with it problems of pollution and contamination, waste disposal, and loss of biodiversity; these problems can affect not only the natural resource base and the environment, but also human health. Moreover, the enforcement of environmental protection regulations and

standards tends to reduce farmers' incomes and create new trade barriers; this is particularly true of standards related to food contamination.

Employment: In most countries, agriculture does not offer sufficient opportunities for gainful employment. Disparities between the living conditions of rural dwellers and urban people tend to grow. In the developing countries, it is often poverty which forces rural people either to eke out their livelihood at the expense of the natural resources which are their sole means of survival, or to leave the countryside in search of employment in the cities or abroad. In many developed countries, farmers' incomes tend to be increasingly vulnerable to the vagaries of weather and markets; farm populations are decreasing, leaving large tracts of land insufficiently inhabited and unattended, and at risk of environmental degradation. As urban populations continue to grow in both the North and South, more intensive forms of agriculture and related processing industries are developing to meet the needs of city markets; these have, in turn, led to problems related to the adjustment of supply and demand, and the disposal of wastes.

Global Environmental Threats: The third challenge in the search for sustainable forms of agriculture and rural development is related to a number of global environmental threats such as the depletion of natural resources, climate change, air and water pollution, deforestation, desertification and loss of biological diversity. These global threats and the role of agriculture are far from being fully assessed. The gravity of these risks calls for a precautionary approach which places additional constraints on the agriculture sector and on rural areas and, more generally, may call for changes in consumption patterns, particularly those of affluent societies.

These challenges have multiple facets at local, national, regional and global levels and are closely related to broader issues calling for major macro-economic adjustments. They relate to policies concerning growth, equity, population, human settlements, lifestyles and consumption patterns, international trade, reduction of debt burden, and development aid. Without concomitant changes in these broad areas in a direction favourable to SARD, the impact of SARD policies will remain limited.

Concurrent with the establishment of an appropriate macro-economic framework, the adoption of SARD policy objectives calls for major revisions in agricultural policies, and rural development plans and programmes. The impact of current agricultural policies on the environment and on the sustainability of development should be evaluated in a longer-term perspective, taking into account population trends, available natural resources, their rate of degradation and depletion, and present and future demands for improved livelihoods. In particular, the impact of such measures as subsidies, output pricing policies, credit and tenancy laws, taxes and regulations should be assessed.

In the face of the multiple requirements for achieving SARD and their often conflicting implications, the choice of appropriate sector policy development plans and programmes will largely depend on a country's needs and conditions. However, three major objectives should guide the choice of options:

Improving Efficiency: Intensification of agriculture and accelerated rural development should be achieved, not by using ever-increasing amounts of resources and inputs, but rather, by using resources more efficiently. Such intensification is imperative, particularly in developing countries, to meet the demands of growing populations without encroaching further on marginal lands and fragile ecosystems. Improved efficiency should reduce waste and loss, rely on improved skills and know-how of the producers, use biological inputs and processes on the farm rather than increased amounts of external inputs, and maximize income rather than yield. Nevertheless, this objective must be carefully implemented, recognizing that in many situations external inputs remain necessary.

Increasing Resilience and Minimizing Risks: Strategies for SARD should reduce the vulnerability of the agriculture sector and the producer to adverse external factors (environmental and socio-economic); strategies should seek to provide a steady income to the producer and regular supplies to the consumer. Risk and degradation hazards should be minimized, in the use of resources and inputs, in the choice of technologies, and in post-harvest and marketing processes. In many cases, this will imply avoiding over-dependence on external supplies and market conditions, and using crops and animals which are more tolerant to environmental stress and more resistant to diseases and pests.

Promoting Diversity: This objective is a corollary of the preceding ones. Diversification will generally increase the resilience of production systems and minimize risks. It will also provide opportunities for the more efficient use of the diversity of environments, local resources and cultures. A diversification strategy does not, however, mean that all production units should be diversified, each one combining different crops, animals and trees in complex farming systems. While these diversified systems are desirable, diversity can also be promoted by developing different specialized production units, including extensive systems, and maintaining areas for other uses such as forestry, aquaculture and fisheries, watershed protection, recreation and nature conservation, adapted to the diversity of natural resources in the rural landscape. Combining on-farm with off-farm activities, including the development of local processing industries, cottage industries and tourism, is another way of diversifying production while relieving pressure on farm resources.

Meeting the above objectives generally implies an in-depth transformation of the agricultural sector and its role in the overall economy and society. The transition towards SARD requires a political commitment and accompanying measures. Such changes cannot occur if the *profitability* of farm enterprises is not ensured in the short term for the farmers who will undertake the necessary transformation in their production systems and production practices.

The Need for Technological Change

Pursuing the triple objectives of efficiency, diversification and risk aversion poses major challenges to research and technology. Most of the modern technologies have been developed for wide-scale application, having as a single objective the productivity of a specific segment of the system, rather than having the efficiency, total output and environmental sustainability of the whole production system in mind. More emphasis should

be placed on improving know-how and practices, drawing upon the experiences of local producers. Technologies should be developed for specific agro-ecological conditions and transferred to similar situations, rather than across different agro-ecological zones. Research and technology development, including biotechnology, should facilitate an increased reliance on biological system processes rather than mechanical and chemical "quick fixes" which tend to create overdependence on individual external inputs in the search for higher productivity and production. For example, there has been considerable recent progress in the biological control of pests. Nevertheless, in many instances, the use of agrochemicals, particularly of mineral fertilizers, remains necessary to produce enough food for the growing urban populations. Present efforts should continue to be directed towards safer and more appropriate use of agrochemicals while aiming at their gradual replacement by inputs and techniques which are less harmful to the environment.

Adjustments in the Relationships Between People and Natural Resources

Beside the necessary adjustments in the prices and trade patterns of food and other agricultural products to internalize the costs of natural resource conservation and environmental protection, another set of adjustments is also needed in respect to the natural resources/population relationship. In many regions, it will be necessary to upgrade the productive capacity/carrying capacity of natural resources so as to avoid excessive migratory fluxes from marginal rural areas towards the cities and from poorly-endowed regions and countries toward better endowed ones. This will entail investments to improve basic land conditions, energy and water supplies, and to protect against degradation hazards or disasters. Although many of these investments may not be profitable in the short term, they are the only way in which some countries will achieve self-sufficiency.

Other adjustments will be required wherever industry and consumer demands tend to perpetuate unsustainable production systems. These may entail the promotion of product substitution, as well as changes in food habits and consumer preferences. In some cases, it may be necessary to search for new uses for agricultural products and by-products and for new roles for agriculture (e.g. energy production), in order to reduce excessive pressures on natural resources and the environment.

Finally, in many countries, adjustments in the structure of property rights or user rights *vis-a-vis* natural resources are essential prerequisites in the search for sustainable production. This may entail carefully planned schemes of land reform, settlement or even transmigration in rural areas to facilitate a better geographic distribution of resource users in relation to the productive capacity/carrying capacity of the environment.

These major structural changes will usually require a parallel strengthening of the supporting services to the producers (e.g. extension, credit, marketing) and the development of producer organizations in order to manage a successful transition avoiding environmental or socio-economic failure.

The International Cooperative Programme Framework for Sustainable Agriculture and Rural Development (ICPF/SARD)

SARD cannot be achieved by promoting only one sustainable agriculture model or by the agricultural producers alone. Many actors need to be involved: consumers; industry and the private sector; governments; and other organizations/institutions, both national and international. The breadth of the task, the diversity of agricultural situations and the number of actors require multiple participatory and networking arrangements at local, national and international levels. This is why, rather than launching yet another international action plan, FAO member governments agreed to establish an International Cooperative Programme Framework for Sustainable Agriculture and Rural Development (ICPF/SARD) as "a flexible, gradual but concerted process" among all parties concerned, including NGOs, to promote the transition towards SARD. The major thrusts of the ICPF/SARD are reflected in *Agenda 21* and are now being translated into action at many levels, including relevant aspects of sustainable forestry and fisheries, encompassing twelve Special Action Programmes of FAO.

Critical Components of SARD

At the producer level, the transformation of farming systems to achieve more productive and sustainable yields and more diversified income is imperative. This will require the development of farmers' associations and the provision of assistance to individual farmers so that they can obtain the necessary supplies, credit facilities and technical support services from local and central government institutions, NGOs and the private sector. *Agenda 21* identifies six areas where such facilities and support services will be particularly important: land use planning and soil conservation; water management; conservation and use of animal and plant genetic resources; soil fertility management; integrated pest control; and rural energy. FAO, in cooperation with other international organizations, has established Special Action Programmes (SAPs) in each of these six areas and in the sustainable development of rural households.

At the consumer level, changes will also be needed in consumption and demand patterns, diet and lifestyles. As a follow-up to the FAO/WHO International Conference on Nutrition (December 1992), FAO is launching a Special Programme on Nutrition and Food Quality, concentrating on the improvement of diets in both the developing and developed countries, and food control.

At the local community level, *Agenda 21* urges governments, NGOs and inter-governmental organizations to become more decentralized, in order to promote the participation of rural populations - and particularly women - in SARD; capacity building (including training in the management of local associations) and infrastructural development are also needed. In 1989, FAO launched an Action Plan for People's Participation, which now forms the basis for a Special Action Programme of the ICPF/SARD. A strategy for capacity-building for SARD has been formulated concurrently by FAO, in cooperation with UNDP.

At the national level, many governments are now embarking on their own sequels to Rio. Clearly, these national agendas should not be developed solely by the ministries dealing with planning, overall economic development and environment. Participation of line ministries, farmers' associations, and NGOs in an interactive process will be essential. This policy review and planning process will call for a new type of structural adjustment to people's needs and macro-economic commitments, and to natural resource endowments and environmental limitations. It will also call for trade-offs among sectors and between short-term and long-term requirements, in particular as regards food security and employment. This should in turn lead to a number of adjustments in sector and sub-sector policies and the development of appropriate instruments and tools (regulatory, fiscal, economic and participatory) in order to provide the necessary income support and investment means to the agricultural sector to enable the transition towards SARD.

The partnership between NGOs, government agencies and the private sector must be developed at both the local and national level. Significant amounts of resources are currently being allocated by some governments and international institutions for independent development and study activities by NGOs; the implementation of SARD, however, will require collaborative action between governments and NGOs, which explicitly recognizes the different but complementary abilities of each partner.

At each of the above levels, there is a need for education and training, aimed at: increasing awareness of environmental and sustainability issues; developing a better understanding of needed changes from agricultural systems, producers and consumers; and disseminating the results of different approaches, methods, and techniques. More than the simple insertion of a few environmental considerations into existing education, training and extension programmes is required; these programmes should be seen as key supportive activities, designed to promote the major changes which will be required in the agricultural sector in order to achieve the objectives of SARD.

Implications of SARD Strategies for Agricultural Education, Extension and Training

Previous FAO Experience

Even before launching the Special Action Programmes under ICPF/SARD in November 1991, FAO had begun to address the need to incorporate environmental education and training into agricultural extension. One good example is FAO's assistance to Indonesia, which has included a project to develop an extension methodology for encouraging community participation in identifying and resolving environmental problems. The project is undertaken by the Ministry of Environment, in collaboration with the Ministry of Agriculture's Agency for Agricultural Education and Training.

Between 1986 and 1988, this project developed and tested extension strategies, methods and materials, through a series of workshops conducted in two districts.

Subsequently, community leaders, field agricultural extension workers and small farmers were trained in the skills and techniques needed to identify, prioritize, analyze and solve local agriculture-related problems. In addition, two groups of agricultural extension workers were trained to incorporate environmental concerns into their extension programmes.

The approach has received an enthusiastic response from both trainers and trainees alike, and has increased the understanding of the beneficiaries (small-scale farmers) of the interactions between environment, population and agricultural development. The training module is now institutionalized within the regular work programme of line ministries dealing with small farmers and within the curricula of extension training institutions.

Since 1992, FAO has been developing an Environment Education Training Module (EETM) for use in training agricultural extension workers. The prototype has been developed and pre-tested in collaboration with the Indonesian Agency for Agricultural Education and Training (AAET). A national seminar recently held in Indonesia noted the need for systematic incorporation of such environment education training modules into the curricula of agricultural extension training institutions. AAET is training trainers from some 25 agricultural training centres in Indonesia in the use of the module.

The training module has also been translated into English by the Agricultural University of Malaysia and will be used as a prototype for adaptation, testing and translation in other countries. A regional meeting will be held in Asia in mid-1994 to share the Indonesian experience and to discuss the procedures for the adaptation and testing of such modules in other countries.

FAO has also been involved with Indonesia's national training programme on integrated pest management (IPM) for rice. This programme has successfully developed and applied an "experiential learning" approach aimed at enabling farmers to develop a better appreciation of the factors affecting biological dynamics and plant growth in irrigated rice ecosystems. As a result, they are equipped to assess the incidence of pest and predator populations and to decide when to use or not to use chemicals or other control agents. Farmers trained in IPM at farmer field schools use significantly less pesticides, attain equal or better yields and earn higher incomes from their crops than farmers who do not practise IPM. A large number of these farmers mobilize local resources and hold the same kind of field schools with other farmers. To date, the programme has trained some 8,000 field extension agents in the use of IPM techniques, and has reached some 200,000 farmers in 12 provinces.

Other FAO projects which have incorporated environmental considerations into extension are the Participatory Forestry Development Project (a regional project in the Andes) and the Community Forestry Project in the Bolivian Altiplano. Under the regional project, a training component has been instituted in Colombia, comprising eight short courses for a total of 135 trainees under 12 trainers. The Bolivian project has provided five courses for 120 trainees under 15 trainers. The subject matter in both projects has involved reforestation and watershed management.

Over the past two to three years, FAO has carried out a series of regional and sub-regional round-table meetings on strategy options for intermediate and higher level training in agriculture. These meetings have been held in Latin America, Francophone Africa, Anglophone Africa, Eastern and Central Europe, Asia and the Pacific, and the Near East. FAO, in collaboration with two regional associations, organized a regional workshop on Environment and Sustainable Development for colleges/faculties of agriculture in Asia in 1992. Additional roundtable meetings are scheduled for 1994 for the Caribbean and the Lusophone countries.

In all of these meetings, participants have emphasized the importance of relevant curricula, effective teaching methods and the integration of environmental and sustainable development topics into the curricula at all levels of training. The fact that farm production will have to be doubled in 25 years, without excessive depletion of the world's natural resources, was recognized at every meeting. If colleges and universities are to address these issues effectively, regional centres of excellence should be established.

The Importance of Incorporating Environmental and Sustainability Concerns into Agricultural Education and Extension

A comprehensive approach to human resource development requires the integration of SARD at all levels of formal and non-formal learning systems and close collaboration among communities, educational systems and extension organizations. Operational guidelines and training methodologies require a strengthened inter-disciplinary understanding and analysis of relationships among economic, ecological and social factors. However, changing the societal perceptions of the importance of an ecologically responsible approach to resource management as a modern development strategy requires more than operational guidelines and training materials; it requires a drastic overhaul of conventional learning institutions, which tend to be sectoral, fragmented and compartmentalized into narrow sub-disciplines of technical knowledge.

There is a need to shift the research effort away from its conventional focus on the enhancement of production, to a new focus on sustainability and the social and policy issues affecting the long-term survival of humankind. In focusing on the technical aspects of production, the deep-seated social causes of poverty and hunger are often overlooked. Agricultural improvement should not be the sole responsibility of researchers in laboratories, but rather, should also involve social scientists and farmers so as to design meaningful, ecologically-sound, development strategies. The goal should be to develop a client-centred system of research, education and extension, which is backed up by "facilitators" who can mobilize groups of small farmers to act together to improve their well-being through SARD. Participatory action research (PAR), in which researchers, small farmers and extension agents work together as equal partners, deserves priority in promoting SARD.

Agricultural education and extension programmes should be designed to meet the special needs of students and trainers, farmers and communities, policy makers and the general public. Agricultural education and extension should go hand-in-hand with the improvement of public information systems and communication capabilities. It is essential

to integrate environmental and SARD considerations into agricultural curricula at all levels, with options for specialization at the graduate level. Teacher training programmes in agriculture, instead of dealing exclusively with technical environmental issues, should also cover the social, economic and political aspects of SARD.

Policy-Makers, Planners and Programme/Project Managers

At the policy-maker level, the main target groups include ministers of agriculture, directors of planning, members of national advisory bodies, and other senior-level staff from these ministries. At this level, the emphasis should be on imparting awareness, and on ensuring that information on the experiences of other countries is made accessible.

Assessing the potentials and limitations of natural resources, and the present and future demands on these resources, calls for the development of user-oriented databases and monitoring systems. These, in turn, will require the installation of appropriate hardware and software, training programmes in computer applications, analysis and interpretation of data, and the presentation of results in a usable format. Networks of compatible data systems should be created. Other decision-making tools should include expert systems, multi-criteria analysis, natural resources modelling, and environmental impact assessments of agricultural policies and programmes - not just isolated projects. By reporting on the seriousness of environmental deterioration and the implications for human survival, an informed media could compel policy-makers to act with a greater sense of urgency. Enhancing the capacity of planning units calls for the presentation and discussion of alternative policy frameworks and strategy guidelines through lectures, seminars and roundtables, and the ability to work as part of an interdisciplinary team.

Managers of successful natural resource conservation and development programmes could be utilized to train other development managers. Environmental and sustainability concerns should influence the whole cycle of programme/project identification, formulation, implementation and evaluation. Environmental check-lists can play a useful role, but monitoring systems which involve both technicians and rural people are preferable; training in monitoring methodologies is therefore of special importance. Capacity-building should not be limited, however, to human resources development. There is usually a need to develop better institutional linkages and cooperative mechanisms between the agricultural development institutions and those concerned with environment and health. Once established, these mechanisms can be used to launch joint education and training programmes. Legal officers will also need to be closely involved in the development of environmental legislation, regulatory instruments and control mechanisms, and in the assessment of their effectiveness. The pressure for change, however, will come from an educated general public.

The General Public

Given the urgent need to mobilize a strong public consensus on sustainability, general public education should focus on changing perceptions and attitudes by highlighting the relationship between consumption patterns, production systems, and the environment. This objective can

be fulfilled by incorporating SARD into the curricula of public and private schools at all levels. Particular attention should be paid to the growing need for community leadership in natural resource management. Raising community awareness about sustainable development could be accomplished through community learning centres, traditional media such as village theatres and blackboard newspapers, as well as through radio and audiovisual channels. A free and responsive press is vital for promoting SARD.

Agricultural Research Staff

Along with the reassessment of the role of technology in agricultural development, research objectives and priorities should be reviewed. This will imply the development of new agricultural research capacities and methods, as well as the improvement of linkages between research disciplines and between research institutions and the users of technology. Areas which should be accorded greater attention by agricultural researchers and by those addressing the complex processes of natural resource degradation and global environmental change include the following: systems research; life-cycle studies of products ("cradle to grave"); balance analysis (salt-water balance, energy balance, plant nutrient balance, etc.); environmental economics; natural resource accounting; and trade-off assessments and management.

Extension Agents and Small Farmers

Agricultural extension agents constitute a powerful force for the non-formal education of farmers in sustainable agricultural technologies. Both formal and non-formal education should be action-level training that integrates indigenous farmers' know-how and value systems with modern, science-based techniques generated through research adapted to local conditions. Agricultural extension programmes should fully reflect this union of traditional and modern knowledge systems.

Non-formal education for SARD should be organized around multi-media systems to reach illiterate farmers, and should provide continuing education to the farming community at large. Experience demonstrates that local people's organizations are sometimes more successful than government extension units in facilitating sound resource management. Emphasis should be placed on strengthening rural institutions, so that farmers can play a greater role in identifying their own needs and priorities; emphasis also needs to be placed on local-level extension programmes dealing with SARD, and on the monitoring and evaluation of programme results. Leaders of cooperatives and other rural institutions should be made aware of government incentives, support services, and markets. It will be equally important for small farmers to learn from one another through an exchange of experiences.

In remote, isolated areas outside the reach of government organizations, NGOs can often provide an ideal channel for training farmers and disseminating appropriate technologies through practical demonstrations. They can serve as facilitators in the community management of common property resources. NGOs should have greater access to information and opportunities to interact with planners and managers. At the same time, private, commercial agribusinesses are often repositories of extensive practical management skills, and can provide valuable technical advice; closer dialogue is needed between entrepreneurs, government institutions and farmers' organizations.

One of the keys to success in achieving SARD will be the development of methods that enable countries to monitor progress in adopting more productive and sustainable practices. To develop these methods, better information is needed on the condition of the natural resource base (for example, the extent of land degradation, the loss of biodiversity, and the sources and effects of pollution); sustainability criteria and indicators must be established and used; and research must be carried out to ascertain the processes involved, to identify the critical elements, and to set the priorities for action.

Concluding Remarks

Major advances have been made over the last few years in our understanding of environment and sustainability issues related to agriculture and rural development, and of the linkages between these issues and others, such as food security, trade and rural poverty. The concepts and objectives of sustainable agriculture and rural development have been elaborated and their multiple implications clarified. The role of agriculture, not only as a provider of food and other products, but also as a manager of natural resources and a supplier of environmental services, is more widely recognized. However, to those who have responsibilities in agricultural education, extension and training, the information available on SARD often appears to be both limited and patchy. It remains difficult, therefore, not only to produce general guidelines, but also to teach and train people in practical solutions.

There is a wealth of know-how on the sustainable management of *individual* resources (soil, water, genetic resources) and on the appropriate and safe use of *individual* inputs (pesticides, fertilizers and agricultural machinery). There is also a rapidly growing body of information on successful grass-root development techniques and participatory methods. In a number of instances, these management and development techniques have been combined successfully. Does this mean that we know how to induce and manage the process of transition towards SARD? Far from it. Most problems and solutions have been formulated in qualitative terms, rather than in quantifiable economic terms which would enable comparison, priority-setting and decision-making.

One of the principal challenges confronting SARD is the need to develop policies which will change current agricultural production and consumption patterns so as to make these more "sustainable" (i.e., not only environmentally sound, but also socially just, economically viable and culturally acceptable), without causing irreversible disruption or unbearable costs to rural people and society at large. The present wide-spread economic recession, together with efforts to liberalize trade, may well perpetuate unsustainable forms of agriculture in many marginal areas and further accelerate the degradation of natural resources and socio-economic conditions. How can we re-launch growth in agriculture, reduce support to this sector and remove trade barriers while, at the same time, ask farmers to incur additional costs or losses of income by introducing natural resource conservation and environmental protection practices?

Although we are far from finding the solutions and being able to make all the necessary prescriptions to implement the complex objectives of SARD, the role of education, training and extension in raising awareness of the problems, understanding their complexity, and influencing attitudes and behaviour can assist significantly with the process of change. The SARD guidelines identified in this paper, together with those contained in the Rio

Declaration and the various international agreements on biodiversity, climate change, forests, pesticides, etc., provide a basis for the general principles which should permeate the programmes of agricultural education, extension and training. As most of the solutions to agricultural sustainability problems are site-specific and should be found and applied by the people themselves, it seems as important to inculcate these basic principles as to transfer and disseminate existing experiences.

Most programmes in agricultural education, extension and training tend to address specific facets of agricultural systems, and to employ a short-term perspective. However, a consideration of environmental and sustainability issues requires a greater emphasis on the interactions and trade-offs among system elements and between short-term and long-term aspects. Many programmes of higher agricultural education and training already address some of these "systemic" aspects, as do - to a much lesser extent - the lower-level education, training and extension programmes. There is also a wide range of programmes which deal with some specific environmental problems related to agriculture (e.g., the effects of excessive pesticide and fertilizer use). The scope of sustainability objectives, however, requires a complete overhaul and integration of these programmes, including not only those for agricultural education, training and extension, but also the associated programmes for agricultural research, information exchange systems, monitoring and feedback mechanisms, human resources planning and institution-building. This is why FAO, in organizing this Expert Consultation, has assembled a wide range of expertise to guide its future activities and those of its member countries in these fields.

Gender Analysis, Environment, and Sustainable Agricultural Development

Prepared by P. Howard-Borjas, Women in Agricultural Production and Rural Development Service (ESHW), in collaboration with ESHE for the Expert Consultation

ANNEX 3

Introduction

The Making of an International Agenda on Women and the Environment

Women have been prominent environmental activists and have brought many issues to the attention of the world. Issues include water and ground pollution (e.g., Love Canal), nuclear power (e.g., the anti-nuclear movement in Great Britain), and deforestation (e.g., the Chipko movement in India and the Greenbelt movement in Kenya). Women's concerns with the environment are related to their roles as protectors of the health and well-being of their families and as managers of household resources, and to their productive roles in every walk of life, from the modern industrial workplace to the subsistence farm. Indeed, with one foot in the household and the other in the workplace, it is not surprising that women can appreciate the disruption and threat posed by environmental degradation.

In 1972, immediately after the Stockholm Conference on the Human Environment, the United Nations General Assembly proclaimed that 1975 would be International Women's Year, showing that international concern about the status of the environment and the status of women evolved simultaneously. However, it was not until the 1980s that international attention was given to the relationships between women's status and the environment. At its Tenth Governing Council in 1982, UNEP sought to expand its target groups to include women as well as youth, professionals, and other community leaders. The relationships between women, the environment and sustainable development began to be elaborated in UNEP's *State of the Environment Report* in 1984. The UN Decade for Women Conference also recognized the links, which were reiterated at the UN General Assembly, thereby encouraging the various UN agencies to develop a better understanding of women's roles in environmental protection and in the promotion of sustainable development (Clones, 1992).

Since the beginning of the 1980s, FAO has emphasized the critical role of women in agriculture, and in particular, in environmentally-sensitive areas such as rural energy supply and swidden cultivation. Explicit references to the relationships between women, the environment and sustainable development are found in reports on the FAO/Netherlands Conference on Agriculture and the Environment (the "den Bosch" Conference), held in April 1991. In November of the same year, the 26th Session of the FAO Conference adopted a specific recommendation on "Women, Environment and Sustainable Development", in recognition of the role of women in the achievement of sustainable agricultural and rural development (SARD).

The environmental movement, the women's movement, and the concern of the UN system with sustainable development all converged in the preparatory work for UNCED. A Global Assembly on Women and the Environment was held in Miami in November 1991, at which over 200 case studies were presented giving examples of the ways in which women are successfully working toward environmental conservation and management. One of the better known cases is the Chipko movement in India, where women save trees by hugging them to prevent contractors from felling the forest; as a result, a 15-year ban was imposed on tree felling in Uttar Pradesh forests, and the movement has spread to other provinces. Another example, the Green Belt Movement in Kenya, was initiated through the National Council of Women; the Movement plants trees nation-wide, for environmental protection, for local fuelwood supplies, and to prevent desertification. Women handle tree nurseries, plant and market trees, and practise professional forestry techniques (Rodda, 1991).

During the International Drinking Water Supply and Sanitation Decade (1980-90), women's primary roles in water supply and sanitation were widely recognized; the implementation of UNDP's programme PROWWESS (Promotion of the Role of Women in Water and Environmental Sanitation Services) is just one example. Many other examples of the effective integration of poor women in projects and programmes oriented toward achieving environmental protection and SARD have been documented (UNEP, 1991a; Rodda, 1991).

The work accomplished at the Preparatory Commissions and the Earth Summit gave rise to Chapter 24 of *Agenda 21*, entitled "Global Action for Women towards Sustainable and Equitable Development", adopted by the UNCED Conference. This chapter includes objectives and activities that directly pertain to agricultural education and extension programmes. One objective is to:

> assess, review, revise and implement, where appropriate, curricula and other educational material, with a view to promoting the dissemination to both men and women of gender-relevant knowledge and valuation of women's roles through formal and non-formal education, as well as through training institutions, in collaboration with non-governmental organizations.

The chapter recommends that participatory research and policy analyses be undertaken with the collaboration of academic institutions and local women researchers, and identifies the following priority topics:

- women's knowledge and experience of the management and conservation of natural resources;
- the structural linkages between gender relations, environment and development;
- programmes to disseminate environmentally sound technologies to women.

Purpose and Scope of this Paper

Increasingly, national and international policies require that national development institutes and programmes be reviewed to ensure they address three interrelated issues: people's participation; environment and sustainable development; and gender or "women in development". The purpose of this paper is to suggest an approach to reorienting agricultural education and extension programmes to permit them to become more gender sensitive and hence more relevant to rural men and women and to the achievement of SARD. The discussion should help agricultural education and extension experts to develop a better understanding of the ways in which these issues are interrelated and relevant to their work; the paper also aims to identify positive steps which can be taken by agricultural experts, to ensure that they can respond to these new mandates in the 1990s and beyond.

Women make up slightly over half of the world's population. Women's relationships to the environment are as diverse as men's, and vary depending on their socio-economic characteristics (social status, occupation, age, ethnicity, etc.) as well as geographical location. Women's relationships to the environment are also often distinct from men's, just as their legal and political status, occupation, and responsibilities differ from men's across all societies because of gender bias.

Any approach to women and SARD must first contemplate the general links between people and the environment, and, second, take into consideration the variations in these relations depending upon gender, social status, geographical location, and other population characteristics. For this reason, this paper begins by presenting a framework for conceptualizing human-environment relations in a manner which is sensitive to these many factors. This conceptual framework serves to delimit the main topics and approaches that could be incorporated in agricultural education and extension programmes, but which, with some exceptions, have largely omitted reference to the relations between people and SARD. The reasons for this omission are based on the failure to adopt approaches that put people first, as knowledge-bearers and as agents in the creation of their own environments. This acts as a barrier to the integration of gender issues and in part serves to explain why women have generally not benefitted from agricultural education and extension programmes.

A Conceptual Framework for a Gender-Sensitive Analysis of Environmental Relations and SARD

People, the Environment and Sustainable Development

All environmental problems are related to the ways in which people use their environment. This means that there are no purely "technical" or "physical" issues in environment and sustainable development. People relate to each other in social organizations and transform nature to meet their wants and needs. The usefulness of natural and environmental resources for any particular society or social group depends upon: a) awareness of the existence of the resources; b) knowledge that permits the resources to be used; c) access to the resources; d) technology for their extraction and processing; and e) the economic viability of their exploitation and use. These conditions differ not only by country, but also by social class, ethnic group, gender and age.

Environmental and natural resources have many different and competing uses. A forest ecosystem, for example, can be a source of timber, a regulator of water flows and climate, a habitat for wildlife, a recreational and visual amenity, a producer of plants and fodder, and a protector against soil erosion. Different social groups use the same resources in ways which may be complementary or in conflict. For example, women may use forests as a source of medicinal plants, fodder and fuelwood, whereas men may use them for timber. Men's timber extraction may disrupt the use of forested areas by women. In addition, different social groups have different knowledge bases and access to technology. Large farmers may have access to land mechanization equipment and understand how to use

chemical inputs, whereas small farmers may use manual methods for land preparation and understand traditional soil conservation and pest control measures. Through the development and transmittal of knowledge, awareness and technology to different groups of people, agricultural education and extension programmes therefore have a major role to play in determining both the use of natural resources and the groups which will benefit.

Sustainable development can be seen as a long-term process of social change which considers the dynamic relationships between socio-economic and natural systems. Sustainable development requires the rational management of all assets: natural, human, financial and physical. This process of social change requires human development, and should bring increasing human welfare together with the preservation and enhancement of the potential of the natural resource base. Human development is the process of enlarging the range of people's choices - increasing their opportunities for education, health care, income and employment, and self determination. It is a process which requires a sound physical environment as well as economic and political freedoms. It is human development, rather than agricultural development, which is the immediate goal of agricultural education and extension efforts, since it is only by widening human capacities, opportunities and choices that SARD may eventually be achieved.

Sustainable agricultural and rural development is impossible to imagine in a world where more than 1.2 billion people in developing countries, or about 24 per cent of the world's population, live in poverty. Environmental degradation affects the poor most directly and profoundly, since it threatens their food supply, incomes and health, and because the poor have the fewest resources with which to cope with these stresses. The need to address poor women specifically arises because: a) they constitute a very large group of agricultural resource users and managers in those developing countries where environmental degradation is most severe; b) they form a majority of the poor population, and their activities provide a major source of sustenance for the rest of the poor; c) their welfare is the most severely affected by environmental degradation; d) their ends, means and constraints are distinct from those of men; and e) the above factors have often been neglected in efforts to achieve SARD.

Gender Bias

Gender refers to socially defined roles and attributes attached to each sex, as well as to the relations between the sexes. For example, although childbearing has historically been important as a determinant of gender roles, the assignment of women to "feminine" tasks has continued long after it is relevant. It is not biology that determines lower wage rates for women field workers, or the absence of women from a large number of agricultural occupations and professions, or women's exclusion from decision-making positions throughout the agricultural sector, but rather, the cultural definition of gender roles. In order to understand the relationship of gender to environment and SARD, the relative positions of both men and women must be examined to understand the constraints and opportunities that are common to both and those which are specific to their gender.

If human development is a prerequisite for sustainable development, gender bias is a major obstacle to achieving this goal. Human development indicators (malnutrition, child

mortality, life expectancy, literacy, education, etc.) clearly demonstrate gender bias, defined as the "unequal status or treatment of women resulting in their physical or economic deprivation relative to counterpart males" (Hanrahan, 1991:10). According to Jacobson (1991:7):

> Gender bias is...a primary cause of poverty, because in its various forms it prevents hundreds of millions of women from obtaining the education, training, health services, child care, and legal status needed to escape from poverty. It is what prevents women from transforming their increasingly unstable subsistence economy into one that is not forced to cannibalize its own declining assets.

UNDP's *Human Development Reports* show that gender bias exists in all countries for which data are available, and is especially marked in developing countries.

Women have traditionally played a major role in the world's agricultural production systems. Whether reference is to Sub-Saharan Africa or the Caribbean, where women produce 60-80 per cent of basic foodstuffs mainly through shifting agriculture, or to Asia, where they perform over 50 per cent of the labour involved in intensive rice cultivation, or to South-east Asia and the Pacific or Latin America, where their home gardens represent some of the most complex agro-silvopastoral systems known, women hold a vast amount of responsibility for and knowledge of sustainable agriculture systems. The recognition of women's critical roles in agricultural production, especially in the food sectors of developing countries, re-emerged with a study published by Esther Boserup in 1970. Boserup hypothesized that, world-wide, farming systems will be female where non-plough, shifting cultivation systems predominate (such as in Africa and tribal South and South-east Asia); plough cultivation systems will be male (such as in Latin America, and Arab cultures); and farming systems will be mixed male-female where intensive irrigated systems predominate (e.g., in South and South-east Asia) (Drake, 1991). Further, Boserup showed that male productivity tends to be raised when agricultural modernization occurs, whereas female productivity stagnates. Women have largely failed to benefit from the expansion of financial support systems, training and extension, mechanization, and the use of agro-chemical and other industrial inputs.

Gender bias is evident throughout the world's agricultural systems, and is a major contributor to unsustainable development. When women have access to land, their tenure is usually insecure, bringing the associated risks this implies for farmers, as well as disincentives to invest in land conservation. When women farm their own land, this is often of lower quality than that of counterpart males (reflecting the fact that women are often responsible for food crops while men are responsible for cash crops). Their access to credit is restricted by gender bias, lack of land title, poverty and illiteracy, which are the same factors that limit women's membership in farmers' cooperative organizations or associations. These organizations often provide training, extension and other services to their members, so women are less likely to be recipients when they are not members.

Women's access to extension services worldwide is only about 1/20th of that of men (Table 1). Without secure tenure, credit, training and extension, women have little access to inputs and improved technologies to raise their productivity. For many women, low agricultural productivity is combined with responsibility for the household (child care and education, care of the elderly, disabled and sick, water and fuel provision, cooking, cleaning and hygiene, etc.), numerous community activities and, increasingly, the need to provide income for the households which they head (about 20 per cent of the world's households) or chiefly support (about 40 per cent of all poor households). As a result, poor rural women work an average of some 14 hours per day - about a third more hours than men (UNSO, 1989).

Table 1: Percentage of time and resources allocated to clientele groups by extension organizations.

Clientele Group	**Africa** N = 38	**Asia & the Pacific** N = 28	**Europe** N = 7	**Latin America** N = 39	**North America** N = 4	**Near East** N = 16	**World Average** N = 132
Commercial Farmers	20	36	69	42	48	31	35
Commodity Producers	26	17	5	24	1	34	23
Subsistence Farmers	31	28	2	18	1	14	22
Landless Producers	1	4	1	2	1	5	2
Young Farmers/ Rural Youth	10	8	7	5	16	2	7
Women Farmers	7	3	3	5	1	9	5
Home Economics	1	2	4	-	9	1	1
Other Groups	4	2	9	4	23	4	5
Total (Per cent)	100	100	100	100	100	100	100

Source: FAO, 1990.
Note: N = number of respondent organizations.

In spite of the predominance of women's labour in many farming systems, and of a significant and rising proportion of female-headed farms and rural households, gender bias is reflected in most characterizations of farming communities, including those within the agricultural education and extension programmes of both the developed and developing countries. "Farmers" are seen as either genderless or male. This mirrors most conceptions of farms and households developed by the social sciences. The household or farm is treated as the unit of analysis, so that the decision-making process within it is obscured. Even where the division of labour in the household or farm is recognized, it is assumed that authority is a function of income, that males are the primary income earners, and that households or farms are therefore headed by a male (Drake, 1991).

Poverty, Gender and Environment

Some Current Ideas: A common idea is that poverty and environmental disruption are strongly interrelated. Poor people tend to concentrate in and exploit marginal areas. Lacking resources and technology, they tend to over-exploit the natural system, with a consequent decline in productivity associated with environmental degradation; the traditional production systems employed by the poor are often considered to be part of the problem. A process of cumulative causation is set off: poverty increases, and this, in turn, exerts even more pressure on the environment, leading to a vicious cycle. An increasingly deteriorated environment is both less productive and more vulnerable to unexpected social and natural events, thereby making poor groups more disaster-prone.

It is also frequently thought that unavoidable environmental destruction results from growing populations, which give rise to poverty, which in turn leads to increasing pressure from poor populations on the natural resource base. However, it is not possible to demonstrate that a high rate of population growth is always associated with lower rates of development and therefore with poverty. Similarly, it cannot be shown that rapid population growth leads unavoidably to environmental degradation. The links between welfare (or lack of welfare) and the environment must be examined more carefully.

Many studies have attempted to demonstrate a correlation between poverty and environmental degradation, pointing out that, "nearly 80 per cent of the poor in Latin America, 60 per cent in Asia and 51 per cent in Africa are living in marginal areas characterised by low productivity and high vulnerability to environmental degradation" (Bifani, 1992:107). The poor are often thought to be responsible for much deforestation through the expansion of shifting cultivation and new settlements in forested areas. However, "there are cases, particularly in Latin American countries, where 5 per cent of the farmers own more than 80 per cent of farmland. Therefore, with less than 5 per cent of the land and forest resources of the region, the poor cannot be held responsible for the deterioration of agricultural resources" (Bifani, 1992: 108). Poor women have even less access to land than poor men. Nevertheless, women's fuelwood collection is often ranked on a par with logging, livestock rearing and agricultural expansion as a major cause of deforestation - despite the fact that, in most countries, it represents only a small fraction of total forest use.

Poverty implies that there are no alternatives to living in deteriorated or marginal areas. The poor occupy the most fragile natural environments and the most scarcely equipped human-made environments. In their efforts to satisfy basic needs, and lacking any alternative means of employment or access to capital, the poor are pushed to over-exploit accessible resources such as land, water and fuelwood, and to occupy marginal lands. The problem is accentuated by the increasing fragmentation of holdings, land conflicts, and the lack of access to capital, inputs and technology.

Resource Access and Control: The first element to be considered in the gender, poverty and environment relationship is resource access and control. Two major, interrelated processes are apparent in the developing world: a) the growing concentration of resources in the hands of a few; and b) the increasing insecurity of tenure for the majority of the rural population and especially for women, as a result of the breakdown in communal tenure systems. As resources are concentrated, the rural poor are displaced to marginal lands or forced to migrate to urban areas in search of employment. This contributes to increasing pressure on fragile marginal lands as well as to urbanization and urban poverty. With the breakdown of traditional tenure systems, the distribution of benefits changes, as do the incentives and risks that people face when making long-term investments in the resource base.

Much of the land in developing countries was alienated during and after the colonial period to expand market-oriented plantations and livestock production and to "modernize" agriculture. It was considered that large-scale agricultural operations were more efficient, so agricultural policies usually promoted the expansion of large production units. In general, large units are devoted to production for export rather than to production of foodstuffs to satisfy internal demand, especially foods consumed by the poor. Thus, although there is no doubt that poor people are increasing the pressure on marginal resources, this phenomenon is often due to the fact that large enterprises oriented toward commercial crops are able to out-compete these producers for access to high quality land resources.

The system of resource control (tenure) which governs agriculture, forestry and fisheries is a critical factor in environmental relations. When referring to forest management, FAO indicates that, "in the first place, the land tenure regime determines the type of land management; and attitudes weigh heavily on the future of the forest. Private ownership, for example, will be conducive to investments in forests only if security of tenure over a long enough time is guaranteed" (FAO, 1987:1). The same is true of any investment in resources that yields benefits only in the long run, such as most of those investments of labour which are required for soil conservation. In general, people are more likely to adopt sustainable practices in relation to resources and the environment if they are confident that they will continue to have access to them in the future.

Landlessness and land concentration have increased in many parts of the developing world as common property rights have broken down. Common property is often confused with "free access", which refers to land or goods which everyone can use. Under common property regimes, social groups determine their members' rights and duties regarding the use and control of common lands, and limit use to members. The natural system is treated in an integral fashion as an ecological system which provides the basis for the group's survival,

rather than as a series of "goods" (e.g., land, timber) that can be parcelled out individually. As such, common property regimes not only provide a mechanism for conserving natural and environmental resources, but also, implicitly recognize the propensity to over-exploit free goods; they are an attempt to avoid free use. Common property systems also promote equity. In fact, according to the growing body of literature on the topic, "it is precisely the breakdown of the traditional control mechanisms resulting from the commercialisation of agriculture and the growing pressure of the marginalised poor that is said to be the cause of environmental degradation" (Bifani, 1992:107).

The economic processes that have relegated food production to marginal land have especially affected women subsistence farmers. Jacobson identified four interrelated trends which can be attributed to the increasing emphasis on cash crops:

> First, large amounts of land once jointly owned and controlled by villagers - and accessible to women - have shifted into the hands of government agencies and private landowners. Second, the distribution of resources on which cash crop agriculture is heavily dependent - including land, fertilizers, pesticides, irrigation, and hybrid seeds - has reflected persistent gender bias. Third, the mechanization of agriculture has reduced or replaced the labor traditionally done by men, but increased that done by women without increasing their income. And finally, the labor available to subsistence households in many countries has become increasingly scarce, largely as a result of the shift of male workers away from subsistence production into cash crops and urban-based industries (Jacobson, 1992:24).

The changes in land tenure that have accompanied agricultural "modernization" have eroded women's customary access to land. Customary land tenure arrangements are usually based on some form of communal land ownership where kinship, ethnic, or tribal group is the organizing factor (Manuh, 1989). Women's rights to land were generally assured under customary systems in those regions where it was recognized that women were major agricultural producers. In Africa, many of the tenancy arrangements for women also depend upon the provision of labour on other land, be this the land of their male kin or communal land. However, over time, use rights in many of these systems have become virtually synonymous with ownership. Legal land tenure systems developed in the colonial states have been juxtaposed with customary systems. These legal systems provide for private property, state property and other forms of tenure including concessions of national land. In these legal systems, women's access to land and other resources has often been proscribed or made dependent on male authorization. For example, in Thailand's traditional matriarchal societies, married women inherited their parents' land, whereas now the legal system requires that all land belonging to couples be titled in the husband's name (Jacobson, 1992). Other elements contributing to the decrease in women's land access include the land scarcity resulting from the expansion of monoculture cash crops, forest plantations and livestock operations, and the development of irrigation, resettlement and agrarian reform programmes which all typically exclude women as beneficiaries. When women are deprived of land

altogether, they turn to sharecropping, land purchase, marriage, or cooperatives in order to gain continued access (Chimedza, 1989).

Women's entitlements can improve or detract from the efficiency with which they use natural resources (Manuh, 1989). If land tenure is insecure because, upon death of the husband, the right to land passes to his closest male heir, women will not be as likely to invest time and energy in tree planting, contour construction or other soil management measures. If women do not have land title, they are usually not eligible for credit which would enable them to purchase technology and other inputs that can help them to stabilize their production systems. In addition, "[the] commons are as indispensable to land-poor women in subsistence economies as these women are to the maintenance of the commons...Commons lands constitute the one resource, apart from their children, to which women traditionally have had access relatively unfettered by the control of men" (Jacobson, 1992:22-23).

Gender, Environmental Degradation and "Modern" Agriculture: If poverty were indeed a principal cause of environmental degradation, then degradation should decline as income increases and poverty is eradicated. However, the environmental problems of developed countries are even greater than those of developing countries. Each population group exerts different pressures over its local environment, depending in part on the patterns of development and production and consumption levels.

The relation between people and resources is often not determined locally, but regionally or even internationally. National, regional and international markets influence local production systems, leading to changes in consumption patterns, the modification of traditional practices, the adoption of alien varieties, and the slow disappearance of local varieties. The growing dominance of cash crop systems tends to shrink the range of natural resources used by the local population, putting biodiversity at risk and increasing human vulnerability. In this case, the pressure on the local environment originates from the demand of populations located in other regions, whose consumption patterns are shaped not by the characteristics of a particular environment and its resource endowment, but rather, by income levels and market access worldwide.

As the international demand for developing country agricultural and livestock products has expanded and production systems have "modernized", women have been especially affected. In many parts of the world, women have been the primary caretakers of agricultural and livestock genetic resources - identifying, preserving, and using wild and domestic species, in order to provide food for their families. As consumption patterns change and market incentives (e.g., for hybrid corn or rice) are introduced, these traditional resources and knowledge have tended to disappear. Women have become dependent on purchasing imported foodstuffs, and on the production of varieties and breeds that are less resistant to local diseases, pests, and climatic vagaries. Often, this has increased their need to produce cash income to purchase foodstuffs, as well as their vulnerability to market failures, drought and famine.

When farmers do manage to increase their productivity by incorporating modern agricultural inputs, this has often provoked land degradation and other forms of environmental deterioration. Natural fertility has been negatively affected, mechanization has contributed to the acceleration of soil erosion, and industrial inputs have led to the increasing pollution of rivers and ground water. Pesticides are one of the main causes of biodiversity loss. Irrigation of large holdings has contributed to the salinization of arable land (FAO, 1993). Indeed, the need to address the "modern" agriculture and livestock sector in order to achieve SARD is at least as great as the need to address "traditional" poor farmers.

Gender and Environmental Dimensions of Agricultural Technology: A consideration of technological change will be critical to the achievement of SARD, not only because the types of technology used can have a direct effect on environmental conditions (e.g., the effects of mechanized soil preparation on soil structure) but also because technology has a direct effect on people's subsistence, opportunities and incomes, and on their abilities to manage their production systems.

There are essentially three means by which the rural population subsists:

- direct exploitation of natural resources in agriculture, forestry, fisheries and mining for consumption and for sale;
- wage employment in agriculture, forestry, fisheries and mining;
- production or wage employment in secondary and tertiary sectors (industries, handicrafts, and services).

When rural people's access to the means of production is eroding, or when they cannot produce enough or earn enough from their agricultural production to survive, their welfare then depends on the capacity of the society to generate gainful, non-agricultural employment on a sustained basis. In general, the agricultural sector cannot generate the wage employment needed to sustain a growing population. This is because: a) agricultural work is often seasonal; and b) the use of labour-saving technology is increasing in the "modern" agricultural sectors, which are the main employers of wage labour. The tendency among almost all countries, developed and developing, is for the proportion of the population that depends directly on agriculture to decrease over time; this is considered a normal process accompanying economic growth. In developed countries, the rate of non-agricultural employment creation has kept up with the decline in rural jobs, but in many poor countries, non-agricultural employment generation is very limited, so that people continue to be dependent on wage labour in agriculture or on agricultural, forestry, and fisheries production. Therefore, the over-exploitation of natural resources is directly related to the lack of non-agricultural employment. The net result of low levels of employment generation and eroding access to the means of production is poverty, which is transferred to agricultural frontiers and urban areas through migration.

The poor rarely benefit from agricultural mechanization and other technologies. If rural wages are high, labour saving technologies are introduced to reduce the demands for labour, putting labourers out of work and depressing remaining wages. For example, weeding is typically performed by hand until rural wages begin to rise; at this point, producers begin to substitute labour with mechanical and chemical inputs, displacing rural workers. Concerns that should arise are: Who receives the technology? What is the impact of technology on the welfare of rural workers? Will they have alternative employment? Will they return to agricultural production, and, if so, under what conditions? Will they be impoverished or migrate to agricultural frontiers or to urban areas?

On the other hand, those who most need agricultural technology in order to reduce their workload and increase their productivity and incomes - the rural poor - do not have access to it. The gender dimension is also highly relevant here. Many rural women are not paid for their work. It follows that there is little incentive to introduce technology for those activities carried out by women, such as weeding, crop processing and most domestic activities. Even when appropriate technologies have been developed, women and other unpaid workers usually cannot afford them. In many regions, the problem is compounded by a lack of infrastructural development (e.g., roads, electricity, water, energy, health, etc) which increases the demand for unpaid labour time. This explains why, all over the developing world, it is common to find rural women using the same technologies they have employed for thousands of years (e.g., the mortar and pestle used for corn grinding throughout Mexico and Central America).

Given the lack of technology and consequent low productivity, the need for unpaid labour remains high, making it difficult for women and other unpaid workers to seek paid employment even if it exists. The net result is that women and other unpaid workers are over-employed in terms of time worked and under-employed in terms of income received. It is not uncommon for a poor farmer to work 50 hours or more a week, yet receive an income equivalent to less than the legal minimum wage. A woman may work 60 or more hours per week between domestic, farm and off-farm tasks, and yet receive no wages or cash income of any kind. Thus, although the demand for labour in many rural areas of the developing world is high and even increasing, this does not translate into more income for the poor.

The fact that women are largely unpaid means that male tasks tend to be mechanized, while female tasks remain non-mechanized: the net result is that women's labour burdens are often increased through mechanization. This can be seen, for example, when tractors are introduced, thereby permitting the area under cultivation to be increased; if weeding is not mechanized or weed control measures are not introduced simultaneously, the demand for women's labour in weeding increases. In some cases, "the aggregate increases in productivity resulted in such severe demands for women's labour that their well-being and that of their families was completely undermined." This negative impact on family welfare is compounded because, "income under female supervision is...usually spent on child nutrition/family needs" (Drake, 1991:5-6), so that when women's income decreases, so does child nutrition and family welfare.

The lack of employment opportunities in rural areas also gives rise to seasonal or permanent emigration. For rural men in Africa, this was explicitly encouraged by colonial and post-colonial policies to provide labour for agricultural plantations, mines and industry. In the Near East, men migrate in search of urban wages either within the region or to Europe. In Latin America, it is principally males who migrate in search of temporary wage labour in agriculture, whereas young women often migrate to cities in search of employment in the service or informal sectors. All over the developing world, male emigration has increasingly left women in charge of farms and rural households, decreasing the supply of labour available to them and enlarging their responsibilities for decision-making while doing little to improve their access to or control over resources. While remittances sometimes place these female-headed households in a relatively privileged position in their respective social hierarchies, the tendency is for remittances to decrease over time (Jacobson, 1992).

When women are able to obtain wage labour, they are typically restricted to local labour markets if they have domestic or farm obligations. Women have greater difficulty entering the wage labour market, since: a) wages for women are often barely above what they would have to pay to substitute their unpaid labour (e.g., for child care); and b) substitutes for many "female" tasks are often either lacking or culturally unacceptable. Because women cannot easily substitute their own unpaid labour, they often cannot respond to "opportunities" such as an increase in the demand for full-time wage labourers, or a price increase for more labour-intensive crops.

Table 2: Female wages as a percentage of male wages in selected countries.

Nation	Percentage
Korea	50
Cyprus	59
Egypt	64
UK	70
Swaziland	73
Sri Lanka	75
Kenya	76
Jordan	79
Iceland	90
Tanzania	92

Source: UNSO, 1989, based on ILO data.

Furthermore, within the occupational structure, high status and high-income professions tend to be occupied by men, while typical women's occupations are extensions of their domestic roles, or are lower-income jobs such as manual field labour. At an aggregate level, women earn less than men (Table 2). This is, in part, a result of the unemployment and under-employment which arise from these occupational barriers, since many women may be crowded into limited sectors of the labour market (as is often the case with the service sector or the farm labour sector).

Workers depend upon their stock of human capital (knowledge, education, skills) for occupational mobility and wage earning power; human capital, in turn, is related to class, caste and gender hierarchies. The rural poor, and especially women, have lower access to education, literacy, numeracy skills, and other training required to manage technology and equipment. In addition, gender and other biases related to caste and ethnicity create further obstacles to occupational mobility.

Since there are so many employment obstacles, many women create their own employment through informal activities, using the little access they have to means of production to add value to farm goods and other raw materials for sale in the market. Women tend to have widespread access to the means of production (often, domestic tools turned toward market use), so that large numbers of women produce a limited range of goods for the market. Productivity is low and competition is fierce, driving market prices down and eliminating profits, leaving less than a subsistence wage.

Small farm households and the landless find additional means of "subsidizing" agricultural production, including wage labour, diversification of production (e.g., with small livestock, food processing, handicrafts, etc.), and use of communal or "free access" resources (e.g., hunting and gathering). With increasing poverty and decreasing access to resources, it is frequently women's and children's labour that is mobilized to increase the subsidies to the farm.

Reducing the direct dependency of the population on natural resources and reducing poverty requires a process of economic diversification to generate adequately-remunerated employment; this entails broadening the markets for value-added goods and selectively introducing appropriate technology so as to increase the productivity of labour, including unpaid labour, while expanding the sources of employment. It also requires changing the status of women by breaking down occupational barriers, increasing women's access to human capital, reducing the burden of unpaid labour through infrastructure, technology and changes in the gender division of labour within the household and on the farm. Although it may appear that this last factor is the most difficult to change, in reality the situation is more dynamic than many suppose, due to: a) urbanization, technological change, industrialization, and expansion of the wage sector; b) strategic state interventions, such as legal reforms and affirmative action or income policies; c) social organizations/movements; d) economic growth and market forces which condition the demand and supply of labour; and e) the growth in services such as training, education and child care (FAO, 1993).

Frequently, the only contacts that rural women and men have with development agents are through extension programmes. It is not unusual for extensionists to be asked to broaden

their responsibilities to include advice to small farmers and rural women on small enterprise development, food processing, and other "non-farm" activities. For example, in Honduras, agricultural extensionists are providing advice to women farmers not only on low-input agricultural production, but also on topics such as corn milling, accounting, and small livestock marketing. Extensionists need to understand and respond to rural people's needs to diversify their income sources, and to give more appropriate advice on sustainable agriculture.

Environmental degradation can increase the demand for unpaid work. For example, labour bottlenecks in deteriorating shifting cultivation systems primarily affect women, in part because the gender division of labour results in a situation in which, "the labour resources of both men and women members of the family [cannot be] easily harnessed in all farm operations during peak periods of demand" (FAO, 1984a:51). Women and children are already responsible for most farm labour in the tropics; with increasing male emigration and greater school attendance of boys, women and girls are often solely responsible. Less labour means that producers cannot expand the area under production even if land is available. According to FAO, a major dilemma confronting shifting cultivators is that:

> Labour shortages can encourage the farmer to either unwittingly increase the length of the cultivation period or shorten the fallow period so as to minimize the labour costs of clearing which increases as fallow lengthens...(but mechanization) often results in increased deforestation and disruption of soil physical structure and other properties to an extent that has caused more erosion, irreversible degradation and loss of fertility and productivity than manual methods (FAO, 1984a:53).

As shifting cultivation systems deteriorate, labour requirements increase, for land clearing, soil conservation and weeding. Weeding requires 200-400 person-hours/ha, and must be done at least twice during a cropping season (FAO, 1984b); as weed invasion intensifies, time requirements increase. Multiple cropping and soil conservation measures also require high labour inputs, so that a major impediment to the introduction of more sustainable agricultural practices may well be labour availability.

Part of the solution is to provide technology. For example, UNIFEM, together with IIED, has developed a series of publications on appropriate food processing technologies, in order to disseminate information on successful methods throughout the developing regions (see the UNIFEM *Food Cycle Technology Source Book Series*). According to FAO (1984a:65), "if appropriate labour-intensive technologies are available to absorb the increased labour per unit area, the reduced area can be made to support a much increased rural population." However, since women's access to labour-saving technology and to credit is lower than men's, they often cannot benefit from such developments. Women's lack of technology and subsequent need for more labour explains the high fertility rates that persist in rural areas over much of the world. Existing appropriate technologies that promote SARD will not reach poor farmers and women unless they are free of charge (i.e., made by the farmers themselves or donated) or accompanied by credit and subsequent increases in income.

Gender, Population and Environment: Considerable investments have been oriented toward reducing fertility levels and population growth in less developed countries, on the grounds of environmental deterioration. Results, however, have been disappointing, especially in those countries where subsistence food production predominates. Increases in the use of contraceptive devices or changes in reproductive behaviour have often not resulted. Although child mortality has been significantly reduced, fertility rates have sometimes even increased. While it is unquestionable that increasing population pressure contributes to the deterioration and depletion of natural and environmental resources, additional factors should be considered in order to understand a very complex phenomenon. Mediating factors in the population/environment link include technology, employment and consumption levels.

For example, an ILO study showed that sub-Saharan Africa's slow agricultural growth is common to all of its agro-ecological regions, indicating that the problem in not essentially one of natural resource endowment. Nor is population growth the major explanatory factor; in 1990, for example, population pressure (as measured by the agricultural population/land ratio) was still less than that for the Far East in 1961. Rather, the low growth rates and yields in agriculture are attributable to the low availability and use of machinery and inputs such as fertilizers, tractors, and irrigation systems, so that, "in many sub-Saharan countries, non-sustainability arises from the general backwardness of the economy rather than from poor per capita natural resource endowment" (Karshenas, 1992:28).

Population growth aggravates the situation where land and other resources are highly concentrated, markets reinforce patterns of resource over- and under-utilization, the majority of the population is dependent upon the primary sector for its subsistence, and human-made capital stocks are low. In these circumstances, as the number of poor increases, there are more inheritors to share land, so farms fragment and finally can no longer support the household, forcing farmers to intensify land exploitation. When they are unable to further intensify production, more marginal land is incorporated, frequently on slopes, with inadequate technology and labour inputs, resulting in increasing erosion and degradation of watersheds. Since they are unable to increase productivity, the poor are driven to engage in agricultural practices which are non-sustainable, such as shortening restorative bush fallows in shifting cultivation, burning dung for fuel instead of using it for fertilizer, cultivating on erosion-prone slopes, grazing more animals, and converting forests to crop land. The ILO refers to this process as "forced environmental degradation" (Karshenas, 1992:25).

Gender also has a great deal to do with stagnation in food production systems and with persistent high population growth rates. In addition to resource access and tenure patterns that favour men, women must cope with poor availability and quality of the means of production, complex timing patterns for various farm and domestic activities, eroding ecological conditions, male emigration, high morbidity, and more. All this implies ever greater labour burdens for women who are already assigned domestic, farm, family and community roles. Having a large number of children continues to be a major asset and a source of immediate and long-term social and economic security, especially among subsistence households. Chances for altering pro-natalist attitudes geared to large-family size are rapidly diminishing, given deteriorating environmental conditions and health standards, labour-shortages, and other processes contributing to the growing time-use requirements and

energy inputs of women in agricultural production (FAO, 1992). Improving the status of women farmers, including their access to labour-saving technology and services, is one way in which agricultural education and extension programmes can contribute positively to stemming population growth.

Women-Environment Relations: Specific Issues

Women as Resource Managers

With the growing emphasis on sustainability, it is now recognized that many traditional production systems are both environmentally sustainable and capable of sufficient production to feed growing populations. The mainstay of many of these viable agro-ecological systems is women, in their role as household managers. Indeed, the relationship between women and the environment can be conceptualized around the elemental concern that women have with household food security.

Changes in land tenure, land-use, and technology are viewed by women according to the likely effects of these changes on the immediate availability of resources such as water, fuelwood and fodder. Women are forced to abuse the resource base to ensure food security in the short term (Chimedza, 1989). Their perceptions of the causes and effects of this dilemma are often correct but are frequently overlooked or not shared by the more powerful decision-makers in their societies.

In women's roles as producers and gatherers of foodstuffs, medicines and fuel, and as drawers of water, they daily manage plants, soil, and wildlife in an integrated fashion. The fodder they gather from natural grasslands and forests feeds the livestock that produce the dung they place on their fields to maintain soil fertility. The potable water used for the household becomes the grey water with which they irrigate plants. The same source of water must often serve livestock as well; it cannot become contaminated without causing human illnesses. If the need for fuelwood and crop land today leads to deforestation, women know that this will sacrifice the fodder, fruit, medicine, fuel and soil productivity they need to sustain their families tomorrow.

Women are the best equipped to manage the environment through their determination and indigenous knowledge. They can identify fresh water sources and determine the quality of the water; they know the local plant and tree species that have economic value as fodder, food, and medicines and understand their growing conditions and other properties; they have a wealth of traditional knowledge about crop associations, organic pest management, weeding, plant protection and soil conservation. Their labour is often called upon for community and national conservation measures such as afforestation, and terrace construction and maintenance. However, women are also the least equipped to manage the environment because they usually have no voice in resource management decisions; their land and tree tenure is generally precarious and eroding; they lack access to basic services, education, extension and credit; and their most critical resource - their labour supply - is diminishing.

Even their traditional knowledge is becoming less of a resource as the conditions around them change: some techniques become dysfunctional as ecological conditions deteriorate, some are lost from one generation to the next, and some simply cannot be applied because of the lack of time and other resources.

Women are the principal bearers of knowledge about the environment and sustainable development - knowledge which they pass on to their children and kin. As principal educators of children, they also impart their values and perceptions - including environmental perceptions - to their offspring. Women's informal community networks provide a major means of communication throughout areas where television is unknown and printed materials have little distribution or populations are illiterate. Nevertheless, women are usually the last to be included as targets in extension programmes, and are often not reached by environmental education campaigns. Information that is imparted to men is often not transferred to women or is transferred only partially or in a distorted fashion. Women are more difficult to reach because of the biases which prevent them from communicating with outside agents or with unknown males, and their illiteracy rates are higher than men's.

Shifting Cultivation and Soil Management

Shifting cultivation is one of the most extensively employed agricultural systems in less developed countries. It predominates in the poorest countries of the tropics, where it produces most of the basic foodstuffs in these environmentally fragile ecosystems. The system has proven to be viable over most of human history, but it depends upon access to resources which are increasingly scarce, and its viability is threatened by multiple phenomena, especially human and animal population pressure, and the spread of monoculture (particularly cash crops). As the viability of shifting agriculture decreases because of environmental deterioration or poor markets for the goods produced, returns to labour also decrease; young people - especially men - begin to emigrate, reducing the amount of labour available and leaving agriculture increasingly in the hands of women.

The deterioration in shifting cultivation leads to the multiplication of pests and diseases, a rapid increase in weed growth and erosion, deterioration of the nutritional status and physical properties of soils, and an increase in drought stress (FAO, 1984a). Reductions in yields threaten food security and necessitate bringing more land into production or applying more labour to counteract these effects. The most critical variable for farmers may be the availability of labour rather than land. This is because, "almost any meaningful alternative to shifting cultivation will essentially be more labour-intensive and more land intensive" (FAO, 1984a:65).

However, female subsistence food producers are not reached by most existing soil management programmes. Women also lack the time to carry out soil restoration activities such as terracing and organic recycling. They do not have access to labour-saving technologies, chemical fertilizers, or extension advice (FAO, 1986). The less developed countries account for only 20 per cent of world fertilizer use, and most of this use is concentrated on cash crop production for export. Many subsistence producers depend on

dung as the only available alternative. As the availability of fuelwood diminishes as a result of deforestation and land conversion, many women begin to use dung as a substitute.

A case study in Malawi serves to illustrate these dynamics. Malawi is affected by competition for land as well as by land degradation. Female headed households constitute 42 per cent of the "core poor" and 34 per cent of the "other poor" households; these households are disproportionately affected by poverty and land degradation, since they depend on smaller plots of land found on the steeper slopes and less fertile soils. As the size of land holdings decreases, the percentage of female-headed households rises, in part because of male emigration. Women cannot afford to purchase agricultural inputs, to rotate annual crops, or to carry out soil conservation measures. Soil fertility and crop yields have declined over time, further exacerbating the poverty of these households while increasing their reliance upon the land and their vulnerability to its degradation. Extension advice does not reach poor women farmers since they are not members of the organizations that provide extension services. In the male-headed households, the female share of income is relatively less, and declines with increasing income and cash crop production. The size of the maize harvest correlates with higher income since richer farmers can purchase inputs. Projects in Malawi have introduced soil conservation measures to farmers, but women face serious constraints in adopting these measures. The achievement of soil conservation targets is much lower on female-headed farms, despite the fact that these are the farms with the greatest land degradation problems (Burgess, 1991).

Weed Control

Weeds are both a boon and a bane to poor women. Women perform most of the weeding in less developed countries. As soils degrade, or as monoculture comes to predominate, weed invasion increases as do women's labour requirements. Weeding must be performed at critical periods but, "the availability of farm labour at the critical times needed for weeding crops is often limited" (FAO, 1984b). When land clearing and ploughing become mechanized, larger areas are often brought into production. But if weeding is not mechanized or herbicides are not introduced, women cannot keep up with the additional weeding requirements and overall productivity decreases. As farm wages increase, mechanization is introduced and manual weeding tends to be replaced by the use of herbicides; however, because women's labour for weeding is often unpaid, there is little economic incentive in many areas to substitute equipment or inputs for this labour. Women do not have access to the credit or cash needed to purchase herbicides for subsistence crop production. These are high cost inputs, requiring knowledge about correct application and associated health risks.

Weeds are also used extensively by women for their economic value. Women use weeds for pest control, medicine, animal fodder, fibres, oil, fuel and dyes, among other things. "Of 158 weed species collected from rice fields in two districts of West Bengal, 124 possessed local economic importance and their uses were of great economic significance to farmers and their families" (FAO, 1984b). Hand weeding, rather than chemical destruction of weeds, maintains the economic and ecological viability of small farms.

Pesticides

Women make up a large part of the agricultural labour force, especially in those jobs on plantations which are lowest paid and require manual dexterity - e.g., weeding, spraying, picking and harvesting. In all of this work, there is a high risk of exposure to dangerous chemicals, such as herbicides and pesticides. For example, in Malaysia, women make up 60 per cent of the labour force on rubber plantations where paraquat is used (Rodda, 1991.). In Nicaragua, in the 1970s, the exposure of pregnant women working on cotton plantations to DDT and other pesticides drew international attention because of the effects on their unborn children and the high levels of DDT concentration in the mothers' milk. In the vast majority of instances, this contamination goes unreported and unchecked. Women are also exposed to pesticides and other dangerous chemicals when these are stored in the home, while washing the clothes of agricultural workers, and when storing food, water, fodder and other household supplies in empty chemical containers. Women have a higher illiteracy rate than men over most of the world and receive only a tiny fraction of all extension visits, so their risks of contamination are higher, and the overall consequences for their health and the health of their children are greater.

Genetic Resources and Wildlife

As monocultures increase, crops become more susceptible to disease, pests and environmental stress. In forest areas, monoculture leads to the destruction of entire ecosystems. Indigenous breeds of livestock are also disappearing, or their genetic variety is decreasing. Women often oppose the introduction of cash crops and monoculture since these displace subsistence food production and eliminate the diversity of flora and fauna upon which they depend.

An example of the differential impact on men and women of the introduction of new crop varieties is provided by the introduction of hybrid maize in Africa, which is credited with nearly doubling maize yields over the past three decades (Jacobson, 1992:29). These new varieties, "require greater efforts for pounding, have poorer storage capacity and are considered to have inferior taste...Women are responsible for pounding, storage, and food preparation, so their perceptions of the benefits of hybrid maize differ from men's" (Burgess, 1991:30). As it is the women who tend to cultivate the poorer soils and who are usually responsible for caring for the crops until harvest time, they are often more aware of the costs and benefits of alternative crop varieties than men, and less prepared to take risks. Hybrid maize is generally cultivated as a cash crop, and requires significant cash outlays. According to Jacobson (1992:29):

> New seeds must be bought each year, and the crop demands repeated applications of fertilizer. Neither the seeds nor the fertilizer is affordable to subsistence farmers who lack credit. On the other hand, the development of high-yielding varieties of millet and sorghum has lagged far behind, even though those traditional food crops are considerably more drought-resistant and nutritionally balanced than maize.

Wildlife is often a major resource for poor women in their efforts to assure household food security. Women obtain protein from animals and insects that are often considered vermin. Supplementing the diet in this way is a common practice in many areas: caterpillars, locusts, rats, crickets, termites and ants are eaten in Africa; grubs are used in Australia; and iguanas, armadillos, rabbits and wild boar are eaten in Central and Latin America. Agricultural practices which reduce the availability of these resources include mechanical land clearing, ploughing and weeding, and the use of biological inputs and pesticides. As animals and insects become scarcer, women must go farther afield to procure them, absorbing time they could be using on their plots. The alternative is to substitute these protein sources with domestic livestock, but sources of livestock feed are also diminishing.

Women depend upon natural grasslands and forested areas to provide for many other household needs: medicines, fodder, fuel, food, fibres and other inputs. For example, in Nepal, 135 tree species are used as fodder (FAO, 1987). Women have economic uses for plants, roots, tubers, leaves, fungi, fruits and barks. Much of this genetic diversity can be found in women's home gardens; they have learned to domesticate both flora and fauna, and to incorporate these species into complex agro-silvopastoral systems, such as the home gardens found in Java.

Fuel and Energy

Over most of the developing world, women are the main providers and users of energy. Cooking and heating requirements account for the largest proportion of energy consumption in poor countries (FAO, 1983). Fuel is also critical to women's rural home production and industry, including smoking fish and drying harvests, curing tobacco, boiling water for food processing, and making dyes. Smoke keeps insects away and heat keeps livestock warm in cold climates. Fuel consists of twigs, leaves, brushwood, grass, straw and dung, but dry, dead wood is the major source. "Using traditional methods of extraction, for example, women in Africa and Asia obtain their fuel from branches and dead wood (often supplemented with crop residues, dried weeds, or leaves), rather than live trees. Seventy-five percent of domestic fuel collected by women in Northern India is in this form" (Jacobson, 1992:22). Under normal conditions, the collection of dry, dead wood does not damage the forest. However, as deforestation, livestock grazing, fire, and crop expansion eliminate traditional sources of fuelwood, women must resort to the purchase of fuel, the cutting of live trees or to travelling further from home to procure supplies. Fuelwood demand is increasing at about two per cent per year in LDCs, and deficits are expanding because of population growth, the deterioration of forest resources and the absence of alternative energies (FAO, 1983).

The negative impacts on women of fuel source depletion are manifold. In Bangladesh, women and children spend three to five hours/day collecting fuelwood. In the Himalaya, women walk five kilometres uphill to gather wood, and supplying the household's needs for a week requires an average of 7.2 hours of labour. This additional burden takes women's time away from other agricultural activities, reducing food supplies (Rodda, 1991). As wood becomes scarce, agricultural and animal products are diverted from other uses and employed

as fuel, decreasing soil fertility. Many women in developing countries also depend upon fuel supplies for their livelihood: in Addis Ababa alone, some 73,000 women and children subsist from sales of fuel. If sufficient supplies cannot be procured, the diet of the poor suffers since food cannot be cooked properly, and poorer quality foods are substituted or fewer meals are prepared. There have been many efforts to develop and distribute efficient fuel burners, but these efforts have been hampered by the need for training and continual supervision. In the case of metal stoves, for example, efficiency can drop from 38 per cent savings to three per cent if they are poorly managed. Similarly, many devices require conditions which are inappropriate for rural women, e.g., solar cookers must be used during the day, but most women carry out the bulk of their cooking in the evening (FAO, 1983). As a result, it is uncertain to what extent these new technologies have actually led to savings of fuel.

Fuelwood deficits have other macro-level impacts. As the dependence on substitute fuels increases, countries must dedicate a higher proportion of their foreign exchange earnings to imports, both to replace fuelwood and to replace dung with chemical fertilizers. Women must earn more income to purchase these fuels and fertilizers, or food security will be jeopardized. Fuelwood programmes also absorb a significant amount of development resources; for example, 40 per cent of the forestry projects funded by the World Bank in Nepal are for fuelwood (FAO, 1987).

Water

In rural areas, women and children provide nearly all the water for the household. Domestic water is used for preparing food, drinking, bathing, irrigating home gardens and watering livestock. Women know the location, reliability and quality of local water sources, collect water, store it and control its use and sanitation. They recycle water, using grey water for washing and irrigation, and employ runoff from these activities for livestock (Chimedza, 1989). Women make multiple and maximum use of water sources, and attempt to ensure that these sources do not become polluted. According to the World Bank, women may prefer more accessible unprotected water sources over more distant protected sources, where reliability, quantity and proximity are more highly valued than quality (Clones, 1992). Given their multiple and competing needs (e.g., water for livestock and for human consumption) and time and resource constraints, women often cannot avoid contaminating water supplies. As water sources become contaminated from humans, animals, or agricultural runoff, as droughts increase or water sources deteriorate because of watershed mismanagement, women and children must walk longer distances to secure water (Table 3).

As farmers, women rarely have access to irrigation schemes, as these are usually oriented to men and cash crops; instead, they depend on small scale or hand irrigation. Women's entitlement to water is often precarious. They have difficulties coping with drought and have little access to technology that would help them use water more efficiently. Often, the technologies that are available do not respond to their needs: e.g., pumps have handles they cannot reach or manipulate. As more women become involved in aquaculture, agricultural runoff, pesticide residues and industrial waste affect production, and their health risks multiply.

Table 3: The hours rural women spend each week drawing water.

Continent	Country	Hours per Week
AFRICA	Senegal	17.5
	Mozambique: Dry season Wet Season	15.3 2.9
	Botswana (rural areas)	5.5
	Burkina Faso	4.4
	Ivory Coast	4.4
	Kenya: Dry Season Wet Season	4.2 4.4
ASIA	India (Baroda Region)	7.0
	Nepal	4.7
	Pakistan	3.5

Source: UNSO, 1989.

Poor water access and quality affect not only agricultural production and labour requirements, but also health. Water-related diseases affect millions of poor each year. Women must take care of those who fall ill with malaria, onchocerciasis, schistosomiasis and diarrhoea, and replace the labour of those who become too sick to work (UNEP, 1991b; FAO, 1986b).

Desertification

Monimart (1989:1) reviewed 43 studies in six countries of the Sahel where, "rural development...is inseparable from the fight against desertification." Women are critical to the fight against desertification, because of male migration from the affected areas. The consequences for women include an increase in domestic labour and scarcity of water. Although they have learned strict water management from childhood and spend a growing number of hours queuing at the wells, women are not fully involved in well management committees. Male emigration leaves women as farm heads without the power or legal basis to insist on their land rights.

In the Sahel, "desertification, deforestation and over-use of wilderness areas have drastically reduced the amount of supplementary products gathered in the bush" (Monimart, 1989:4). This decline has been accentuated by population growth, which has led to an increase in gathering activities at the same time as the bush is reduced by the expansion of crop land. Women's knowledge of plants for food and medicinal purposes is also decreasing;

traditional practices have to be abandoned, and women can no longer choose between species.

Women constitute more than 50 per cent of the work force on anti-desertification projects, and up to 95 per cent of the work force in reforestation schemes. However, "as a rule, they are given the least skilled, most arduous jobs" (Monimart, 1989:8), and their work is largely unpaid. Women also have unequal opportunities for training in comparison with men, and their decision-making power relative to the projects is very limited. Furthermore, when reclaimed land has become available, women have not received access to this land: although 84 per cent of projects to date have made reclaimed land available, women have obtained individual property rights in only six per cent of the cases. Women's small marginal fields are not legally owned by them and hence are not affected by projects. The owners of the plots they cultivate often oppose improvements, because this can lead to ownership rights for the tenant; if permission is given to make improvements, the land is often taken back after improvements have been made.

Gender, Environment and Sustainable Development in Agricultural Education and Extension Programmes

Conceptual Issues

Agricultural education and extension programmes are concerned primarily with the formation and communication of knowledge around agricultural systems and practices. During their formative periods, many LDC agricultural programmes drew upon the available knowledge of the developed countries, in the form of texts, fellowships, study tours, and exchange of staff. Much of this information was based either on the developed countries' own agricultural systems, or on the systems they were interested in promoting in the developing world (usually export systems). The perceptions and biases evident in the developed countries' agricultural education and extension programmes were largely reproduced in the LDCs through this knowledge transfer and patronage.

In general, the biases introduced into developing countries' programmes reflected not only the pattern of agricultural development in industrialized countries, but also their agro-ecological conditions, genetic base, economies, and social perceptions (including, for example, the perception that women are not farmers). The ramifications of the "transfer" of knowledge are manifold and are only beginning to be corrected by joint efforts between nationals of the developing countries and their international counterparts. This new knowledge is rapidly being constructed on the basis of research and extension practice carried out in developing countries. In the process of reorientation, the knowledge coming from the developed countries and the lessons learned over the past few decades must be reappraised and selectively adopted; however, an even more important source of knowledge must be that which has been accumulated over centuries in local production systems. As Jommo (1991:2) has noted:

> ...post-independence development strategies in Africa have, far from bringing the expected widespread benefits, only resulted in socio-economic crisis, a seriously-compromised resource base, and environmental degradation. A major vehicle for these strategies has been a model of education, science and technology premised on a vacuum on the part of the recipients.

A reorientation of agricultural education and extension programmes to incorporate SARD should explicitly recognize the interrelated nature of social, cultural, economic, environmental and agricultural systems, so that research and teaching would be multidisciplinary. A main focus should be on establishing links between phenomena that have previously been isolated for the purposes of investigation, so that the approach would be systemic and holistic. Most importantly, the transfer of knowledge should become reciprocal. It would presume that a major vacuum of knowledge exists with respect to the specificities of local agro-ecological systems; the principal transmitters would be the local people, and the principal recipients would be the "experts". Given that the main purpose of agricultural education and extension programmes is to improve people's roles as resource managers, the starting point for these programmes must be the people's own knowledge-base.

Stereotypes regarding poor people have been developed largely within the urbanized sectors of both the developed and developing countries; they are difficult to alter, unless learning becomes based upon experience of working with rural people. The belief that illiterate people are ignorant, that the poor degrade their environment because they do not know any better, that women are housekeepers and not principally agricultural producers and resource managers, and other such common misperceptions, can be quickly and radically altered when experts make serious and sustained contact with rural people, and begin to ask the right questions in a non-patronizing way. The methods of contact and communication must be relearned, since they are very different from that which predominate among professionals; they must be adapted to local cultural systems (such as those that make contact between professionals and rural women difficult), overcome language barriers, and depend upon communications techniques that presuppose visual, symbolic and verbal competencies among the people rather than literacy and numeracy.

If agricultural education and extension are to contribute to SARD, the link between research, teaching and outreach cannot be casual or optional. All become reciprocal: outreach becomes research, teaching becomes research and outreach, and through outreach, needs are identified for further research. The development of appropriate knowledge, skills and attitudes on all parts requires such a relationship. Research, teaching and extension priorities must be established in the interests of sustainable development. However, "research is not neutral, it is undertaken for, or on behalf of, vested interests of all sorts" (Jommo, 1991:17). Extension services also reflect political and economic priorities, as can be seen clearly in Table 1; to date, these priorities have not often reflected the interests of poor farmers or women. This means that the reorientation of agricultural education and extension programmes must be negotiated politically.

To incorporate gender concerns remains a major challenge, as is evidenced by the fact that few of the 20 case studies presented to this Expert Consultation mention women in any context; they similarly neglect the social sciences. The danger is that environmental issues will be divorced once again from reference to people or societies, which is as potentially harmful as the uncritical introduction of "modern" agricultural technologies and methods. This is far from saying that little is being done in the field to integrate social, gender and environmental issues into the quest for sustainable development. For example, the International Center for Research on Women (ICRW) questioned 350 governmental, non-governmental and international organizations in Latin America about their work on women and the environment. Ninety-four responded that they are involved in these issues, mostly in the context of broader programmes which target development and environmental issues. Most organizations (81 per cent) are NGOs engaged in development activities and/or women's promotion. Their specific activities are related to "organic gardening, agroforestry, reforestation, cultivation of medicinal plants, waste management, sanitation and hygiene, creation of 'green areas', environmental activism, education, and information dissemination" (Paolisso and Yudelman 1991:14-15). The programmes tend to concentrate on technical assistance, nonformal education, and, to a lesser extent, research. However, the report notes that only a small percentage of research organizations is working on these issues, and calls for much more research, in order "to help women learn to balance subsistence needs with environmental goals."

Implications for Agricultural Education and Extension Programmes

There are two marked contrasts related to substance and to method between the existing orientation of most agricultural education and extension programmes and the approach to SARD proposed in this paper. In terms of substance, the approach suggested herein is interdisciplinary and systemic, focusing on relations, whereas existing programmes are generally specialized and sectorally-based, focusing on topics. In terms of method, the proposed approach not only calls for - but also requires - interaction between scientists, practitioners and the rural population in order to promote learning and change; goals are mutually determined. By contrast, most agricultural education and extension programmes are based upon a one-way flow of information from scientists/practitioners to the population, where one induces change in the other according to predetermined goals.

It is not accidental that gender issues have not been treated in any depth in any of the case studies presented to this Expert Consultation. The integration of gender as a socio-economic category presupposes, above all, that people - rather than animals, vegetation, techniques or even ecosystems - are the primary subject and object of investigation, learning, and change. The moment that activities become people-centred, it should be recognized that "people" do not constitute a homogeneous mass, but are divided into many social groups according to class, caste, ethnic group, age and gender; each of these groups, in turn, has different knowledge bases, needs, constraints, and opportunities. Nevertheless, even in those case studies which noted the lack of a people-centred approach in existing agricultural education and extension programmes, none recognized the absence of a gender-perspective; this indicates that "gender blindness" is not automatically overcome by a people-centred approach. It is significant that those programmes which have implicitly,

if not explicitly, begun to address the critical roles of rural women as agents of SARD are also those which have the closest links with the rural population through agricultural extension programmes oriented toward small-scale food production and sustainable agriculture (e.g., Indonesia and India).

What is needed to reorient agricultural education and extension programmes so that they become people-centred and gender-responsive and hence contribute toward defining and promoting SARD in their countries? The essential requirements may be summarized as follows: a) a comprehensive, interdisciplinary and dynamic understanding of the relations between social groups and their environment must be constructed that is relevant to national reality, and must become part of the consciousness of the different actors involved; b) a continuous dialogue between the different agents involved must be developed; and c) goals, policies and actions must be reoriented to accommodate what is learned. These are, in fact, inseparable processes; i.e., goals and policies must change to permit this reorientation, and it is only through dialogue that the dynamic relations relevant to SARD will become evident.

Reorienting Agricultural Education and Extension Policies

Virtually all agricultural education and extension programmes have been developed to raise productivity. The decision to reorient the goals of these activities toward the achievement of SARD cannot be independent of the inclinations and interests of the clientele served by the programmes, including both the farming and non-farming sectors. The case studies on agricultural education programmes in the developed countries cite as forces of change mainly factors in the non-farming sphere, such as increased government research funding, the impact of environmentally-related laws and regulations, consumer perceptions and mass movements, and student pressure, related especially to job market change. Those in developing countries also cite policy and legislative changes, but many indicate that these have not been accompanied by real mandates or new resources and therefore are largely rhetorical to date. Case studies of both developed and developing countries indicate that significant resistance is encountered from traditional farming clientele and older staff.

Contrasts are provided by the cases of Colombia and Thailand. In Colombia, there is currently no training in universities oriented towards small-scale agriculture. Some 20,000 agronomists and 10,000 veterinarians have been educated in agricultural programmes, and work for the approximately 200,000 large farms existing in the country, while 2,200,000 small farmers receive no technical assistance. Gaitan Arciniegas (1993) indicates that it is important to transmit environmental messages to large farmers, given that the technology and inputs these employ are the most damaging to the environment; however, there has been almost no training in environment, and the demand in the private sector is low. Peasant agriculture is considered to be backwards, despite the fact that it is the most sustainable form of agriculture in the country. Thailand, on the other hand, has initiated research to develop alternative agroforestry systems for ethnic minorities which build on "the more sustainable systems practised by Karen and Lisu minorities"; collaborative programmes between universities have also been started, in order to examine shifting cultivation systems in the same region (Angkasith, 1993).

The situtation in Chile is similar to that in Colombia. Hermosilla (1993) points out that the obstacles to achieving SARD in Chile are economic, political, technical and cultural, and that the prevailing model of develoment has not satisfied human needs or preserved natural resource potentials. Since the environment is a global rather than a sectoral dimension of society, it becomes a problem of general policy. For this policy to be effective, no social group should be marginalized from the process of policy formulation.

However, in most developing countries, poor farmers have very little economic or political power as clientele and very little input into policy-making processes, except when they are highly organized and mobilized. Women farmers have comparatively much less power and representation. The decision to serve poor men and women farmers is therefore political and requires advocacy. This advocacy is greatly facilitated by an information base which can demonstrate to decision-makers the need to expand the breadth of agricultural education programmes and extension programmes to cover the needs of poor men and women farmers. This advocacy would also be strengthened and given far greater poignancy if it were to be undertaken jointly by agricultural education institutes and under-represented clientele, and initiated through dialogue and consultations. A long-term commitment on the part of students, staff and under-represented clientele to working together can only be developed slowly as a result of positive contact and mutual learning - issues which are discussed in greater detail below.

The Need for Experientially-Based Learning and People's Participation

Most agricultural education and extension programmes are still based upon an approach in which knowledge, techniques and technology are developed by scientists, who then transfer their results to recipients. It is believed that recipients must be "convinced" of the utility of the new information. Most researchers, professors and extension agents have been educated in this manner, and hold the conviction that these are the only valid and rigorous methods available; changing this approach will, therefore, require that professionals learn new methods and patterns of behaviour.

Agricultural education experts often indicate that the main sources of environmental information are international, and that national research is incipient. Moreover, two-way communication between agricultural education staff and target communities is rare, since most programmes do not carry out extension, and have little contact with non-governmental or governmental organizations that do. Given that human-environment interactions are, in most instances, specific and local, the absence of research, extension contact and dialogue between different knowledge bearers is critical. Similarly, very few of the extension programmes discussed in the case studies were designed to draw upon farmers' knowledge of human-environment relations; the standard approach is for farmers to be viewed as recipients. The case in India is somewhat distinct, where it is noted that indigenous technologies are targetted.

The development of the skills required to facilitate a mutual learning process requires more than communications training; in most cases, training seeks to convince farmers but not to involve them as teachers. Over the past decade, techniques for rapid participatory appraisal have helped to fill the methodological gap in the repertoire of skills available to

field-oriented personnel. Experientially-based learning ("learning-by-doing"), combined with participatory rural research and consultation, increases comprehension and retention on the part of the educands, develops critical thinking and research skills, and alters the attitudes and behaviour of all participants, creating a relationship of mutual respect for the knowledge and circumstances of each. The information received is significantly enriched, which in itself can initiate a process of change. Further, by facilitating participatory research, field personnel give farmers an opportunity to exchange information with each other, to analyze their circumstances jointly, and to set common goals.

Rapid participatory appraisal and other experientially-based, learning processes require the development of facilitation and "people" skills on the part of professionals. Professionals must be taught to listen, to treat people of different class, ethnic, gender and age groups with respect, to stimulate dialogue, and to handle conflicts and differences of opinion. They must also learn to see the process as one which is meant not only to exchange knowledge, but also to impact on the orientation and goals of their own activities, thereby facilitating the achievement of the goals of these social groups. This requires organizational restructuring to incorporate participatory principles within agricultural education and extension programmes, such that students, staff and extension agents take an active part in the decision-making process at all levels.

Reaching women farmers requires special effort. When they are physically present at public discussions, they often do not participate, or only ratify the opinions of men. Moreover, in many cultures, male "outsiders" are not permitted to contact women. Specific efforts must therefore be made to involve women in the process of mutual learning; these will depend on the circumstances in each country, and will often vary by region, religion and ethnic group. Considerations should include: holding meetings when and where women's routines permit; holding separate meetings with women; and ensuring that female field staff are available for these contacts. (For a more detailed analysis of the constraints to increasing women's access to extension services, see FAO, 1990).

Field personnel must also be sensitized to the dangers of perpetuating stereotypes. These stereotypes are not only held by professional and technical staff - they are also deeply ingrained in the social groups who are the victims of these typifications. Rather than breaking down social and gender biases, agricultural education and extension programmes often serve to reinforce stereotypes:

> ...much of the media available is still more a part of the problem than the solution...intentionally or not, educational media has also become one of the instruments of socializing predominant values and perceptions. Many of the media are 'urban' biased, assuming that most women are mothers and housewives. If this media is used in rural areas, the values may be accepted as being 'more right' (even though they may conflict with what is actually happening in people's daily lives), with the result that women feel badly about themselves. Or the media may be rejected together with the message it is trying to convey ("Gender Issues and Extension Media", *Sustainable Agriculture Newsletter*: 26-27).

Developing an Interdisciplinary and Holistic Approach to SARD

In large measure, the purpose of this paper has been to demonstrate the need to consider fully the human dimensions of environment and sustainable development. Although many agricultural education and extension programmes have broadened the range of their subject matter, most continue to focus almost exclusively on technical, physical and biological considerations; this is antithetical to the goals of SARD. Perhaps the greatest obstacles to achieving effective interventions related to SARD through agricultural education and extension programmes are the barriers erected between and within the physical, biological and social sciences, which prevent the links between humans - and between humans and their environments - from being recognized and acted upon. In virtually all the case studies, environmental and sustainable development issues have been reduced to their physical and technical dimensions. This problem is shared by the developed and developing countries alike. Only the case study from Thailand mentions efforts to understand the socio-economic and cultural context of farmers within agricultural programmes.

An interdisciplinary and holistic approach to SARD will require more than the *ad hoc* introduction of economic, sociological, and anthropological curricula into agricultural education and extension; the social sciences have themselves often failed to adopt a holistic approach, and frequently lack a knowledge base grounded in local research and contact with rural social groups. It is not surprising, therefore, that the theoretical perspectives and approaches to environment and sustainable development diverge significantly within these displines. As with agricultural education and extension curricula, different perspectives in the social sciences often correspond to different interests and clientele, and are also subject to class and gender bias.

A people-centred approach within agricultural education and extension programmes will require the participation of individuals prepared in the various social and physical science disciplines, and the direct participation of current and future clients. Multi-disciplinary, participatory research involving all of the social groups that can be identified as having interests in the sectors being addressed is a prerequisite both for curriculum development and for effective extension interventions; ideally, this research should become the *modus operandum* for the processes of learning and change rather than simply the starting point. The substantive issues addressed in this paper - such as the relations between resource access and control, employment, technology, market incentives and disincentives, and consumption patterns by social strata - may give an initial indication of the types of social, economic and gender analyses which need to be explored in the process of developing a local knowledge base for SARD; however, the hypotheses elaborated herein cannot provide a substitute for a reiterative process of consultation, investigation, and reorientation of actions. In this process, conflicts will arise over resource access, resource use, and the distribution of costs and benefits; circumstances impeding SARD which are far beyond the control of agricultural education and extension programmes will also become apparent. This is the point at which the practitioners in these programmes are most likely to expand their roles, becoming advocates of policies which create a more propitious environment for the achievement of SARD in their countries.

Raising the number of women in agricultural education and extension programmes is important not only as an affirmative action measure, and to assure that contact can be made with rural women, but also to reinforce the committment to understanding and changing the status of women. However, increasing the number of women professionals and practitioners will not "resolve" gender bias, since women as well as men are bearers of these stereotypes. Women practitioners must also become aware of the socio-economic and gender factors which contribute to environmental degradation and unsustainable forms of development; once conscious of these relations, they can more readily act as role models for rural women and support them in their efforts to improve their status. Assigning work with women to women should, however, not lead to a renewed marginalization of "the women's issue". Putting "women's issues" at the centre can do no other than facilitate all that is required to move programmes toward SARD, and is therefore a concern of all those involved in agricultural education and extension.

References

Angkasith, P. 1993. "Report on the Integration of Environment and Sustainable Agricultural Development into Education Programmes in the Faculty of Agriculture, Chiang Mai University." Case study prepared for the Expert Consultation on "The Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes", FAO, Rome, Italy, 30 November - 3 December, 1993.

Arintadisastra, S. 1993. "Agricultural Extension in Java, Indonesia. Case study prepared for the Expert Consultation on "The Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes", FAO, Rome, Italy, 30 November - 3 December, 1993.

Byra Reddy, H.N. 1993. "Integration of Environmental and Sustainable Development Themes into Agricultural Extension Programmes - A Case Study of State Agricultural Extension System: Andhra Pradesh." Case study prepared for the Expert Consultation on "The Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes", FAO, Rome, Italy, 30 November to 3 December, 1993.

Bhalla, A.S. (ed.). 1992. *Environment, Employment and Development.* Geneva: ILO.

Bifani, P. 1992. "Environmental Degradation in Rural Areas." In: Bhalla, *op. cit.*, pp. 99-120.

Buchner, G. *et. al.* 1991. *Gender, Environmental Degradation, and Development: The Extent of the Problem.* LEEC Paper DP 91-04. IIED/UCL London Environmental Economics Centre.

Burgess, J. 1991. "Land Management and Soil Conservation in Malawi: A Case Study." In: Buchner *et. al.*, pp. 25-36.

Chimedza, R. 1989. "Women, Natural Resource Management and Household Food Security: An Overview." In: *Women's Role in Natural Resource Management in Africa.* Manuscript Report 238e. Canada: IDRC/CRDI/CIID, pp. 73-85.

Clones, J. 1992. *The Links between Gender Issues and the Fragile Environments of Sub-Saharan Africa.* Working Paper No. 5, WID Unit, Africa Region. Washington, D.C.: World Bank.

Drake, V. 1991. "The Gender Bias Issue in Environment and Development: Fact or Fiction." In: Buchner *et. al.*, pp. 4-9.

FAO. 1983. *Fuelwood Supplies in the Developing Countries.* FAO Forestry Paper 42. Rome: FAO.

FAO. 1984a. *Improved Production Systems as an Alternative to Shifting Cultivation.* FAO Soils Bulletin 53. Rome: FAO.

FAO. 1984b. *Improving Weed Management.* FAO Plant Production and Protection Paper 44. Rome: FAO.

FAO. 1986. *FAO and the Environment.* Rome: FAO.

FAO. 1987. *Guidelines for Economic Appraisal of Watershed Management Projects.* FAO Conservation Guide 16. Rome: FAO.

FAO. 1990. *Report of the Global Consultation on Agricultural Extension.* Rome: FAO.

FAO. 1992. *Women, Population and Environment in Agricultural and Rural Development.* Rome: FAO.

FAO. 1993. *Towards a Common Perspective on Socio-economic and Gender Analysis (SEGA).* Synthesis of papers presented at the FAO/UNDP/World Bank Project Meeting on "A Conceptual Framework for Social and Gender Analysis in Project and Programme Formulation", Rome, Italy, 29 March - 1 April 1993.

Gaitan Arciniegas, J. 1993. "La integration del medio ambiente y elemento de desarrollo sostenible dentro de los programas de educacion agricola: reporte de estudio de caso." Case study prepared for the Expert Consultation on "The Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes", FAO, Rome, Italy, 30 November - 3 December, 1993.

"Gender Issues and Extension Media". n.d. *Sustainable Agriculture Newsletter.* Southeast Asia Sustainable Agriculture Network. Luzon, Philippines: pp. 26-27.

"Gender Issues in Upland Farming: A Case from Northern Thailand." n.d. *Sustainable Agriculture Newsletter.* Southeast Asia Sustainable Agriculture Network. Luzon, Philippines: p. 11.

Hanrahan, D. 1991. "Women in Development and Environment: Indicators of the Extent of Bias". In: Buchner *et. al.*, pp. 10-17.

Hermosilla, V. 1993. "Estudio de Caso: Chile". Case study prepared for the Expert Consultation on "The Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes", FAO, Rome, Italy, 30 November - 3 December, 1993.

Jacobson, J. 1992. *Gender Bias: Roadblock to Sustainable Development.* Worldwatch Paper 110. Washington, D.C: Worldwatch Institute.

Jommo, R. 1991. "African Women's Indigenous Knowledge in the Management of Natural Resources." UNCED Research Paper No. 18. UNCED/UNICEF/UNFPA Symposium, "Women and Children First", Geneva, 27-30 May 1991.

Karshenas, M. 1992. "Environment, Development and Employment: Some Conceptual Issues." In: Bhalla, *op. cit.*, pp. 11-40.

Manuh, T. 1989. "Women, the Law and Land Tenure in Africa." In: *Women's Role in Natural Resource Management in Africa.* Manuscript Report 238e. Canada: IDRC/CRDI/CIID. pp. 26-33.

Monimart, M. 1989. CILSS/Club du Sahel. *Women in the Fight against Desertification.* IIED Drylands Programme, Issues Paper No. 12. London: IIED.

Paolisso, M., and Yudelman, S. 1991. *Women, Poverty and the Environment in Latin America.* Washington, D.C.: International Center for Research on Women.

Rodda, A. 1991. *Women and the Environment.* London: Zed Press.

UNEP. 1991a. *Global Assembly on Women, Environment and Sustainable Development. Final Report.*

UNEP. 1991b. *Water is Life. (Vol. 1).* Athens: UNEP/WAGGGS.

UNSO. 1989. *The World's Women: Trends and Statistics, 1970-1990.* New York.

The Integration of Environmental and Sustainable Development Themes into Higher Education in Agriculture: Case Study Review

Prepared by K.O. Herz (formerly Senior Officer, Agricultural Research, FAO), in collaboration with ESHE

ANNEX 4

Summary

This paper states the case for the inclusion of environmental education (EE) and sustainable development (SD) themes in higher agricultural education. On the basis of selected case studies, it examines the attention given to environmental issues in programmes of university-level faculties of agriculture. It identifies some of the principal obstacles and challenges, and suggests a number of measures to strengthen the environmental and sustainable development content of programmes of teaching, research and public service.

Institutions of higher agricultural education play a vital role in bringing about changes in people's attitudes and practices so that they are more environmentally responsible. The case studies illustrate the current situation in ten faculties of agriculture in both developed and developing countries. These highlight the opportunities for, and the constraints to, the integration of EE/SD into higher education in agriculture.

The two faculties located in the USA and the UK illustrate the ways in which concerns about environmental matters have evolved and influenced the integration process in the developed countries. The case study from the USA demonstrates the way in which laws and regulations, as well as pressure from the general population, have reoriented the agricultural education away from its traditional focus on production toward a greater emphasis on resource conservation. Wye College in the UK has experienced a similar evolution in its programmes. Both cases offer instructive examples of how developed countries have adapted to environmental imperatives and how developing countries might approach similar issues.

The case studies from countries in the developing regions show that, prior to 1990, little attention was given to integrating EE/SD themes into faculty of agriculture programmes. Specific mandates to deal with these themes existed only in Morocco. In the absence of mandates and policies, strategies for formally integrating environmental themes into programmes were not designed or implemented. Earlier concerns within the faculties appear to have related mostly to sustainable agriculture, and may have led, in some cases, to semantic rather than actual increases in the environmental content of programmes. Since 1990, changes in actual policy are evident.

In those universities which did incorporate EE/SD themes into their programmes, faculties of agriculture were not always the initiators or the driving forces for action. A traditional preoccupation with agricultural production and a disciplinary approach to teaching and research may have contributed to the slow introduction of EE/SD topics. Progress has occurred largely through the efforts of individual faculty members, who have recognized the need to address environmental issues as a result of their research. Limited and, in some cases, decreasing resources have inhibited the introduction and consistent integration of EE/SD, and most likely will continue to hamper future initiatives. Suitable materials for teaching, facilities for research, opportunities for increasing staff competence and incentives for staff to take on the additional work are all in short supply. Despite these obstacles, most of the case studies concluded on an optimistic note, and foresaw greater integration of EE/SD themes in the near future.

The successful integration of EE/SD topics into higher education in agriculture will require a stated policy with forward looking objectives, as well as a realistic strategy for achieving objectives. Changes may be called for in admission standards and grading criteria, in teaching and research methodologies, in courses of study, degree and public service offerings, and in pay and promotion criteria for staff. Effective linkages will need to be established with practitioners and enterprises in the agriculture sector, with relevant governmental bodies and NGOs, with the mass media, with lower-level schools and training institutions, and with appropriate rural groups and communities. Given the scarcity of resources, collaboration within and between educational institutions will be the most feasible approach for achieving optimal coverage of EE/SD in programmes of higher agricultural education.

Introduction

In 1972, the United Nations Conference on the Human Environment created the impetus for a United Nations Environment Programme. Twenty years later, the United Nations Conference on Environment and Development (UNCED) established *Agenda 21*, a blueprint for global, sustainable development. The FAO Conference on Agriculture and Environment in den Bosch (the Netherlands) in 1991 provided much of the input to UNCED. Although these conferences recognized the need for the development of human resources, there has been little discussion to date on the role of education and extension in promoting sustainable agriculture and rural development. Based on a set of ten case studies, this paper aims to recount experience and draw lessons from attempts at integrating environmental and sustainable development issues into higher agricultural education.

In this document, **environmental education (EE)** includes those elements of teaching, research and public service which address environmental concerns as they affect sustainable development in agriculture, and in particular, the management of natural resources. Two kinds of environmental education may be distinguished: education leading to special competence and qualifications in areas of environmental science, technology and management; and the creation of an environmental consciousness throughout the institution's curriculum and operations of teaching, research and public service. Both kinds of environmental education are needed to sustain the agricultural development upon which human well-being depends.

Sustainable development (SD) in this context refers to sustainable development in agriculture in rural areas, as defined by FAO at the 94th Council.

Higher agricultural education is defined as post-secondary school education in agriculture, including university/college education as well as "intermediate agricultural education" consisting of one, two and three year programmes leading to sub-baccalaureate qualifications such as certificate, diploma and brevet de technician agricole.

The Case Studies

Ten case studies were commissioned to serve as input for the Consultation and this overview document. The case studies provide valuable insights into the constraints encountered by the various institutions when they sought to insert or integrate EE/SD into their programmes. They raise a number of questions: Why should special attention be given to EE/SD by institutions of higher agricultural education? EE/SD for whom? What is the current role of these institutions, particularly in developing countries, in dealing with EE/SD? What constraints hinder the insertion or integration of EE/SD in programmes of higher education in agriculture? What should governments, NGOs, donors, international agencies and others do to support new or greater efforts by institutions seeking to integrate EE/SD in their programmes?

The ten case studies were as follows:

Chile	Universidad de Chile, Faculty of Agriculture
Colombia	Fundacion Universitaria Agraria de Colombia
Lebanon	American University of Beirut, Faculty of Agriculture and Food Science
Malaysia	Universiti Pertanian Malaysia, Faculty of Agriculture
Morocco	Institut Agronomique et Veterinaire Hassan II (a research Faculty of Agriculture)
Nigeria	University of Ibadan, Faculty of Agriculture and Forestry
Thailand	Chiang Mai University, Faculty of Agriculture
UK	Wye College (Faculty of Agriculture, University of London)
USA	Michigan State University, College of Agriculture and Natural Resources
Zimbabwe	University of Zimbabwe, Faculty of Agriculture

Detailed summaries of the individual case studies are provided in the Appendix.

Environmental Education in Agriculture: A Conceptual Framework

Higher education in agriculture has traditionally been concerned with finding and applying better technologies, and has been guided by discipline-led teaching and research in the natural sciences, engineering, economics and the social sciences. The task of integrating an environmental dimension into the teaching, research and public service functions calls for a multi- and inter-disciplinary approach because of the wide range of factors involved. It will necessitate a change in attitudes, practices, policies, goals, and resource allocations. The need for change is urgent.

Institutions of higher education in agriculture are a vital resource for bringing about change in society. As stated in *Agenda 21*, "education is critical for promoting sustainable development and improving the capacity of the people to address environmental and development issues...Both formal and non-formal education are indispensable to changing people's attitudes so that they have the capacity to address their sustainable development concerns." Agricultural universities should focus directly on attitudes and practices involving the use of natural resources, expand the knowledge base and educate the general population (not just students) about the environmental effects of their actions in agriculture and related industries. The ultimate goal should be a contribution to the fullest possible awareness of and commitment to environmentally responsible behaviour in all segments of society. As a first step, institutions should assess the needs that exist at national and regional levels, and especially at the local level that they serve. They then should define the role that they will play in EE/SD. In general, the audiences and purposes will include the following:

Primary Audiences:

- Students of all kinds, including those in public and private schools, and those in intermediate and higher institutions of education. The aim should be to develop a sense of responsibility for the environment;

- Teachers and trainers of all kinds, and administrators of educational institutions at all levels (primary, secondary, tertiary), particularly university staff.

Secondary Audiences:

- agricultural producers;
- rural families, especially women and youth;
- community leaders, local NGO staff, agribusiness managers and entrepreneurs;
- extension workers, agricultural researchers, subject-matter specialists and technicians;
- decision makers in politics, law and finance, whose functions impinge on agriculture and its further development.

EE/SD Integration: Roles and Challenges

The growing demands of the world's population are placing an increasing strain on the environment. Unfortunately, some of the actions taken in the name of development have been responsible for adverse environmental effects. In large-scale agriculture, a least cost/maximum profit orientation has often led to forest clearance, soil compaction, loss of water quality, over-exploitation of useful species, and loss of biodiversity. In the case of small-scale, resource-poor agricultural producers, the challenge is to convert farming systems of low productivity with relatively high sustainability to systems combining higher productivity with increased sustainability. A critical need is to combine indigenous knowledge with science-based technology, but technology alone is not the answer. Ultimately, development is a matter of priorities and choices, by governments, communities and individuals. Societal choices are conditioned by knowledge, motivation and politics. Societal choices usually reflect the needs of the sector which has the greatest power to exert influence.

Universities should examine societal needs so as to help set development policies and strategies, taking into account the needs of the less influential segments of society. Higher education cannot afford to shirk the responsibility for stimulating change in environmental attitudes and practices, and for directing choices of action so as to benefit all segments of society. The integration of EE/SD into agricultural programmes is thus a challenge and an opportunity for educational institutions.

Acceptance of this responsibility implies a willingness to be responsive to the needs of society. Many universities have shown such a willingness, but have found it difficult to convert good intentions into effective action without risking the loss of autonomy. The key to the usefulness of universities is their relevance to the needs and wants of the population to be served. Some trends are discernible: governments will employ progressively fewer people in the same categories of work; new categories of productive employment will call for greater skills in the management of complex agricultural systems (e.g., farming will

increasingly become a multi-faceted enterprise interacting with non-agricultural pursuits); agriculture will become a progressively less important part of the economic life of the nation and employment in the sector will be affected accordingly; growth in agriculture will be supported predominantly in the large-scale commercial sector, in part because of the difficulties faced in trying to maintain the viability of small-scale, resource-poor, farming (nonetheless, small farms will continue to provide a substantial part of the livelihoods of large numbers of people in rural areas).

As production systems in agriculture become more complex, students will need to become versed in management and business skills, but not at the expense of discipline-based competency. A major challenge to educational institutions may be the blending of discipline-based and system-based education. Universities should be prepared to mount programmes in areas removed from the traditional agricultural production process. Teaching about development should equip students to gain a perspective on the role of agriculture in the economic life of the nation as well as the local area served by the university. An awareness of the dependence of development on the protection of the environment and the conservation of natural resources will be reinforced.

Environmental education is likely to be required for the newer categories of jobs in government and private enterprise: environmental impact assessments will become increasingly common; natural resources and environmental factors will increasingly be taken into account in setting national policies and devising economic development strategies; and the promulgation and enforcement of new environmental laws and regulations will require specialized knowledge. Training in "environmental literacy" will be required by specialists and generalists alike, and will be essential for the improvement of both small-scale and large-scale farming.

What the Case Studies Show: Findings and Comments

Two case studies were carried out in each of the four developing regions plus one each from Europe and North America. They do not, of course, fully represent the diversity of nations (or agricultural universities and faculties) in each of the regions nor do they represent a random sample. Institutions in the Near East have a regional rather than a purely national orientation, thus limiting to some extent the possibility of making comparisons. In the two Latin American case studies, information was provided from a national (rather than specific faculty) perspective.

The case studies show that faculties of agriculture are not always the main initiators of efforts to integrate EE/SD within the university. In some developing countries, they are lagging behind governmental and non-governmental organizations in the environmental and natural resource conservation fields. Themes related specifically to the environment have entered the programmes of faculties of agriculture in developing countries only very recently. In the limited cases where they exist, policy statements on the introduction or integration of EE/SD have not always resulted in effective implementation strategies. The case studies suggest that, given budget constraints and the lack of trained faculty members, the process of integrating environmental education will continue at a relatively slow pace. Nevertheless,

a number of the developing country faculties have made considerable progress in promoting environmental education programmes (e.g., Universiti Pertanian, Malaysia).

Institutional and EE/SD Capacities

All of the faculties of agriculture represented in the case studies have been in existence for over 20 years (Table 1). Some have acquired additional service areas, while a few (Malaysia, Zimbabwe) have been restricted in coverage as other faculties were formed. With the exception of Latin America, teaching staff are involved in research and often in outreach. Except in Colombia, faculties obtain research funds from public sources or through contracts. In eight of the cases, the annual expenditure on research activities is US$ 500,000 or greater. Two faculties (the USA and Malaysia) offer diploma programmes, the UPM faculty offers only B.Sc. programmes, while all the other faculties offer at least Masters programmes; several offer a Ph.D. in agricultural sciences. Funding sources vary depending on whether or not public support is available. Research funding is frequently the result of faculty member initiatives. Wye College welcomes students from foreign countries and has developed a distance learning programme to cater to their needs. At least half of the students attending the American University of Beirut come from outside Lebanon, while the Moroccan faculty welcomes francophone students from any country.

Student enrolment in the faculties of agriculture located in developing countries is relatively modest (Table 2). Faculty sizes are reasonable, with the possible exception of Morocco, which would appear to be over-staffed; this, however, may reflect the heavy involvement of faculty members in field work and research. The percentage of staff with EE/SD experience ranges from a low of five per cent in Chile to a high of 50 per cent in Malaysia and Lebanon. The time that faculty spend on EE/SD ranges from "very little" (or in the case of Colombia, seven per cent) to 40-49 per cent for Nigeria. It is likely that these higher percentages refer primarily to SD, rather than to EE. A similar conclusion is likely to apply to the estimates of the environmental content of the programmes and budgets in Nigeria and Zimbabwe. Morocco may be an exception given its extensive village-level research and field studies. Most students in agricultural programmes are reached by environmental messages of some kind; however, these messages lack consistency, and students are rarely given the opportunity to integrate the various themes. The degree to which university students outside the field of agriculture are reached by environmental messages depends in large measure on offerings in other programmes.

Table 3 shows that degrees in agricultural extension are offered by three of the faculties in developing countries and in the USA. Five of the case study faculties carry out formal extension activities. All of the case studies, however, mention that extension or outreach activities are sometimes carried out independently by faculty members or students, e.g., in connection with field research. Extension is largely absent in the faculties in Latin America. Emphasis on continuing education and training is limited or absent in developing countries other than Nigeria, although contact with nearby communities is common to almost all cases.

Table 1

Institutional Capacities

INSTITUTION		AGRICULTURAL FACULTY		RESEARCH Activity Level (2)	DEGREES (and Diplomas)	FUNDING (m)=main sources	NOTES
Country (1)	Year Founded	Names	Academic Staff				
UK	1946	Wye College	104	A	B.Sc., M.Sc.	Fees, Contracts (private)	(a)
USA	1855	MSU CANR	N/A (3)	A	2-year Dipl., B.Sc.,M.Sc.PhD.	Mich. State (m)fees, Federal	(b)
MAL	1972	UPM, Faculty of Agriculture	88	A	3-year Dipl., B.Sc.	Research: MOSTE (m) (4)	
THA	1967	Chiang Mai Univ., Faculty Agr.	117	A	B.Sc., M.Sc.	N/A (3)	(c)
NIR	1949	U. Ibadan, Fac. of Agr. & For.	120	A	B.Sc. (Hon.)	Federal (m)	(d)
ZIM	1980	U. Zimbabwe, Faculty of Agric.	60	A	Dipl.,B.Sc.(Hon.),MSc,Ph.D.	N/A(3) (Public)	(e)
LEB	1952	A.U.Beirut, Fac.Agr.& FoodSci.	38	N/A (3)	B.Sc., M.Sc.	Private sources	(f)
MOR	1966	IAV Hassan II	350	A	1st, 2nd, 3rd cycle	National (m) Contracts	(g)
CHI (5)	1928	U. de Chile, Fac.Agr.&FoodSci.	164	A	Ingeniero, Maestria	Research: National (m)	(h)
COL	(6)	(6)		B	Ingeniero, D.V.M.	N/A (6)	(i)

(1) **UK** = United Kingdom, Wye College, Faculty of Agriculture; **USA** = United States of America, Michigan State University, College of Agriculture and Natural Resources; **MAL** = Malaysia, Universiti Pertanian Malaysia, Faculty of Agriculture; **THA** = Thailand; **NIR** = Nigeria; **ZIM** = Zimbabwe; **LEB** = Lebanon, Faculty of Agriculture & Food Sciences; **MOR** = Morocco, Institut Agronomique et Vétérinaire; **CHI** = Chile; **COL** = Colombia

(2) **A** = Above; **B** = low; viz. above or below US$ 500,000 per year.

(3) **N/A** = not available/indicated in Case Study.

(4) **MOSTE** = Ministry of Science, Technology and Environment.

(5) Information for Chile presented in national, not institution's perspective in Case Study text.

(6) Colombia - Case Study represents analysis of responses to questionnaire by 11 (including 3 private) Universities' Faculty of Agriculture.

(a) Many non-UK students. (b) State (province) orientation. (c) 27% (31) women on academic staff, 54 academic assistants, a few non-Thai students
(d) 80 technical support staff. (e) 30% of Faculty budget for technical support staff. (f) Regional (Near East) orientation, 42 assistants (academic/research)
(g) French education system, open to francophone students from foreign countries. (h) Chile in national perspective, data on Univ./Fac. of Agric. obtained separately from Case Study report. (i) Case Study report is composite of 11 Universities/Faculties of Agriculture.

Table 2

Capacities of Faculties in Environmental Education

INSTITUTION	FACULTY						EE MESSAGE
Country (1)	Student Enrollment	Academic Staff			Programme	Budget	% of Students reached
		No.	%with EE (2) Expertise	% Time on EE	% of EE Contents	% Spent on EE	
UK	867	104 (3)	32 (3)	v. little	2-25	20-25	100
USA	3200	N/A (4)	N/A (4)	<10	<10	<10	100
MAL	N/A (4)	88	50	15	15	15	N/A (4,5)
THA	1037	117	N/A (4)	25-74 (6)	12-24 (6)	27	90-100
NIR	1200	120	40	40-49	40-49	44	N/A (4,5)
ZIM	350	60	33	av. 35	av. 30	10 (7)	100 (5)
LEB	400 (9)	38	>50	10-50	20	N/A (4)	75 (8)
MOR	2000	350	33	35	33-50	33	100
CHI (5)	1252	164	5	v. little	5-10	2-3	30 (9)
COL	(10)	(10)	(10)	av. 7	(10)	(10)	N/A (4)

(1) Country Code and Faculty name - see Notes to Table 1.
(2) EE - relating to Environment or Environmental Education.
(3) 66 fulltime, percentage relates to fulltime staff.
(4) N/A - not available/indicated in the Case Study report.
(5) 3 Faculties indicated % students reached in University: MAL - 15%; NIR - 10%; ZIM - 70%.
(6) First number relates to B.Sc. programme, second to M.Sc.
(7) Applies to budget for teaching only.
(8) 25% of students are enrolled in Food Sciences programmes, hence 75% reached.
(9) Applies to students in Agr. Programmes, 100% reached in Forestry Programmes.
(10) Composite of 11 Faculties of Agr. in Colombian Universities. Generally, entries relating to EE would be "a very small percentage".

Table 3

Other Institutional Activities Related to EE/SD

INSTITUTION Country Code (1)	AG. EXTENSION		PUBLIC SERVICE/OUTREACH			FACILITIES	UNIV. UNITS (2) with Env. Progs.
	Degrees	Activities (2)	Contg. Ed.	Training	Community	Exp. Sta. Use	
UK	--	X	X	X	X	X	
USA	B.Sc.	X	ns (3)	X	ns (3)	X	
MAL	--	X	ns (3)	ns (3)	X	X	5 (4)
THA	B.Sc., M.Sc.	X	ns (3)	X	X	X	Science, Social Science
NIR	B.Sc. (Hon.)	X	X	X	X		Chemistry, Geography
ZIM	--	--	--	--	--	X	Sci., Agr.Eng., Soc. Studies
LEB	M.Sc.	--	--	--	--	X	Engineering, Health Science
MOR	--	--	X	--	X(5)	X(5)	
CHI (5)	--	--	ns (3)	ns (3)	--		
COL	--	--	ns (3)	--	ns (3,6)	ns (3,6)	

(1) Country Code and Faculty name - see Notes to Table 1.
(2) Faculties/Departments offering courses/programmes outside Faculty of Agriculture
(3) ns - not stated in Case Study report
(4) UPM - Forestry, Fisheries, Economics and Management, Vet./An. Science, Science and Environmental Studies - the last has the mandate for environmental education.
(5) IAV conducts extensive village-level/research and field study involving some outreach. Farms in France are used for practical experience by students.
(6) Analysis of information from 11 Colombian universities suggests very little, if any, community outreach is done; some universities/faculties may have land and other facilities.

EE/SD Mandates, Roles and Activities

Only two of the case study institutions have formal mandates: Wye College and the Institute Agronomique et Veterinaire Hassan II (Table 4). The former has a mission statement relating to EE/SD in its 1991-92 academic plan, while the latter's mandate is by royal decree. It is important to note that, in most of the faculties of agriculture, the initiative for EE/SD activities has come from individual faculty members who are concerned about environmental problems. In some cases, EE/SD efforts are expected to be stimulated by national educational development plans and strategies.

Table 4: Source and type of environmental mandate for faculties of agriculture.

Faculty of Agriculture	Source and Type of Mandate
Wye College	Mission statement/academic plan for 1991/92 contains various statements related to environment, including "sustainable food production through...science and technology that is compatible with conservation of natural resources and protection of the environment."
Michigan State University	No statement on environmental education. Faculty have included environmental topics in the curricula and integration of EE/SD is a priority of the administration; endowed chair in Sustainable Agriculture established.
Universiti Pertanian	No mission statement on EE in Faculty of Agriculture. University has assigned mandate to Dept. of Environmental Science in Faculty of Science & Environ. Studies. Faculty of Ag. has a "guiding philosophy" on EE and its role is made more explicit in its Master Plan to the Year 2020.
Chiang Mai University	No indication of EE mandate for Faculty of Ag. Faculty has taken its cue from the policy of the National Educational Development Plan, which states that students should be offered EE programmes.
University of Ibadan	No specific EE mandate at University of Agriculture faculty levels but National Universities Commission has given attention to the topic in setting course standards and faculty has followed this lead. Nigeria contributed a National Conservation Education Strategy to UNCED in 1992.
University of Zimbabwe	No formal mandate. Faculty concern for environment has been the main impetus. However, following UNCED, a national conference discussed *Agenda 21* and urged universities to include EE in their curricula.
American University of Beirut	No formal mandate and no directives from university; however, faculty have included EE topics in response to regional environmental problems.
Institut Agronomique et Vétérinaire Hassan II	The royal decree establishing IAV specifies that it should concentrate on agricultural development in the Hassan II context of environment.
Universidad de Chile	No mandate for EE at the national level or from the Council of Rectors. Ministry of Education is seeking to develop EE policy.
Fundacion Universitaria Agraria de Colombia	No national mandate for EE at university level within any of the 11 universities in the case study. Initiatives by Min. of Education may lead to university EE policies.

Table 5 summarizes information on the EE/SD roles and activities of the colleges and faculties of agriculture. Six of them (Wye College, Michigan State, Universiti Pertanian, Chiang Mai University, Hassan II, and the University of Ibadan) carry out teaching, research and outreach with EE/SD content. The others have EE/SD teaching and research activities, although in the case of faculties in Chile and Colombia, the emphasis is mainly on teaching. In addition to the more traditional roles of teaching and research, faculty are involved in a wide range of EE/SD activities, including participation in development projects, consulting, direct contact with farmers, lectures for the general public, and publications.

Integration of EE/SD into academic programmes (Table 6) has been extensive in some faculties (Michigan State, Universiti Pertanian) and much less evident in others (Universidad de Chile, University of Zimbabwe). In the absence of EE/SD mandates and policies, integration has been piecemeal and largely through the individual efforts of faculty members and the demand from students. In the case of Michigan State, research preceded and promoted integration in teaching; in the case of Wye College, the incorporation of EE/SD into research was more difficult than in teaching. Where there is resistance to inter-disciplinary collaboration, integration is slow. Curricula reviews offer opportunities for greater integration, especially with administrative support and collaboration across faculties.

Lessons

Table 7 presents a brief summary of the lessons learned from the case studies. A general shift in focus is evident, with many programmes moving away from a commodity-oriented production approach toward a broader perspective which encompasses environmental and sustainable development concerns. However, there continue to be conflicts between the short-term demands for economic development and the longer-term goal of environmental protection. In some cases, national environmental policies and laws have prompted faculties of agriculture to integrate EE/SD into their programmes; in most cases, however, the impetus has come from the individual and often isolated efforts of concerned faculty members. In developing countries, these faculty have scant access to teaching materials, research equipment or other facilities which could be used to support EE/SD activities. In the majority of cases, it would appear that the extent to which a particular faculty member incorporates EE/SD into teaching and research is dependent primarily upon his or her personal attitude towards environmental issues. External factors, however, can play a role, including pressure from students, local environmental problems, and opportunities for faculty to participate in development projects with a sustainable agriculture focus.

Table 5: EE/SD roles and activities of faculties of agriculture.

Faculty of Agriculture	Roles and Activities
Wye College	Teaching, research and training activities; outreach with local conservation groups and farmers. B.Sc. & M.Sc. degrees offered; M.Sc. external programme for non-resident students. Short-courses offered by Continuing Education Dept. Considerable faculty research, both local and international in scope.
Michigan State University	Teaching, research, extension, outreach; faculty commonly have responsibilities in all areas. Degrees offered at B.Sc., M.Sc., Ph.D. and 2-year technical degree levels. Has major responsibility for state-wide extension activities. Of 240 research projects, just over 100 deal with environmental matters. Outreach to public is through information office, conferences and seminars offered to various audiences. Faculty disseminates EE/SD messages to media.
Universiti Pertanian	Teaching, research and public service. Significant research activity from 88 member faculty. EE themes in short courses for specific target groups. Outreach on IPM, soil conservation and organic farming through UPM Extension Villages.
Chiang Mai University	Teaching, research, extension. 11.5% of B.Sc. and 24.2% of M.Sc. courses strongly related to EE/SD. Of 71 research studies, 30 in agricultural systems, much of them with Dept. of Ag. research stations. Faculty conduct EE/SD extension-type activities in nearby areas, participate in SD projects and encourage students to take part in campaigns with conservation focus (e.g., tree-planting).
University of Ibadan	Teaching, research, and public service, including consultancy and extension. EE is integral part of various degree programmes and research activities; 22 research projects with environmental relevance are listed. Training given to NGO and government staff. Extension and outreach provided through faculty rural development programme, covering 31 villages. Faculty give advice to farms through demonstrations, bulletins and other materials.

[Table 5 continued over.]

[Table 5 continued.]

Faculty of Agriculture	Roles and Activities
University of Zimbabwe	Teaching and research. Sixteen courses are offered which deal with EE/SD; several donor-funded EE/SD research projects carried out by faculty. No formal outreach/extension, although a review is underway to incorporate outreach for hands-on experience in courses.
American University of Beirut	Teaching and research. No outreach or extension, but lectures, symposia, and demonstrations are open to the public. Faculty publish research, consult and maintain active contact with national and international research organizations.
Institut Agronomique et Vétérinaire Hassan II	Teaching and research. Course work involves student short-term assignments to "discover nature" and learn about "ruralism"; later in their programmes, students live with farmers and study development constraints in the area. In their research and teaching, faculty have contact with various audiences through publications, conferences and special courses requested by national and international organizations.
Universidad de Chile	Teaching and research. EE/SD topics are more evident in graduate studies than first degree programmes; research on EE/SD from 1988-1991 involved about 67 projects. Outreach is virtually non-existent.
Fundacion Universitaria Agraria de Chile	Teaching is the main activity; 80% of faculty lecture part-time. Lack of funding limits research. Outreach and extension absent from faculty activities. EE/SD in courses is largely at the initiative of individual faculty.

Table 6: Integration of EE/SD in faculties of agriculture.

Faculty of Agriculture	Integration of EE/SD
Wye College	Integration is well advanced in academic programme; guiding policy exists; integration led internally by college decree. Pressure from students also led to new EE/SD degree programmes. EE/SD in research has been more difficult than in teaching. Integration in outreach mainly through Continuing Education Department.
Michigan State University	Integration is well advanced despite lack of EE/SD policy statement. Impetus for university integration has come from federal and state environmental laws and faculty sensitivity to topic. Demand from students has led to proposal for environmental science curriculum; students required to take capstone environment course before graduating. EE/SD integration in research often preceded and promoted integration in teaching. EE/SD major part of extension and outreach to public.
Universiti Pertanian	Integration began in 1973 with the first course offerings of the Faculty of Ag., initiated at the department level based on the view that agriculture and environment are inextricably linked. Faculty of Environmental Sciences offers a B.Sc. in environment. In research, EE/SD in 12 out of 19 projects, many multidisciplinary; projects with EE/SD content with international organizations and commodity research institutes. Also, EE/SD in outreach/extension, short courses and seminars.
Chiang Mai University	Integration in academic programme arises from assessment of needs at local and regional/national levels; also from national Education Development Plan. New courses with EE/SD focus have been approved for offering in the next two to three years. Cooperative research arrangements with international and national agencies have led to EE/SD integration. EE/SD in various short courses and farmer training activities; EE/SD public awareness through university radio station and newspaper releases.
University of Ibadan	Integration was limited until 1967/68, when additional degrees were added and curricula were developed based on farmers' needs for improved productivity as well as safeguarding the environment. Fuller integration is expected when a cross-curricular introduction of EE takes place under the National Education Policy.

[Table 6 continued over.]

[Table 6 continued.]

Faculty of Agriculutre	Integration of EE/SD
University of Zimbabwe	Integration in academic programme has been piecemeal and based on the initiative of individual faculty; sixteen courses named with EE/SD integration and new ones proposed. Integration in research is focused on smallholder and communal agriculture. Some integration of EE/SD is evident in other units, e.g., Centre for Applied Social Studies. Plans exist for an Institute of Environmental Studies.
American University of Beirut	Integration has until recently resulted from the efforts of individual faculty members. Civil strife has hampered efforts considerably. Details of integration not provided in case study. At present, faculty is trying to formulate a multi-disciplinary MS programme in Environmental Sciences. EE/SD has been stronger in research programme, with 14 projects listed, various with international organizations.
Institut Agronomique et Vétérinaire Hassan II	From its inception, the Institute has oriented its teaching and research to environmental factors; impetus came from a few key faculty. Students become deeply involved with rural life as part of course work. Research also has a strong EE/SD focus, involving both faculty and graduate students in activities with 23 national and international bodies.
Universidad de Chile	EE/SD has not been evident in first degree teaching programmes but has been introduced somewhat in graduate studies. In research, approximately 200 scientists have been regularly or occasionally involved with EE/SD topics between 1988-91. Universities do little outreach.
Fundacion Universitaria Agraria de Colombia	Integration of EE/SD chiefly in teaching, as a result of individual faculty interest, but topics are dispersed without a coherent focus. The curricula are oriented to large-scale agriculture production and isolated faculty efforts to introduce EE/SD have had limited impact.

Table 7: Assessments and lessons learned from case studies.

Faculty of Agriculture	Assessments/Lessons
Wye College	At times, EE/SD has been seen as detracting from role of College to serve farmers and industry; as a result, inserting environmental content in curricula has been a slow process. However, reassessment of role of agriculture has taken place with increased interest in EE/SD. A special Environment Section now provides guidance to College. Lack of social science integration with EE/SD topics and reduced funding are mentioned as negative aspects.
Michigan State University	State and federal laws have influenced the university's response and have led to progressively greater EE/SD content in teaching and research programmes. Perspective of particular faculty member is a key factor. Process of integration has been fostered by faculty research activities with strong EE/SD content.
Universiti Pertanian	Shift towards EE/SD evident in Malaysia agriculture, as reflected in laws and in faculty perspectives and inclusion in curricula. However, there is still resistance and some faculty are reluctant to move to the multi-disciplinary collaboration necessary for EE/SD approach.
Chiang Mai University	Faculty approach to teaching and research is "systems analysis", which fosters EE/SD integration. Environmental problems and faculty involvement in development projects seen as stimulating interest and scope of EE/SD at the university.
University of Ibadan	Decreasing student enrolment and inadequate funding have hurt EE/SD integration; also, faculty outreach activities have been reduced for lack of funding. Thus, a relatively strong EE/SD start has been weakened.
University of Zimbabwe	Lack of a policy statement is seen as constraining EE/SD activities. In research, EE/SD findings are viewed in isolation and lack socio-economic aspects. Faculty lack equipment and expertise to prepare quality EE/SD instructional materials. The proposed establishment of an Institute of Environmental Studies is seen as positive initiative.
American University of Beirut	Until recently, NGOs have been the active agents in EE/SD. New Ministry of Ed. has been established and EE/SD national policy soon to follow. Academic programmes are being reviewed with the intent of incorporating EE issues; constraints are lack of trained faculty, research facilities, and funding.
Institut Agronomique et Vétérinaire Hassan II	Emphasis has been on EE/SD and linking academic programmes to the real world, with special attention to socio-economic factors. Alumni have played a major role in influencing EE/SD policies in Ministry of Agriculture.
Universidad de Chile	Clashes between EE/SD proponents and development planners have slowed down university efforts to integrate EE/SD into academic programmes. Faculties lean towards traditional disciplinary approaches which are not easily adapted to EE/SD.
Fundacion Universitaria Agraria de Colombia	Large-scale production orientation which offers best student employment has restricted EE/SD impact on universities. Research with EE/SD content is limited and extension virtually non-existent. Case study notes the need for attitudinal changes toward the environment.

While there is some participation in relevant research and extension, the case studies indicate that a number of institutions lag behind governmental and non-governmental agencies in fields related to the environment and to the conservation and efficient use of natural resources. However, it should be kept in mind that the EE/SD topic is: a) very large and loosely defined; b) a new challenge for most universities and faculty members; c) hampered by weak or unstated policies; and d) supported by inadequate funding. As urged in *Agenda 21*:

> Countries should stimulate educational establishments in all sectors, especially the tertiary sector, to contribute more to awareness building. Educational materials of all kinds and for all audiences should be based on the best available scientific information, including the natural, behavioral and social sciences, and taking into account aesthetic and ethical dimensions.

Constraints and Problem Areas

The case studies illustrate the diversity which characterizes institutions of higher agricultural education. This diversity often reflects the historical development of the nation or of the local area which the educational institution serves. Many developing country universities have been modelled on universities in the industrialized nations of Europe, North America and Australia. In many instances, the evolution of developing country universities has been influenced more by administrators and faculties from the North than by the realities of national needs and capabilities. In some cases, political pressure has led to the establishment of a greater number of universities than can be justified on the basis of employment opportunities, the availability of qualified faculty members, or numbers of students.

Agricultural universities in the more developed countries have encouraged expanded enrolment of students from developing countries. Those students, upon taking up positions in the universities of their home countries, have often followed the foreign university model. In some respects, including the demand for academic and research excellence, the effect has been positive. On the whole, however, the outcome has been an uneasy fit between the foreign model and national educational needs and capabilities. The influence of foreign academicians, foreign literature and a foreign-trained faculty has meant that the content of some environmental programmes has been more relevant to conditions in the industrialized nations than those of developing countries.

In some developing countries, environmental legislation is in the early stages of formation, reflecting the problem of balancing environmental protection with social and economic development. This can become a controversial theme for faculties in countries where unrestrained exploitation of natural resources is perceived as a requirement for development. The result, in some cases, has been resistance to university environmental education programmes.

In a number of countries, agricultural institutions have experienced constraints to the integration of EE/SD because of their linkages with the Ministry of Education. This may test the limit of influence which the Ministry of Agriculture can exert in setting educational

policy, and may in effect place the two ministries at odds over the importance of EE/SD in the university system. In addition, some countries (e.g., Lebanon) have recently created Ministries of Environment to oversee environmental concerns. There is a danger that a profusion of policies and signals may give confusing or conflicting guidance to universities and educational systems.

In many universities, especially the older ones, university administrators have traditionally invoked a right of independence in matters of academic and operational programming. Greater difficulties can be anticipated if proposed changes are perceived as having controversial features or a damping effect on funding. The Nigerian case study, for example, describes the way in which the introduction of environmental education was stopped because the administration believed that it would be viewed unfavourably by a National University Commission that was about to undertake a review of university programmes. Although innovation may be more feasible for newer universities or faculties, similar constraints may still be experienced.

University research serves to expand the knowledge base, and most of the older universities support research in their faculties and departments. However, in many newer universities, research is weak, particularly where postgraduate programmes are new or absent. Natural resource topics have always been included in the research agenda of agricultural universities. However, even in industrialized countries, environmental topics have entered research programmes only during the past few decades. They have been virtually absent from the curricula of universities in developing countries until very recently. Similarly, public service programmes have had only limited environmental content. Chiang Mai University in Thailand has solved some of these problems by linking faculty research and outreach to development programmes with an environmental component.

Economic pressures have led many governments to implement sizeable reductions in the public work force. The message of a shrinking government job market is not lost on university administrators, faculties and students. Whether the slack can be taken up by the private agricultural sector depends on the state and rate of growth of economic development. Unfortunately, much of this economic growth is likely to be concentrated outside the agriculture sector. Agricultural faculties can ignore the trends only at the risk of sliding into irrelevancy. Consultations with prospective employers are essential to obtain estimates of the numbers and types of positions which are likely to be available. Efforts must be made to stimulate interest in agriculture as a vocation promising a decent livelihood, as much to stem the exodus of young people to urban and industrial job markets, as to maintain agriculture's prominent position within the economic arena.

Reduced numbers of government job opportunities may have an effect on the curricula of educational institutions. Many agricultural universities have curricula which are strong in science, technology and engineering for larger-scale agriculture. Increasingly, enrolment is characterized by urban students and an absence of students from small-farm families. With fewer government jobs available, many students look to careers in agribusiness. Only a small minority actually plan to farm themselves, e.g., those from large family estates. If there has been a curriculum change, it has been more in the direction of science-based management of agricultural production for profit rather than for environmental protection.

A notable exception is the Hassan II Institute of Agronomy and Veterinary Sciences in Morocco, which has a tradition of integrating the technical aspects of the environment with the socio-economic needs of traditional farmers and pastoralists.

The authors of the case studies lament the fact that there have been too few incentives for faculties to incorporate environmental themes into their programmes. Few of the available teaching materials are directly relevant to sustainable development at the national or regional level; fewer still deal with the environmental concerns of the local area which the university may seek to serve. The available materials and information deal mostly with global concerns or with situations in the industrialized countries. The difficulty of accesssing appropriate information and materials is likely to continue to be a major disincentive to an increased emphasis on environmental issues. The fact that funding for universities has not increased, and has in some cases declined, means that departments of agriculture are unlikely to have additional funds allocated for EE/SD. Reallocation of existing funds to EE/SD activities may be met by resistance from both administrators and traditionally-minded faculty. The setting of priorities will become increasingly more important as limited funds are divided among different interest groups.

Faculties have only a limited number of professors who are well prepared in the subject of EE/SD in agriculture, and there are few incentives (e.g., grants, salary increase) for them to develop their expertise further. In the absence of institutional incentives, professors are unlikely to undertake the work necessary to integrate environmental themes into their courses of study. Unless they are convinced that environmental themes are a critical addition to their courses and research, there will be little expansion. They will also hesitate to take action if they sense that the university administration, or outside financial supporters, are opposed to the introduction of environmental themes.

The case studies show that, prior to 1990, environmental themes did not figure significantly in the teaching and research programmes of agricultural faculties in developing countries. In the wake of the growing awareness stimulated by UNCED, governments and private enterprises are beginning to encourage universities to undertake an expanded role. Faculties should respond, not simply by retitling courses and research projects to imply environmental content, but by contributing to the development of sustainable agricultural technologies. Technologies for both the correction and prevention of problems are needed, and universities should have a comparative advantage in tackling the long-term research that is seldom of interest to commercial enterprises.

Another area for contribution is in public service. In many developing countries, societal expectations of university public service and outreach programmes may be rather low. Faculties will have to address this shortcoming if they wish to be perceived as valuable to the general public. One essential step is to facilitate access by members of the public to the knowledge and experience contained in the university. Environmental education should be part of faculty offerings in public service because ultimately an informed public is the best guardian of the environment and its natural resources. University administrators and faculties should look beyond their enrolled students to provide short courses and other in-service training opportunities for teachers in public and private schools as well as for managers in enterprises and institutions related to agriculture.

As the Chilean case study notes, "development of EE/SD requires more knowledgeable professors, more equipment, more basic and applied research, and more and better outreach and extension activities that draw in the communities and indigenous agricultural knowledge to help solve environmental problems." Extension/outreach programmes should be an important public service, seeking to disseminate information on research results through presentations by faculty, publications and other communication materials. A positive attitude should be cultivated within the university towards collaboration and information exchange with outside organizations and groups such as NGOs, cooperatives, community organizations and others, including the mass media. This two-way communication can often benefit universities, by making their programmes more relevant to societal needs and wants.

Reviews of curricula and related activities are relatively frequent in most institutions; reviews of policy and strategy, however, are less common. Does the integration of EE/SD require a policy and strategy review? Institutions which have already achieved a strong momentum in integrating EE/SD usually have a guiding policy; much can be learned from their experiences. Did the policy arise as a result of outside pressure (e.g., government, private sector) or was it developed from the inside, in recognition of a responsibility to fill a societal need? How comprehensive is the policy - does it affect all of the relevant programmes and activities of the institution?

Common Issues from the Case Studies

A review of the case studies suggests that there are a number of educational institutions in which the process of integrating EE/SD has been relatively slow. One cause may be the absence of a stated policy. Once the need for EE/SD is accepted, a policy becomes indispensable. It is the job of the administration to take the steps leading to a policy statement, including consultations both inside and outside the institution. Internal consultations should involve the faculties, departments and staff and, to the extent feasible, students. Outside consultations should include, for a publicly supported institution, the Ministry of Education and other relevant ministries, university associations, education or research councils, community organizations, NGOs, and prospective employers in the private and public sectors.

Realistic goals and strategies should be set. Funding will need to be considered, as well as student enrolment projections and the availability of staff for instruction, research and public service functions. Relevant questions might include: Which faculty members are most likely to insert EE/SD themes into their courses? What additional teaching materials and aids are required, and how can these be prepared or acquired? What in-service training is needed for faculty members? What laboratory equipment and research assistance are needed? If the institution concentrates on teaching, how can students be given an understanding of the importance of research in EE/SD? In public service, can EE/SD best be promoted through short courses for public school teachers, in-service training for civil servants, outreach to cooperatives, or other activities? Since effective integration of EE/SD means deviation from a strictly disciplinary approach, is this to be accomplished by cooperation and coordination among faculties/departments? If students fail to integrate topics from different courses on their own, then a multi-disciplinary, inter-faculty approach must

be taken. Multi-disciplinary research and inter-disciplinary projects of various kinds should be put into practice within a teacher/student collaborative mode of learning. At the same time, however, it is important that disciplinary competence not be sacrificed.

The case studies raise the question of whether EE/SD should be promoted within existing faculties and departments or whether a separate unit, centre or institute should be created for this purpose. Although there will be a need for higher-level graduates in environmental science, this demand is likely to be small and should not be an excuse for allowing a centre or institute to engage in "empire-building". The proper role of such a centre should be to assist and coordinate faculties, such that EE/SD themes are effectively integrated throughout the institution's teaching, research and public service functions.

A number of the most important issues which are likely to confront faculties as they seek to integrate EE/SD into their programmes are discussed in greater detail below:

Students: There is a need to increase the number of students who choose agriculture as a career. The effort to encourage capable secondary school graduates to pursue further education as a preparation for such a career deserves strong support from agricultural universities. Universities will need to find ways to recruit more students from the rural areas; this may entail setting special standards for admission, as well as the establishment of more flexible grading systems, particularly during the first terms. Role models should be identified (perhaps among alumni), so that students can be made aware of career possibilities in agriculture, especially those with EE/SD aspects.

Instructors and Staff: The integration of EE/SD will require additional work and responsibilities on the part of professors and other staff, and may require changes in attitudes and in teaching and research methodology. Without incentives, the additional work will be performed grudgingly, with little enthusiasm or change in attitude. Opportunities should be provided for in-service training and various forms of updating (e.g. attendance at conferences and seminars), in order to strengthen the capacity of instructors to provide sound education and to undertake quality research in subjects related to EE/SD.

As highlighted in *Agenda 21*, "awareness should be increased of the fundamental linkages between improving the status of women and demographic dynamics, particularly through women's access to education, primary and reproductive health programmes, economic independence and their effective, equitable participation in all levels of decision-making." Women are under-represented as students (and faculty) at agricultural universities and intermediate institutions. In many developing countries, this is in sharp contrast to their numbers in agricultural production and marketing. It is important to provide role models for young women in rural areas, so that they develop aspirations for higher education. One way to do this is to increase the number of women instructors in faculties/departments of agricultural universities. The special needs of women must be considered and met in courses with content designed to advance the participation of women students in EE/SD.

Themes and Courses: The extent to which EE/SD themes are integrated into the programmes and activities of an institution will be an important factor in developing an implementation strategy. It may not be feasible, for financial or staffing reasons, to do more

initially than introduce EE/SD themes into selected parts of the existing curriculum. Nevertheless, a long-term plan should be drawn up, leading towards the integration of environmental education across disciplinary lines, and, where appropriate, across faculties. If a decision is made to offer specific EE/SD courses, the future need for trained environmental personnel should be borne in mind when determining the subject matter content. A focus on sustainable agricultural and rural development should be maintained, as opposed to an emphasis on environmental protection alone. Current graduate examinations tend to promote specialization along disciplinary lines; in contrast, examinations for courses with EE/SD themes should promote interdisciplinary thinking. Course teachers should be well-trained professionals.

Degrees and Training: A decision on whether to offer a degree programme in environmental education should be determined by the employment prospects for specialists in this area. Government agencies may need trained people for positions related to environmental protection and natural resource conservation, while commercial enterprises may also require environmental specialists, especially if complex laws and regulations have to be obeyed. Agricultural production activities could absorb some trained graduates in order to improve operations in an environmentally sound manner, provided funds are available from the sector or, in the case of small-scale resource-poor agriculture, from public or donor sources. As the number of traditional government jobs continues to decline, publicly supported institutions should heed the criticism that graduates are often inadequately prepared in management and marketing. An appreciation of the importance of advanced science and technology should be developed in all students, especially in relation to the development role of agriculture. A systems approach to environmental problems in an ecosystems context is appropriate, especially in teaching and research on EE/SD themes.

Linkages: Within the institution, linkages which can support the integration of EE/SD include curricula review committees, and public service activities such as continuing education and teacher training programmes. Extending outward from the institution, linkages are sometimes non-existent and frequently inadequate. Linkages should be sought with other educational and research institutions, governmental and non-governmental organizations, private sector enterprises, rural communities and the mass media. Such linkages are a necessary part of the interactions which make the institution effective in the performance of its teaching, research and public service functions.

The institution can both contribute to, and gain from, linkages with the national agricultural research system. Joint appointments of faculty members on the staffs of research institutes and representation on research councils can be helpful. Arrangements with ministries can make experiment stations and other facilities available for better instruction and research on EE/SD themes by faculty and students. Contacts with national and international agricultural research centres can give access to information, aids and materials for teaching and research; staff from such centres can also serve as mentors for graduate students pursuing EE/SD related thesis work.

Better linkages with the commercial private sector related to agriculture are desirable both to fill its needs for trained personnel and to explore opportunities for support through remunerated provision of advice, research results, information and other services. Linkages

with the general public should be pursued, since ultimately, increased goodwill and perhaps support for the institution can come from greater public awareness of EE/SD as a necessity for agricultural and rural improvement. The mass media can be allies in helping to disseminate messages about EE/SD and the role being played by the university.

The linkage of educational institutions with agricultural producers is normally very weak. In the absence of extension, outreach and continuing education programmes, the scope for delivering the EE/SD message and obtaining feedback from audiences is limited. Institutions should seek mechanisms which will effectively link them to practitioners in the commercial sector and in rural communities. Commodity associations may be useful in the commercial sector, while cooperatives or NGOs may fulfil a similar role in local communities.

Concluding Statements

Institutions of higher education in agriculture have often been on the sidelines as their governments, aid agencies and non-governmental organizations have grappled with environmental issues. However, the case studies reviewed in this paper indicate that some educational institutions in both the developed and the developing countries are taking effective steps to reorient their programmes of teaching, research and public service to incorporate EE/SD themes.

EE/SD must be interwoven with our agricultural education philosophy and practices. However, there may be no "best" way to integrate EE/SD themes into higher education in agriculture. Based on the case studies, there are a number of approaches that could be effectively utilized. Whichever approach is adopted, it is critical that no student leave tertiary level training without a firm belief in the importance of the conservation of natural resources for future generations.

From universities, society expects research and the development of technologies which will increase agricultural productivity with the least possible adverse effects on the environment and human health. From governments, society expects policies which will guide all sectors of the national economy, such that the natural resource base is conserved and well-managed, and sustainable agriculture becomes a cornerstone of development; this means that adequate public funds must be allocated to agricultural institutions, in order to train the human resources that will be required. Lastly, from the UN, donors, governments and NGOs in the more developed nations, there is a need for leadership, technical assistance and financial support, if higher education in agriculture is to achieve the necessary progress, especially in fields related to EE/SD. Partnerships for development need to be established. Concerted and coordinated action from all nations will be required to reach a higher level of understanding of environmental issues and an ability to deal with them on both national and global scales. Environmental education has a critical role to play in this process.

Appendix: Case Study Summaries

CASE STUDY 1: WYE COLLEGE, UNIVERSITY OF LONDON

Country: England, United Kingdom

Authors: Professor M. Redclift
Dr. G. Woodgate

General Information

Land Area: 24 million ha, of which 18.5 m are in agriculture, and 2.5 m are forest/wooded. The climate is moderate/temperate, with adequate rainfall and water sources.

Farming Systems: Livestock-dairy, arable crops, mixed upland rainfed and irrigated horticultural crops. Agriculturally active population: 622,000 (two per cent of total population), of which some 20-25 per cent are women, and ten to 15 per cent are youth.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: Numerous, at local, national, and EC levels, covering land use, farming practices, protection of natural environment, control of toxic chemicals and pollutants.

Institutions: Numerous, both public and private, e.g., the Ministry of Agriculture, Fisheries and Food and the Agricultural Development Advisory Service.

Environmental Regulations: Numerous. Assistance is provided by the Nature Conservancy Council, the Soil Association, local and county councils, the County Trust for Nature Conservation, Farming and Wildlife Advisory Groups.

The Institution

Description: Wye College is essentially the Faculty of Agriculture of the University of London. It is a recognized national and international centre for studies in the natural sciences, rural areas, and the management and economics of agriculture. It is organized into three departments: Biochemistry and Biological Sciences; Agriculture, Horticulture and Environment; and Agricultural Economics. It offers B.Sc., M.Sc., and Ph.D. degrees. There is a strong emphasis on postgraduate research.

Mandate: The academic plan for 1991/92 reads in part: "Wye College...will sustain its distinctive identity as an international centre of excellence for the study of science, management and economics relating to agriculture and the rural environment. The natural and social sciences will continue to be applied to production and trade, to conservation and amenity and to the protection of the environment." The mission statement also refers to "sustainable food production...that is compatible with conservation of natural resources and the protection of the environment...harnessing improved understanding of the natural and social sciences to managing the rural environment to maintain biodiversity, enhance amenity and control pollution....improving living standards of rural communities through appropriate development and by increasing sustainable agricultural production."

Roles and Activities: Wye College exercises its mandate through teaching, research and training. Outreach activities with local conservation groups and farmers are mentioned but not described in detail. Teaching forms part of B.Sc. and M.Sc. degree programmes. An external programme has been created for some 150 non-resident students (mostly from developing countries) leading to the degree of M.Sc. in Environmental Management. The presence of 38 research staff (out of a total staff of 104) attests to considerable research strength. Short courses run by a separate Continuing Education Department offer training to a substantial number of people in mid-career (more than 300 in 1991/92). Outreach is fostered through conferences and specific short courses for public audiences, as well as through contacts with the mass media.

Integration of EE/SD

Integration has been guided by a policy statement, and is now well advanced in the **academic** programme of the College. Pressure for integration has been largely internal, and was particularly facilitated by a restructuring of the College in 1986/87, which brought Agriculture, Horticulture and Environment together within a single department. Pressure from students has also led to increased EE/SD content in existing courses, and to a demand for new degree programmes. Although faculty members in all units other than the Environment Section were slow to accept the need for EE/SD content, several new degree programmes were eventually introduced, including an M.Sc. in Rural Resources and Environmental Policy, a B.Sc. in Countryside Management, and and a B.Sc. in Agriculture and Environment.

Despite this progress, environmental education remains only a small part of the activities of the College. Although environmental issues have become an integral part of many of the newer degree programmes, the environmental content of most degrees is still provided by the natural sciences. Significant social science input is restricted to degree programmes that may be viewed as environmental degrees, e.g., Rural Environmental Studies, Countryside Management, Rural Resources and Environmental Policy and Sustainable Agriculture. Environmental teaching, training and information are offered as separate courses in these degree programmes and several others, including Integrated Pest and Diseases Management. Integration of EE/SD into courses is most pronounced in programmes such as Agriculture and the Environment, Conservation of Soil Fertility, and Environmental Management.

The integration of EE/SD in **research** has been more difficult, although topics such as soil conservation, farming systems, agricultural development, energy and natural resources management are addressed. Staff who are particularly interested in environmental issues spend a significant part of their time on research and have produced much of the material for teaching environmental topics.

The integration of EE/SD in the **outreach** programme of the College appears to be dictated by opportunities for the Continuing Education Department to present short courses and seminars of interest to a particular audience. Short courses on compost technology, countryside management, rural development, and environmental assessment were held in 1991/92 for some 300 mid-career professionals; a training seminar for managers of protected areas was also organized.

Materials and methods for integrating EE/SD into the teaching programmes of the College include laboratory demonstrations, field trials on land belonging to the College, and visits to relevant institutions. Audio-visual materials supplement formal lectures. Library accessions are largely research driven and comprise a large collection of materials on EE/SD. Library services such as inter-library loan arrangements and CD ROM abstracts provide ready access to publications and other materials in the area of EE/SD issued by research agencies, environmental networks and international organizations, including the UN Environment Programme and IUCN.

Students form the ultimate target for the materials on EE/SD. There has been no special training of faculty members in areas of environmental education. However, involvement in joint programmes in which an environmental element is important and in research across departments are activities that increase the competence of faculty members in EE/SD over time. Evaluation and monitoring of the environmental aspects of teaching, research and outreach are not organized as separate activities, but rather, are included within the regular academic audits of courses. In regard to outreach, a "College Public Relations Committee" assists with the design and preparation of publications and other materials for audiences external to the College.

The **environmental message** is still evolving. The creation of an Environment Section has helped to move the College away from an initial position of viewing resource conservation as a means to maximizing production toward a broader concern for the environment. The ready availability of new environmental publications and information is leading to specialization by some faculty members, and faculty research provides important input to the environmental message. Other sources of input include faculty contacts with the Ministry of Agriculture, the Overseas Development Administration, and other government bodies, professional societies, and scientists working in environmental areas in a number of developing countries. Accordingly, the content of the environmental message reflects the research, contacts and interests of the faculty; there is as yet no coordinated effort to generate a comprehensive or consistent environmental message.

Specific audiences outside the College are reached through the activities of the Continuing Education Department and the recently-established Countryside Management Centre. This centre will provide training and short courses as well as undertake research. It will also develop a "rural conservation and development park" where government agencies, voluntary organizations and rural industries can work in close proximity to the College. The College seeks to create public awareness of its mission through various means, including the Public Relations Committee.

Assessment and Lessons Learned

A transformation has occurred in the roles of the College over the past two decades. Traditionally, the College had been a source of education and training for farmers and the agricultural industry. This client sector has on occasion seen EE/SD as detracting from the traditional role of the College by promoting limitations on the use of natural resources for agricultural production. In this situation, and in the absence of a coordinated approach towards environmental education nation-wide, it is not surprising that Wye College and other institutions of higher agricultural education in the UK (eight such institutions are indicated by name) have had to make their way slowly to enrich the environmental content of the curricula.

However, a reassessment of the role and importance of agriculture in the UK itself has taken place, spurred by three developments: increased public interest in environmental issues (e.g., wildlife conservation); the recognition that environmental management is necessary to resolve competing claims for land use; and evidence that local environmental problems have implications regionally, nationally and even internationally. There has been a growth of student and outside interest in environmental matters which has led to considerable activity in the College's Environment Section.

The addition of younger staff, both in agriculture and the environment, has served to strengthen the process of integration. New staff with environmental interests have also been appointed in the economics department and recently, have strengthened the social science group within the Environment Section, providing a focus for research and teaching throughout the College.

CASE STUDY 2: MICHIGAN STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

Country: State of Michigan, United States of America

Authors: Professor F. Bobbitt
Professor D. Johnson

General Information

Land Area (Michigan State): 7.64 million ha, of which 3.54 m are classified as agricultural land. Of this, some 1.7 m ha are cultivated, 400,000 ha are left idle, and 100,000 ha are in pasture. The number of farms has decreased from 203,000 in 1900 to 55,000 in 1992. The climate is characterized by cold winters and warm summers, although it is moderated in parts by the Great Lakes. There are more than 22,000 inland lakes.

Farming Systems: Highly diversified, with emphasis on dairying. Crop production is the source of 56 per cent of farmers' total cash receipts, and livestock account for the balance. Corn (maize), soybeans, sugar beets and beans are major crops. Fruits, vegetables and other speciality crops account for over 40 per cent of receipts from cultivated products. Approximately 143,000 ha are under irrigation. There are some 100,000 full-time, paid agriculture workers, including 55,000 self-employed workers; this figure excludes an estimated 75,000 family workers and 55,000 seasonally hired workers. Total employment in the state is 3,458,000 workers.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: Numerous, at local, county, state and federal government levels, covering administration, environmental protection, natural resources management, and human resources management.

Institutions: Numerous, including those of the Federal Government (14 cited). Public lands are administered by the Bureau of Land Management; the Department of Interior oversees national parks and wildlife refuges; the Department of Agriculture manages forests and grasslands and oversees farm prices, farm policies and soil conservation.

Environmental Regulations: The Environmental Protection Agency sets and enforces clean air and water standards, and regulates the use of pesticides; the state government also plays a role, principally through its Department of Natural Resources and the Department of Agriculture. Environmental impact statements are now required for new initiatives. Non-governmental organizations (33 listed) are primarily national; their concerns include policy, conservation, natural resources, family planning, consumer protection, and others.

The Institution

Description: The College of Agriculture and Natural Resources (CANR) is part of Michigan State University, which was established in 1855 as a "land grant" university to teach "agriculture and mechanical" arts. It offers Ph.D., M.Sc. and B.Sc. degrees in most of the majors, as well as a two-year technical agriculture programme. The case study does not provide staff data for CANR alone; however, in 1992, the University as a whole had some 9,372 staff, including 2,093 tenure-track professors (1,641 men and 452 women), and 1,913 other academic appointments, including extension (1,060 men and 853 women).

CANR offers 19 separate programmes of instruction, including Agricultural Technology and Systems Management, Crops and Soil Science, Public Resource Management, Fisheries and Wildlife, Forestry, Parks and Recreation, and Resource Development; a two-year Agricultural Technology programme is also offered. Enrolment in September 1992 consisted of 400 Ph.D. students, 382 M.Sc. students and 2,521 B.Sc. and two-year students. Women made up 32 per cent of the total student population.

CANR conducts most of the agricultural education, research and extension in the State of Michigan. The College has direct links with state and federal agencies. The budget is funded by the State to the extent of approximately 53 per cent for teaching, 83 per cent for research and 50 per cent for extension. Federal government sources account for approximately 17 per cent of the research and 24 per cent of the extension budget. The latter relies for approximately 26 per cent of its budget on local government support. Tuition fees and miscellaneous income cover the balance of the budget for teaching. Cooperative activities are carried out by the College with federal agencies. Various advisory panels for major commodity groups in the State review the research programme and recommend future directions.

Mandate: The University has no mission statement on environmental education. However, the administration of CANR has given priority to the integration of environmental science into the curricula. An endowed chair (professorship) in "Sustainable Agriculture" has been established as an indication of this priority status. In addition, CANR faculties have already broadened their curricula to include more environmental education, and further changes are proposed.

Roles and Activities: CANR exercises its mandate through teaching, research, extension and outreach. Academic staff commonly teach at all levels (through Ph.D.) and conduct research and extension programmes. Some 420 research projects are cited in the 1992 Annual Report of the MSU Agricultural Experiment Station, of which over 100 deal with environmentally related subjects. Outreach to the public is managed through an office of information. Releases, based primarily on research findings, are issued to 92 Michigan radio/TV stations, 72 newspaper editors, 99 farm editors and 28 women's editors, and on occasion to 130 weekly publications.

Integration of EE/SD

Integration into the **academic** programme of CANR is fairly well advanced, despite the lack of a policy statement on environmental education. The impetus for integration has come from federal and state laws (e.g. concerning pesticides, ground water contamination, antibiotic residues in livestock products) and from a growing sensitivity of individual faculty members to environmental issues.

Integration of EE/SD has been pursued through the introduction of new degree options and new courses, as well as through the introduction of new topics to existing courses. The process has been facilitated by the recent transition to a semester system, which permitted changes to be made during the re-organization of courses and curricula. The graduation requirements of CANR now include a course on environmental impacts, covering such issues as energy resources and use, atmospheric changes, neo-malthusian theory, and impacts of agriculture. In response to student demand and a growing job market for graduates in environmental fields such as conservation biology and waste disposal, the College has proposed a new curriculum entitled "Environmental Science". A committee of faculty members and administrators has developed a curriculum drawn from virtually all departments, and approval by the curriculum committees of the College and the University is expected shortly.

The integration of EE/SD topics in **research** has often preceded and promoted integration in teaching. Most research is funded from external sources which increasingly demand work on environmental matters. This research has, in turn, stimulated much of the introduction of environmental topics in teaching. As may be expected, however, the process is very much *ad hoc*. Similarly, CANR's office of information relies on research findings for many of its media releases; these releases constitute a major form of **outreach.**

Materials for integrating EE/SD into teaching are obtained from external sources (educational and other institutions, research centres, agencies, or the commercial market) and are also produced in-house. Media materials available on loan to staff include 93 titles (out of 744) directly related to environmental education. More than 80 of the 2,080 periodicals available in the University deal specifically with environmental concerns. Publishers of textbooks supply overhead slides, teaching and study guides, videotapes and films. These and other commercial sources assist in presenting environmental topics in the classroom.

The primary targets of CANR's environmental messages are the students and the citizens of the State of Michigan. An additional dimension is introduced by the fact that students come from many states other than Michigan and from many foreign countries. The University has a strong international programme, and CANR has been involved in many foreign assistance projects. **Materials** produced by faculty members are often addressed to professionals in agriculture or agribusiness, but many target home owners, backyard gardeners and others in the general population.

Supervision of curricula and courses with environmental content is the same as for other academic programmes. Thus, each curriculum is the responsibility of a designated department or combination of departments. Courses in the curriculum are supervised by an appointed chairperson and by the departmental curriculum committee. Changes in curriculum or in courses, and new introductions, are approved by the two departmental units and by the curriculum committees of CANR and the University. Departmental "chairs" review with the professors the accomplishments of the past and the plans for the coming academic year. Students evaluate the instruction and their evaluations are communicated to the department chair.

The **environmental content** of CANR's curricula has increased greatly during the last decade; it has not, however, been coordinated or managed so as to generate a comprehensive and consistent environmental message. A wide range of environmental topics is taught, related in particular to the conservation, protection and restoration of the farm environment, the local environment, or specific natural resources. For example, topics in sustainable agriculture deal with crop management, rotation, effects on soil microbial activity, nutrient use efficiency, weed management, and the development of systems to meet environmental constraints in cash crop production. Topics in soil conservation include tillage methods, changes in organic contaminants in the soil, and proper fertilizer application to avoid adverse effects on soil and water.

Assessment and Lessons Learned

In response to growing public and governmental concern with environmental issues, Michigan State University and its College of Agriculture and Natural Resources have significantly expanded their involvement in environmental education. This integration process has been facilited by the rapidly increasing environmental content of the research conducted by individual faculty members; this, in turn, has led to a greater environmental emphasis in both teaching and outreach.

The University's increasing involvement in environmental issues has led to new degree options, to new courses in several programmes, and to the introduction of environmental topics in numerous "traditional" courses. CANR now requires all its students to take a course on environmental issues. A new "Environmental Science" curriculum is under development, and a "chair" has been endowed to underline the importance assigned by CANR to sustainable agriculture.

The environmental message is not consistent, however, and the way in which sustainability is addressed appears to vary greatly among departments and faculty members. The need to integrate socio-economic aspects with natural science aspects is said to be well recognized, and is met to some extent by guest lecturers and research consultants.

Outside CANR, the University offers various programmes with environmental majors in Inter-disciplinary Social Science, in the College of Natural Science, and in a residential college. To date, the University has failed to coordinate these dispersed efforts so as to maximize student opportunity and programme efficiency. The situation is better within CANR and promises to improve further when the "Environmental Science" curriculum is introduced.

CASE STUDY 3: UNIVERSITI PERTANIAN MALAYSIA, FACULTY OF AGRICULTURE

Country: Malaysia

Authors: Professor Wan Sulaiman W.H.
Professor M. Rosli
Professor M. I. Yaziz

General Information

Land Area: 32.86 million ha, of which 13.78 million are suitable for agriculture. 5.3 m ha are cultivated (70 per cent of this is below 300 m); 0.23 m ha are irrigated; forest land occupies some 19.37 m ha, of which 2.13 m ha are reserved as protection forests and 3.45 m ha are designated "conversion forests" (i.e., may be used for agriculture, infrastructure, etc.). Fertile soils: 20 per cent marine/river alluvia. Climate: largely humid-tropical with rain throughout the year (2-3,000 mm with two peak seasons). Uniform average temperature of 27-28° C; abundant sunshine.

Farming Systems: Estate/plantation monoculture of oil palm, rubber and cocoa (80 per cent of total cropped land); smallholder farming of tree, food and speciality crops (20 per cent of cropped land, of which most is run as group farms on an estate basis). Livestock: intensive pig and poultry industry, fewer ruminant/dairy operations. Fisheries: significant marine catch with rising aqua-culture production. Agriculture sector labour force: 1,841,000 (27.8 per cent of the total employed in Malaysia, 18.6 per cent of total population). Estimated participation of women in agricultural labour force is 28.2 per cent; of youth, 1.42 million. Labour shortage in the agriculture sector has caused a shift to less labour intensive crops such as oil palm, an increase in the use of foreign labour and increased mechanization. Other relevant trends are movement out of agriculture by self-employed and unpaid family workers, a decline in the proportion of the population under age 15 and an increase in that over age 64.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A National Environmental Policy was introduced in 1971, environmental directives were included in the Third Malaysia Plan of 1976-80, and the groundwork for a coherent environmental plan was laid in the Fifth and Sixth Malaysia Plans. A New Development Policy issued in 1991 states that priority should be given to "responsible and well-balanced exploitation of natural resources to safeguard the requirements of future generations." Sectoral, sustained development is emphasized in the National Forest Policy of 1972 and the National Agricultural Policy of 1984 (revised in 1992).

Institutions: Governmental ministries and agencies responsible for implementing environmental regulations include the Ministries of Science, Technology and Environment, Agriculture, Primary Industries, Factory & Machinery Department, Land & Cooperative Development, Housing and Local Government, the Forestry Department and the Forest Research Institute, International Trade & Industries, Education, and Information. Universities and research institutes for Agricultural Research and Development (MARDI), for Forestry (FRIM), for Palm Oil (PORIM), for Rubber (PRIM) and for Petroleum are directly or indirectly involved in advisory capacities. Non-governmental organizations with a role in environmental protection include the Malaysian Nature Society, the Agriculture Institute of Malaysia, the Malaysian Society of Soil Science, the Malaysian Plant Protection Society and the Malaysian Ecological Society. Regional and local development agencies have relevant functions at these levels.

Environmental Regulations: Regulations on environmental quality control are embodied in some 37 legal documents issued by ministries.

The Institution

Description: Universiti Pertanian Malaysia provides virtually all of Malaysia's tertiary agricultural education. Its foundation faculties include Agriculture (the institution providing the case study), Forestry, Veterinary Medicine and Animal Science. The Faculty of Agriculture offers a three-year Diploma of Agriculture, and two four-year undergraduate programmes leading respectively to B. Agric. Sc. and B. Hort. Sc. degrees. The four-year programmes have majors in crop science, horticultural science, plant protection and soil science. A minor in extension is offered in collaboration with the university's Centre for Extension and Continuing Education. Masters and Ph.D. research programmes are also offered.

Other faculties offer B.Sc. programmes in Forestry, Engineering, Agribusiness, Resource Economics, Fisheries, Food Science and Biotechnology, Human Development, and Agricultural Science Education. A D.V.M. programme is offered by the Faculty of Veterinary Medicine and Animal Science. Several of the newer faculties were established around core units of the Faculty of Agriculture. Each year, some 800 students enter programmes in or related to agriculture, of which some 250 enrol for the B.Sc. degrees offered by the Faculty of Agriculture.

Outside the University, the Ministry's Department of Agriculture issues a Certificate to junior extension workers who have completed a two-year vocational programme in the Institute of Agriculture. Only one other institution, the Mara Institute of Technology, offers tertiary agricultural education through a three-year programme leading to a Diploma in Plantation Management.

Mandate: The University has mandated environmental education to the Department of Environmental Science in the Faculty of Science and Environmental Studies. The mandate may in the future be shared with a proposed Faculty of Environmental Technology and Management. There is no executive order or mission statement on environmental education in the Faculty of Agriculture. However, the promotion of environmentally sound practices and sustainable agriculture is clearly implied in the faculty's guiding philosophy, which recognizes that the agricultural environment is a system in which climate, soil, water, plants, microbes, animals and humans are constantly interacting. In its Master Plan to the Year 2020, the faculty has made its role more explicit.

Roles and Activities: The Faculty of Agriculture plays its role in the promotion of sound environmental practices and sustainable agricultural development through teaching, research and public service. The most significant contributions originate from the research conducted by the faculty's 88 member academic staff. Environmental themes are also addressed in short courses, conferences and seminars.

Integration of EE/SD

Integration into the **academic** programme started with the first course offerings of the faculty in 1973. Integration was based on the view that agriculture and environment are inextricably linked, and that the conservation of natural resources is vital to agricultural productivity. Incorporating environmental considerations is the role of the course designers (lecturers). A faculty committee has the task of ensuring adequate coverage of EE/SD within the curriculum. The students promoted integration through demands for better applications of agricultural sciences. Environmental issues have introduced a faculty-wide perspective that combines sound environmental practices with sustainable agricultural production. In a planned revision of the curricula, agricultural systems and global agriculture are expected to receive emphasis through a proposed new course on environmental and resource management.

A minor programme dealing with environmental topics could be established within the main agricultural disciplines. This could take advantage of elective offerings accessible to the students under the programme of the Faculty of Science and Environmental Studies leading to the B.Sc. (Environment). This four-year degree programme comprises courses in the natural sciences, the social sciences, computer and mathematical sciences, engineering technology and environmental studies. A general course on the environment is available as an elective. Closer cooperation between members of the Faculty of Agriculture and of the Department of Environmental Studies is seen as an avenue to further integration of EE/SD in teaching and research.

The integration of EE/SD in **research** has been strongly promoted by faculty members. EE/SD was represented in 12 out of 19 research projects in 1988-90, absorbing US$1.5 million or 64 per cent of the research budget. The programme for the period 1991-95 has 15 (out of 26) projects with EE/SD components at twice the previous budget. Among final-year undergraduate research projects, between one-third and one-half had EE/SD contents during the period 1988-92. Research sponsorship or collaboration determines to a considerable extent the areas of EE/SD in which faculty members are engaged. Topics for collaboration have included soil conservation, IPM and biocontrol, and recycling of wastes. Collaborating institutions were the Department of Agriculture, research institutes (MARDI, PRIM, PORIM, FRIM) and others. Formal joint projects have dealt with topics such as management of soil acidity, sloping land technology and urea volatilization. These projects attract international funding. Partners are mainly the commodity research institutes. Within the university, an Intensification of Research in Priority Areas programme, for which research grants are obtained largely from the Ministry of Science, Technology and Environment, involves well coordinated cross-faculty participation in multi-disciplinary research.

The integration of EE/SD into the **outreach** activities of the faculty depends on the topic. Such activities appear to be limited in number and scope. Faculty members participate in the outreach programmes for UPM "Extension Villages" in integrated pest management. Some advisory services are offered *ad hoc* to farmers. Faculty members undertake consultancies and short courses, serve on national committees concerned with agricultural extension and development, and participate in conferences and seminars.

Printed **materials** appear to constitute the main **methods** for integrating EE/SD in teaching. Much of this is obtained from publications from international organizations. Data concerning Malaysia are available in public agencies and from industry sources and are used in case studies or lecture texts. NGOs are a source of useful local materials. The faculty accords low priority to the preparation of EE/SD materials; however, slides, video tapes and radio scripts are available on a full range of topics and are widely used by lecturers.

Students are the major target group for materials on EE/SD. Each student is exposed to elements of EE/SD in the major disciplines constituting the degree programmes. Other target groups for the materials are the faculty members, the general public, and specific audiences such as extension workers, estate/plantation workers and field supervisors. There is no organized system for staff training, as the administration considers the staff to be sufficiently qualified and motivated. Faculty improve competence in EE/SD topics through participation in short courses organized by local and international agencies.

The evaluation of environmental aspects of individual courses is minimal. An external examiner/assessor evaluates student performance in each degree curriculum once every three years and is expected to comment on the substance of the curriculum. Students evaluate the courses they have taken. Evaluation of research projects takes place under terms set by donors.

No effort appears to be made to generate a coherent and consistent **environmental message** for the faculty. The input from research on environmental topics presumably finds use in teaching in an *ad hoc* manner. The case study states that the curricula give understanding and confidence to students who enter jobs dealing with such environmental matters as landscaping and water treatment, policy research, and enterprise management. Environmental messages related to sustainable agriculture are said to be covered comprehensively, though some specific areas may deserve deeper treatment in student instruction.

Assessment and Lessons Learned

Sustainable agriculture is not a new idea in Malaysia, but the linkage to environmental topics constitutes a new approach. The idea that agriculture should be reoriented from production/profit maximization to being environmentally friendly and sustainable has already found wide acceptance in Malaysian agriculture. The government has responded through the promulgation of laws and regulations; however, these are as yet insufficiently coordinated and jurisdiction is scattered among ministries. Enforcement is hampered by lack of staff, infrastructure and funding.

In the Universiti Pertanian Malaysia, concern for environmental issues is held by most faculties. However, an integrative course on EE/SD is not yet a requirement for all students. The case study presents conflicting points of view concerning EE/SD in the Faculty of Agriculture. It states that environmental elements have been given importance within the framework of the present curricula while also noting that curricula are too rigid to allow substantial inclusion of environmental and sustainable agriculture as separate courses or as part of existing courses. The limited number of faculty members with suitable EE/SD perspectives and field experience is also mentioned as a constraint, as is the reluctance on the part of some to move from a disciplinary to a multi-disciplinary approach. A general shortage of EE/SD reference materials for teaching has also hampered integration.

The case study provides a number of recommendations to remedy these deficiencies. Within the Faculty of Agriculture, staff should become more proactive in respect to the integration of EE/SD, and more oriented towards multi-disciplinary teaching and systems research. Linkages with the Department of Environmental Science should be strengthened. Lastly, a course which unifies and integrates EE/SD should be required for all students.

In regard to outreach, the case study suggests that this is primarily a function of the Centre for Extension and Continuing Education. However, the study recommends increased cooperation between the Centre and the Faculty of Agriculture, in order to generate improved materials and methods.

CASE STUDY 4: CHIANG MAI UNIVERSITY, FACULTY OF AGRICULTURE

Country: Thailand

Author: Professor Pongsak Angkasith

General Information

Land Area: 18.2 million ha of agricultural land, of which 0.16 m ha is pasture land and 0.39 m ha is forest land. Climate: subtropical monsoon with hot, rainy and cool seasons; average temperatures are 24-30° C; rainfall 1,050 mm on plains, up to 4,000 mm in mountain areas.

Farming Systems: Monoculture, responding to export promotion by government. Major crops: rice (60 per cent of arable land), maize, cassava, sugar cane, and legumes (soybean, mung bean). Other major cash crops are rubber, fruit and kenaf. Livestock: cattle numbers have increased from 989,000 in 1978 to 1,223,000 in 1988; buffalo numbers have decreased from 1,214,000 in 1978 to 628,000 in 1988. Pig and poultry production is substantial. Fisheries production is not indicated but is a major source of protein for the Thai population. Agriculture accounts for about one-quarter of GNP and employs more than two-thirds of the labour force. Of the total population of about 54 million, 58 per cent (31 m) is rural and engaged in agriculture. The agricultural labour force is estimated to consist of 52.6 per cent men and 47.4 per cent women.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: One of the three main objectives of the country's seventh Five-Year Plan for Economic and Social Development (1992-96) is, "to accelerate human resource development concerning quality of life, environment, and natural resources." Specifically regarding the environment, the plan proposes an "environmental policy which will promote the knowledge [about] and campaign [against] pollution of the environment by chemical substances, including agricultural chemicals"...and a "natural resources development policy that addresses appropriate use and conservation of forest, mining, land and water resources."

Institutions: The Ministry of Science, Technology and Environment is responsible for environmental control, conservation, development and promotion. Other governmental and non-governmental organizations (not named) and universities are said to be delivering information to the public and promoting environmental awareness. A role for the Ministry of Agriculture and Cooperatives is indicated.

Environmental Regulations: Thailand's national legislation concerning the environment was revised in 1991, providing guidance at national and local levels, particularly concerning development of agricultural land.

The Institution

Description: Chiang Mai University is located in the north-western region; it is one of six institutions in the country which offer tertiary education related to agriculture. The Faculty of Agriculture is organized into eight departments offering programmes that lead to B.Sc. or M.Sc. degrees. Major degree programmes include Agricultural Extension, Agronomy, Animal Science, Entomology, Horticulture, Soil Science and Conservation, Agricultural Systems, Post-harvest Technology, and Agricultural Economics. Total enrolment in 1993 stood at 804 for B.Sc. programmes and 233 for M.Sc. programmes. The faculty has three experiment stations available for teaching/training, each representing a major agro-ecosystem of northern Thailand.

Mandate: The case study does not indicate whether a specific mandate for environmental education has been given to the faculty. The faculty appears to have taken its cue from the policy stated in the Educational Development Plan embodied in the Seventh National Economic and Social Development Plan, i.e., that students should be offered programmes related to the environment.

Roles and Activities: The Faculty of Agriculture promotes sound environmental practices and sustainable agriculture through teaching, research and extension. The faculty offers no programmes or courses exclusively on environmental themes. The case study states that 29 (11.5 per cent) of 253 courses offered in the B.Sc. programme are strongly related to environment and sustainable agriculture, as are 37 (24 per cent) of 153 courses offered in the M.Sc. programme. Environmental assessment is said to comprise a substantial part of programmes dealing with biological pest control, soil conservation, and forest resources. Sustainable agriculture is a core element of M.Sc. programmes in Agricultural Systems and in Agro-forestry.

A great deal of research is done by the faculty. Of 71 studies listed by field, 30 were in agricultural systems, an outgrowth of the interdisciplinary research conducted since 1970 by the faculty's Multiple Cropping Centre. M.Sc. candidates are involved in the research projects, which can be undertaken at highland research stations, including those operated by the government's Department of Agriculture. Faculty members participate in research on the Sustainability of Agricultural Systems within the South-east Asian Universities Agro-ecosystems Network.

Outreach is concentrated on agricultural extension. The faculty conducts community service training courses for farmers in nearby areas on problems of concern to them, e.g. pest control; faculty members are also involved in development projects in the northern region. The faculty encourages students to participate in campaigns with an environmental aspect, such as tree planting and garbage collection.

Other faculties also offer courses with environmental and ecological themes. The Faculty of Science, for example, offers numerous ecology courses, as well as a six-course unit on "Environmental Risk Assessment". The Faculty of Engineering has an 18-course programme on "Environmental Engineering". Social and economic dimensions of environmental issues are explored in eight courses offered by the Faculty of Social Sciences.

Integration of EE/SD

The impetus for integration has arisen from a growing awareness of social needs at local, regional and national levels; the environmental problems associated with cash crop cultivation are cited as an example. The Educational Development Plan (within the National Five-Year Plan) has also served as a stimulus.

Integration starts with the professors and lecturers at the departmental level. Proposals for change must typically be cleared by the Faculty Committee, submitted to the University Committee for policy scrutiny, and forwarded to the University Council for approval. If approved, the course contents are developed by the originating Department Committee, reviewed by the Faculty Academic Committee, and given detailed consideration by the University Academic Committee.

Integration of environmental themes has proceeded for some time without proposals for new courses, and has been especially fostered in programmes of soil conservation, integrated pest management, and biological control. However, new courses with a special emphasis on EE/SD have recently been approved, and will be offered in the next two to three years; these include a B.Sc. in Forest Resources, a B.Sc. in Landscape Design, and programmes in Agro-forestry and Land Resource Management at the M.Sc. level.

The integration of EE/SD in **research** has been facilitated by the faculty's many projects, which are undertaken in all the major agro-ecological zones of northern Thailand. A wide range of topics is addressed, including farming systems, field and tree crops, seed production, post-harvest technology, animal nutrition, and biotechnology applications. Cooperative arrangements exist with the Agricultural Department, the Land Development Department, and the Agricultural Extension Department, as well as with universities in China, Japan, and the USA. Cooperative arrangements and a good reputation have led to joint research with five International Agricultural Research Centres and to research sponsorship by seven international donors.

The integration of EE/SD in the **outreach** activities of the faculty has centred on the provision of training to highland farmers in the safe use of agricultural chemicals. Training programmes for agricultural extension

officers are mounted regularly, and cover various EE/SD topics. A programme called "Environmental Conservation Training for Youth Volunteers" was organized by the faculty in 1992. Public awareness related to EE/SD is promoted by two radio programmes (including the university radio station) and two newspapers. Other activities, such as journal articles, seminars and workshops, are directed primarily at students and professionals, rather than the general public.

Textbooks and journals (including the technical journal of the Faculty of Agriculture) are the principal **materials** used in teaching. The majority of these are purchased from more developed countries, but some are obtained through exchange programmes or from non-governmental organizations. The faculty library contains more than 46,000 books and subscribes to some 110 journals. Audio-visual aids and computer programmes have been created by faculty and M.Sc. students for use in teaching and research. Equipment for research related to EE/SD is also available. Experiment stations are used for field demonstrations and for research by M.Sc. candidates and faculty members.

Students are the principal target group for the materials, many of which touch on EE/SD topics. At the B.Sc. level, about 90 per cent of the students receive information on environmental problems through instruction, and all M.Sc. candidates receive general information on environmental issues and sustainable agriculture through teaching and research. Other target groups include extension workers, local area farmers, and the general population. The case study makes no mention of an organized system for staff training in EE/SD. Some staff members are said to have received national or international specialized training.

An Academic Committee is charged by the faculty to look after monitoring and follow-up, and to provide guidance for new programmes. Outside experts and former students undertake programme evaluations every three years.

The faculty has not enunciated a consistent or coherent **environmental message**. To date, the emphasis of outreach programmes has been on the safe use of pesticides, and the consequences of deforestation. Student instruction focuses on conservation issues at the farm level, and on natural resource management in relation to such topics as soil science, plant protection, integrated pest management, and cropping systems. Environmental messages are expected to permeate the proposed new curricula in Agro-forestry and Land Resource Management.

Assessment and Lessons Learned

The faculty believes that its approach and internal structure (including a Multiple Cropping Centre) provide a firm, interdisciplinary foundation for dealing with EE/SD topics. In particular, the faculty's "systems analysis" approach integrates the biophysical and socio-economic aspects of environmental management.

Interest in EE/SD has increased as a result of the environmental problems in northern Thailand, and is seen as the best catalyst for the development of new programme offerings to students. Involvement in development projects through faculty research and outreach helps to ensure that teaching is based on real-world situations. There is considerable scope for collaboration with other faculties in the development of new programmes. Impetus for new courses or programmes also arises from collaboration in inter-university networks, from expert consultations and seminars on EE/SD topics, from staff and student exchange visits, and from the issues debated in the periodic curriculum reviews.

Among the recommendations implicit in the case study is the need for a faculty policy on EE/SD. Staff experience and expertise in EE/SD should be enhanced. More support is required for long-term research on EE/SD topics; this would, in turn, reinforce the integration of themes in teaching. More up-to-date materials and equipment are also needed.

CASE STUDY 5: UNIVERSITY OF IBADAN, FACULTY OF AGRICULTURE AND FORESTRY

Country: Nigeria

Author: Professor E. Olabode Lucas

General Information

Land Area: 81.2 million ha of arable land, including 44.9 m ha of grassland and wooded grassland, 36.3 m ha of farmland and plantation land, and 8.8 m ha of forest. Cultivated land amounts to 34 m ha. Of the total land area of 923,768 sq. km., 40 per cent is Sudanese savannah, 35 per cent is Guinean savannah, eight per cent is derived savannah, ten per cent is lowland rain forest (this has decreased from more than 30 per cent in 1951), four per cent is swamp and mangrove forest/coastal vegetation, and three per cent falls within the Sahel. Soils are mostly ferruginous, but are very variable across the ecological zones of the country. The climate is tropical, with distinct wet and dry seasons. Mean annual rainfall varies greatly, even at the coast (4,300 mm in Bonny, 1,750 mm in Lagos), and decreases to levels as low as 625 mm in Maiduguri to the east. Scanty and irregular rainfall in the north (e.g., Kano) makes drought a common feature of this region. Adequate to abundant water resources in most parts of the country, with four major drainage systems (Niger river, Lake Chad, Atlantic Ocean east and west of the Niger river). Temperature (average-maximum) ranges from 20° to 35° C.

Farming Systems: Where there is abundant land and a scattered population, as in the northern part of the country, shifting cultivation and a bush-fallow system are still widely in use, especially by smallholders. Where land is scarce and rural population density high, as in the south-east, agriculture is practised on the same piece of land year after year. The principal subsistence crops are yams, maize and cassava. Smallholder export crops include cotton, groundnuts, sesame seed, cocoa, palm produce and rubber. Large-scale arable farming with irrigation is carried out in the north. Livestock populations are estimated at 13.9 m cattle (beef and dairy), 23.1 m sheep, 34.5 m goats, and substantial numbers of pigs and poultry. Ninety per cent of the fisheries production is from small-scale operations. From self-sufficiency in food prior to 1960, Nigeria became a major food importer; in 1983, food accounted for 18 per cent of total imports. The share of agriculture in the Gross Domestic Product, which stood at 60 per cent in the early 1960s, dropped to 40 per cent in 1989.

Some 40.4 million people are actively engaged in agriculture, out of an estimated total population of 123 million (1991 census). Women have important roles in agriculture, supplying 80 per cent of the labour for food crop production, 65 per cent for cash crop production and almost 100 per cent for processing and marketing of smallholder production. Several schemes were mounted in the past three decades to increase the participation of rural youth in agriculture, but without ultimate success.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A national policy on environment exists. Its objectives are to conserve and use the environment and natural resources for the benefit of present and future generations, to "restore, maintain and enhance the ecosystems and ecological processes essential for the functions of the biosphere to preserve biological diversity and the principle of optimum yield in the use of natural resources and ecosystems", to raise public awareness and participation, and to foster cooperation in the prevention and abatement of transnational pollution. Nigeria's agricultural policy deals with improved protection of agricultural land from drought, desert encroachment, soil erosion and floods.

Institutions: A Federal Environmental Protection Agency was established by decree in 1988. It advises the federal government on national policy and priorities, prepares periodic master plans for development of environmental science and technology, promotes cooperation with foreign and international agencies for protection of the environment, and cooperates with governmental bodies at federal, state and local levels. The national environment plan identifies implementing agencies. For example, the Ministries of Agriculture and

Natural Resources at federal and state levels are responsible for the establishment of botanical and zoological gardens, game reserves, forestry and fisheries activities, plant quarantine and soil erosion control. Extension functions are implied in these responsibilities.

Non-governmental organizations concerned with environmental problems (14 are named) lobby for sound environmental and conservation policies. Their activities include raising public awareness, education, training and extension, and in some cases project coordination, management and direct implementation.

The Institution

Description: The University of Ibadan is one of 19 federal universities in Nigeria providing tertiary level agricultural education and training. In addition, Nigeria has 55 intermediate level agricultural training institutions offering programmes leading to ordinary (two-year) and higher (four-year) diplomas. The Faculty of Agriculture and Forestry offers five-year B.Sc. (Honours) degree programmes. Options under these programmes were reduced recently from eleven to the following six: Crop/Soil, Crop Protection, Animal Science, Agricultural Economics/Extension, Forestry/Wildlife Management, and Fisheries Management. The fourth year of these programmes is devoted to "practical studies", including field work and extension. The fifth year is divided among core and specialization courses, and includes research by the student under the guidance of academic staff. There are a number of postgraduate courses offered under each of the options. The faculty is organized into seven departments corresponding to the options (with Ag. Economics and Ag. Extension separately serving one option). In other faculties, the Department of Chemistry and the Department of Geography offer courses related to agriculture and environmental management.

Mandate: There is no specific mandate for environmental education either at the university or the faculty levels. The National Universities Commission has been empowered by decree to set minimum academic standards for courses in university curricula. Adherence by the university/faculty to the standards set for curricula in agriculture, forestry/wildlife management, and fisheries began with the 1992/93 academic year. By percentage of total courses, environmentally related courses constitute more than half of each of the three curricula, reflecting the attention given to the topic in the standards set by the National Universities Commission. The Nigerian contribution to UNCED (1992) contained a draft "National Conservation Education Strategy" drawn up earlier by the Federal Ministry of Education in collaboration with the Nigeria Conservation Foundation (an NGO). Cross-curricular introduction of conservation education was recommended and has been made part of the National Policy on Education. A start is to be made in primary and secondary schools, with tertiary education to follow.

Roles and Activities: The Faculty of Agriculture and Forestry engages in teaching, research and public service, including consultancy and extension. Environmental education is an integral part of the various agricultural degree programmes. Environmental topics are included in courses on soil conservation, irrigation, and pesticide use, but no specific courses on environmental issues are offered. Environmental topics are clearly in evidence in the research conducted by faculty members, which addresses such topics as fertilizer and pesticide residues in soil, pollution, and land preparation techniques; a list of 22 environmentally-related research topics is given in the case study. Short courses are provided for the staff of government institutions and NGOs; these often address environmental issues, particularly those related to the use of pesticides and fertilizers. Extension and outreach take various forms. The faculty's pilot programme on rural development covers 31 villages in two different agro-ecological zones (tropical forest and derived savannah). An on-farm adaptive research project undertakes activities on farms over a large area (1,650 sq. km.; pop. 468,000). Individual faculty members conduct outreach relevant to environmental issues as part of their research by giving expert advice to farmers visiting the campus, by arranging demonstrations, and by preparing and distributing extension bulletins and other technical materials. Faculty members are also involved in the preparation of position papers for government agencies and consultancy activities.

Integration of EE/SD

EE/SD themes were introduced into the **academic** programme as early as 1949, with an emphasis on the use of natural resources to increase agricultural productivity. With only one general B.Sc. Agriculture programme, scope for the integration of environmental topics was limited until 1967/68, when additional degree options were offered. The faculty has aligned its syllabus to comply with the minimum standards for courses recently set by the National Universities Commission; environmental concerns are well represented in these minimum standards. The Commission accredited the programmes of the faculty in 1990 and is expected to review its accreditation regularly. Further integration of EE/SD in the academic programmes may be expected when the cross-curricular programme on conservation, proposed under the National Education Policy, is introduced to tertiary education. An indication of the interest of the faculty is given by the proposal to the University Senate that the name of the Department of Agricultural Biology be changed to the Department of Crop Protection and Environmental Studies.

The integration of EE/SD in the **research and outreach** components of the academic programme has proceeded largely on the initiative of individual faculty members. However, a substantial part of the research programme relates to environmental issues. Similarly, many of the extension and outreach activities address environmental concerns.

A wide range of **methods and materials** is used. The faculty targets both students and the public (particularly farmers). There is no organized system for training staff in environmental issues. Journal articles and audio-visual presentations are useful for students. Technical bulletins are prepared in local languages and in English for distribution to literate farmers. Messages via radio and television reach more people but do not appear to have sufficient impact on their own. Billboards, practical field demonstrations and drama presentations on site are considered most effective in communicating environmental messages to farmers. Materials on global or foreign environmental issues are obtained from international agencies. In the last five years, information on national environmental problems has become available, predominantly on the effects of petroleum oil pollution on farmland, drinking water and aquatic resources. Non-governmental organizations concerned with environmental issues provide the faculty with publications. However, the supply of journals and textbooks dealing with environmental issues is inadequate and presents a handicap, especially in teaching.

No concentrated effort appears to have been made to generate a coherent or consistent **environmental message**. As a central theme, the faculty promotes the use of environmental resources for profitable agricultural activities in ways that avoid degrading the environment. Supporting this theme are messages concerned with soil conservation (new technologies such as alley cropping and no-till farming); integrated pest management (resistant varieties and biological control technologies); sound cropping practices (mixed stands and supply of nutrients other than by chemical fertilizer application); and techniques for weed management.

Assessment and Lessons Learned

Enrolment in agricultural programmes is declining because students increasingly perceive agriculture as a low-income sector. Enrolment is also falling as a result of the relatively low priority accorded to agricultural education by the federal government. Inadequate funding is held to be responsible for the lack of staff trained in environmental topics, for deficiencies in research and outreach activities, and for inadequate facilities and equipment. There is a dearth of experienced communicators to disseminate environmental messages to semi-literate farmers. Faculty outreach activities with villages have been weakened by the withdrawal of Rockefeller Foundation funding, although Ford Foundation funding of on-farm adaptive research still continues.

Stronger linkages with NGOs are advocated; in particular, funding from NGO sources is viewed as more stable than federal support. However, an Ecological Fund set up by the federal government promises to improve funding for teaching and research in universities. New degree options are envisaged, including Agriculture and Environment, and Rural Environmental Studies (within the B.Sc. Agriculture programme). The former option is likely to be modelled on the programmes at Wye College in the U.K. The introduction of special courses on environmental economics is also considered essential.

CASE STUDY 6: UNIVERSITY OF ZIMBABWE, FACULTY OF AGRICULTURE

Country: Zimbabwe

Author: Professor Lindela R. Ndlovu

General Information

Land Area: 390,759 sq. km., of which 86 per cent is used for agriculture, 13 per cent is in national parks and state forests, and one per cent is urban. There are five agro-ecological regions based on annual rainfall, which decreases from east to west.

Farming Systems: Agro-ecological Zone 1: two per cent of land area, 900-1000 mm rainfall, 74 per cent large commercial, 24 per cent communal, two per cent small scale. Products: forestry, fruit, livestock, plantation crops such as coffee and tea. Zone 2: 15 per cent of land area, 750-1000 mm rainfall, 74 per cent large commercial, 22 per cent communal, four per cent small scale. Products: cash crops (tobacco), food crops, horticulture, livestock. Zone 3: 19 per cent of land area, 650-800 mm rainfall, 49 per cent large commercial, 43 per cent communal, eight per cent small scale. Products: livestock, fodder crops, maize and cotton. Irrigation required. Zone 4: 34 per cent of land area, 450-650 mm rainfall, 34 per cent large commercial, 62 per cent communal, four per cent small scale. Products: livestock, wildlife, drought tolerant crops. Irrigation required for many crops. Zone 5: 27 per cent of land area, less than 400 mm rainfall, 35 per cent large commercial, 45 per cent communal, 20 per cent national parks. Products: cattle and game ranching.

Soils are mostly of granitic origin; agriculturally important red soils are from igneous and metamorphic rocks other than basalt; vertisols from basalt are found in the north and extreme south. Seasons: five months dry, cool, occasional night frost, a short (two month) dry, hot season with max. temperatures 30° C at high altitudes and 44° C at low altitudes, and a wet hot season (five months) with the main rains. Dry spells and droughts are frequent problems in Zones 3-5.

Communal areas support about 60 per cent of Zimbabwe's population of ten million. All communal households are involved in agriculture. Women are highly involved as few are in formal outside employment; 35 per cent of male heads of household have jobs and live elsewhere, leaving farming work mostly to women. Households headed by women make up between 12 per cent and 20 per cent of the total. Youth assist on family farms. Government efforts to provide separate income generating opportunities for youth have not proved successful. Commercial agriculture employs about half of the total sector labour force of some 600,000. Women make up one-quarter of the employed, more during peak seasons as casual labour.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A national environmental policy as a single instrument does not yet exist. However, a policy statement requiring inclusion of environmental education in all primary and secondary school programmes has been issued by the Ministry of Education.

Institutions: Institutions include the Agricultural, Technical and Extension Service (AGRITEX); the Departments of Natural Resources, National Parks and Wildlife, Fisheries, and Environmental Health; the Forestry Commission; and the universities. Environmental NGOs include the Environment and Development Agency (ENDA), and the Zimbabwe Environmental/Energy Research Organisation (ZERO). Four other NGOs and two farmers' unions enter the debate on environment and access to natural resources.

Environmental Regulations: Numerous, covering natural resources, forest/plantations, parks and wildlife, mines and minerals, communal lands, and water. One act deals with pest/disease control in cash crops and another with control of hazardous substances and pollution. The emphasis seems to be on "control"; "extension" is only implied, and for the most part, the acts do not address the communal areas where

environmental problems tend to be most severe. Current initiatives being undertaken by the Ministry of Environment and Tourism aim to harmonize the various governmental policies and legal instruments that deal with natural resource management so as to avoid conflicts arising from multiple authorities and to enable enforceable implementation.

The Institution

Description: The University of Zimbabwe at Harare (in Mashonaland Central) is one of two government-funded universities in the nation. Both universities have a Faculty of Agriculture. Two agricultural colleges, both in Mashonaland West, offer diploma programmes. Two of the five teacher training colleges, those in Midlands and Mashonaland Central, cover agriculture. The Faculty of Agriculture of the University of Zimbabwe enrols less than five per cent of the University's 8,000 students. It offers a Diploma programme in Agricultural Systems Analysis. Its three-year B.Sc. Agricultural Honours degree has options in Agricultural Economics, Animal Science, Crop Science and Soil Science. Options approved but not yet offered are in Agricultural Education and Extension, and in Horticulture. Jointly with the Faculty of Engineering, a B.Sc. in Agricultural Engineering Honours is available. M.Sc. programmes have options in Crop Protection, Animal Science and Agricultural Economics, and M.Phil. and D.Phil. research degree programmes are also available for most options.

Mandate: The faculty has no formal mandate for environmental education. There is no stated policy that requires a minimum content identifiable as EE/SD in courses. However, as land and natural resources are the basis of agriculture, the faculty has a primary concern for the protection of the environment and has therefore dealt with environmental issues. A "National Conservation Strategy" was drawn up by the government in 1987 but has not been implemented. In the wake of UNCED, a national conference discussed *Agenda 21* and urged universities to include environmental issues in the curricula.

Roles and Activities: The Faculty of Agriculture is involved in EE/SD mainly through teaching and research. No single course deals specifically with EE/SD, but at least 16 courses deal with the protection and conservation of the environment, sustainable use of natural resources, and/or sustainable agricultural systems. Several research projects (donor-funded) are on EE/SD topics, e.g. soil conservation, reforestation, and the alleviation of grazing pressure in communal areas. The faculty has no formal outreach programme, nor has it had strong linkages with extension services. This, it is believed, has deprived students (and faculty members) of "hands-on" experience. A faculty committee has recently recommended the establishment of an outreach programme which would include EE/SD messages. A curriculum review is ongoing, and seeks to include EE/SD more emphatically in courses.

Integration of EE/SD

Integration into the **academic** programme has been piecemeal and based on the initiative of individual lecturers. Thus there is no separate or coherent programme for EE/SD. Sixteen courses are named in which substantial integration has taken place at the instigation of individual staff members with an interest in environmental education, and new courses are being proposed. Such new courses require approval of the Academic Board of the Department concerned and subsequently of the Faculty Board. The exposure of students under the various B.Sc. options is substantial, with estimates ranging from 21 per cent of the course content in Animal Science, to 32 per cent in both Soil Science and Agricultural Economics, to 42 per cent in Crop Science.

The integration of EE/SD into the **research** component of the academic programme has, as a result of the faculty's general orientation, come to emphasize smallholder and communal agriculture. Research projects implemented by faculty members deal with improvement of cattle production and small ruminant productivity, socio-economic issues in natural resource management for sustainable agriculture, introduction of forage legumes in common property grazing areas, and maize-groundnut crop management in resettlement areas. Substantial research (and in many cases teaching) on topics related to the environment, natural resources and sustainable agriculture is also carried out elsewhere in the University, particularly in the Centre for Applied

Social Studies and the Department of Biological Sciences. Individual members of the Faculty of Agriculture are involved in some of these projects. The University has plans for an Institute of Environmental Studies which, when established, would coordinate research on environmental topics and provide a basis for a university policy on environment.

Textbooks (foreign), publications of international organizations, and copies of journal articles are the main **materials** used by faculty members in teaching. Few audio-visual aids are used. Other sources of information include the Ministry of Environment and Tourism and NGOs specializing in environmental issues. In general, research by faculty members on EE/SD topics is not transformed into materials for teaching. Reports and proceedings of relevant meetings at national, regional and international levels comprise another source of materials. The lack of useful materials in environmental education is keenly felt.

The principal target group for environmental **messages** is the student body, and in particular, students in undergraduate programmes. There is no organized system for academic staff training. Preparation specifically for EE/SD is through literature reviews, discussions and workshops. Some lecturers have received training in environment/natural resources/sustainable agriculture as part of their graduate degree programmes. Two staff members have had a brief exposure to environmental education approaches and natural resource economics in North America. There is no formal supervision of the environmental aspect of the faculty's programmes. Department Chairs, the Dean of the Faculty, and professors may, at their discretion, monitor the quality of the environmental content as part of monitoring the academic quality and relevance of courses offered.

As the integration of EE/SD topics in the academic programme has been rather *ad hoc*, no coherent and consistent **environmental message** has so far been adopted by the faculty. The conservation, protection, and restoration of farm environments and agricultural resources provide the focus for teaching. Specific topics with environmental contents include grazing management, range management and conservation, pest control including IPM, weed control, agrometeorology, irrigation principles, tillage principles, cropping systems, agro-forestry, and soil conservation. More directly related topics are environmental impact assessment, natural resources use, environmental management, energy use, and conservation of genetic resources. The topics are dispersed among numerous courses (16 are cited, including economic and sociology courses) but are usually not clearly labelled as EE/SD.

Assessment and Lessons Learned

A recent proposal to establish an outreach programme involving the faculty has prompted a much needed review of the curriculum with a view to giving greater emphasis to EE/SD. It may also lead to the formulation of a clear policy statement on EE/SD, the lack of which is a constraint to further integration and development. The lack of a policy on EE/SD content and integration, combined with the absence of mechanisms for monitoring and evaluating environmental messages, has also led to mixed results as regards relevance and applicability. In research, the findings are viewed in isolation and important linkages, especially to socio-economic aspects, are missed. Deficiencies in equipment and skills hamper the production of quality instructional materials.

Several initiatives are in progress. One is a proposal to integrate all EE/SD activities into a multi-disciplinary offering of the University. Another is the establishment of an Institute of Environmental Studies, which would coordinate and integrate environmental elements into teaching, research and outreach programmes and would enable better use of the expertise scattered across faculties. An important goal is to obtain funds for an endowed chair in EE/SD, thus lending status to the field.

CASE STUDY 7: AMERICAN UNIVERSITY OF BEIRUT, FACULTY OF AGRICULTURAL AND FOOD SCIENCES

Country: Lebanon

Author: Professor Adib T. Saad

General Information

Land Area: 10,452 sq. km., of which 65,000 ha is forest land, 360,000 ha is arable, 67,000 ha is irrigated, and 145,000 ha is in pasture. There are eight agro-ecological regions: three near the coast, with mild winters and warm, humid summers; three on the elevated Beqaa plain, with continental climates; and two in mountainous areas, with cold winters, temperate summers, and adequate rainfall. Soils: calcareous, low in phosphorus and organic matter.

Farming Systems: Main agricultural products: cereals, potatoes, olives, fruit. Livestock estimates: 55,000 cattle, 400,000 goats, 250,000 sheep, 12 million poultry. Fishing is underdeveloped. Official agricultural statistics have not been issued since 1973. Estimated population in agriculture: 40 per cent of 3.4 million total population; agricultural labour force made up mostly of people working only part time in agriculture. FAO estimates that of a total labour force of 670,000, those in agriculture have declined from about 40 per cent in 1960 to 20 per cent in 1970, and reached a low of 50,000 people or 7.3 per cent in 1984.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A national policy on environmental matters does not exist. However, the recently created Ministry of the Environment has been charged with "establishing general policies for environmental affairs".

Institutions: Institutions charged with implementation of environmental laws include the Ministries of Agriculture, Health, and Interior. In April 1993, the Lebanese Parliament passed an act establishing a Ministry of the Environment. Non-governmental, non-political organizations have been active in environmental protection and sustainable development. Most of the existing 21 NGOs were founded during the last decade. The case study specifically mentions the Lebanese Union for the Conservation of the Environment, the Committee for Environmental Care, the Society for the Protection of Nature and Natural Resources in Lebanon, and the Tree Society.

Environmental Regulations: Many laws have been issued over the past century, but implementation in recent times has been far from satisfactory. By general category, legislation covers health and sanitation, protection of forests, agricultural development, mining and quarrying, protection of wildlife, and protection of scenic and tourist sites.

The Institution

Description: The American University of Beirut is a private educational institution with a regional mandate for the Near East. It is the university at which agricultural education was first introduced in Lebanon. Since 1979, three other faculties offering higher agricultural education have since been established, at Saint Joseph University, at the Lebanese University, and at the "Saint Esprit" University. All of these follow the French tertiary education system (five-year Diploma) and none of them has facilities (land) for conducting research. The Faculty of Agricultural and Food Sciences enrols about 400 students, more than half of whom are in the B.S. Agriculture programme; some 75 students are in M.S. programmes. B.S. candidates spend two semesters at the faculty's 100 ha Agricultural Research and Education Centre in the Beqaa plain to gain hands-on experience. Between 1956 and 1992, the faculty produced 3,054 graduates; approximately half of these were nationals of Lebanon, while the rest were from other countries in the Near East region. The faculty is

organized into five departments: Agricultural Economics and Development; Animal Sciences; Crop Production and Protection; Soils, Irrigation and Mechanization; and Food Technology and Nutrition. M.S. degrees are offered in ten majors.

Mandate: The faculty has no formal mandate for environmental education, and there are no directives from the University to include environmental topics in the curricula or research programmes. However, environmental problems related to agriculture - such as soil erosion, nutrient exhaustion, and water scarcity - are acute; as a result, individual faculty members have increasingly turned their attention to environmental issues.

Roles and Activities: The Faculty of Agricultural and Food Sciences is involved in EE/SD mainly through teaching and research. There are no outreach or extension programmes, but many activities are open to the general public, including lectures, conferences and exhibitions. The faculty's major external contributions are made through the work of its graduates, through published research findings, and through consultations by individual staff members. Regional activities are emphasized.

Integration of EE/SD

Integration into the **academic** programme has, until recently, been limited to the efforts of individual faculty members. Years of civil strife have greatly hampered efforts. For example, a programme on Environmental Engineering was initiated in 1973, only to be discontinued in 1978. Mention is made of the recent introduction of elective courses on landscape horticulture and "Ecology for Students of Agriculture". The latter course deals with the environmental/resource limitations of farming systems, and the development of sustainable agriculture. Elsewhere in the University, the Faculty of Health Sciences offers a three year B.S. degree programme in environmental health.

There is some cooperation with the Faculty of Engineering and Architecture, principally on courses dealing with soil conservation and irrigation. The Faculty of Agricultural and Food Sciences is presently endeavouring to formulate a multi-disciplinary, inter-faculty, M.S. programme in Environmental Sciences, which would be implemented in cooperation with the Faculty of Health Sciences and the Faculty of Arts and Sciences.

The integration of EE/SD in **research** has proceeded more rapidly than in teaching. Current research topics include: soil and water degradation; waste water treatment; plant and livestock genetic resources utilization and improvement; and farming under marginal conditions. The Faculty of Engineering and Architecture has recently established an Environmental Research Centre for teaching, research and service to the community; the Centre is open to other faculties.

The faculty has collaborative research agreements with the National Agricultural Research Institute of Lebanon, the International Centre for Agricultural Research in Dry Areas (ICARDA) and the Arab Centre for Studies on Arid Lands and Dry Areas (ACSAD). Active contacts are maintained with Faculties of Agriculture in Jordan, the United Arab Emirates, and the Agricultural Research Institute in Nicosia, Cyprus.

The primary target group for environmental messages is the student body of the faculty. At the undergraduate teaching level, students observe demonstrations and gain hands-on experience at the University's Agricultural Research and Education Centre. Graduate research programmes involve many different exposures to environmental issues. There is no organized system for academic staff training in EE/SD. Most faculty members obtain relevant materials for use in teaching and research from professional journals, books, publications issued by international organizations, national agencies, and NGOs, information provided by the mass media, and from their own research and contacts. The faculty has not yet developed a procedure for evaluating and monitoring the environmental aspects of the instructional programme.

As the faculty does not have a plan in place for promoting EE/SD integration, a consistent and coherent **environmental message** has not been developed. Environmental topics are addressed within the context of courses on soil and water management, the use of fertilizers and crop protection chemicals, and ecologically

sound cropping systems. Twenty-one topics related to EE/SD are listed in the case study, including: diversification; crop-livestock interactions; the role of crop rotation in weed control; the use of legumes for improved soil fertility; biotechnology and biodiversity; insect ecology and biological control; sheep production; fruit tree production; and studies on farming under marginal, arid conditions.

Assessment and Lessons Learned

The situation in Lebanon is changing rapidly with the ending of civil strife. The Ministry of Agriculture has yet to rebuild the extension service and collect agricultural statistics that could guide planning. Until now, NGOs have been the active agents in regard to environment and sustainable development. A general rise in public awareness of environmental issues and concern for sustainable development augurs well for the future. A new Ministry of Environment has been established, and a national policy of environment may not be far away. This may provide the impetus for policies and actions to promote EE/SD.

A Faculty Programme Planning and Curriculum Development Committee is currently reviewing the academic programmes, with a particular view to incorporating environmental issues and sustainable agriculture in future programmes. At the graduate level, efforts to develop a multi-disciplinary programme on environmental sciences continue.

Greater integration of EE/SD will require more staff, more research facilities and equipment, and more training. Limited funding emerges as the main constraint. Recommendations for the future may be summed up by quoting the report of a workshop at the University's first Alumni European Convention in 1991, which called for the establishment of "a Research Institute specialising in environmental protection and water science. The Institute is to develop a multi-disciplinary programme incorporating empirical, policy systems research and offer consultancy services to national, regional and international organisations."

CASE STUDY 8: INSTITUT AGRONOMIQUE ET VETERINAIRE HASSAN II

Country: Morocco

Author: Professor M. L. Firdawcy

General Information

Land Area: 71 million ha, of which 9 m ha is agricultural land, 5.8 m ha is forest land, 3.2 m ha is grazing land, 0.9 m ha is irrigated, and 1.87 m ha is left fallow. Agricultural possibilities depend on the availability of water. Only 2.8 per cent of the country receives more than 400 mm rainfall per year. Great variations in climate exist.

Farming Systems: In mountainous areas, livestock, fruit trees and specialized agriculture predominate. Desert oases have evolved their own systems of water provision and agricultural production. Cereals and legumes are the major field crops. Pastoralism is widely practised. The agricultural population includes 1.45 m farmers, three-quarters of whom work less than five ha and who, as a group, occupy only one-quarter of the total cultivated land. Family farms predominate, in which women contribute some 44 per cent of the labour and youth under 15 years of age contribute 14 per cent, mostly without remuneration. Rural areas have high under-employment. Agricultural (paid) employment stands at 80 per cent of total employment in rural areas.

Policies and Institutions Concerned with Sustainable Development in Agriculture

A national policy does exist. A "sous-secretariat" was created in 1992 to coordinate the protection of the environment. It is expected to prepare a national action plan for the environment, including education and training in environmental management. Ministries, enterprises, universities, professional societies and other NGOs are expected to provide input to the action plan and in due course to receive guidance from it.

The Institution

Description: The Institut Agronomique et Vétérinaire Hassan II (IAV Hassan II) is an institution of higher agricultural education, research and development. It is in essence a Faculty of Agriculture providing primary, secondary and tertiary post-baccalaureate education (French three-cycle system) to students from Morocco and other nations. The Institute has one campus at Rabat and another at Agadir, and operates two experimental farms. Students are candidates for degrees based on "memoirs d'ingenieurs", "theses veterinaires" and "theses d'Etat des Sciences Agronomiques." Each of the three cycles is of two years duration. IAV Hassan II is organized into 35 departments; of these, Soil Sciences, Plant Ecology, Rural Economics and Management, Pastoralism, and Forestry are directly concerned with environment and sustainable development. Since its formation, the Institute has contributed to the education of 3,400 students. The Institute has some 350 lecturers/researchers and 250 academic assistants; facilities include forty laboratories, and numerous field research sites within Morocco and France. Particular emphasis is placed on the education and training of future teachers and researchers.

Mandate: The royal decree establishing IAV Hassan II specifies that the Institute should concentrate on development of agriculture and the local environment. This decree has been taken seriously from the inception of the academic programme.

Roles and Activities: The Institute focuses on teaching and research. Short-term assignments to "discover nature" and to learn about "ruralism" (village level studies) are woven into second year studies. Similar assignments in the third year cover agricultural production systems in three seasons, during which students live with farmers. The fourth year includes an intensive period of studies on the constraints to development in a small local area. Although there is no formal outreach programme, these assignments reach people in about

250 villages of 200-1,000 inhabitants each and about 120 farms in different agro-ecologies. Research at the higher levels reaches many rural inhabitants and people active in agriculture and rural development, through personal contact, publications, conferences and special courses requested by national and international organizations.

Integration of EE/SD

From its inception, IAV Hassan II has oriented its academic and research programmes to provide a detailed understanding of the role of natural resources and environmental factors in sustainable agriculture. The impetus for such an orientation came from four tenured professors on the staff of the Institute. Rural studies and on-farm experiences are designed to provide first-cycle students with a real-world context in which to place their studies of botany, biology, physiology, and geology. Similarly, second-cycle students are expected to learn how to analyze environmental issues, against a background of courses in soil science, plant and animal ecology, and forestry.

Major research activities touching on environmental issues are usually undertaken as part of third-cycle doctoral thesis work. Theses may deal with soil science, water management, plant production and ecology, forestry, pastoralism and social science. Research at the Institute is said to constitute a significant proportion of the scientific research in Morocco. IAV Hassan II faculty collaborate with other faculties in Moroccan educational institutions, with the Institut National de la Recherche Agronomique, and with universities and research centres in eight European countries and five US states. Staff are members of professional organizations and NGO working groups. They are also involved with numerous national and international bodies (23 are named), including the Association Marocaine pour la Protection de l'Environnement, the Association Marocaine pour le Droit de l'Environnement, the UNESCO Man and Biosphere programme, Environment and Development in Africa and the Third World, UNEP and FAO.

Methods of instruction include the "discover nature" and "rural life" courses for first-cycle students, the on-farm studies carried out by second-cycle students, and the extensive use of the Institute's laboratories. Students and lecturers/researchers contribute materials chiefly through theses and publications. Changes in courses are evaluated for educational appropriateness at the level of the Department or by a committee (conseil) of the section involved. National and international donors arrange regular evaluation studies of the Institute and its work.

At IAV Hassan II, production concerns have been modified to embrace the rational management of natural resources in the service of sustainable development. The aim is to ensure a decent livelihood for the population, in terms of both food and income, while safeguarding the productive capacity of the ecosystems. Many of the **environmental messages** originate from the Institute's research, which covers such topics as: soil conservation; irrigation and environment; useful plants and genetic resources; forest management; improvement of crop and livestock production; treatment and use of waste water; treatment and use of agro-industrial waste and by-products; control of pollution, etc.

Assessment and Lessons Learned

With its long record of education, research and development activities in sustainable agriculture and the environment, the IAV Hassan II is considered a pioneer among developing countries. The Institute views the agricultural scientist of tomorrow not only as an expert in food production, but also as a promoter of sustainable agriculture and environmental protection. Through its alumni, it has had a major impact on the EE/SD policies followed by the Ministry of Agriculture and by other governmental agencies.

The formulation of sound environmental messages requires interdisciplinary collaboration, at local, regional and international levels. Educational programmes must be linked to the real world, such that students are given a feel for the rural areas, their people, and the inter-relationships between sustainable agricultural production and the environment. The Institute gives special attention to socio-economic aspects.

CASE STUDY 9: UNIVERSIDAD DE CHILE

Country: Chile

Author: Professor V. Hermosilla

[Note: This case study offers a generalized, national perspective rather than an individual institutional profile.]

General Information

Land Area: Total land area of 75.7 million ha (without Antarctica). Productive use is made of 35 per cent of the total land area, as follows: cultivated: 4.7 m ha; livestock raising: 12.8 m ha; production forests: 8.8 m ha. The terrain is largely unsuitable for the production of high-yielding field crops, as there are few plains between the Andes and the coast where the environment is not fragile. The climate is highly variable, both along the great length of the country and within its valleys. The northern, coastal zone is characterized by desert. A cold and arid steppe dominates the altiplano in the north and in the extreme southern region. The central region has a Mediterranean climate, with dry summers and rainy winters. In the south, a maritime climate prevails, without a distinct dry season.

Farming Systems: Economic factors have dictated major changes in the agricultural sector. The contribution of agriculture and forestry has declined steadily as Chile has become predominantly urban, and now stands at only nine per cent of GNP (including 0.9 per cent from fisheries). Profound structural changes have taken place over the last two decades. The promotion of exports has shifted interest away from staples (rice, maize, oilseeds) for domestic consumption to fruit (grapes, apples, nectarines, pears, kiwis, etc.) for export. Forestry and fisheries have retained their export orientation.

The rural population is decreasing both in absolute and relative terms; recent statistics show that it has fallen from 24.2 per cent of the total population in 1972 to 15.4 per cent in 1992 (out of an estimated total population of 13 million in 1992). Agriculture absorbed more than one-sixth of the country's active labour force, accounting for nearly 0.8 m people in the 1985/86 agricultural year and four per cent more in the following year. Since then, the stimulation of fruit production for export has led to a further increase. Unemployment in agriculture is notably lower than the average for the country. Recent development of capital intensive, conglomerate enterprises has taken land away from the small holders (campesinos), whose numbers have been reduced but not in proportion to the land lost by the small-scale sector. Hired, full-time agricultural workers numbered 208,000 in 1964/65, but only 120,000 in 1986/87; temporary hired labour, including many workers from urban areas, rose from 147,000 to 300,000 during the same period. Unpaid family labour makes up 11-12 per cent of the total agricultural workforce. In 1982, 14 per cent of rural households were headed by women. The proportion of women in the paid agricultural labour force rose from 8.6 per cent in 1970 to 13.8 per cent in 1985.

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A concern for safeguarding the environment is reflected in Chile's national constitution; however, this has been largely rhetorical, and during the 1980s, economic pressures led to unfettered exploitation of natural resources. A national environmental policy *per se* does not yet exist, although parliament is currently debating an "umbrella" package of environmental legislation; in addition, the Ministry of Education has formulated a "Policy for Environmental Education in Chile".

Institutions: A National Commission on Environment was created in 1990, in order to develop a national policy, formulate umbrella legislation, and define institutional arrangements; it also expected to guide environmental education and extension. The National Commission is the apex body for similar commissions at regional, provincial and community levels. Four ministries have important responsibilities in regard to the environment. The Ministry of Mines is concerned with the reduction of contamination from mining activities.

The Ministry of Health regulates waste disposal, water quality, and environmental standards in the workplace. As discussed above, the Ministry of Education has formulated a national environmental eduation policy. The Ministry of Agriculture has created a special, multi-disciplinary unit (Sistema Medio Ambiental del Sector Silvoagropecuario), which integrates forestry, agriculture, livestock, research, development, and policy; the aim of this unit is to introduce a concern for social equity and environmental protection into the traditional activities of the Ministry; a Department of Sustainable Development has also been created.

Fourteen NGOs are named, of which three are said to have a significant impact. The National Committee for the Defence of Flora and Fauna is active country-wide, and promotes the conservation of ecosystems and natural resources with a view to improving the quality of life of all citizens. The Environmental Research and Planning Centre holds scientific meetings, with the aim of promoting economic development which combines both social equity and environmental conservation. The National Network for Ecological Action, an organ for more than 80 environmental groups, seeks to create a powerful national ecological movement and an "ecological society".

Environmental Regulations: The Chilean parliament is debating comprehensive legislation related to the environment, based on a document collecting some 2,000 laws, standards and regulations which have been issued in the past. To date, environmental legislation has addressed specific problems by sector, and many different approaches have been taken. The umbrella law under discussion is expected to try to reconcile the needs for economic growth with the conservation and improvement of the environmental heritage.

Tertiary Agricultural Education in Chile

Description: A Council of Rectors coordinates 22 "Universidades Estatales Regionales" (Regional State Universities), which are supported to primarily by public funds. Since 1980, more than 40 private universities have been established exclusively for teaching, including some with laboratories to support teaching of the natural sciences. Fifteen universities currently have faculties devoted to agriculture, forestry and/or livestock; of these, six also undertake research and extension (all six are Regional State Universities). In addition to bachelor (ingeniero) degrees, most confer masters degrees in various specialities and Ph.D. degrees in science areas. Mention of environment or ecology is now made in a number of degrees, and "postitulos" are awarded that contain the word "environment".

Total 1991 enrolment for a first degree in agriculture-related fields in all universities was 3,432. Subjects include agro-industry, food technology, rural development, plant and animal production, fruit cultivation, soil management, irrigation and drainage, mechanization and energy, agricultural economics, viticulture, etc. Enrolment for veterinary medicine was 1,425, and for forestry and forest products 1,454. In general, universities have shifted degree programmes to reflect changes in the job markets. Agricultural extension does not appear to feature in university programmes, either as a degree or as a department of faculty.

Mandate: There is as yet no mandate for environmental education. The environmental sciences are still in an embryonic state of development in Chile. The efforts of the Ministry of Education to develop an environmental education programme may give rise to specific mandates in due course.

Integration of EE/SD

Topics on EE/SD have had a slow introduction in first **academic** degree teaching programmes of universities. Often such topics appear under other names. Somewhat greater has been the infusion of EE/SD topics in graduate studies, possibly in response to increased environmental concern among the public and the government. Overall, however, the paradigm of economic advancement, even at high environmental cost, prevails.

Some 200 university scientists deal with environmental topics in their **research**; between 1988 and 1991, 67 research projects dealt with environmental issues. Funds for research generally, and for environmental research in particular, are very scarce in Chilean universities. Outreach programmes, including extension, are

CASE STUDY 10: FUNDACION UNIVERSITARIA AGRARIA DE COLOMBIA

Country: Colombia

Author: Professor J. O. Gaitan Arciniegas

[Note: This case study offers a generalized, national perspective based on responses from eleven faculties of agriculture in institutions of higher education.]

General Information

Land Area: 114 million ha, of which 3.8 m ha is cultivated, 23.4 m ha is improved grazing land, 16.3 m ha is natural savannah, and 52.5 m ha is forest land. Terrain/climate: The three cordilleras of the Andes, and the two coasts (Pacific Ocean and Caribbean Sea) give rise to many different ecological conditions, ranging from humid tropical to dry tropical. Rainfall is generally high but variable (average 1,500-2,000 mm per year, range 500-12,000 mm), relative humidity is high at lower altitudes, temperature averages 24° C, depending on altitude; ten per cent of the territory has a temperate climate and ten per cent a cold climate.

Farming Systems: Major field crops are maize, rice, sorghum, cane sugar, soybean, potato and cotton. Coffee is the main tree crop, grown on about one million ha. Other tree crops are cocoa, plantain/banana and fruits. Livestock production is mainly beef cattle, but pig and poultry production has grown rapidly. Fisheries production from maritime and fresh waters is low and decreasing. Agriculture contributes 16.8 per cent to gross domestic product, having steadily decreased over time as a proportion of total GDP. A modern sector of about 200,000 large-scale enterprises owns title to 70 per cent of the registered land. The small-scale "campesino" sector consists of 2,200,000 parcels of usually poorer quality land of less than 50 ha (325 m parcels less than three ha), yet produces 70 per cent of the food needs of urban consumers. Infrastructure and services for production, processing and export exist for the commercial sector, in which chemical control of insect, disease and weed pests is widely practised.

The rural population has decreased in relative terms, falling from 70 per cent in 1950 to 30 per cent in 1990. Absolute numbers, however, have continued to grow; between 1973 and 1985, for example, the rural population increased from 8.9 m to 9.5 m. Campesinos make up one-third of the total labour force. The production systems do not allow the 53 per cent of campesinos who are fully occupied in working their land to engage in wage labour. The 47 per cent who work for wages are absorbed in agricultural production (70 per cent) and in livestock raising (25 per cent).

Policies and Institutions Concerned with Sustainable Development in Agriculture

Policies: A national policy can be derived from the national constitution of 1991, which contains such phrases as "property has an inherent ecological function"; "state intervention in various economic areas serves...to safeguard a sound environment"; "in regard to the environment, the law sets limits to free enterprise"; "environmental policy is an integral part of the national development plan". These constitutional injunctions are leading to legislation and standards that seek to define a blueprint for sustainable development with appropriate economic, social and environmental features. The 1990-94 National Plan for Economic and Social Development established objectives in some areas, such as the conservation and rehabilitation of renewable natural resources, the prevention and mitigation of adverse impacts of productive activities on the environment, and the introduction of environmental considerations in processes of planning and development.

The National Ministry of Education published a National Plan for Environmental Education in 1991. A government office for higher education (Servicio Publico de la Educacion Superior) was established by law in 1992; one of its objectives is the "promotion of the conservation of a sound environment and of an ecological education and culture."

Environmental Regulations: Laws and regulations on the use and conservation of renewable natural resources are numerous, but their enforcement is weak and ecosystems continue to deteriorate.

Tertiary Agricultural Education in Colombia

Description: Post-secondary education is offered at three levels, in 235 institutions (50 of which have been accorded the rank of university). Of the 552 programmes on offer, only 35 are in agriculture, and only 13 of these are at the "professional" level. The programmes include agronomy, veterinary medicine, agricultural production, sanitation/health, forestry, fisheries, engineering, agricultural technology, agro-industry, agricultural sciences, economics, and administration and management. Student demand for enrolment in agricultural programmes has been decreasing for some years and currently stands at 2.2 per cent (of 40,000 students entering tertiary educational institutions annually) for agronomy and 2.1 per cent for veterinary medicine (the two programmes in greatest demand).

Of the ten most sought-out universities offering professional level programmes, seven are public and three private. Private universities are in ascendancy as state subsidies to public universities are being progressively reduced, leading to a drop in the quality of educational programmes. This trend is particularly evident in agricultural science programmes. One result is the emergence of a more elitist body of students at agriculture-related private universities.

Mandate: There is no mandate for environmental education at the national level, or within any of the 11 universities consulted in preparing the case study. Faculties of agriculture have found it difficult to define a specific environmental role, partly because environmental topics are so broad and seem to extend over virtually the entire curriculum, and partly because new programmes are difficult to mount in periods of decreasing financial support. Initiatives by the National Ministry of Education may in due course lead to university and faculty policies, and to funding that will promote environmental education.

Roles and Activities: Colombian universities implement their academic programmes primarily through teaching. However, there is little information on local ecosystems, and faculty members who are interested in EE/SD themes are frustrated by the lack of two-way communication with the real world of Colombian agriculture. Little research is undertaken. On average, faculties of agriculture have three researchers on their staff, who must make do with an annual faculty allocation for research of about US$70,000. Environmental topics are likely to be covered only incidentally under these conditions. Outreach and extension programmes are absent from the curricula of faculties of agriculture.

Integration of EE/SD

The curricula are oriented toward large-scale commercial agriculture. There is limited interest in sustainability and no demand so far for technologies which make agricultural production more sustainable. Where integration has occurred, it has resulted from the initiatives of individual faculty members and student demand. Although a recent curriculum review led to the introduction of several environmental topics in agricultural programmes, no overall environmental policy was created nor was a coherent environmental message established. Environmental topics tend to be dispersed across many courses, most of which have non-environmental titles. In some cases, a basic ecology course is offered in a faculty other than agriculture; these courses do not include environmental education and are not linked to agricultural production. Students are the main target of EE/SD messages. The general public is reached via radio, but no systematic efforts are undertaken to disseminate environmental information. Newspapers and television programmers display little interest in EE/SD topics.

Assessment and Lessons Learned

The present lack of interest in EE/SD within the large-scale sector is the result of a production orientation which fosters antagonism toward conservation and environmental issues; within the small-scale "campesino" sector,

lack of interest in EE/SD relates to the inability to command the research and extension efforts that would be needed. In these circumstances, it is not surprising that there are no university programmes to promote EE/SD in agriculture, and that the curricula of faculties of agriculture reflect the production orientation of the large-scale sector in which employment may be found for its graduates.

The universities and their faculties of agriculture have little involvement with extension, and the concept of sustainable development is given scant attention. Research is very limited, and tends to deal with ecological issues rather than environmental problems or the site-specific problems of Colombian farmers. Interest does exist, but in the absence of faculty follow-up to general university injunctions that are not backed by funds, efforts to introduce EE/SD themes are sporadic and based on the personal interests of individual faculty members; such efforts remain isolated and largely ineffective. Although there is considerable student demand for EE/SD, this has not yet evoked a response from the faculty as a whole.

The recommendations in the case study amount to a call for a change in attitudes. Universities cannot be expected to act alone, but should participate in plans and activities financed by government and agricultural enterprises. There is a critical need for research and extension to address the environmental damage being caused by large-scale agricultural operations and excessive deforestation in areas inhabited by campesinos.

Faculties of agriculture should do their part to promote these wider changes. They should seek to overcome the limitations created by the absence of extension (and hence, the lack of contact with farmers, communities, and "real world" problems) and by the minimal role played by environmental research to date. The faculties should respond to the general directives of their university administrations. In particular, the concept of sustainable development must be buttressed by a demonstration of the economic advantages to be derived. The most viable strategy for promoting the integration of EE/SD themes into the activities of faculties of agriculture will be through curricula review and reform.

Integration of Environmental and Sustainable Development Themes into Agricultural Extension Programmes: Case Study Review

Prepared by Michael Stocking,
Reader in Natural Resource Development,
with the assistance of Scott Perkin,
Research Associate, School of Development Studies,
University of East Anglia,
Norwich NR4 7TJ, United Kingdom

ANNEX 5

Summary

This paper synthesizes and consolidates the information contained in ten case studies of agricultural extension services of both developing and developed countries and the extent to which environmental and sustainable development issues have been integrated into their programmes and work schedules.

Extension agencies have adapted in a variety of ways to the new environmental imperatives. Some topics such as the use of farm inputs have been widely tagged onto production goals. Soil and water conservation and alternative cropping systems have relatively easily been accommodated in extension messages. Other issues such as biodiversity and habitat conservation present greater difficulties for extension, and the concept of sustainable development itself remains elusive.

There are a number of positive indicators that extension agencies have the potential to adapt. Some agencies have changed substantially without vast increases in resources; some topics are amenable to the production goals of land users and can be relatively easily incorporated into the general extension message; other organizations may be willing partners in transmitting the environmental message. However, the danger of overloading extension agencies with new demands has to be recognized.

The paper concludes with elements of what might constitute "good practice". National level legislation is appropriate to give an underpinning to policy, and environmental programmes are strongest where the extension agency has an explicit environmental mandate. Liaison and collaboration are essential features in the delivery of the message: no single agency will have the skills and breadth of experience to cope with all environmental issues; there is particular potential for collaboration with environmental protection agencies and NGOs. Staffing and training deserve special examination with the need indicated not only to develop specific environmental training modules for existing staff but also to integrate environmental issues throughout the initial extension training programme. Specialist environmental staff may be needed, and the recruitment of female extension agents could greatly enhance the effectiveness of environmental concerns. Programme planning should be carried out in both top-down and bottom-up ways, so that the interests of land users and of society are captured. A wide range of target groups should be addressed, including rural and urban populations, input suppliers and credit organizations. Both the message and the methods need to be tailored to suit particular groups; special efforts are urgently required to reach rural women and the poor. A major weakeness currently is the assessment of the effectiveness of current programmes; evaluation is indicated with measures that can monitor changes in behaviour.

Full integration of the environmental message is the desirable long-term goal. A fully integrated programme cannot dispense with its environmental components, thereby ensuring that the goal of sustainable agricultural development itself will be more sustainable.

Introduction

This paper addresses two crucial aspects of agricultural development:

Sustainability and Environmental Management: a composite theme which describes a concern that our utilization of natural resources must consider long-term and off-site impacts as well as the protection of the resource base for future users;

Agricultural Extension: the educational process of advising and assisting farmers in getting the best use of agricultural land and other natural resources in their care in the context of prevailing economic, technical, social and institutional conditions.

Each aspect has its own imperative. Sustainability was a 'buzz-word' of the 1980s but it expresses both the recognition that much that has been promoted in the past as agricultural development cannot be maintained in the future, and the understanding that there are ways of using the environment which can effectively be continued in perpetuity. Agricultural development must clearly change emphasis from the maximization of short-term outputs which may be attractive in economic terms but which cannot be sustained to the promotion of 'environmentally-friendly' technologies which meet both the needs of society and the demands of land users.

Agricultural extension similarly is under pressure. In developing countries, extension services are often hopelessly overstretched: huge demands are typically placed on a few professionals, labouring in institutions which have difficulty in adapting to new challenges. In developed countries, extension is increasingly being privatized and farmers forced to pay for services which now have to be cost-effective. Short-term demands are favoured over the long term. Both developing and developed country situations mean that extension services have little room for manoeuvre. New demands must be rigorously examined as to their content and necessity.

Logic, however, suggests that environmental issues should be at the heart of extension messages. Society demands that farmers take a responsible, long-term perspective to the land and other natural resources. Individual users want to protect for their own benefit, and that of future generations, the resources in their keeping. Environmental and sustainable development themes would then be at the forefront of agricultural extension because of the logical public and private interests of both society and individuals. If logic were the only criterion, this Consultation would be unnecessary. Many other factors come into play in determining policies, priorities and procedures. Some institutions are reluctant to change; some individuals may personally gain by not accepting environmental concerns (albeit at the cost of other individuals). The case studies will demonstrate some of these factors.

In focussing on the integration of environmental and sustainable development themes into agricultural extension, this paper has three principal objectives:

(1) The situation now: To examine the nature and scope of involvement of agricultural extension institutions in environmental and sustainable development;

(2) Potential for integration: To identify roles, strategies and appropriate approaches through which agricultural extension institutions could contribute to the implementation of *Agenda 21* of UNCED;

(3) Improvement of present functions: To suggest policy changes and lines of action to improve the contribution of agricultural extension in environmental management and sustainable agricultural development.

The paper will address these three objectives through the information contained in ten specially-commissioned case studies. Through an examination of a cross-section of extension institutions in developed and developing countries, it asks: have institutions adapted to the new priorities? As currently constituted, can they adapt? What changes might assist the process of achieving sustainable development through agricultural extension?

The Case Studies

Ten case studies were commissioned by FAO to examine the integration of environmental and sustainable development themes in agricultural extension services in a number of countries and states representative of different continents, agro-ecologies, population densities and stages of development. Table 1 lists the different case studies, by country and author.

Table 1: Case studies by country, state/province and author.

No. Country	State/Province	Case Study Author
1. United States	Nebraska State	Charles A. Francis
2. Ireland	Whole country	J. Mannion
3. Brazil	Parana State	Joaquim Severino
4. Mexico	Whole country	Jose Feliciano Ruiz Figueroa
5. Malawi	Whole country	S.J. Muyaya
6. Burkina Faso	Whole country	Sibiri Traore
7. Indonesia	Java Island	Soemitro Arintadisastra
8. India	Andhra Pradesh	H.N. Byra Reddy
9. Syria	Whole country	Hazam Al-Samman/Rajab Ali
10. Egypt	Whole country	S. Sallam

N.B. Case study numbers as above will be used throughout this paper. Reference to a particular country will imply specific relevance to the state/province highlighted in the country case study.

From the case studies, the range of environmental conditions and identified problems is large. Parts of the most populated countries in the world [1,7] are set alongside some of the least populated [2]; nearly the highest population density in the world [7] with one of the lowest [6]; a very large area [4] with a relatively small [2]; humid [7], sub-humid, seasonal rainfall [4,5,8], temperate-maritime [2], temperate-continental [1,3] against largely semi-arid to arid [6,9,10]. It is not surprising, therefore, that the environmental problems are different and that the threats to sustainable land use quite varied. Key differentiating criteria include:

- climate: e.g. the draw-down on water resources; the erosivity of the rainfall; rate of mineralization of organic matter in the soils;
- quality of the resource base: land use history; proportion of currently usable land; water availability; soil types and distribution; agro-ecological zones;
- state of national development: e.g. resources available for education and extension; farmers' resources; access to technology, input supplies, credit, private and public sector services;
- intensification of land use: e.g. the technologies employed; the demand placed on the intrinsic quality of the natural resources; point and non-point source pollution;
- population factors: density, growth rate, proportion in agricultural activity, change in rural-urban balance; related effects on land pressure and consumptive use of resources, especially pasture and woodland.

Some of the most urgent environmental issues identified in the case studies (country case studies signified by numerals 1 to 10 as above) are:

Deforestation and Loss of Biodiversity [1,2,3,4,7]: Forest cover is declining rapidly in some of the developing countries: Mexico reports an estimated one million hectares loss of forest annually over the last 30 years; Malawi's deforestation is 3.5 per cent annually. Ireland has insufficient protection for broad-leaved woodlands and valuable wetland areas. Nebraska has suffered from the loss of wetland habitats and natural prairie ecosystems.

Water Shortages and Stream Pollution [1,2,4,5,6,8,10]: Nebraska reports multiple demands on its rivers, depletion of aquifers and non-point source pollution by nitrates and pesticides of rivers and aquifers. Ireland notes the specific problem of acidification of lakes and rivers by conifer plantations. In arid environments, water conservation and erratic river flow are seen as primary problems, while Malawi lists the drying and siltation of water bodies. Mexico describes water pollution by sewage and industrial effluents; Ireland has the problem of safe disposal of farmyard wastes and silage effluent; and India the difficulty of dealing with both industrial and agricultural wastes.

Agricultural Intensification [2,3,4,10]: Ireland notes the particular problems of national and European Community policy on intensification conflicting with the conservation of wildlife habitats, especially wetlands. Brazil identifies the excessive use of fertilizers, and Mexico the increasing commercialization and development of agro-industries as problems.

Egypt has worries over pesticide and herbicide use promoted by agricultural intensification.

Soil Erosion, Land Degradation and Desertification [3,4,5,6,9,10]: The deterioration of soil and land resources is identified specifically by only half the case studies; nevertheless, it is widespread, leading to impacts both on- and off-site. Only arid countries such as Burkina Faso and Egypt mention desertification, and there is some confusion as to whether this is a specific process. Egypt and Syria note the problem of salinization. Land degradation in the case of Burkina Faso appears to be related to agro-ecological zone, the resilience of which decreases with increasing aridity.

Aesthetic Impacts [2]: Only Ireland emphasizes the deterioration in landscape beauty and quality of visual amenity through the impact of farm buildings and what are seen as unsightly afforestation schemes. This is very much a developed country concern. Signs are that countries such as Mexico are realizing that sugar refineries, pulp mills and other agro-industries are potential threats to the quality of life.

Amidst the range of concerns, certain prevailing issues are clear:

(1) Agriculture, through a variety of social, economic, cultural and political forces, is being forced to utilize natural resources in ways that are potentially unsustainable;

(2) Land pressure is threatening a number of scarce wildlife and ecologically-vulnerable habitats: wetlands, forests, woodlands, and prairies receive specific mention;

(3) Agricultural intensification brings with it a number of almost-inevitable deleterious side-effects for the environment: soil and water pollution; erosion, acidification and salinization; deforestation and desertification;

(4) Immediate production and longer-term productivity concerns are evident from the case studies, where current usage must be undermining future capability to use natural resources. Several countries (e.g. No. 6) are completely reliant upon rural land use which supports most of the population; yet certain sectors of that land use such as livestock and exploitation of wood resources inevitably undermine the resource base and must be unsustainable at current levels.

Agricultural extension, if it is to address the range of potential problems and possible solutions, has to have an extraordinarily flexible response. The challenge is immense. The case studies will bring out the different ways in which extension agencies have adapted to the environment and sustainable development mandate.

Current Roles and Activities of Agricultural Extension Services in Environmental Issues

Mandate for Extension Agency to Include Environmental Issues

Extension agencies draw their environmental mandates from a variety of sources, ranging from direct departmental instructions through to national level decrees and legislation. All our case studies claim an environmental mandate, but the degree to which this is made explicit in terms of direct policy instruction to the extension agency is variable (Table 2).

Table 2: Type and source of mandate to include environmental issues.

Country	Type and Source of Environmental Mandate
1. United States	Promotion of "environmental well-being" is specifically mentioned in the agency's mission statement.
2. Ireland	Instructions from the director of the agency.
3. Brazil	Legislation passed in 1977, creating the extension agency, gives implicit mandate. Environmental mandate also implied by other state legislation, including Law No. 8,014 of 14/12/84, which states that: agricultural soil is a natural heritage which should be preserved; and that the use of agricultural soil will only be permitted under planned conditions, according to the capacity of the soil and with appropriate technology. Extension agency has made environmental objectives explicit in sub-programmes: e.g. the Integrated Forest Development Programme is to "promote environmental education".
4. Mexico	Recent explicit mandate in 1992 Programme for the Productive Conversion of Agriculture, which calls for the reorientation of extension services to meet a programme objective of agricultural sustainability.
5. Malawi	Government agricultural policy states that one of the objectives of land husbandry is to promote long term sustainable use of natural resources.
6. Burkina Faso	Mandate to extension expressed in two national plans: National Plan for Desertification Control and National Programme for Common Property Resource Management. Extension agents have five natural resource/environmental themes in work programme.
7. Indonesia	National level legislation and provincial policies on environment and natural resources. Memoranda from the Ministry of Agriculture on river basin and watershed management, land conservation and refforestation.
8. India	Instructions from the Central Government's Department of Forests and Environment. Circulars from the Directorate of Extension (Ministry of Agriculture) and the Indian Council of Agricultural Research.
9. Syria	Defined task of extension agency is to "train farmers to...implement...agricultural production plan(s) (which) ensure protection and conservation of natural resources."
10. Egypt	Decree of Ministry of Agriculture and Land Reclamation. Reinforced by executive order from within extension agency.

Because of the difficulty of determining the immediacy of the environmental mandate to the agency, no attempt here is made to determine the degree of explicit/implicit insistence on incorporation of the issues into the work programme. For some agencies, the mandate merely expresses what extension workers are already doing; for others, it may have led to a reorientation and new programmes.

Stated Roles and Activities of Extension Agency

The case studies deal in detail with a large range of activities and ways in which the agency mandate is exercised (Table 3). All extension agencies directly address farmers and land users with a variety of programmes and techniques. Often-mentioned activities are: translation of research into extension messages; diagnostic studies and research trials; mass media campaigns; technical meetings; practical courses; on-farm demonstrations; visits and individual contacts; and seminars. More general public awareness features as an important role for some agencies [7,8,10]. Few of these roles and activities could be said to be specific to environmental and sustainable development themes. Most agencies act in an advisory role and do not have legal powers for enforcement of environmental legislation. Few agencies have a specified role in gathering environmental data and monitoring. With the exception of Brazil's microcatchment strategy, it is not possible to identify from the case studies any evidence that extension agencies have deliberately changed the way they work to encompass environmental issues; rather, existing methods may have been adapted or re-prioritized to accommodate the additional messages. This is perhaps unsurprising given the existing vast range of stated activities. However, it does leave open the question of whether there are roles and activities which are especially geared towards the environmental message and which might therefore be recommended for stronger promotion. It must also be asked whether extension agencies should be given greater powers of enforcement of environmental protection in order to fulfil their mandate, or of the collection and monitoring of environmental data.

Liaison and Coordination with Other Agencies

In environmental matters, extension agencies cannot expect (or be expected) to cope alone; they must liaise and coordinate with specialist, research, project and other institutions. If these links are not made, then it is unlikely that the promotion of sustainable development could be achievable within the confines of a single agency that has many other matters with which to deal. Table 4 lists from the case studies the stated links with other organizations. Again, the range of links is impressive. This Expert Consultation must ask whether some of these links are particularly vital for environmental issues; if so, which; and what priorities should be attached to liaison and coordination activities.

Arising from the source material for Table 4 is the relatively minor role played in many countries by specifically environmental agencies and/or institutes. The majority of liaison activities are, as they have always been for most extension activities, with conventional agricultural research establishments - agencies which themselves may have adapted only poorly to environmental and sustainable development themes.

Table 3: Stated roles and activities of extension agency.

Country Case Study	Roles and Activities of Extension Agency
1. United States	Primary environmental role is to assist farmers and ranchers to comply with the law, by increasing their understanding of the relevant regulations. Specific environmental training is provided in the form of training programmes for farmers on safe pesticide use. There is no legal role for monitoring compliance with environmental regulations. Activities include: mass media programmes; distribution of written materials; meetings; field tours to experimental stations and demonstration farms; workshops; development of curricula for classroom use; and coordination of 4-H programmes for youth.
2. Ireland	Teagasc is responsible for providing advisory, training, research and development services to the agriculture and food industry; all farming enterprises are targetted, together with horticulture, forestry and rural tourism. The agency has no legal, regulatory role in respect to environmental standards; it is advisory, to assist farmers to comply with regulations. Activities include mass media campaigns, demonstrations and seminars, and the organization of a three-year part-time Certificate in Farming course for young entrants to farming.
3. Brazil	EMATER-PR has adopted what it terms an "environmental model" for all its extension activities, based on the use of micro-catchments. It seeks to promote the rational utilization of natural resources by encouraging production practices which are appropriate to each unit's soil, relief and water conditions, and farmers' situations. Within this context, activities include: mass media campaigns; technical meetings; practical meetings; courses; field trips; excursions; exhibitions/fairs; demonstration units.
4. Mexico	To promote agricultural production which is profitable, efficient and competitive. A key role is undertaking diagnostic studies of actual and permissable rates of soil erosion, and the design of programmes to improve soil conservation. Activities are based primarily on field visits and on-farm demonstration plots.
5. Malawi	Overall aim of the agency is to provide efficient extension and training services to smallholder farmers in order to increase crop and livestock production. Principal activities are: awareness raising through the Block Extension System (a modified form of the Training and Visit System); agricultural shows; use of the mass media; provision of specialized courses through a network of day and residential training centres; formation of local groups, including credit groups.

[Table 3 continued over.]

[Table 3 continued.]

Country Case Study	Roles and Activities of Extension Agency
6. Burkina Faso	The two principal extension agencies (DVA and CRPA) are expected to promote the major national strategies in natural resource management, desertification control, food security and forest resources. At the local level CRPA takes on specific themes which currently include five of direct environmental significance: erosion control, agroforestry, fodder production, bush fire control and crop rotations. Radio, field schools and village group promotion activities are the primary means of delivery of messages.
7. Indonesia	To create public awareness among farmers and the general public. Key activities include: farmer training courses; field visits; demonstration plots and farms; farmer field days; farmer competitions; and use of Training & Visit approach.
8. India	To process information related to the environment and sustainable agriculture and develop specific messages for integration into extension programmes. Public awareness is created through the use of mass media (press releases, television and radio), printed materials (posters, extension literature), meetings (farmers' group meetings, village councils, farmer training sessions) and individual contact and visits. Little use is made of methods relying on local leaders or contact farmers. There is no systematic monitoring of environmental data or information.
9. Syria	To increase agricultural production quantitatively and qualitatively; to improve the quality of rural life; and to guide agricultural development to ensure conservation and rational utilization of natural resources. Activities include: production of radio programmes; agricultural theatre; workshops; field visits; demonstration and pilot farms; on-farm research trials; agricultural competitions.
10. Egypt	To create public awareness through mass media campaigns (50% of programme), meetings and group methods (30%), visits and individual contacts (15%), and use of local leaders and contact farmers (5%). There is no systematic monitoring of environmental data or information.

Table 4: Liaison and coordination with other agencies.

Country Case Study	Liaison Agencies and Other Links
1. United States	Local school districts, Soil Conservation Service (SCS), Agricultural Stabilization and Conservation Service (ASCS), Natural Resource Districts, and the US Department of Agriculture. Extension activities are overseen by a Board of Directors, with wide-ranging representation.
2. Ireland	Largely informal. Regional Fisheries Board may advise farmers to contact Teagasc if potential pollution problems arise. An Taisce (National Trust for Ireland) provides input on conservation and wildlife issues during training courses. Some involvement with County Development Team Committees. The management committee which oversees the environment programme has representatives from the construction industry.
3. Brazil	Principal liaison bodies are the State Secretariat of Agriculture and Supply (SEAB), and the Ministry of Agriculture, Supply and Agrarian Reform (MAARA). Additionally, EMATER-PR has an Administration Council, with representatives from SEAB, the municipalities, commercial associations, the state agricultural research institute, the state university and the cooperatives organization. There is some involvement of NGOs.
4. Mexico	Credit institutions (FIRCO, FIRA, BANRURAL), research institutions (INIFAP), and other government bodies (PROBOSQUE, CNA), universities, and technical assistance bureaux.
5. Malawi	Agricultural Engineering Department at the University of Malawi; Chitedze Agricultural Research Station, Ministry of Agriculture.
6. Burkina Faso	Only formal collaboration with research institutes in the development of materials for use by extension. "Sometimes they discover each other only at seminars and workshops."
7. Indonesia	Collaboration with Departments of Population and Environment; Information; Forestry; and Home Affairs. The first has been formalized through a national-level memorandum of understanding between the Ministry of Population and Environment and the Ministry of Agriculture. There appears to be some liaison with NGOs, input distributors and credit organizations.
8. India	Responsibility for processing information related to environment and developing messages for inclusion in extension programmes is shared with State Agricultural University. Liaison also with research institutions, implementing agencies, and educational institutions at national, state and district levels. However, coordination meetings described as "infrequent" with "no proper liaison mechanisms".
9. Syria	Research centres, peasant unions.
10. Egypt	Research institutes: Agricultural Research Centre; Water Research Centre; Desert Research Centre; and others. Environmental agencies: Agency for Environmental Affairs; Soil Amelioration General Authority. Educational institutions: Environmental Studies and Research Institute.

NGOs are noticeable by their absence in most case studies and it must be presumed that little formal liaison occurs between them and state/national extension agencies. Indeed, other studies have brought out some degree of mutual suspicion between NGOs and traditional extension agencies (e.g. Moris, 1991, for sub-Saharan Africa). Yet, as acknowledged in India and Brazil, NGOs are an important source of assistance to farmers at the very local level, and certainly present an opportunity to engage with communities at a level of intensity impossible with current staffing levels of most extension agencies. Is this an opportunity being missed? Another case study from Turkey, discussed by Roling (1988), puts the view that appropriate collaboration could strengthen extension activities very significantly.

Environmental Materials and Target Groups

A generalized extension approach conveying uniform recommendations is unlikely to suit all clients and all environmental subjects. Indeed, there is firm evidence that extension workers tend to concentrate on certain groups in society - typically, men and the wealthiest - and avoid the more difficult challenges (Roling, 1988). To reach all land users with appropriate environmental messages would need specific targetting of groups with particular types of materials. Is there any evidence this occurs in our case studies? Table 5 distills the information from the written cases.

Table 5: Target groups.

Country Case Study	Target Groups
1. United States	Rural families, including youth; crop advisors and input suppliers; chemical and fertilizer industries; absentee land owners; rural banks and credit agencies; urban populations.
2. Ireland	Mainly farmers, but also contractors and local authority engineers. Some mass media campaigns for general public.
3. Brazil	Small and medium-scale farmers; urban secondary schools; general public; decision-makers. The Integrated Forest Development Program targets individual small-scale farmers, farmers' associations, forest product consumers' groups, cooperatives, municipalities and environmental groups.
4. Mexico	"The producers."
5. Malawi	Smallholder farmers; estate sector; school pupils.
6. Burkina Faso	"Men and the young."
7. Indonesia	Government officials; farming families, including women and rural youth.
8. India	Farming families, including women and youth.
9. Syria	Farmers and rural households, including some programmes specifically designed for women.
10. Egypt	Farm people. Men are said to make up 80%, women 15% and youth 5% of the target group.

Two main points can be derived from Table 5. First, although there is some differentiation occurring at a very broad level, essentially the same environmental message is being given to all groups of land users. The only major distinction is that school curricula are used to reach the youth. Secondly, the methods and materials used for the dissemination are, for the most part, the same as those used for the general extension message. In other words, environmental and sustainable development themes do not seem to elicit much distinctive or special treatment.

It must, of course, be asked how far environmental issues should be integrated with general extension messages. One school of thought would say that sustainable development cannot be treated separately from production issues; in that case, it is appropriate that there be no special targetting for the environment. The other school would argue that the environment is so important and the issues so poorly treated that the only way to promote it is to have specific programmes. The Expert Consultation should consider these opposing views. Any answer for a particular country may depend on the current effectiveness of agricultural extension, and the society and culture of the people to be targetted.

Concluding Comments on Current Roles and Activities

An interesting difference in emphasis arises between case study countries in how environmental themes are translated into roles and activities:

- one group [exemplified most clearly by studies 5 and 9] retains production and transfer of technology issues to the fore, concentrating more narrowly on the farming community and its needs. Environmental issues are added to the general set of extension messages;

- the other group [e.g. 1, 2 and 3] has ostensibly undergone more radical change to a mandate which highlights environmental protection, and, in so doing, therefore finds it necessary also to target groups other than farmers: for example, input suppliers, contractors, banks and credit agencies, urban populations, the general public and decision-makers.

The extent to which either approach is appropriate does naturally depend on how far other agencies are fulfilling the environmental mandate. There would appear to be room for substantial improvement in liaison and coordination with such agencies, especially NGOs, and the better targetting of environmental messages. One priority area would be the integration of production and environmental messages, demonstrating how sustainable development can also be economically rational and financially profitable.

It is concluded, then, that on policy and mandate questions, environmental and sustainable development issues are largely in place. No doubt there is scope for appropriate strengthening of the mandate but most countries at least have rhetorical backing for a reorientation of extension practice. It is in the translation of policy into practice that most differences occur. The environmental mandate for some has simply been tacked onto general issues of increased production and technology transfer. In other countries, a more radical restructuring has been put in place, although how far this has caused actual practice to change at the local level is still open to question.

The Environmental Content and Messages

Nature of the Environmental Message

As noted in Table 6, the environmental message differs significantly from country to country, and in the detail in which it is specified. In part, as already commented upon, this difference reflects varying environmental problems conditioned by the nature of the physical environment. In part also, the environmental message is affected by how important the issues are seen to be vis-a-vis the traditional roles of extension.

Extension Materials for Environmental Issues

A range of extension materials is specified in the case studies (Table 7), no one type being wholly specific to environmental or sustainable development themes. The main problems are:

- reaching target groups who are illiterate;
- no quantitative assessment of impact of extension materials, even though quality is often stated to be good;
- a discrepancy in provision of materials between what farmers perceive to be high priority and what extension actually provides. This applies particularly in extension of environmental issues, where it is often the case that no obvious advantage is seen by the client;
- most materials deal with agricultural practices, land stewardship and government regulations, rather than environmental issues per se. Particular local problems, as in Nebraska (e.g. nitrate and pesticide levels in drinking water), are sometimes targetted. The inevitable result is that the land user is pinpointed as the potential villain; this is a negative message, inviting negative responses from the primary clients of extension, the same land users.

As with roles and activities, it is difficult to separate the materials which are specifically intended to transmit environmental and sustainable development themes from those which form the overall extension message. Nevertheless, there is a contrast between the way different types of material are used for particular messages. Written materials are used for specific production technologies, while radio and television tend to be used more for broader environmental messages. For example, in Brazil typical printed matter includes "Beekeeping is Easy and Profitable" and "Technical Manual of Vegetable Growing", while television programmes are entitled "Forest Reserves" and "Ecology of Itaipu Lake". Different audiences are clearly indicated, and it may be that the land user is being missed in the essential environmental message, while the urban dweller receives the message but misunderstands the production demands on the land user.

Table 6: Nature of the environmental message.

Country Case Study	Environmental Message
1. United States	Weather Modification: planting of field windbreaks; use of filter strips along riparian zones to minimize impact of heavy rains; varied time of planting and different cultivar maturities to avoid major stress events during cropping season (2,500 men; 200 women; 800 youth). Land and Soil Management: terrace construction; minimum and zero tillage practices; contour planting; strip inter-cropping; reduced water application rates (12,000 men; 500 women; 6,000 youth). Farm and Domestic Water Management: water testing service; irrigation scheduling; alternative irrigation methods (5,500 men; 200 women; 4,000 youth). Ecologically-sound Cropping Systems: crop rotations; feedlot design to ensure efficient collection of manure and its spreading on cropland; grazing of crop residues by livestock (16,000 men; 3,200 women; 2,000 youth). Use of Farm Inputs: crop scouting for insect and weed incidence; chlorophyll meter readings of maize leaf tissue to test nitrogen sufficiency; late spring soil tests to allow lower fertilizer N application rates; promotion of crop rotation, clover and manure; training in the safe use of pesticides (35,000 men; 6,000 women; 8,000 youth). Use of Communal Areas: organizing committees to develop local parks, lakes and recreational areas (5,000 men; 6,000 women; 4,000 youth). Waste Management: composting of organic yard waste; promotion of recycling; inter-community facilities to meet new federal guidelines on solid waste management (8,000 men; 9,000 women; 2,000 youth). Broad Environmental Issues (global warming; deforestation) are promoted through the formal education system (10,000 youth). Other topics (water and nutrient cycles; recycling) are handled similarly but more generally (350,000 children).
2. Ireland	Waste Management: the main environmental message is control of wastes in order to reduce water pollution. Emphasis has gradually switched from point sources of pollution (e.g. silage effluent) to a reduction in non-point sources (e.g. correct methods of landspreading of wastes and fertilizers). Information also on safe disposal of pesticides. Other Topics: recent programme on countryside management and conservation.
3. Brazil	Integrated Soil and Water Management: soil conservation, waste disposal, green fertilization. Between 1983 and 1992, this programme covered 1,732 microcatchments (approx. 21% of the state) and involved 160,360 farmers. Integrated Forest Development: windbreaks, erosion control, wildlife protection, native forest protection. Between 1987 and 1992, this programme involved 15,400 farmers. Water and Drainage: waste disposal, water conservation, drainage and irrigation.
4. Mexico	Land and Soil Management: primarily soil conservation. Soil erosion rates estimated using the Universal Soil Loss Equation, and then a programme of intervention is designed to bring erosion rates down to a sustainable level. Otherwise, the author of the case study says: "The agricultural extension programmes...do not have any components related to the environment."
5. Malawi	Land and Soil Management: mainly soil conservation; most extension messages directly related to promotion of biological and physical conservation practices. Related to these under the heading "Land husbandry" come: farm planning; agroforestry; agropastoralism; fire management; gully reclamation.

[Table 6 continued over.]

[Table 6 continued.]

Country Case Study	Environmental Message
6. Burkina Faso	Erosion Control: mainly physical measures such as stone bunds (63,844 "adopters" in 1992-93 campaign. (An adopter is someone who accepts to practise the recommended technique). Agroforestry and Refforestation: tree planting campaigns, related to desertification national plan (19,055 adopters). Fodder Production: to relieve semi-arid rangeland and overgrazing (6,562). Crop Rotations: for soil improvement (26,587). Bush Fire Control: a general extension message to conserve scarce grazing resources.
7. Indonesia	Weather Modification: "bakao" tree cultivation; coconut trees as windbreaks; moisture and shade planting. Land and Soil Management: terracing; "sorjan" systems in tidal areas; river bank stabilization with bamboo; mulching; intercropping and multi-storey systems; crop rotations. Farm and Domestic Water Management: water conservation; irrigation management (water scheduling, fish ponds, chemical analysis). Ecologically-sound Cropping Systems: mulching; legumes; crop varieties and planting density; integrated pest management (IPM). Use of Farm Inputs: application of organic and inorganic fertilizers; training in use of biocides and IPM techniques; crop rotations to reduce pests; biological control. Use of Communal Areas: local agreements on use of forests, lakes and rivers; forest protection and refforestation of communal areas. Waste Management: waste disposal and processing; water and soil pollution control, especially with regard to agrochemicals.
8. India	Ecologically-sound Cropping Systems: use of green manure and organics. Farm inputs: safe use of biocides; IPM; appropriate equipment and sprays. Other Topics: watershed management; deforestation.
9. Syria	Weather Modification: windbreaks; afforestation of selected sites. Farm and Domestic Water Management: drip and sprinkler irrigation; rainfall collection and storage. Ecologically-Sound Cropping Practices: livestock utilization of agricultural residues; crop rotations and fallows (especially as part of IPM); promotion of agro-sylvo-pastoral systems. Farm Inputs: reduction in use of chemicals; IPM and biological control. Other Topics: forestry management and utilization; forest protection; natural preservation areas.
10. Egypt	Weather Modification: windbreaks, shade and moisture planting (6% of environmental message). Land and Soil Management: soil conservation; prevention of salinization; desertification control (13%). Farm and Domestic Water Management: irrigation and drainage; prevention of water pollution (15%). Ecologically-sound Cropping Systems: soil conservation; soil fertility improvement (15%). Farm Inputs: fertilizer and biocide use; seed varieties, in relation to timing, quantity and treatment methods; encouragement of IPM; appropriate agricultural machinery and tools (38%). Waste Management: appropriate, economic and non-polluting methods of disposal of farm and domestic wastes.

NB. Number of persons reached is given only where this is specified in the case study.

Table 7: Extension materials (see also Table 3, which includes additional details on materials.)

Country Case Study	Extension Materials
1. United States	Topic specific guides; bulletins and circulars; videos; slide sets; mass media programmes (press releases, radio and TV spots, features in farmers' magazines).
2. Ireland	Mass media (press and radio); local newsletters; booklets and leaflets; videos.
3. Brazil	Radio; television; videos; leaflets; technical manuals.
4. Mexico	Leaflets; audio-visual materials; posters; radio.
5. Malawi	Posters; flip charts; circulars; films; videos.
6. Burkina Faso	Printed matter; pamphlets; audio-visual; photographs/slides.
7. Indonesia	Slides; films; posters; leaflets; manuals; brochures.
8. India	Extension materials include leaflets, folders, posters, exhibits, and radio and television programmes. Most material on environmental matters is prepared by Ministry of Forests and Environment.
9. Syria	TV, including advertisments; radio; theatre and plays; booklets; farmers' magazine; technical agricultural journal.
10. Egypt	Extension magazine; bulletins; posters; videos; radio and TV

There is little commentary in the case studies on the quality of the material. It must be presumed that the environmental and sustainable development message is accurate; whether it is attractive and exerts a positive influence on the target audience needs more detailed assessment.

Extension Source of Information on Environmental Issues

Table 8 brings out the overwhelming reliance on state and national level institutions for information and the provision of the basic environmental message. In one sense, this is good in that the extension materials will be geared to local environmental conditions. In another sense, important source materials may be being missed:

- there is an apparent lack of international cooperation. For example, research and extension messages on the impacts of pesticides are applicable across international boundaries. Environmental and sustainable development themes have more than a purely local dimension: deforestation, global warming; soil erosion; flooding and sedimentation; pollution and acidification all transcend the scale of the farm, district, region and country. Source materials are available internationally for many of these issues but are under-utilized;

- few materials emanate from local organizations, farmers' groups and NGOs. The latter especially are relatively strong on environmental matters, producing newsletters, local theatre productions, even poetry and song, that will appeal to target groups that are largely untouched by printed matter or personal contact.

Ways of extending the sources for extension materials are an obvious area for further discussion and development. There is a wealth of material available; the problem is accessing it.

Table 8: Extension sources of information on environmental issues.

Country Case Study	Sources of Information
1. United States	Agricultural Research Division, Institute of Agriculture and Natural Resources, University of Nebraska; additional information from federal research specialists and research results from adjacent states.
2. Ireland	Mainly internal, especially from Teagasc's own data bases; additional information from University College, Dublin and Environmental Research Unit.
3. Brazil	[no information]
4. Mexico	[no information]
5. Malawi	Research results from University of Malawi and research stations of Ministry of Agriculture; also from books (national and international mentioned), reports and circulars, Department of Research and Environmental Affairs, and Environmental Education Unit of Ministry of Agriculture.
6. Burkina Faso	Research institutes in association with development agencies.
7. Indonesia	National agricultural and forestry research agencies; national universities.
8. India	National level research, training and development centres (e.g. Indian Institute of Ecology and Environment, the Indian Renewable Energy Development Agency); national and state pollution control boards.
9. Syria	National research centres; university.
10. Egypt	National level research organizations such as Desert Research Centre and water Research Centre; national level educational establishments such as Environmental Studies and Research Institute; also from national environmental agencies such as Agency for Environmental Affairs and the Soil Amelioration General Authority.

Conclusion on Environmental Content and Messages

As might be expected, the overall scope of the environmental content and messages is large, reflecting the balance of interests of the agency and country, the physical environment, and the degree of development of environmental awareness.

More illuminating than what is said in the case studies is what is not said. The lack of input from environmental agencies at international, national and local levels is striking. The standard lines of communication (typically, from agricultural research institutes and universities) used for general extension messages are the ones most frequently mentioned. Are these the most suited for the purpose? Further, there is little evidence that extension agencies themselves are feeding back a demand for environmental information to the primary sources; they seem to be reactive rather than proactive.

Because the nature of the environmental message must necessarily be so varied, it is not possible to make definitive comments on what matters are routinely missing. There is an overall worrying tendency that much of the environmental content is geared to lecturing land users on what they are doing wrong. This negative message - as opposed to the message that sustainable development is beneficial to both the land user and society - is likely to ensure that a far lower priority is given to environmental messages than to information on how to enhance production. This is an aspect that this Expert Consultation should address. How can we make the environmental message both appropriate and attractive?

Extent of Integration

Type of integration of environmental education

All agencies, with the possible exception of Malawi's Land Husbandry Branch, claim that environmental concerns have been integrated into existing agricultural extension programmes, and that separate programmes to address these concerns have not been initiated. Malawi's case is interesting because the Department of Agricultural Extension and Training has a separate section, the Land Husbandry Branch, which is mandated to tackle soil and water conservation down to the local level. This leaves extension advice on commodities largely to standard extensionists. This model is explained partly in the history of soil and water conservation where it was recognized that the techniques being promoted and the very name "conservation" had negative connotations. T.F. Shaxson, one of the originators of the Malawi land husbandry approach, calls it "conservation-by-stealth", by which he implies that soil conservation needs to be incorporated within a broader production strategy. This type of approach to environmental matters, attaching them in specialist units to practical production concerns of small farmers, perhaps deserves wider attention and emulation.

Otherwise, the integral approach prevails. In Ireland's case, this was deliberate in order to ensure credibility of the environmental message and to avoid increases in cost. The cost factor probably underlies most reasons why specialist units are not employed. As Moris (1991) points out for ministry-based extension services in Africa, an increasing share of the total budget (over 80% in many cases) is taken up by staff salaries. Field staff are therefore stranded with very little left for activities once salaries have been paid. In such circumstances, it is hardly likely that environmental matters will receive greater attention. Project-supported extension services and farmers' associations would be more appropriate to deliver environmental concerns.

Proportion of Total Agency Work Devoted to Environmental Issues

Table 9 extracts what information is given in the case studies. Of course, where environmental concerns are truly integrated into the general extension message, it should be impossible to measure the proportion of total agency work devoted to environmental themes.

Table 9: Proportion of total agency work devoted to environmental issues.

Country Case Study	Per Cent of Time/Budget/Subject Matter	Per Cent of Staff Specifically Devoted
1. United States	Budget: < 5% Subject Matter: 5%	30% of subject matter specialists have "some" expertise in environmental and natural resource management.
2. Ireland	Time: 15%	Three advisors out of 16 are involved in environmental education and training full-time. 50% of staff have specialist in-service environmental training.
3. Brazil	No data.	Three full-time foresters out of a total technical staff of 1,071. Approx. 50% of extension workers are said to have had some formal training in environment-related fields.
4. Mexico	No data.	No data.
5. Malawi	Subject matter: 16% Time: 20%	10% of subject matter specialists.
6. Burkina Faso	Subject matter: 22% Time: 20-25%	26% of 31 specialist technicians in 5 districts occupied specifically on environmental protection.
7. Indonesia	Subject matter: 25% Time (uplands): 50% Time (lowlands): 25%	10% of subject matter specialists.
8. India	Subject matter: 10% Time: 10%	Less than 10% of subject matter specialists. 21% of extension staff have received some training in environmental issues and sustainable agriculture.
9. Syria	No data.	No data.
10. Egypt	Subject matter: 19% Time: 10%	No data.

The figures in Table 9 should be treated with caution, since most authors have made gross approximations using rather different assumptions. The estimates from some of the developing country case studies appear unduly optimistic, and there may be a definitional problem as to what constitutes an environmental theme. Figures on staffing levels are likely to be more reliable.

The striking similarity between most countries is that environmental concerns make up only a small proportion of the time, subject matter and budget of agricultural extension agencies, and that the number of specialist staff employed to deal with such issues is typically less than ten per cent of the total. A few agencies attempt to deal with this by providing in-service training on environmental matters to all staff: in a period of severe budget constraints, this may be the most effective way to promote environmental and sustainable development issues.

Extent of Reach of Environmental Message

There is difficulty separating the coverage achieved by the environmental message from the overall extension message, and the figures in Table 10 should be treated cautiously. With the possible exception of Malawi, more men seem to be reached than women. Burkina Faso, for example, acknowledges that many more men are reached by the standard extension materials of printed matter than women. Youth are reached mainly via school curricula because of the relative ease of incorporating environmental matters into geography and agriculture lessons. Children are also less dispersed and there is broader scope to address the major environmental issues, not just issues of immediate local concern. In contrast, the farm situation demands an emphasis on production issues and immediate problems.

There is some indication of a significant difference in the extent of reach between developed and developing countries, possibly reflecting differences in resources, the availability of mass communication systems, and the smaller rural population. The fragmentation of land, the large numbers of farmers, the resource-poor situation of most farmers, and limited support services to extension are frequently identified as constraints to extension activities generally in developing countries. Such constraints will be especially operative in the case of environmental themes where the message may not be high priority in land users' minds.

Conclusion on Extent of Integration

Integration of the environmental message is being tackled in one or both of two ways: (1) by ensuring that an environmental content is inserted into general extension messages; and (2) using specialized technical and inputs agencies. The first is more common than the second, probably on the grounds of cost. Some agencies use a mix of both, with some specialist materials (e.g. legislation and safe use of pesticides) but other issues of sustainable agriculture (e.g. use of green manures) integrated into the general message. There is evidence of a difference of approach to integration between developed and developing countries.

Table 10: Extent of reach of environmental message.

Country Case Study	Per Cent Adult Males	Per Cent Adult Females	Per Cent Rural Youth
1. United States	50	15	100
2. Ireland	The extent of coverage is implied to be high. In 1989, all booklets on the environment produced by Teagasc were posted to all farmers in the country. In 1988/89, 200,000 people attended agricultural seminars. Since the total adult farming population is about 274,000, this might suggest up to 75% coverage.		
3. Brazil	In 1992, technical meetings, courses and field excursions were attended by 427,000, or about 20% of the total rural population. 216,000 people (including 27,300 rural "housewives"), or about 10% of rural population, were reached by microcatchment management materials. Radio is believed to reach an audience of 1,750,000 (21% state population), with TV reaching 2 million (24%).		
4. Mexico	No data.	No data.	No data.
5. Malawi	It is estimated that 72% of the total rural population is reached by environmental messages. 90% of adult females are said to be reached.		
6. Burkina Faso	In 1992/93 campaign, 12% of rural people were reached by subjects related to environmental protection. Data kept on total number of "adopters" of environmental messages: e.g. 63,844 adopted erosion control practices in 1992/93.		
7. Indonesia	50	25	No data.
8. India	19	14.5	18 (male) 10 (female)
9. Syria	No data.	No data.	No data.
10. Egypt	19	19	14

The extent of reach is somewhat problematic. There is a dearth of quality data on this, despite the obvious need to target specific groups of rural land users with different messages. The needs of women farmers appear generally to be neglected, notwithstanding their crucial rôle in rural activities such as fuelwood gathering and water collection and in food crop production. It may be that some extension systems do target women for some aspects (e.g. home economics) but the lack of specific information strongly suggests greater attention to gender and age divisions in the management of rural resources is urgently needed.

Processes of Integration

Impetus for Change

Any introduction of new ideas into an organizational system that is essentially conservative needs an impetus for change. Environmental and sustainable development themes are no exception. Table 11 presents the evidence of such an impetus from the case studies.

It is evident that sometimes dramatic and catastrophic events have been necessary to precipitate change [e.g. 2 and 5]. In other cases, there have been direct external pressures from agencies such as the World Bank to introduce environmental themes [7]. Even when no such pressure is acknowledged, it is clear that practices have changed and that some impetus has been involved, often in the form of national level legislation. Because the expectation of funders of projects and environmental lobbyists (e.g. aid donors, international organizations, environmental groups) has moved towards the explicit inclusion of environmental matters and because researchers are framing their work in terms of sustainability (indeed, it is almost obligatory that the word now appears in research funding proposals), both policy and practice have been under pressure to change. This overall change in the international climate of opinion - with individual country governments and extension agencies not wanting to be seen out-of-step - may in the final analysis be the most important single impetus for change. It is a process that this Expert Consultation may seek to consolidate in those agencies where practices may not yet be matching policy changes, or where policy on the environment is still ill-defined.

Type of Planning

The process of integration of any new message is not solely about pressures on the system and the impetus for change. For change truly to occur, the right modes of planning need to be in place which would allow the wide-ranging implications of environmental themes to be articulated into instructions and imbued into good working practice.

Planning in agricultural and rural development has characteristically been top-down: i.e. the analysis of the problem, potential solutions and practical implementation have all been generated amongst planners and professionals and then imposed on what was hoped to be a grateful people. Much has been written of the folly of this approach and the need for participatory planning (a bottom-up approach) where the "beneficiaries" are part of the decision-making structure.

Environmental issues will be extraordinarily difficult to incorporate in a participatory planning approach unless it is absolutely clear that rural people will benefit. To date, this message has not been well-formulated and there are only a few instances in the case studies (e.g. health impacts from pesticides and nitrates) to suggest that environmental themes are going to be spontaneously attractive and high on the priority list of local people. In theory, by concentrating on key themes such as the relationship between productivity and land degradation, it should be possible to identify attractive benefits of adopting sustainable agricultural practices. However, this is a poorly-developed field as yet in which FAO has a major interest but in which much remains to be done.

Table 11: Impetus for inclusion of environmental concerns.

Country Case Study	Impetus for Change
1. United States	Original impetus from 1930s "Dust Bowl" conditions which led to emphasis on soil conservation. Subsequent environmental concerns included as a result of state and national legislation, pressure from environmental groups and concern from within the academic community. Some evidence of client demand for environmental inputs on specific issues, fueled primarily by concern over health impacts. Energy crisis was a contributory factor, along with depletion of aquifers.
2. Ireland	Dramatic fish deaths in 1987 caused unfavourable public image of farming, leading directly to start of environmental extension campaign. Additional impetus from government's perception of the environment as an economic asset for marketing Irish food and tourism; also EC policies and programmes have assisted.
3. Brazil	Large scale rural-urban migration, unplanned expansion of urban areas and serious soil erosion provided initial impetus; led particularly to Northwest Project of early 1970s, focusing on control of urban erosion, expanding later to include peri-urban and rural areas. Additional impetus from national and state legislation, especially Law No 6636 of 29.11.74 which created the State Agricultural System and redefined institutional support and the roles and responsibilities of state government agencies.
4. Mexico	Mexico initiated series of strategic changes in its support to the agricultural sector in the run up to the free trade agreement with the USA and Canada. Main aim was to increase agricultural production, profitability and competitiveness in the world market. Key aspect is an analysis of sustainability of agricultural practices and an evaluation of land potential.
5. Malawi	Widespread famines in 1948/9 led to initiation of major campaigns of soil conservation. Environmental issues have been important ever since, but reinforced by aid donors and specific projects.
6. Burkina Faso	Impetus arose primarily from research and an "intellectual preoccupation" that environmental and sustainable development themes are necessary.
7. Indonesia	World Bank recommendation in 1976 to create agricultural extension agency. Environmental themes included at outset.
8. India	In 1985, Department of Forests and Environment created with mandate to intervene as a coordinating agency in the programmes of other agencies which have environmental components, so as to encourage research, education and extension related to environmental issues. Additional impetus has come from passing of the Comprehensive Environment (Protection) Act in 1986, and the holding of the 1990 International Symposium on Sustainable Agricultural Development.
9. Syria	[No information given]
10. Egypt	Integration of environmental concerns began in mid-1970s with a ministerial decree. Further impetus came with the establishment by Presidential Order of a national level environmental agency in the 1980s. Process of integration accelerated since 1990 when Egypt adopted new policies aimed at privitization and economic liberalization. As part of these changes, the roles of the Ministry of Agriculture and Land Reclamation have been redefined such that main focus is now on extension and research.

The beneficial role of natural ecosystems, in particular forests and wetlands, is another undeveloped topic. This Expert Consultation should consider ways in which the process of integration of environmental themes into extension might be enhanced by a more attractive message.

Not surprisingly, Table 12 indicates the dominance of top-down approaches. If the environmental message is composed mainly of legislative demands on rural land users and central government decrees to protect the environment, there is probably no alternative to hierarchical imposition of the message via extension. However, as already noted, there is a disturbing tendency for environmental issues to be couched in such a way as to blame land users for creating environmental degradation. The top-down planning approach merely reinforces such perceptions, inviting the land user to reject the message (and the messenger!).

There are a few positive indicators in that farmer advisory panels, farmer organizations and local-level extension staff are helping to identify some concerns but this is still far removed from a true participatory mode in which local people are part of problem identification, diagnosis, planning and implementation. The gender dimension is largely ignored.

Table 12: Type of planning in the process of integration.

Country Case Study	Type of Planning
1. United States	Combination of approaches; farmer advisory panels, on which sit men and women, review extension programmes to assess relevance to current problems and priorities. Local counties, representing farming communities, have considerable financial control of extension budgets.
2. Ireland	Mainly top-down; some input from farming organizations.
3. Brazil	Combination of approaches; community participates in programme identification through municipal soil committees.
4. Mexico	Not clear from case study, but by implication mainly top-down.
5. Malawi	Mainly top-down; initial soil conservation strategies developed by colonial government, and same basic approach used today.
6. Burkina Faso	Standard top-down; consisting of (1) problem identification; (2) translation into researchable questions; (3) experimental research; (4) presentation of results; (5) professionals plan for transmission of results to rural producers.
7. Indonesia	Top-down; no evidence of involvement of farmers in programme design.
8. India	Top-down mainly; some evidence of greater local involvement.
9. Syria	Combination of types; extension staff at village level identify key constraints and problems; then extension programme designed around village needs.
10. Egypt	Largely top-down; increasing local inputs to planning from 1985.

Training of Extension Agents in Environmental Themes

The integration of environmental matters into the regular extension message also involves reinforcing the message through training. The importance of training is recognized by, for example, the T&V Extension System with its monthly two-day meetings for subject matter specialists and fortnightly training sessions to field staff. On the evidence in the case studies (Table 13), some specific training on environmental matters is given (e.g. the one-week intensive seminars on environmental protection given in Ireland) but most is assumed to be integrated in the general in-service training. The effectiveness of such training is difficult to establish but is probably variable in quality, intensity and content.

Table 13: Procedures for training extension agents in environmental concerns.

Country Case Study	Environmental Training Procedures
1. United States	In-service training in sustainable agriculture, erosion control, waste management and pesticide safety.
2. Ireland	In-service training through one-week intensive training in environmental protection. Courses contain a section on conservation and wildlife, taught by the National Trust for Ireland. One-day, annual refresher courses also offered.
3. Brazil	Standard extension methods training courses, into which some environmental matters have been incorporated.
4. Mexico	No mention of environmental component in training of extension agents.
5. Malawi	A Land Husbandry Centre provides a professional induction course for new recruits, as well as in-service training. Training in land husbandry practices is also provided at the Natural Resources College, as part of the Certificate in Agricultural Technology.
6. Burkina Faso	Conservation and refforestation are now an integral part of advanced training for extension agents.
7. Indonesia	In-service training of existing extension staff through seminars and workshops run by university and research centre staff.
8. India	Environmental components incorporated into regular training for Subject Matter Specialists and extension personnel. Training done by State Agricultural University and the Advanced Training Centres.
9. Syria	Environmental matters built into regular training, with components on soil and water conservation, IPM, biological control methods, use of farm inputs, waste disposal, forest protection and range management.
10. Egypt	Environmental concerns incorporated into existing training.

Programme Development in Environmental Matters

Table 14 lists the intended programme developments from the case studies. The information base is only partial, but the inevitable impression is that the large demands currently imposed on formal extension systems mean that new developments are only reluctantly included in future work programmes.

Table 14: Programme development in environmental matters.

Country Case Study	Programme Development
1. United States	Recent grant funds to develop new materials on environmental topics. No plans to change current emphasis or to integrate environmental messages into overall extension.
2. Ireland	Broadening of programme to include components on countryside management and a new programme on nutrient management.
3. Brazil	No information.
4. Mexico	No information. However, the agency is undergoing a process of consolidation and has initiated a voluntary redundancy scheme for technical and administrative staff. The implication is that environmental activities will also be reduced.
5. Malawi	A project to integrate population issues into the curricula of agriculture and forestry training programmes has been initiated. Campaigns in catchment conservation, gully reclamation and borehole afforestation are being expanded. Research into environmental issues at University of Malawi is being increased.
6. Burkina Faso	Greater priority continuing to be attached to environmental issues; development of specific training inputs (e.g. afforestation) as well as an integrative training approach ("tronc commun"). Further development of training hampered by demands of Structural Adjustment Programmes.
7. Indonesia	Development of specific programmes in certain fields (e.g. integrated pest management) and programmes (e.g. agricultural intensification).
8. India	Programme development currently rests on individual effort and commitment of agents; no agency-wide programme development is reported.
9. Syria	No information.
10. Egypt	With the 1990 policy initiatives, environmental matters are expected to receive greater priority, rising to 60% of all extension activities.

There is a general tendency to load extension agencies with more and more tasks, especially in developing countries. In Africa, for example, field staff often have responsibility for input supplies and organization of credit, as well as technology transfer and liaison with local people. In such circumstances, an added remit in new programmes on environment and sustainable development is unlikely to be achievable. The situation in developed countries, where extension is being increasingly privatized, is somewhat different but no less challenging. New developments demonstrably have to have short-term returns

on investment and they have to overcome the (sometimes prejudicial) interests of the bodies providing extension advice. Agro-chemical companies have every interest in providing advice on the safe use of pesticides but not on the reduction in application rates to meet overall environmental standards. Commodity boards will advise on optimum production methods for their crops but will understandably neglect intercropping or agroforestry. In such situations, environmental messages that are not in the immediate interest of the promoter need to be inserted in a broader package of benefits for the land user. Is such insertion to be done legislatively [cf. case study 1], by authoritative direction [9], by general persuasion [3] or by allowing interest groups and environmental lobbies to have free reign?

This Expert Consultation might consider how the environmental message might replace or reorganize current messages in developing countries. Sustainable agriculture is potentially a theme which could unify the extension message. But the current reality is that such a theme is crowded out by day-to-day pressures on field staff and the whole extension system. In developed countries, how can the interests of extension advice providers be related to the environmental message and the needs of society? With the increasing commercialization of agriculture, this last question will apply to developing countries also.

Conclusion on Integration

A full integration of environmental and sustainable development themes has to be seen as the ultimate goal of protecting the long-term viability of rural land use. Only if integrated can these themes enter the mainstream of extension. "Special pleading" for the environment is probably an essential interim measure to raise awareness, but any message which continues to rely on making special cases is not itself sustainable. In the end, the message has to be in the interests of both the promoter (extension agency) and the client (land user).

The situation pertaining today is that full integration has not been achieved by any extension system. In some programmes, environmental concerns have been reasonably well integrated, but the number of issues addressed is small. In other programmes, environmental matters have simply been tagged onto existing programmes. Most new developments are geared to making distinct environmental inputs to training and work schedules. This process may need to be accelerated with the ultimate aim of making environmental issues inseparable from the production goals of farmers and the needs of society for a safe and secure environment.

Lessons

As they move towards the goal of promoting environmentally-friendly and sustainably-sound agricultural practices, national and regional agricultural extension agencies need to know what other agencies are doing and what lessons have been learned internationally. This final section draws together the experiences in the case studies to highlight positive and negative lessons that might inform extension and suggests an agenda of what might constitute "good practice". By way of conclusion, the three objectives specified in the introduction are formulated into three principal questions:

Have extension institutions adapted to the new environmental imperatives and priorities?

This review of ten case studies suggests that the majority of environmental issues being addressed by extension programmes are conventional topics, closely linked to increasing farm productivity. Mentioned by nearly all countries, the use of farm inputs was the commonest "environmental" topic. This includes not only the safe use of pesticides but also fertilizer regimes and chemical inputs in order to maximize production in a cost-effective and efficient manner. The message is often little different from previous extension efforts, except there is now greater emphasis on integrated pest management and there is concern that inputs should not be used in a wasteful manner for fear of polluting the environment. Other common extension messages promoted soil and water conservation and appropriate cropping systems. Again, the content of such messages has hardly changed. The "environmental" tag and the goal of sustainable development are useful means of repackaging and repromoting standard practices. In other words, the new imperatives may be reshuffling the priority order of extension messages but little fundamental change in the messages themselves has occurred.

The review also demonstrates that environmental matters receive a relatively small proportion of the time and funding allocations of extension agencies, and that few specialized staff have been employed to deal with environmental concerns.

Part of the weakness in adapting to the new imperative may lie in a generalized failure to access appropriate sources of environmental information. Missed opportunities are evident in the abundant messages emanating from the international community on subjects which transcend national boundaries or with which other agencies have had to grapple: e.g., flooding, sedimentation, global warming, biodiversity. Further opportunities are available at the local level with learning from individual innovative farmers whose practices are environmentally-sound and from farmers' groups and NGOs. The last is especially strong on environmental issues.

There has, therefore, been no radical transformation of extension agencies. Instead, issues have been reclassified. Soil conservation in the United States of the 1930s was a production issue; today it is an environmental concern. A gradual broadening of the extension agenda is also evident. There is a tendency to react to any new situation by adding more topics to the extension mandate. With the broadening comes the danger of dilution of the impact of any single message.

The effect of concentrating on production-oriented environmental issues and repackaging existing messages is to keep the focus of topics relatively narrow. Subjects which are not directly related to productivity or to compliance with environmental legislation (e.g. biodiversity and habitat conservation) receive scant attention. Similarly, the concept of sustainable development has not really been addressed and is elusive - it remains the preserve of academics and senior professionals, while land users and field staff will often see it in a negative context, limiting production and giving greater on-farm costs and restrictions.

Should we be surprised or even disappointed in the current situation? No. Farming and rural land use have other imperatives also, such as immediate survival in a world economic

order that is itself not conducive to environmental issues. The reaction of extension agencies reflects that:

- increasing the efficiency of production and "food security" remain the primary concerns of most agricultural ministries;

- farmer demand for extension services is also production-driven. The economic situation faced by many farmers is so precarious that the over-riding concern is one of enhancing profitability, usually by means of increased inputs;

- the concept of "sustainable development" is vague, ill-defined and used more for rhetoric than reality. Consequently, agencies have difficulty translating the concept into practical action.

Can extension agencies, as currently constituted, be adapted to take on board environmental and sustainable development themes?

The case studies demonstrate that there is still large scope for integrating environmental concerns into existing extension programmes. Although the current situation may seem somewhat inadequate, the potential for expanding the breadth of environmental topics is considerable. A number of positive indicators make such expansion both desirable and feasible:

- the experience of at least one agency (Ireland) shows that environmental issues can be effectively addressed without major organizational change, increase in funding or additional staff;

- many environmental topics can be incorporated into existing programmes. Tagging the safe use of pesticides, for example, to integrated pest management makes sense for farm profitability and the environment;

- although farmers rate production issues above environmental concerns, this does not mean they are uninterested in the future. Several case studies implied that rural communities wanted to learn more about environmental topics and were willing in some instances voluntarily to change their behaviour. A challenge for research is to identify under what circumstances farmers might change practices without compulsion or the threat of fines for non-compliance;

- many NGOs are involved in environmental programmes. Considerable scope exists for formal collaborative programmes utilizing the pioneering zeal of NGO workers but within established structures. On environmental issues, NGO documentation services are a potentially rich source of information. Examples are few in the case studies of collaboration between NGOs and government extension services, but several useful partnership agreements between NGO development agencies and government institutions are in operation in the rainfed farming areas of Rajasthan and eastern India.

Negative factors need to be addressed also. These include the conservative and hierarchical nature of some extension agencies, where any change will be resisted.

Environmental topics are often seen as just another layer of extension messages to be added to the ever-growing demands on field staff, and yet more information to put onto overloaded farmers. Professional and career advancement requirements are more easily measured by output indicators rather than unmeasurable environmental themes. Salary levels for field staff are often hopelessly inadequate. Corruption and political interference are problems in some places. A particular problem for some extension agencies is the mutual suspicion between NGOs and government. However, many of these difficulties are common to all organizations and it would be wrong to load the environmental debate with the burden of solving all such generalized issues. The challenge of ensuring sustainable development can realistically only be tackled incrementally and piecemeal, utilizing the various opportunities as they present themselves. Radical restructuring may need a stronger unifying theme than is currently offered by the concept of sustainable development.

There is, then, a good potential for the further development of environmental themes within the general agricultural extension programme. Advancement is more likely if the message is fully integrated with themes that are immediately relevant to the farming community, rather than as a separate programme. Various models for undertaking integration are indicated by the case studies: this Expert Consultation should consider the comparative advantages of each.

What changes might assist the process of achieving sustainable development through agricultural extension?

This analysis has as its most challenging objective the identification of policies and practices which might constitute "good practice". The experiences summarized in the ten case studies suggest that the following factors should be considered, if integration of environmental concerns is to be successful:

National Level Environmental Legislation: In several case studies, the impetus for inclusion of environmental themes has come from national environmental legislation. An inevitable outcome of this impetus is that extension is used for the enforcement of policy. Nevertheless, countries such as the United States have seen the need to help farmers understand and comply with new regulations. Where compliance is essential and this role of extension does not jeopardize other functions, national environmental legislation appears to be an effective way of increasing the environmental content of extension programmes. There remains a doubt as to whether this approach is itself sustainable, but in the right circumstances it may be a useful buffer in time while the environmental message becomes fully integrated into good farming practice.

Environmental Mandate: Environmental programmes are strongest where the environmental mandate of the extension agency is most explicit. Ideally, this mandate should be enshrined in a mission statement of the agency. *Ad hoc* decrees from, for example, a government minister, are subject to change and have a lower status with extension staff. Implicit mandates arising from the interpretation of general policies can be important, but are subject to alteration and reinterpretation.

Liaison and Collaboration: Partnerships across ministries, agencies, research and educational institutions, and NGOs are a vital way of ensuring the security of the environmental message. Such collaboration needs to be formalized because of past distrust between organizations. Good examples are the Indonesian memorandum of understanding between the Ministry of Population and Environment and the Ministry of Agriculture, and the training provided by the National Trust of Ireland. NGO collaboration is especially valuable because of its low cost, access to people at local levels and the high motivation of workers. Because of the central importance of research in support of identifying sustainable agricultural practices, particular emphasis should also be placed on developing linkages with environmental research and protection agencies. In some countries, strengthening of environmental extension activities probably cannot be achieved without also assisting environmental agencies.

Staffing and Training: These need to reflect environmental concerns by including: the provision of specific environmental training modules for existing staff; integration of environmental dimensions into standard curricula of initial extension training, "training of trainer" courses, and primary, secondary and tertiary education; and the recruitment of environmental specialists to the full-time staff. As a general goal, the recruitment of female extension agents would enhance the effectiveness of the environmental message to women who, in some countries, make up the majority of land users.

Programme Planning: The most effective agricultural extension programmes employ a combination of bottom-up and top-down planning (Roling, 1988). This applies particularly to environmental messages which need to reflect both the interests of the land user and the long-term security of future generations. Environmental messages may conflict between the two clientele: society may ask for something which is not in the individual interest of the land user; and the land user may carry out practices which impact on others in society. [It has to be said also that some messages are beneficial to both groups, and it is these which should be targetted first]. Planning must resolve conflicts and the only way to ensure a respect for the interests of both land users and society is to employ bottom-up and top-down planning together - in effect, a participatory dialogue.

Environmental Topics: The number of topics must be broad in order to encompass the array of practices that impinge on the environment. Essential components for most physical environments must include: soil and water conservation; biologically-based practices such as rotations and green manuring which naturally conserve soil quality; reductions in use of inputs to levels which are cost-effective, biologically-efficient and safe to society. Not to be forgotten are the more difficult issues of biodiversity, habitat conservation, pollution and other aspects which may not in the immediate future have an obvious pay-back to the land user who is asked to consider such concerns. Sustainability should be promoted as a specific goal by making explicit how a change in practices is to the benefit of all. If farmers are expected to bear an environmental cost on behalf of society, such explicit analysis would provide the basis for subsidy payments.

Sources of Environmental Message: In order to capture the diversity of environmental messages, especially those not immediately related to production issues, a greater utilization of non-standard sources of information needs to be promoted. Standard sources such as

agricultural research centres will continue to provide some aspects such as pollution monitoring. However, more innovation is needed in (a) providing appropriate materials containing the message from international and local sources such as farmers' groups, and (b) increasing the capability of extension agencies to access these sources. The importance of developing and validating messages derived from individual land users whose practices are environmentally-sound should be stressed.

Methods and Target Groups: Methods vary according to country and local situation, and some would not be appropriate to all situations (e.g. television). But, as a general rule, the strongest programmes use a variety of media with different methods for different target groups and address a wide variety of audiences. Different approaches with better targeting need to be made to rural producers, agricultural institutions (e.g. input suppliers, credit organizations), urban audiences, and youth. Special efforts need to be made to reach the poor, the illiterate and semi-literate, and women.

Evaluation: Both the materials and methods used need to be assessed for effectiveness. In the Andhra Pradesh case, "there is an immediate need for systematic scientific verification procedures to formulate appropriate messages...At present the message preparation, its assessment for its technical quality and relevancy by involving concerned target groups is totally absent, and it is one of the greatest weaknesses." The candour of this Indian comment could have been repeated for most of the case studies, and it would be worthwhile to consider how effectiveness assessment could be developed in different institutional settings. Evaluation needs to move beyond standard reporting procedures dealing with, for example, the number of farmers attending meetings, toward an assessment of changes in people's knowledge, beliefs and attitudes. Measurable changes in behaviour would be a profitable line for investigation.

The effect of these "good practice" components is to integrate environmental and sustainable development themes into agricultural extension programmes. It is this integration which is fundamental to the transmission of environmental messages. Unlike environmental programmes which are simply tagged onto conventional extension, a fully integrated programme cannot be separated if funding or political support dwindle. By integrating environmental concerns so completely that they cannot be singled out as separate or dispensable issues, the goal of sustainable development itself will be more sustainable.

The transmission of the environmental message will be enhanced if the message is related to the benefits it brings to the land user and to society. Farmers are rational beings, and will generally react positively to messages which either are individually favourable or have a benefit to society. In this context, the message needs to be presented in a positive, holistic way, aimed explicitly at improvement of livelihoods. Restrictive legislation and compliance orders may sometimes be necessary, but are unlikely to ensure long-term success by themselves.

Finally, it is perhaps tempting to conclude that extension systems need radical restructuring in order to take on environmental and sustainable development themes. Our case studies show that with goodwill, help from the international community, and sometimes modest changes to policy and working practice, environmental issues can be supported. Innovative

methods, a reordering of priorities and collaboration with other organizations can achieve the goal of a more effective extension service, geared to the imperative of sustainable development. This Expert Consultation should be seen as a small but significant step in assisting national and regional extension services to adapt to the new demands.

References

Moris, J. 1991. *Extension Alternatives in Tropical Africa.* Overseas Development Institute, London.

Roling, N. 1988. *Extension Science.* Cambridge University Press, Cambridge.

Agenda

ANNEX 6

Agenda

Tuesday, 30 November

Session 1	Chairperson: Mr. H. Meliczek Rapporteur: Mr. T.E. Contado
0900 - 0915	Opening and Welcome. Mr. H. Meliczek, Officer-in-Charge, Human Resources, Institutions, and Agrarian Reform (ESH) Division.
0915 - 0930	Introduction of participants.
0930 - 0945	Keynote Address: *Integration of Environmental and Sustainable Development Themes into Agricultural Education and Extension Programmes.* Presentation by: Mr. H.W. Hjort, Deputy Director-General, FAO.
0945 - 1030	*FAO's Policies and Actions Related to Environment and Sustainable Development: Follow-up to UNCED.* Presentation by: Mr. P.J. Mahler, Special Adviser to the Director-General and Assistant Director-General for Environment and Sustainable Development.
1030 - 1045	Coffee
1045 - 1200	Meeting of Session Rapporteurs
1200 - 1345	Lunch
1345 - 1400	Consultation Objectives and Working Procedures. Mr. T.E. Contado, Chief, Agricultural Education and Extension Service (ESHE), and Secretary for the Consultation.
Session 2	Chairperson: Mr. L.R. Ndlovu Rapporteur: Mr J. Mannion Secretariat Liaison Officer: Mr. G. Hemrich
1400 - 1430	*Rural Women and the Environment: The Implications for Agricultural Education and Extension.* Presentation by: Ms. L. Kirjavainen, Chief, Women in Agricultural Production and Rural Development (ESHW).
1430 - 1515	Discussion. Lead Respondents: Mr. V. Baranyitondeye, Mr. J.W. King, Ms. A. Pala Okeyo, Mr. A. Trueba-Carranza.
1515 - 1530	Coffee

Session 3	Chairperson: Mr. S. Yassin Rapporteur: Mr. J.W. King Secretariat Liaison Officer: Mr. W. Lindley
1530 - 1615	*Current Status, Problems and Needs of Environmental Education and Training in Agricultural Educational Institutions: What the Case-Studies Reveal.* Presentation by: Mr. K.O. Herz.
1615 - 1700	Discussion. Lead Respondents: Mr. H. Samman, Mr. H.F. von Baer, Mr. F. Bobbitt, Mr. M.L. Firdawcy.
1730 - 1900	Reception

Wednesday, 1 December

Session 4	Chairperson: Mr. M.L. Firdawcy Rapporteur: Mr. H.N.B. Reddy Secretariat Liaison Officer: Mr. R. Adhikarya
0900 - 0945	*Current Status, Problems and Needs of Environmental Education and Training in Agricultural Extension Services: What the Case-Studies Reveal.* Presentation by: Mr. M. Stocking.
0945 - 1030	Discussion. Lead Respondents: Mr. S. Martaamidjaja, Mr. M.S. Sallam, Mr. J. Mannion, Mr. E.O. Lucas.
1030 - 1045	Coffee
Session 5	Chairperson: Mr. R. Bawden Rapporteur: Mr. E.O. Lucas Secretariat Liaison Officer: Mr. L.V. Crowder
1045 - 1215	Panel Discussion: Lessons Learned from the Experiences of Integrating Environmental and Sustainable Development Themes into Agricultural Extension and Education Programmes. Moderator: Mr. R. Bawden Panel Members: Mr. S.J. Muyaya, Mr. A.T. Saad, Mr. J. Severino, Mr. M.R. Redclift, Mr. S. Yassin
1215 - 1230	Group photo.
1230 - 1400	Lunch

Session 6	Small Group Meetings Secretariat Liaison Officers: Mr. N. Doron (Group 1) Mr. J. Jallade (Group 2)
1400 - 1700	Group 1: The Role of Agricultural Education Institutions: Strategies and Approaches for Incorporating Environmental Concerns. Group 2: The Role of Agricultural Extension Services: Strategies and Approaches for Incorporating Environmental Concerns.

Thursday, 2 December

Session 7	Chairperson: Mr. H.F. von Baer Rapporteur: Mr. F. Bobbit Secretariat Liaison Officer: Mr. R.W. Seiders
0900 - 0930	Group 1: Report on the results of Session 6
0930 - 1045	Plenary Discussion: Policy Implications and Proposed Implementation Actions for Integrating Environment and Sustainable Development in Agricultural Education Programmes.
1045 - 1100	Coffee
1100 - 1130	Group 2: Report on the results of Session 6
1130 - 1215	Plenary Discussion: Policy Implications and Proposed Implementation Actions for Integrating Environment and Sustainable Development in Agricultural Extension Programmes.
1215 - 1400	Lunch
Session 8	Small Group Meetings. Secretariat Liaison Officers: Mr. N. Doron (Group 1) Mr. J. Jallade (Group 2)
1400 - 1700	Group 1: Specific Suggestions for Improving the Capabilities of Agricultural Education to Support Environment and Sustainable Agricultural & Rural Development (SARD). Group 2: Specific Suggestions for Improving the Capabilities of Agricultural Extension to Support Environment and SARD.

Friday, 3 December

Session 9	Chairperson: Mr. J. Mannion Rapporteur: Mr. P. Angkasith Secretariat Liaison Officer: Mr. A. Gaaya
0900 - 0945	Group 1: Report on the results of Session 8
0945 - 1030	Group 2: Report on the results of Session 8
Session 10	Chairperson: Mr. M. Stocking Secretariat Liaison Officer: Mr. A. El-Zoobi
1030 - 1530	Drafting Committee Meeting: Formulation/preparation of Draft Consultation Report
Session 11	Chairperson: Mr. T.E. Contado Rapporteur: Mr. M. Stocking Secretariat Liaison Officer: Mr A. El-Zoobi
1530 - 1630	Review and discussion of the Draft Consultation Report
1630 - 1645	Presentation of the Draft Consultation Report to FAO. Summarized by: Mr. M. Stocking, General Rapporteur of the Consultation.
1645 - 1700	Closing of the Consultation

List of Participants

ANNEX 7

Invited Participants

Pongsak ANGKASITH
Dean, Faculty of Agriculture
Chiang Mai University
Chiang Mai 50200, Thailand
Tel: (66) (53) 221828
Fax: (66) (53) 225221 or 222014

Heinrich F. von BAER
Rector, University of La Frontera
Avenida Francisco Salazar 00145
Temuco, Chile
Email: UFRO@UCH CEC V.M.CHILE.CL.
Tel: (56) (45) 252658
Fax: (56) (45) 252658

Vital BARANYITONDEYE
Director General, SRD IMBO
B.P. 192
Bujumbura, Burundi
Tel: (257) (2) 22065 or 22362
Fax: (257) (2) 22873

Richard BAWDEN
Professor of Systemic Development
School of Agriculture & Rural Development
University of Western Sydney
Hawkesbury
Richmond, NSW, Australia 2753
Email: r.bawden@VWS.EDU.AU
Tel: (61) (45) 701374
Fax: (61) (45) 885538

Frank BOBBITT
Professor, Department of Agricultural
& Extension Education
Michigan State University
410 Agricultural Hall
East Lansing, MI 48864-1039 USA
Email: BOBBITT@IBM.CL.MSU.EDU
Tel: (1) (517) 3554580
Fax: (1) (517) 3534981

Mohamed Larbi FIRDAWCY
President, African Association of
Faculties of Agriculture
Director, Department of Education,
Research & Development
Min. of Agriculture & Agrarian Reform
1, Rùe Jaaffer Essadig
Rabat, Morocco
Tel: (212) (7) 61371/6
Fax: (212) (7) 763378
Telex: 81899 DIPROATT M

James W. KING
Associate Professor & Extension
Specialist - Communications
Inst. of Agriculture & Natural Resources
Communications & Computing Services
104 Agricultural Communications Building
University of Nebraska
Lincoln, NE 68583-0918, USA
Email: agcm009@UNLVM.UNL.EDU
Tel: (1) (402) 4723022
Fax: (1) (402) 4723093

E. Olabode LUCAS
Dean, Faculty of Agriculture & Forestry
University of Ibadan
Nigeria
Tel: (234) (22) 400550 to 400614 ext. 1221 Ibadan,
Fax: (234) (1) 682651 (c/o FAOR)

Joseph MANNION
Professor, Head of Department of
Agribusiness, Extension & Rural Development
Faculty of General Agriculture
University College — Tel: (353) (1) 7067792
Belfield, Dublin 4, Ireland — Fax: (353) (1) 2837328

A. Soedradjat MARTAAMIDJAJA
Director of Agricultural Extension
Agency for Agricultural Education
and Training (AAET)
Ministry of Agriculture
Jl. Harsono Rm. 3
Pasar Minggu — Tel: (62) (21) 7804386
Jakarta 12550, Indonesia — Fax: (62) (21) 7805209

Simon Joe MUYAYA
Programme Manager
Agricultural Development Division
Ministry of Agriculture
P.O. Box 259 — Tel: (265) 743911 (direct); 744099 (switchboard)
Lilongwe 3, Malawi — Fax: (265) 744055

Lindela R. NDLOVU
Dean, Faculty of Agriculture
University of Zimbabwe — Email: LNDLOVU@ZIMBIX.UZ.ZW
P.O. Box MP 167 — Tel: (263) (4) 303211 ext. 1402
Harare, Zimbabwe — Fax: (263) (4) 333407

Michael R. REDCLIFT
Professor of Rural Sociology
Wye College
University of London — Tel: (44) (233) 812401
Wye, Ashford, Kent TN25 5AH, UK — Fax: (44) (233) 813187

H.N. Byra REDDY
Director of Extension
Andhra Pradesh Agricultural University — Tel: (91) (40) 245326
Rajendranagar, Hyderabad 500 030, India — Fax: (91) (11) 4620115 (c/o FAOR)

Adib T. SAAD
Dean, Faculty of Agricultural
& Food Sciences
American University of Beirut — Tel: (11) 343002 or 340740
Beirut, Lebanon — Fax: (1) (212) 3035673 (USA No.)

Mohamed Shafie SALLAM
Director, Agricultural Extension &
Rural Development Research Institute
The General Cooperative Society Building
for Agrarian Reform
4th floor, Dokki
P.O. Box Ministry of Agriculture — Tel: (20) (2) 706133
Dokki, Cairo, Egypt — Fax: (20) (2) 3497908

Hazem SAMMAN
Director of Training & Education
Ministry of Agriculture & Agrarian Reform
Al-Jabri Street — Tel: (963) (11) 2226291, 22213613
Damascus, Syria — Fax: (963) (11) 3330429 (c/o FAOR)

Joaquim SEVERINO
Teacher, Federal University of Parana
Rua José Bruzamolin, 191 — Tel: (55) (41) 2261399
82210-280 Curitiba (PR), Brazil — Fax: (55) (41) 2253120

Alejandro TRUEBA-CARRANZA
Technical Secretary of the Agriculture Sub-Secretary
Ministry of Agriculture & Water Resources (SARH)
Insurgentes Sur 476-11
Col. Roma C.P. 06760 — Tel: (52) (5) 5840720; 5840632
México, D.F., Mexico — Fax: (52) (5) 5745273

Sulaiman M. YASSIN
Director, Center for Instructional Services
Professor of Development Communication
Universiti Pertanian Malaysia
43400 UPM Serdang — Tel: (60) (3) 9485886
Selangor, Malaysia — Fax: (60) (3) 9483244 (O); 8251551 (H)

Resource Persons

Michael STOCKING (also General Rapporteur)
Reader in Natural Resource Development
School of Development Studies — Email: m.stocking@uea.ac.uk
University of East Anglia — Tel: (44) (1603) 592339 (direct); 456161 (switchboard)
Norwich NR4 7TJ, UK — Fax: (44) (1603) 593382 (direct); 505262

Karl HERZ
Former Senior Officer, Agricultural Research, FAO
Viale dell'Astronomia, 19
00144 Rome, Italy — Tel: (39) (6) 5910114

Food and Agriculture Organization (FAO)

H.W. Hjort, Deputy Director-General and Assistant Director-General a.i., Economic and Social Policy Department

P.J. Mahler, Special Adviser to the Director-General/Assistant Director-General for Environment and Sustainable Development

Regional Office for Asia and the Pacific

A. Wahid Jalil, Senior Regional Rural Development Officer, RAPA, Maliwan Mansion, Phra Atit Road, Bangkok 2, Thailand.

Regional Office for Europe
R. Krell, Regional Officer, REUR, FAO HQs, Rome

Regional Office for Latin America and the Caribbean
Polan Lacki, Agricultural Education and Extension Officer, RLAC, Av. Santa Maria 6,700, Casilla 10095, Santiago, Chile. Tel: (56) (2) 185323; Fax: (56) (2) 182547

Regional Office for the Near East
A. Kharrat, Agricultural Education, Extension and Training Officer, RNEA, P.O. Box 2223, Cairo, Egypt. Tel: (20) (2) 702229; Fax: (20) (2) 708563

Office for External Relations
W. Mann, Senior Liaison Officer

Animal Production and Health Division
Meat and Dairy Service:
J. Henriksen, Milk Production & Institutional Support Officer
Animal Production Service:
J. Mäki-Hokkonen, Senior Officer, Livestock Production Systems

Agricultural Operations Division
M. Kalim Qamar, Country Project Officer, AGO-1

Plant Production and Protection Division
Plant Protection Service:
C.A.J. Putter, Epidemiologist
Seed and Plant Genetic Resources Service:
K. Tao, Agricultural Officer

Research and Technology Development Division
Environment and Sustainable Development Coordinating Centre:
L.S. Botero, Chief
J.B. Tschirley, Environment Programme Officer
P. Anid, Environment Officer

Agricultural Services Division
Farm Management and Production Economics Service:
H. Wattenbach, Assistant Professional Officer

Food Policy and Nutrition Division
Nutrition Programmes Service:
F. Egal, Nutrition Officer
Food Quality and Standards Service:
E. Casadei, Food and Nutrition Officer

Policy Analysis Division
Policy and Planning Service:
D.B. Antiporta, Senior Economist, Asia and Pacific Group
Training Service:
F. Viciani, Chief
F. Pétry, Economist

Fishery Industries Division
Fishing Technology Service:
R. Maine, Fishery Industries Officer

Forest Resources Division
Forest Research, Education and Training Branch:
F. Schlegel, Forestry Officer (Education)

FAO Population Programme Coordination:
A. Marcoux, Officer-in-Charge

Human Resources, Institutions and Agrarian Reform Division:
H. Meliczek, Officer-in-Charge

Rural Development Analysis and Organization Service:
O.A. Monteza, Senior Officer (Rural Development)
J. Bonnal, Rural Development Officer
G. Giannini, Rural Employment and Manpower Planning Officer

Agrarian Reform and Land Settlement Service:
A. Herrera, Agrarian Analysis Officer

Women in Agricultural Production and Rural Development:
L. Kirjavainen, Chief
S. Erozer, Senior Officer (Food Systems)
M. Fernandez, Women-in-Development Officer
P. Howard-Borjas, Training and Project Officer
Z. Roca, Population Officer (Women-in-Development)

Agricultural Education and Extension Service:
T.E. Contado, Chief
W.I. Lindley, Senior Officer (Agricultural Education)
A.M. El-Zoobi, Training and Extension Specialist
R. Adhikarya, Extension, Education and Training Methodology Specialist
E. Baier, Population Education Officer
L.V. Crowder, Agricultural Education Officer
N. Doron, Agricultural Education Officer
A. Gaaya, Agricultural Training and Extension Officer
J. Jallade, Agricultural Training and Extension Officer
W. Seiders, Rural Youth Officer
G. Hemrich, Associate Professional Officer, Rural Youth
R. Lobb Maltsoglou, Assistant