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ABSTRACT

This document contains a series of 12 case studies undertaken in various institutions of higher education in Australia, Canada, France, Sweden, the United Kingdom, and the United States. These studies review recent experiments in the training of future environmental specialists and generalists. Information in each of the case studies is organized under the following headings: Who Does the Teaching?; Institutional Organization; Course Content; Teaching Methods, Media, and Materials; Research Base; Criteria of Success; and Recurrent Education. (DT)

centre for educational research and innovation

ENVIRONMENTAL EDUCATION AT POST SECONDARY LEVEL

THE TRAINING OF GENERALISTS AND SPECIALISTS

1

OECD

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Centre for Educational Research and Innovation (CERI)

ENVIRONMENTAL EDUCATION AT POST SECONDARY LEVEL

THE TRAINING OF GENERALISTS AND SPECIALISTS

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
1974

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PREFACE

Document No.1 brings together a series of 12 case-studies undertaken in various institutions of higher education in OECD Member countries. These studies review recent experiments in the training of future environmental specialists and generalists.

This investigation is part of CERI's work on Interdisciplinary teaching and research. The concept of "Interdisciplinarity" which had been clarified by extensive epistemological analysis(1) needed to be considered from the point of view of its applications to and implications for the organisation of curricula, teaching methods, structures and role of the institutions in relation to the community at large. To this end, two fields of study which are interdisciplinary by nature, have been selected: Environment and Health. These two fields are studied simultaneously.

As regards the field of environment, an international workshop on "Environmental Education at University Level" was organised by CERI in Tours (France) in April 1971.

The main working papers, a survey on the state of the art of environmental education in Member countries as well as the conclusions and recommendations, have been published under the title "Environmental Education at University Level: Trends and Data", pp. 320, OECD, 1973.

The Tours workshop mainly concentrated, on the one hand, on defining the objectives of environmental education at university level, i.e. the training of specialists, of generalists or co-ordinators, the education of citizens and the training of researchers; and on the other hand, on defining basic principles for curriculum organisation (e.g. identification of unifying themes permitting interdisciplinary teaching, i.e. the integration of the various disciplines involved in environmental matters).

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1) Interdisciplinarity was the subject of an international seminar held in Nice (France) in September 1970. Preparatory work and conclusions of this meeting have been published by OECD: "Interdisciplinarity: Problems of Teaching and Research in Universities", pp. 334, OECD, 1972.

The recommendations formulated at this workshop(1) stressed the importance of international co-operation between institutions providing a coherent environmental education at post secondary level. Furthermore, as the first graduates from these institutions training environmental generalists and/or specialists have just entered professional life, the moment seems particularly appropriate for reviewing experience. In order to so do, a series of questions was suggested to the authors of the case studies under the following headings:

- Who does the Teaching?
  Kind of expertise possessed by educators, criteria for faculty selection, status, background (professional specialists or educators) ...

- Institutional Organisation
  Department, School, Faculty, Centre ...? Relationship between the institution and the university, relationship with the community ...

- Course Content
  Theoretical bases of courses (interdisciplinary approach), scope of studies ...

- Teaching Methods, Media and Materials
  Teaching methods, use of new educational technologies, non-classroom learning, evaluation ...

- Research Base
  Role and use of student research, basic or applied research (Environmental Consultancy) links between teaching and research ...

- Criteria of Success
  Number of enrolments, proportion graduating, increase in numbers enrolling, employment opportunities, professional assessment of quality of the degree ...

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1) See Recommendations for International Co-operation, op.cit. pp. 35.

- Recurrent Education(1)
  Retraining, access to the institution for various groups (citizens, educators, professionals dealing with the environment, decision-makers) to enable them to take courses on the environment.

The case studies described in the following pages will be used as reference documents for the international meeting to be held at RUNGSTED in Denmark from 4th to 7th June 1974. The main objective of this "Conference on Environmental Education at Post-Secondary Level: Review of Experience - Future Action" is to survey past experience and to draw from it relevant conclusions for necessary future action. It should also make it possible to survey the environmental training required by educators at primary, secondary and higher levels, by professionals dealing with environmental matters (engineers, architects, doctors ...) and by decision-makers acting at the political level.

The case studies carried out in OECD Member countries in the three categories above are the subject of document No. 2.

The Centre for Educational Research and Innovation of OECD is greatly obliged to the authors of the case studies and especially to the National Association for Environmental Education (United States and Canada) for its key role in the collection and establishment of North American studies.

The opinions expressed in these studies are those of the authors and as such do not necessarily reflect the position of the OECD or those of the national authorities concerned.

J. R. GASS
Director
Centre for Educational Research
and Innovation

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1) Recurrent Education is a long-term strategy of continuing education based on the principle of alternative periods of professional work and study. In this instance, it is mainly the continuing education and retraining aspects which are involved. See "Recurrent Education : A Strategy for Life-long Learning", pp. 91, OECD, 1973.

MACQUARIE UNIVERSITY

DIPLOMA IN ENVIRONMENTAL STUDIES PROGRAMME

New South Wales, Australia

by A.G. MITCHELL, Vice-Chancellor

BACKGROUND TO ENVIRONMENTAL STUDIES AT MACQUARIE UNIVERSITY

Macquarie University began undergraduate teaching in 1967 as Australia's fifteenth university. The academic organisation of the University is based on a College of Arts and Sciences with the teaching and research programmes divided among ten Schools. These are the Schools of Behavioural Sciences, Biological Sciences, Chemistry, Earth Sciences, Economic and Financial Studies, Education, English and Linguistics, Historical, Philosophical and Political Studies, Mathematics, Physics and Modern Languages. The teaching of Law is to commence in 1974. Each of the Schools is engaged in the teaching of undergraduate and postgraduate students and in research.

Courses in Environmental Studies are spread through seven of these Schools, namely Behavioural Sciences, Biological Sciences, Chemistry, Earth Sciences, Economic and Financial Studies, Education, and Historical, Philosophical and Political Studies.

There are three types of courses. At the undergraduate level students with an interest in Environmental Studies are advised to obtain a sound training in one discipline, with supporting courses which are relevant to basic environmental issues.

At the postgraduate level there are two types of programmes. Firstly there is the normal specialist study leading to a Master's or Ph.D. degree in one of the appropriate disciplines. Secondly there is a general postgraduate Diploma in Environmental Studies. The first students began their studies for this Diploma in March 1973. This is a two-year part-time programme and it forms a self-contained unit within the University structure. It is therefore

proposed to base this case study in Environmental Studies on the Diploma course rather than on the few other programmes. These vary widely owing to the flexibility in the choice of courses that the University organisation allows. Part of the case study, however, will be devoted to an outline of the current research programmes within Environmental Studies.

1. WHO DOES THE TEACHING?

The University has adopted a policy of using existing staff from the Schools of Behavioural Sciences, Biological Sciences, Chemistry, Earth Sciences, Economic and Financial Studies and Historical, Philosophical and Political Studies for a team-teaching approach to the Diploma course. The staff concerned from these Schools have great concern for environmental issues in addition to their teaching and research within their original disciplines. In this way the course gains strength as all these staff members remain in close contact with their original discipline while linking it to the study of particular environmental problems.

All these staff members are at lecturer level or above. They have expertise in at least one of the following areas: chemistry, plant ecology, animal ecology, meteorology, politics, land management, social and urban geography, social psychology, economics, demography, social history. Staff participate in the Diploma course because of their interest in this area. Their level of commitment varies, with probably the School of Earth Sciences having the greatest commitment. All staff members are experienced in research in the area of their specialisation and are prepared to co-operate in joint projects.

Staff for participation in the programme are selected primarily on the basis of their expertise and interest in the subject. Teaching ability as such is very secondary except insofar as knowledge and enthusiasm are dominant features therein.

Non-university based professionals are brought into the programme for two reasons:

Firstly where environmental issues extend beyond the present expertise of the University - as with the law and its relation to the environment;

Secondly where specialist consultants contribute knowledge gained as a result of their continuing employment in some environmentally related field such as administrators within Local, State or Federal Government Departments, or persons from private firms.

Their contribution to the programme to date has been limited and they have had no direct role in developing the course. Indirectly, however, as University staff members know such experts and exchange views with them, their ideas could be said to have influenced the course. They also contribute to a series of general lectures open to the whole University.

It is also clear that there are particular skills needed for teachers in such a course. Such skills are as follows:

i) skill in a particular area of specialisation which bears closely on environment issues;
ii) the ability to apply this specialist knowledge to assist in the solutions of environmental problems currently existing and new problems as they arise;
iii) the ability to work as a member of a group of professionals;
iv) an attitude of open-mindedness;
v) the ability to teach a group of people each more expert in his own field than the lecturer in that field.

2. INSTITUTIONAL ORGANISATION

The Diploma in Environmental Studies is essentially an interdisciplinary programme. It is currently administered through a Committee on Environmental Studies which is a Sub-Committee of the Academic Senate of the University. The Academic Senate is the body principally responsible for academic matters within the University. It consists of twenty-three members, including the Vice-Chancellor, who is its Chairman, a Deputy Vice-Chancellor, fifteen professors, eight of whom are Heads of School, and six members of the sub-professorial staff. The Registrar acts as Secretary to the Academic Senate.

There are thirteen members of the Committee on Environmental Studies and these are drawn from the Schools offering courses in Environmental Studies. The present Chairman is a Professor of Biology who also has the overall responsibility for the Diploma course. With only two exceptions, that of the Head of the School of Earth Sciences(1) and that of the representative from the School of Education, all the committee members are currently engaged in

1) Within the University Heads of Schools are professors elected by the members of the Schools for a three-year period.

the teaching of the Diploma Course. (Minor changes in personnel involved in teaching this course occur from time to time.)

This Committee meets monthly and thus is able to review the working of the Course (and other environmental issues) from an interdisciplinary base.

The organisation of the Diploma in this way does cause some administrative problems. Their solution depends very much on the goodwill of the Heads of the Schools concerned. This goodwill exists. The development of the University, like that of all other universities in the States of Australia, is financed by grants from the Australian and State Governments. The Australian Universities Commission following submissions from all the universities allocates funds for a three-year period. As there is no separate School of Environmental Studies within Macquarie University the finance for the Diploma goes to the relevant Schools which in their budgeting must allocate staff and money for the expenses of the course in proportion to their commitment to it.

It is now believed that the activities have developed to the stage where there is need for a full-time Director of Environmental Studies to be responsible for co-ordinating, developing and directing the Diploma Course, as well as developing other activities within this area. It is considered appropriate that the appointment should be at Professorial level. It is hoped that this appointment may be made in 1975 in order to take advantage of the momentum which has strengthened since the initiation of the postgraduate diploma in March 1973. There had been a growing need for someone with the time and background to be able to co-ordinate all the existing courses and activities in Environmental Studies and to develop the area of teaching general environmental issues as distinct from the more specific issues which would remain with the Schools. Such a professor would have a co-ordinating responsibility with the Heads of the Schools concerned; he would also develop close associations with government bodies, private industry and citizens involved in environmental matters. The Committee on Environmental Studies still feels that the existing interdisciplinary nature of the programme would be retained although it does not rule out the possibility that at some future date there may be a separate School of Environmental Studies.

Each May within the University structure staff members considering themselves worthy may apply for promotion from the grades of lecturer to senior lecturer to Associate Professor. All staff members are entitled to apply for any new post the University may

advertise. These means are thus available to the staff teaching within the Diploma programme.

The Diploma was introduced to the University programme of studies as a result of the interest of existing members of staff and their recognition that the University could play an important role in developing expertise directed towards the solution of environmental problems. Within the University proposals for innovations go through the Standing Committee of the School initiating the proposal, to a meeting of the School as a whole, to the relevant Sub-Committee of Academic Senate, to Academic Senate, then to all Schools for consideration of the proposal and any amendments to it, and finally back to Academic Senate for a decision on adoption. This procedure would be followed for any major changes in the existing programme. Other changes may be made by the Committee on Environmental Studies. Proposals for innovations can be initiated by any members of staff.

As the Diploma began only in 1973 there has been no major Inter-Institutional co-operation to date. It is expected that this will develop and would be encouraged. There is, for example, fairly close mutual co-operation with the Natural Parks and Wildlife Service and the N.S.W. Department of the Environment.

Each student at Macquarie University is given an Academic Adviser at the time of enrolment. The adviser is chosen from the School in which the student has his major interest. Wherever possible the particular interests of the student and adviser are matched. Such an adviser is available for consultation throughout a student's course. Where student interests change, advisers may be changed. In addition there is a Student Counsellor whose work is separated from that of the individual Schools and can thus be more impartial if this is necessary.

3. COURSE CONTENT

The aim of the Diploma in Environmental Studies is to give candidates of widely differing backgrounds the opportunity of widening their knowledge of environmental issues and, by interchange of ideas and studying particular systems, to arrive at more effective ways of solving current problems. Every opportunity is given to encourage the interplay of ideas both between and among candidates and staff in a rigorous and disciplined manner. The experience is planned to be broadening, attempting to break down the barriers between specialists in an area of major social concern involving all areas of knowledge.

A particular feature of the course is the opportunity to participate in and develop approaches to the assessment of proposed actions on the environment. (Macquarie University Calendar, 1973, p. 522).

The Diploma consists of the following courses:

First Half-Year	General Principles of Environments
Second and Third Half-Years (running concurrently)	Environmental Impact Assessment Management of Natural Ecosystems Chemicals in the Environment
Fourth Half-Year	Environmental Impact Assessment Urban Ecology.

In addition some lectures on environmental law are given during the third half-year.

This programme involves 12-15 hours of formal and individual study during each of the 13 weeks constituting each half-year. Except during excursions formal contact is rarely more than 5 hours per week.

Intake is limited to 30 students per year.

These courses will now be discussed in turn.

1. General Principles of Environments

This course attempts to discuss and analyse how human ecosystems function and are controlled; the underlying ecological principles and how these are modified by economics and politics; the flow of materials; effects of population; the initiation and control of change; lessons to be learnt from major past civilisations. It considers resources and use of resources, generation and avoidance of wastes, aesthetics and "the quality of life". Attention is given to environmental policy, planning and implementation, the determination of standards, resolution of conflicts, and decision making on environmental quality. A feature of the course is the study of broad topics by groups of 5 students with a member of staff, leading to the preparation of a report.

2. Environmental Impact Assessment

This course involves initially the presentation to the whole group of a case study involving an environmental impact assessment and a brief discussion of the range of research techniques available for impact assessment in the various disciplines. In the

second half of 1973 a number of subgroups were formed to carry out an environmental impact assessment of a small inner city peninsula area of Sydney. The final assessment is dependent on the work of all the subgroups, each of which is working under the guidance of a staff member with expertise in one aspect of the environment. In 1974 five parallel groups, each of six students, covering a range of disciplines will make separate studies. These independent groups will meet regularly to exchange information on the separate environmental impact assessments. The reports of these assessments are to be written with publication of them as an aim.

3. Management of Natural Ecosystems

The aims of this course are to introduce familiarity with the structure and function of naturally occurring communities whether pristine or altered by man; to appreciate the influence of environmental factors, and of human actions, on these systems; and to understand the problems and issues inherent in their preservation or utilisation.

The course surveys Australian ecosystems and analyses man's impact on these including urbanisation, agriculture, grazing, forestry, recreation and natural parks. It discusses the features, purposes and management of natural ecosystems, including the maintenance of diversity, aesthetics, compromises with other activities; the management of recreational and national parks, roadsides etc; and the principles of wildlife management and control including the maintenance of populations. It is taught primarily in the field.

4. Chemicals in the Environment

This course aims to develop a knowledge of the chemicals being deposited in the environment, their detection, sources, movement and means of detection.

The content is presented under three headings; air pollution, water pollution and solid waste disposal. There are special sessions on radioactivity and toxicology.

5. Urban Ecology

This course aims to develop a knowledge of the structure and function of the city in ecosystematic terms and to demonstrate the role of planning in urban design and management.

The content includes discussions of man-made environments including the adjustments, interactions, organisation flows and exchanges; the principles of urban ecological change and their syntheses in simulation systems.

4. TEACHING METHODS, MEDIA AND MATERIALS

To achieve the objectives of the Diploma as a whole and of each component, a wide variety of teaching methods is used. These range from the formal lecture session to discussion groups, debates, group projects, field work and individual projects. This variety in teaching methods is also in line with the Chaucerian motto of the University: "And Gladly Teche". It also recognises that students have different competences so that the final outcome is more fairly judged following a variety of interim teaching and assessment measures.

Within the Diploma programme the co-ordinator has a heavy load as it involves so many different people. It is a full-time job and it is for this reason that a full-time Professor of Environmental Studies is being sought.

Non-classroom experience is essential for Environmental Studies. Each course contains elements of field work.

Major emphasis occurs in two courses. In the course Environmental Impact Assessment two group field projects are to be completed. The course Management of Natural Ecosystems provides three excursions to three different ecosystems. These are:

a) Rangelands and desert (Broken Hill/Tibooburra);
b) Sclerophyll, heath and rainforest (Myall Lakes);
c) Forest and Alpine (Snowy Mountains).

Each field study is of approximately nine days' duration and students are required to attend at least two of the three. Each field trip has at least three staff members with detailed knowledge of the area, one with expertise in land management, one in plant ecology and one in animal ecology. Local experts, including members of the National Parks and Wildlife Service, are also involved. The aim of each project is to characterise the system as far as practicable and to identify the parameters by which and the degree to which it might be managed. Having established the feasibility of various measures, the group is then in a position to comment on the desirability of particular policies. Research for information is carried out by the student before each visit and collated, and individual reports are required at the conclusion. Accommodation on these field studies is mainly in the field. Students are required to provide their own subsistence but travel costs (usually minibuses) are covered by the University. The experiences students gain from working together in the field cannot be overemphasised.

Laboratory experience is not a feature of this course, but may be involved, depending on the project, with parts of the Environmental Impact Assessment.

Computer facilities are available to the students for completion of their assignments.

The wide variety in the background of the students, the team-teaching approach, and the use of visiting lecturers, together with field work, are a means of ensuring that students encounter actual environmental problems because they serve to link theory and practice in an intimate way.

As the first students have not yet graduated, varied approaches to the teaching have not yet been tried other than those inherent in the existing courses. It is intended that in 1974 the course General Principles of Environment will be less wide in scope in the hope of achieving greater integration of subject matter. Other approaches will be tried in later years.

Student progress in the various non-classroom learning components is evaluated almost entirely on reports and essays and on contributions to discussions. There are no formal examinations.

Few commercially produced educational materials (video tapes, audio tapes, modular packages, graphics, etc.) are used. Any that are used are assessed on their adequacy to fulfil the specific purpose required. Most material is prepared by staff to meet the detailed need.

5. CRITERIA OF SUCCESS

1. Students

The Diploma Course began in March 1973. By February 1973 the University had received 71 applications from adequately qualified people wishing to enrol in it. Offers were issued to 31 applicants. Preference was given to those with some standing in a field directly related to the environment, such as conservation, pollution, natural resource management or urban affairs.

As was hoped the students came from a wide variety of backgrounds and were already well qualified in their original disciplines (see Table).

EMPLOYMENT AND DISCIPLINES OF DIPLOMA STUDENTS

Employing organisation	Number	Discipline	Number
Local state and federal departments and agencies	14	Architecture and Planning	8
Private industry	9	Engineering	7
Private employment (consultant, etc.)	4	Physics, Chemistry, Biology	7
University and other educations	2	Economics	4
Other (politics, environment organisation)	2	Geography	3
		Law	2
Total	31		31

2. Staff

In 1973 no additional staff were appointed for the Diploma course. The teaching load was distributed through seven of the Schools of the University.

In 1974, the equivalent of three staff at lecturer level are to be appointed to the Schools of Behavioural Sciences, Chemistry, Earth Sciences and Economic and Financial Studies. (Staff are not appointed specifically to teach in this programme but many members spend a part of their time thereon.)

It is hoped eventually that there will at least be lecturers attached full-time to the Chair of Environmental Studies. These staff will have a major responsibility for teaching, with help from existing staff, the following courses:

i) General Principles of the Environment;

ii) Environment Impact Assessment;

iii) A new undergraduate general education course possibly called Man and His Environment. This will be a second-year course normally available to students in their fourth half-year of study towards a three-year Bachelor of Arts degree. It is expected this course would discuss such topics as population, availability of resources, energy use, economic conflicts and social impacts. It may be expected that 150-200 students would enrol in the course, because of the great interest in environmental issues.

3. Student Comment

At the conclusion of the first offering of the course General Principles of the Environment there was a general consensus of

opinion among students that it was very successful. However, it was felt some parts were more successful than others. The students considered the exercises were more useful than the lectures, which appeared not to be sufficiently coherent, although each of the separate segments was well appreciated. A few were dissatisfied with the choice of area for the first Environmental Impact Assessment. There was great enthusiasm for the first excursion in the Natural Ecosystem course and some students have asked for a further excursion outside of the formal course.

4. Employment

As the first students have not yet graduated from the course it is too soon to tell the impact they will have on the community. No precise information is available for the employment opportunities but the growing Australian interest in environmental issues is being reflected in an increasing number of advertisements for professional specialists in various areas as well as for people with a general awareness of environmental problems. At present only a few people are concerned professionally with the environment although their numbers are expected to grow in the next few years. Such people are those staffing new Government departments of environmental control, managers of national parks, ecologists with mining companies, city planners, and public health authorities. However, there are many people to whose work environmental issues are and will continue to be directly relevant. In this group are people such as architects, chemical engineers, geographers, economists, teachers and journalists, where it will prove advantageous for the graduate to be a competent specialist and able to relate his specialisation to environmental matters.

There is also a rapidly growing demand for environmental impact assessments, for which panels of consultants are appointed.

With one exception all the present students in the Diploma course are employed already and it remains to be seen whether their jobs will change as a result of these studies.

5. Changing of Events

In Australia today there is increasing community interest in environmental issues. As knowledge of the University's course offerings and research interests within this area of study spreads, it is expected that the University will be asked more and more to assist in projects concerned with current environmental issues . Some members have been involved as consultants and the University has been asked to undertake a number of studies.

6. Credibility

The teaching and research activities of staff lead to the establishment of a certain degree of credibility. (This particular course is too recent for graduates to have made any impact.) For example, a numoer of staff have been asked by the N.S.W. Minister for Environment Control to assist him in various regional enquiries and in the preparation of a manual on environmental impact assessment. One has served as an adviser to the Commissioner conducting a public enquiry on a proposed natural-gas pipeline.

Some of the reports prepared by students in this course have been sought by ministers of the Crown and other responsible authorities.

7. Extent and Nature of Student Involvement and Participation in the Programme

This is great as each week the students continue to spend long hours after the formal components of the course are completed discussing and arguing about environmental issues. They are also required to produce many reports and are intimately concerned in planning and executing the environment impact assessments.

8. Community Involvement

For November 1973 the Committee on Environmental Studies has planned a two-day workshop limited to 30 participants with the aim of assessing and interpreting possible qualitative indicators of the quality of an urban environment. The topics for the workshop include:

i) the quality of urban life;
ii) the quality of air and water;
iii) the quality of spatial arrangement and land use at city level;
iv) the quality of spatial arrangement at neighbourhood level;
v) economic indicators;
vi) social indicators - measurable/non-measurable.

There are to be discussion leaders for each session. It is planned to publish the proceedings of the workshop as "Macquarie University Studies on Environmental Issues, No.1".

A number of discussions and seminars are held throughout the year on environmental issues; these are open to the whole university. There is usually one one-day seminar open to the general public.

6. RESEARCH BASE

Research falls into two categories:

1. That being undertaken by individuals within the different Schools. This covers both pollution - pesticide residues, thermal pollution, re-vegetation of scree slopes, effects of fire, fish population of Port Jackson, air pollution of the Sydney area, medical geography of an industrial area, surface-active pollutants, chemistry of exhaust gases, heavy metals in sea water - as well as more general studies, including ecological relationships of several marsupial species, coral reef fishes, and forest species, water relations of crops, simulation of crop growth, management of koala populations, adolescents and the community, leisure and work resource, inventories and land syetems. Some of this research is being undertaken by students in order to attain higher degrees. In some instances higher degree candidates and staff members are working together while in others the research is entirely the responsibility of individual staff members.
2. That embarked on by the Committee of Environmental Studies as a result of specific requests from outside the University. For example, the N.S.W. Department of Environmental Control initiated the research which is to lead to the examination of indices by which the nature of an environment can be described.

Research activities are sponsored by finances from a number of sources, including the Australian Research Grants Commission, the N.S.W. Department of Environmental Control, the N.S.W. State Electricity Commission, Wheat Research Council, and Local Government.

It is necessary to pursue both basic research in existing disciplines and environmental consultancy. The former makes an expert with something new to contribute. The latter gives relevance and guides the direction of the research. (However, in sociology it is virtually impossible to draw a line between basic research and environmental consultancy or applied studies.) The proportion of time spent on consulting in environmental matters compared with that on basic research varies widely between different staff members. A number do undertake consultancy work for individual private institutions commissioned to undertake an environmental study -

e.g. on sand mining, hovercraft transport on Sydney Harbour, new shopping complex, proposed car park for Opera House, study of social impact of Housing Commission, high rise project in the inner city area of Sydney, etc. - and also for environmental studies by N.S.W. Government departments - e.g. regional studies, pollution monitoring network, preparation of manual on environmental impact studies, etc. These studies feed back into basic research and often encourage staff to bias their investigations from more basic towards immediate applied aspects. It is desirable that all projects have theoretical value or at least advanced general knowledge of environmental systems.

These considerations and the teaching of the Diploma Course also influence university priorities in various ways. Quite a lot of effort is expended in examining many issues which may reach crisis level; often these are local and immediate such as the environmental influences of a proposed action, e.g. a new Sydney airport, rather than general, such as the changing density and composition of transport on pollution.

There is appreciable interchange and feedback between teaching, research and consultancy, reports of the last often being used as immediate teaching materials, and influencing the choice of student assignments and future staff research.

Funding of more detailed projects is primarily by the Australian Research Grants Committee. Particular mention may be made of the Botany Bay and George River Basin Project which is a large multi-million dollar study of an interdisciplinary nature being sponsored by the various Australian Academies. This tends to direct work towards this specific region and also encourages investigations which might not otherwise be undertaken.

At present there appears to be no mechanism for the employment of post-doctoral research workers in the university though this would be a great asset. There are also difficulties in funding expensive survey type research where spending is of a recurrent type, i.e. for salaries and not for equipment.

7. RECURRENT EDUCATION

Within the area of Environmental Studies Macquarie University has been following at least five lines in an attempt to encourage career professionals and others to seek recurrent education.

By offering a Diploma Course as a part-time evening course spread over two years it allows its students to continue in

employment as they study further in an area directly related to their job.

Macquarie University has made a study that shows that maturity and motivation are important in determining the quality of a student's performance in university. It has therefore a policy of admitting mature age students. In 1973, for the first time, it has adopted the policy of admitting some students over the age of 25 years who do not have the usual qualifications for entry but who demonstrate their ability and motivation by successfully applying themselves to an academic task immediately prior to seeking admission. Thus they do not need to rely solely on secondary school performance which may have receded so far into their backgrounds as to be irrelevant and to have been superseded by experience and purposeful activities likely to contribute to the quality of their university work. (Third Report of the Vice-Chancellor: May 1973.)

The proposed two day Workshop on Environmental Indices, in November 1973, will bring together thirty people whose jobs are intimately involved with the environment to discuss questions of mutual concern. This Workshop is part of a regular pattern of annual symposia. In previous years they have been open to the public or directed specifically towards senior secondary school students. In 1970 and 1971 the symposia were entitled "Environmental Teach-In" while in 1972 the topic chosen was "Population and the Environment".

It is hoped by many staff members that finance may be found to allow more non-degree students to enrol in individual courses.

Publication of student exercises allows them to reach a wider audience in an informal way.

In 1970 a series of fortnightly lunch-time lectures were begun at the University. These lectures aim to interest and educate members of the University in environmental issues. Outside lecturers included the Federal Minister for Urban Affairs, and various staff members have also been lecturers in this series and have allowed time for discussion at the end of the lecture.

Research activities by staff members have involved the assistance of members of the public. In particular a current study of air pollution over the Sydney Basin would not be possible without the three-hour measurements of wind speed and direction over two-day periods by many people. These research assistants responded to advertisements in newspapers and on radio and by their participation are actively involved in environmental education.

The majority of students currently enrolled in the Diploma Course are already in positions of responsibility where they regularly make decisions affecting the environment. It is hoped that this will continue. The use of specialist consultants for guest lecturing is a further means of encouraging interaction among persons with common interest and this in itself is a means of recurrent education for all concerned. Staff also provide key note lectures for public discussion groups and this proves a two-way educational exercise.

THE FLINDERS UNIVERSITY OF SOUTH AUSTRALIA

INTERDISCIPLINARY COURSE ON "ECOLOGY OF MAN AND SOCIETY"

Bedford Park, South Australia, Australia

by R.L. HEATHCOTE, Course Coordinator

This course arose out of discussions between undergraduate students and members of staff of Flinders University over the period late 1971 and 1972, and was mounted for the first time in 1973. The success of the course has been sufficient to justify its continuation in 1974.

1. WHO DOES THE TEACHING?

The teaching staff is composed of:

- 3 biologists
- 2 geographers
- 1 economist
- 1 chemist
- 1 political scientist
- 1 hydrologist
- 1 meteorologist
- 1 earth scientist.

The teaching responsibilities of staff vary according to the level of the course taught.

A "core staff" of four was established, comprising a biologist, an economist, a geographer and a political scientist. This was deliberate policy from the outset and was intended to expose students to at least these four possibly different ways of looking at the course content. All staff participants had substantial teaching commitments extra to this course but participation generally was high and all "core staff" attended lectures given by their colleagues, even though timetable clashes prevented a constant attendance. At

least two of the core staff attended and assessed each seminar and assessed the final written project.

No non-university speakers were brought into the course as a wide variety of expertise was available within the university.

At the level offered, i.e. to third year undergraduates, the varied backgrounds of the core staff appeared to provide a sufficient range of skills, knowledge and experience for basic teaching and guidance. Detailed investigation of local problems for student projects required field interviews as well as archival search and between them the staff were able to direct enquiries to the appropriate outside university contacts.

2. INSTITUTIONAL ORGANISATION

As an interdisciplinary offering the course could be taken by both science and arts students as part of their normal degree structure. In terms of student workload the course represented one-sixth of their year's work.

The staff commitment to teaching was arbitrarily registered for university staff-student teaching ratios as equally divided between the four core members only, hence the disciplines who provided those staff were officially credited with teaching one-quarter of the students enrolled for the course. This meant that maintenance money was budgeted to the discipline on this basis.

As a university course offering, the day by day organisation was carried out by the core staff, principally the coordinator, but innovations came from students as well as staff and some will be incorporated in next year's course.

All core staff were available to all students as advisers, particularly for the preliminary planning of student projects. In fact few students made use of this, which may suggest indifference, or a low opinion of staff expertise, or (we felt more likely) that most knew, or thought they knew what they wanted to do beforehand. Consultation of staff tended to increase after the work-in-progress seminar on their project had revealed omissions and discrepancies(!).

3. COURSE CONTENT AND METHOD

The University Calendar entry for the course read as follows:

"The course is intended as an analysis of the physical and cultural factors which affect the relationship between man

"and his environment. Introductory lectures will provide a basic background to the course in the principles of Biology, Economics, Earth Sciences, Geography and Politics. Themes which will be developed on this foundation may include: general principles of ecology and interactions within ecosystems; the cultural evolution of man; history of man's concern for the environment; population growth and dynamics; resource availability and control; waste disposal; relationship between economic system and environmental problems; political causes of current eco-crisis; the ecological contradictions inherent in state and corporate capitalism; political consequences of the range of proposed solutions; the long-term effects of economic growth on consumption of natural resources; the implications of a stationary state on economic organisation."

The course was organised and taught in three ways:

a) A series of 36 lectures introduced the concepts and methods used by the disciplines represented by the four core staff members (biology, economics, geography and political science), then went on to examine in turn the three major themes thought to be central to the course, namely "pollution", "resources", and "population".

b) Paralleling the lectures in time were four tutorial meetings, one taken by each of the core staff, where students were required to provide a 1000 word report on a topic set by the staff member taking the meeting.

c) The final third of the course was occupied by a series of seminar meetings at which students presented a 30-minute verbal exposition of their project as a 'work-in-progress' report. A fellow student was given the job of discussion leader for each report.

The detailed layout of the course in 1973 is described in the table.

Theme	Date	Lecture 1	Lecture 2	Student Assignments
Concepts from each discipline relevant to course; background to current "eco-crisis"	Term One Week 1	- Concept of Ecosystem	Man on Earth	Readings and preparation of tutorial papers for meetings in weeks indicated below:
	2	- Change and stability in ecosystem	Man's role in changing face of the earth	
	3	- Interaction within/ between populations	Origins of Conservation Movement.	
	4	- Economic concepts on Eco-crisis I	Economic concepts on Eco-crisis II	
	5	- Nature of Government	Political Philosophy and Eco-crisis	
Case studies of "Pollution"	6	- Problem of DDT	Freshwater Pollution	Tutorial Round One
	7	- Urban Pollution I	Urban Pollution II	
	8	- Economics of pollution	Pollution in World Model	Tutorial Round Two
	9	- Politics of pollution	Politics of pollution reform	
Case studies of "Resources"	Term Two Week 10	- Nature of Resources	Coastal Resources of South Australia	
	11	- Water Resources	Mineral Resources	
	12	- Economic nature of resources	Case study: Limits to growth	
	13	- Imperialist theories of world resource extraction	Political ecology of underdevelopment	Tutorial Round Three
Case studies of "Population"	14	- Birth Control	Effectiveness of ZPG	
	15	- Human reproduction	Genetic engineering	
	16	- Micro-models of fertility	Macro-models of fertility	
	17	- People and Food	People and Energy	Tutorial Round Four
	18	- Politics of P.Ehrlich	Theory of population pressure and warfare	
Multi-disciplinary approach to the ecology of man and society	Term Three Week 19-27	Seminars for student work-in-progress versions of their project		Seminars

While the lecture material drew upon global examples, tutorials and particularly seminars were aimed at local Australian conditions. In the case of seminars, students were specifically encouraged to attempt studies incorporating field research data collection by observation and interview - as well as local archival sources. Some students made use of the university's computer faoilities for rudimentary tabulation of interview data.

Assessment in the course was as follows:

10 per cent for each of the four tutorial papers, graded by the 1 core staff in charge of tutorial.
10 per cent for the verbal presentation of the work-in-progress seminar, graded by at least 2 and usually 3 of the core staff attending.
50 per cent for the final project report (which could be in the form of a written report, film, maps or statistical analysis), graded by at least 2 of the core staff.

4. RESEARCH BASE

The course was not seen as central to any specific research project either of the university or of the core staff, but individual student projects were influenced by staff expertise and research interests and, in the case of the projects, did contribute analyses of primary data which had a fundamental research value. Copies of these reports will be retained for future use.

5. CRITERIA OF SUCCESS

Enrolment initially was 27 which rapidly dropped to the final 23 "stayers". The course attracted almost equal numbers of "science" and "arts" students with a representative mix from the four core disciplines.

This report is written before the end of the course so any comments on its success are premature. However, from the staff viewpoint the course appears to have been successful in exposing students to contrasting and often conflicting opinions, as well as data, on environmental questions. Most students have responded and only 2 of the 23 appear to be in danger of failing the course because of incomplete assignments at the time of writing. The seminar work-in-progress reports have so far shown an awareness of

the uses for multi-disciplinary approach to questions - which was the aim of the exercise - and a fair to good standard of research ability.

As noted earlier, the course originated from student requests for studies on environmental questions and at the end of the course the students will be asked to make constructive suggestions as to how the course might be improved next year.

In conclusion it would appear that the course has fulfilled its original purpose - to provide an interdisciplinary approach to environmental questions within the existing university teaching programme. This has been achieved with the minimum amount of re-allocation of funds or capital equipment and would seem to be a useful way of introducing broader environmental studies into a university teaching programme which already offers a wide variety of specialist courses.

UNIVERSITY OF WATERLOO

DEPARTMENT OF MAN-ENVIRONMENT STUDIES

Waterloo, Ontario, Canada

by George R. FRANCIS, Chairman

INTRODUCTION

Waterloo is one of the newer universities in Canada, having been established in 1959 in the urban area of Kitchener-Waterloo about 60 miles west of Toronto. The university has since grown to over 12,000 students enrolled for studies in its six Faculties and four affiliated Colleges. In 1969, the Division (now Faculty) of Environmental Studies was created to group together a professional School of Architecture, a professional School of Urban and Regional Planning and the Department of Geography. At the same time a new academic Department of Man-Environment Studies was created. This was to be a multidisciplinary department which would develop its own programme of teaching and research. By complementing the expertise of the other three units, man-environment studies would also strengthen the Faculty through mutual cooperation both within the Faculty itself and among other Faculties whose teaching and research are related to man-environment themes.

The main mandate given to the new Department was to develop and present a four-year honours undergraduate programme of studies oriented around the broad theme of the inter-relationships of Man with various environments. This programme would be academically justified in its own right and lead to a Bachelor of Environmental Studies (B.E.S.) degree. It is the one described in this case study. The Department also offers courses of general interest for students enrolled elsewhere in the university and advises graduate students in geography, planning and other programmes.

As of June 1973, the Department had a multidisciplinary teaching faculty equivalent to 13 full-time people (some 18 people in all) and a total enrolment of about 200 students as it was about

to enter the 1973-74 academic year. It had evolved a core programme of studies which students seeking the honours degree take along with a number of other courses they individually select from anywhere in the university. The first small graduating class of ten students had only recently received their B.E.S. degree and had either entered full-time employment or were about to go directly to post-graduate study elsewhere.

1. WHO DOES THE TEACHING?

The 18 faculty who teach in the Department collectively represent a wide range of disciplinary backgrounds and several have qualifications in more than one area. The academic backgrounds include anthropology, agriculture, biology and ecology, chemistry and chemical engineering, communications science, economics, fine arts, geography and planning, geology, mathematics and physics, political science and public administration, psychology and social psychology, sociology and social work. About half of the people involved teach full-time with the Department. Most of the part-time people teach in some other programme under joint-appointment arrangements which at present are mainly with the two professional schools of Planning and Architecture.

The criteria which have gradually been developed for selecting faculty include recognised academic qualifications in some discipline or profession related to "environment", an attitude and aptitude favourable to multidisciplinary work, a clearly expressed preference for undergraduate teaching along with personal attributes that would make for good faculty-student relations, and a definite interest in experimenting with different approaches to teaching and learning. Once the initial small core of people had been recruited by 1969-70, consideration was then given to "rounding out" the group by selecting people with different academic and other experiences judged useful for developing the undergraduate programme. This judgement was largely a consensus arrived at among faculty and students already within the programme. In practice it meant recruiting persons with natural science or applied science orientations to complement the initial group who were more representative of the social sciences and the arts.

Of necessity, everyone recruited to teach within man-environment studies came from academic backgrounds other than "environmental studies". The question each found themselves asking was whether or not they should retain an affiliation with their

original or major discipline. This became an important dilemma for some and two distinct attitudes emerged. Some felt that such affiliation is vital and that their function in the programme is to provide some kind of intellectual bridge between a discipline offering substance and method and the application of this discipline to environmental studies as a broad problem area. Others insisted that it is more important to grow intellectually away from whatever discipline was once studied and tackle environmental themes, issues and problems directly. In this view "disciplined" thinking is not something possible only within the traditional disciplines, and much of the content and methods of particular disciplines may be of no use, or even a liability for understanding environmental questions.

Administratively, the most harmonious way of accommodating these two divergent views is to have those not overly concerned about their disciplinary identity agree to work within the more innovative core of the programme. The others in fact really only want a partial involvement. They feel a need to maintain standing among their former disciplinary colleagues and this often results in some felt conflict between the two commitments. Their dilemma seems most satisfactorily resolved if they can in fact adopt some "bridging" role by offering seminars in topics such as "environmental geology" or "environmental psychology" particularly if these are also increasingly recognised as sub-areas within the associated discipline. However, unless this role can be recognised by joint appointments with the appropriate mono-disciplinary department, unhappiness may develop among faculty because it is generally the "core courses" which reflect multi- or interdisciplinary aspirations the most and make greater personal demands on the time, learning and effort of faculty. The "discipline-bound" faculty may appear to the others to be opting out of this commitment, while in fact they may be trying to discover how best to relate their discipline to it.

Non-university based professionals and others have been extensively drawn upon by the Department as guest lecturers in its programme. They bring unique first hand experiences of situations which students and faculty both find of particular interest and they add a desirable measure of diversity and variety to an ongoing programme. It is important to have faculty members coordinate visitors so that their presentations fit reasonably well within the overall theme and sequence of a course or seminar. Our general experience has been that the visitors themselves enjoy the opportunity of meeting with students although they may initially be

somewhat apprehensive. Many career professionals seldom get the opportunity to talk with student-aged youth, particularly ones who show keen interest in what they have to say.

The only instance where outside professionals have been drawn upon to develop a course is for "environmental law". The University does not have a Faculty of Law so arrangements have been made for a group of five lawyers to present an evening course on law for non-lawyers as it relates to urban planning, environmental pollution, and natural resources management. This course is taken through elective choice by students from all programmes in the Faculty of Environmental Studies. Otherwise the influence of non-university personnel in developing curricula and courses is indirect but not necessarily unimportant; suggestions and reactions from various sources are solicited and taken into account by faculty for revising material and its presentation.

On the basis of our experience so far, we would suggest that effective teachers of environmental studies are more likely to be found among people who, besides having teaching skills, have a well developed "systems mode" of reasoning directed towards questions of the inter-relationships between people and various man-made or natural environments; whose interests are oriented at least as much to the future as to the present and past; and who have had related first hand experience working with various professional and other specialists on particular problems. They would also have a healthy scepticism about conventional pedagogy in educational institutions, and be prepared to make maximum use of non-institutional environments for teaching and learning.

2. INSTITUTIONAL ORGANISATION

The University of Waterloo is organised along the conventional lines of Faculties subdivided into academic Departments, or "Schools" in the case of some professional training programmes. Faculties have a high degree of administrative autonomy as do Departments and Schools within them.

Under this arrangement the Department of Man-Environment Studies can develop its curriculum and courses as it sees fit subject only to University Senate approval of the initial proposal for any new course; it can experiment at will with different approaches to teaching and learning; it directly administers its annual budget in accordance with university policies governing

categories of expenditures once a total amount is set within the Faculty; and it administers the "faculty reward system" although major questions of academic promotion and tenure have to be approved by both the Faculty and the University to assure a degree of university-wide consistency in deciding such matters.

Budgeting is a rather more complex process. In Canada the federal government only provides funds directly to universities in the form of specific research grants. Operating budgets for universities come from provincial government grants according to a formula based on total student enrolment. The allocation within the university among Faculties is essentially done through bargaining with the university administration for slight adjustments over the current year's allocation among Faculties. Strong student interest, as evidenced by enrolments in courses and programmes within each Faculty, is an important factor in bargaining and is working increasingly in favour of environment studies. Essentially the same process allocates funds to Departments within Faculties.

The question of establishing new programmes of study is still left largely to the judgement and discretion of the universities themselves. A measure of control over new programmes at the graduate (post-Baccalaureate) level was introduced in 1971 by the provincial government. It now withholds operating funds "earned" by students enrolled in a new programme until such time as the Ministry of College and University Affairs approves the establishment of it. Approval comes when it is judged that graduates would have reasonable employment prospects, and there is no unwarranted duplication with similar programmes elsewhere within the province. New undergraduate programmes do not require government approval.

While there may seem to be a contradiction in having a semi-autonomous Department operating a programme of environmental studies which inherently should not be "departmentalised", on balance this seems a viable way of going about it. Regardless of the organisational form there is always a danger that there will not be enough informal cooperation with faculty from elsewhere in the university who could contribute to environmental studies and should be drawn upon to do so.

While the form of institutional organisation may be an important factor in facilitating or inhibiting cross-disciplinary cooperation there remains a considerable problem of communication among people from different disciplines who literally speak different academic languages. In our experience some also have incompatible yet rigid views of what needs to be known by students and how

they should be taught. This is not easily reconcilable. One important aspect to having a multidisciplinary environmental studies faculty, particularly if they can be "housed" together in the same organisational unit within the university is to provide "translation services" among the academic languages and ideas which should be brought to bear on a programme of studies.

3. COURSE CONTENT

Because "environment" is so inherently unlimited in scope it poses a considerable problem in defining, bounding and outlining a curriculum for environmental studies. One favourable aspect of this is that it forces more careful consideration to be given to the academic objectives being sought and reasons why "environmental studies" may be a preferable way of trying to reach them.

Man-environment studies at Waterloo have all along been looked at as a potentially very effective vehicle for an undergraduate education process. It was also conceived as an academic response to the "environmental challenge" in the sense that it was to help prepare people to cope more effectively with environmental problems, variously perceived and interpreted. When more careful consideration was given to how this might be done, the "challenge" was recognised to be one posed directly to the educational system itself. "Environment" has become symbolic of the need to understand inter-relationships and to strive to catch a sense of the "wholeness" of things. As such it can be seen as a much-needed "countervailing force" to overcome the narrowness of viewpoints, the proliferation of "one and two factor solutions" and the divisiveness resulting from the excessive fragmentation of knowledge and skills into innumerable specialties.

This is not to say that it is thought necessary to replace "specialists" with "generalists", the false dichotomy so often suggested. Rather it is a question of how to develop specialised abilities, technical or otherwise, in an educational process which recognises and stresses synthesising and integrating skills as well as analytical ones, and engenders those attitudes of mind and values which help individuals search for and understand the human, social and other implications of what they do with their specialised abilities. The problems of "environment" serve as a reminder that the building of this broad perspective of awareness and understanding is a lengthy and difficult task and not one to be dismissed lightly

in favour of narrow and premature professional specialisation for currently available jobs. At Waterloo, it was decided to start this process at the undergraduate level so that students would have the added advantage of being able to select their more specialised areas of interest and expertise knowingly on the basis of some exposure to the considerable range of possibilities and opportunities.

The rationale for using the broad and wide-ranging theme of man in relation to biophysical, socio-economic and man-made physical environments as a guide for studies is that it not only permits, it requires students to investigate a wide number of subjects. Otherwise they may well be discouraged from doing this given the organisation of academic institutions and programmes into quite isolated disciplines or professions and given the concentrated attention so often placed on acquiring technique in the rush to establish professional or disciplinary identities. The wide scope of "environment" is a great asset for opening up many avenues of enquiry, teaching, and learning and giving maximum scope for students to maintain and develop their intellectual curiosity.

This really amounts to recognising "education" for what it should properly be - a process of individual learning best accomplished if students themselves can determine with minimally imposed artificial constraints the direction and pace for discovering and pursuing what they want to know, supported by faculty able to sustain this in a wide variety of ways. This differs significantly from the view that "education" means "covering" a fixed body of subject matter in a manner and at a time determined unilaterally by professors in a near exclusive master-apprentice relationship. It also differs from the view that if what is sought is "merely a liberal education", then this is only done properly in the one small corner of academia where dwindling numbers of students are guided through studies in the history, literature and philosophy of "Western civilisation".

The development of the man-environment studies curriculum has therefore been guided primarily by views on how to stimulate and sustain learning rather than deciding on "essential contents" in terms of subject matter and constraining all teaching and learning to these. It became too obvious too soon that a plausible case can be made for including almost any subject under "environmental studies", so that a content approach to defining a curriculum would really become little more than an exhibition of the disciplinary biases and limitations of whatever academic committee set to work on it. The adoption of a "process-over-content" approach was deemed

even more valid when considering the implications of what may be the single most important educational challenge now facing post-secondary institutions - that of being expected to decide today what kind of education and training will best serve the first groups of people to enter the 21st century in their working years.

From this viewpoint, in considering what particular skills students should be encouraged to acquire as a basis for developing their individually chosen specialities over a period of time, it was concluded that this can only be seen realistically in terms of some basics for problem identification and problem solving. This directs attention to ways of initiating a process leading individuals towards increasing sophistication in their abilities for obtaining and evaluating information for clearly defined and understood purposes, and presenting it in any of a number of ways suitable for whatever the occasion demands. Skills of this nature can then be refined, adapted and applied in the many different situations each person will encounter in a lifetime. This emphasis becomes all the more important when it is recognised that today's students are destined to live in a world of rapid change where specific factual knowledge and particular scientific and technical skills will be rendered obsolete at ever-increasing rates.

Turning directly to the structure of the man-environment studies curriculum, about half of the total number of credits required for a degree are given as a "core" of required courses within the Department over four years. The other half are "free electives" which mean that students can select a series of courses from elsewhere in the university to get the mix of subjects and skills they want. Under this arrangement it is possible for them to combine environmental studies with some one other discipline to the extent of earning a joint honours degree, they may concentrate in some other subject to the extent it is recognised as a "minor" orientation in addition to man-environment studies, or, if they wish, they may explore a number of other subjects they find of interest.

The "core" of required courses is taken mainly in the first and second years. There is a set of introductory courses in the first year which examine the inter-relationships of the natural and social sciences to major environmental themes and issues and introduce ways for doing analyses and research on them. In the second year this is followed by further work in ecology, the social sciences and research techniques. Instruction is also offered in the production of video tapes, audio tapes, films and graphics as

communications techniques which can be used effectively for certain purposes. In each of the four years there are "seminar-workshops" in which individual or small group projects are undertaken on topics the students themselves select in consultation with faculty. Project-oriented learning provides the occasion to practice skills in problem definition, information and data gathering, the analysis and synthesis of material, and the presentation of results in a suitable format using the most appropriate communications media.

The "conceptual base" for organising the multidisciplinary core of the programme includes major issues and themes of environmental significance such as urban systems, energy, environmental health, or "futures". These are used to demonstrate the interrelationships of concepts and subject matter from a number of natural science and social science disciplines. A systems mode of reasoning is generally adopted as the most effective way of examining problems and issues, while project-oriented learning is a device for students to integrate material for themselves in ways particularly insightful for them at any given point in time.

The international or global perspective is brought out from time to time in discussions or as examples. One "senior honours seminar" in the fourth year of the programme examines the international aspects of environmental issues which requires placing them in the context of international cooperation for economic development, finance and trade, and in relation to associated questions like global population growth, the management of the oceans, or the emerging institutions governing international relations.

4. TEACHING METHODS, MEDIA AND MATERIALS

A variety of approaches to teaching and learning are being used along with the more conventional lectures, seminars and laboratory work judged to be preferable for some purposes. Approaches such as team-teaching and "workshops" to introduce and practise particular skills are relatively modest variations in commonly used methods. In man-environment studies these are used extensively in the first year of the programme to demonstrate the scope and the variety of concerns as well as alternative lines of enquiry in environmental studies.

The use of major issues as a lead-in to particular concepts and methods of enquiry is done by several faculty working as a

team in close collaboration. Members on these teams vary as different issues are examined, and the viewpoints they bring are supplemented by guest lecturers from outside the Department. Despite some obvious advantages, the main difficulty is that it becomes expensive in faculty time since the whole team should be present to interact at each session, and considerable additional time is needed to arrange the necessary degree of coordination and sequence in presentations.

To the extent that a measure of integration of material is sought, as it is in senior seminars such as one to introduce approaches for doing environmental impact analyses, or another for integrating social-psychological data into environmental design problems, then faculty themselves have to engage in a long learning process by working closely together in teaching, research, and preferably both. This is the crucial difficulty in moving from multidisciplinarity which may pose little more than a coordination problem for classroom teaching, to a measure of true interdisciplinarity.

Students are introduced to certain techniques of data and information gathering and processing from the first year so that these may be elaborated later according to individual interest and felt needs. Small group "workshop" sessions have been run by the Department to introduce elementary methods for measuring environmental pollution including noise; for the identification and sampling of local flora and fauna in the context of approaches to ecological studies; for the design of questionnaires and interviewing techniques; for an introduction to computers and terminal systems; for the preparation of project proposals and briefs; for experiencing small group interaction dynamics; and for the use of cameras, video-tape and audio-recording equipment. More intensive instruction along most of these lines can be obtained elsewhere in the university and students are encouraged to follow-up particular areas by choosing the appropriate courses as electives.

Off-campus activity is playing an increasingly important role within the whole programme. Field trips are used in the context of particular courses and include nearby visits to sites such as nuclear power plants, waste treatment facilities, local ecological preserves, or inner city redevelopment areas. A few more extended trips have been made for longer periods to cities such as Montreal and New York, and to regions of the province such as the mining belt of Northern Ontario and outposts on James Bay. The expense of these, however, limits their extensive use.

Another useful learning situation which has been taken advantage of is out-of-town conferences. The Department has used these as "field trips" for small groups or even individual students known to be seriously interested in the conference topic and judged able to benefit by attending. Combined with the ingenuity students will show to travel, relatively small subsidies have enabled students from the programme to attend conferences throughout North America and report on them when they return.

As students move into their third and fourth year in particular, more of them elect to undertake project assignments in the context of on-going work of local government agencies and community organisations. To facilitate this, the Department has a full-time staff assistant to help with the liaison and coordination for this kind of student involvement. He helps identify situations where student participation would be both productive and welcomed and arranges for faculty to meet with government officials or representatives of citizen groups to assess what individual students would be asked to do and judge its relative merit for their academic studies. Students themselves often show considerable initiative in setting up these kind of arrangements.

Included among these diverse student undertakings are: formation of an advisory committee to the Waterloo city government to promote a noise control by-law; volunteer work as assistants to local elected politicians on a range of urban issues; work for the regional Conservation Authority on the effectiveness of its public information programme; analyses of a water pollution problem in a nearby rural municipality to make representation to the provincial Ministry of Environment for its solution; work with the provincial Ministry of Natural Resources on a recreation and open space plan for a county bordering on Lake Ontario; work for the provincial Ministry of the Solicitor-General on the recruitment and training of police (arising in part from an examination of police-community relations); conducting an audience research study for the Canadian National Film Board; and taking a leadership role in the establishment and licensing of a community-owned radio station. Arrangements by which students have carried out these projects vary considerably and range from support by special grants (from non-university sources) through part-time employment or the payment of expenses, to straight volunteer work. Academically, students are placed in the role of participant-observers and asked regularly to report on and analyse their experience in an appropriate context. A variable amount of course credit may be awarded for work done, if in the judgment of faculty this is warranted.

The experience so far with this kind of off-campus learning has been most encouraging. There is no doubt it can create and sustain a high motivation to learn, it gives occasion to develop a variety of skills of both an academic and non-academic nature, and, judging by the first group of graduates from the programme, it opens up full-time employment opportunities. There have been a few cases where students have accepted full-time commitments without completing their baccalaureate degree, but this may be part of a larger trend emerging whereby students increasingly are breaking the "lock-step" sequence through educational systems to gain other kinds of experience along the way.

5. RESEARCH BASE

Since the main emphasis in man-environment studies is placed on an undergraduate teaching and learning process, the faculty may pursue a number of alternative non-teaching activities which add to the quality and variety of experience they can bring to students. Besides individual pursuit of subjects ranging from palaeoentomological studies in the Arctic to the making of documentary films, special research or consulting has been done by department faculty for international organisations such as OECD, UNESCO and UNDP; for federal government bodies like the Ministry of Urban Affairs, Ministry of Science and Technology, Department of the Environment, and Atomic Energy of Canada, Ltd.; for special federal-provincial groups such as the Canadian Council of Resource and Environment Ministers, and for provincial agencies. Involvement with citizen groups ranges as widely and includes work on behalf of local issues such as civil rights, pollution, highway construction, housing, and health care through to national groups concerned with oil and gas exploration in the Arctic, new National Parks and major water resource development schemes.

So far there has not been an attempt to have the Department's faculty work extensively together in research teams among themselves, although some do so informally. After eight months of working together during the academic year, most faculty prefer to pursue their interests alone or in cooperation with other people and other organisations. This adds to the diversity of first hand experience they can then bring to bear on the teaching programme.

The structure for financing environmental research in Canada generally does not facilitate multidisciplinary research, either for "mission-oriented" topics directed to environmental policy and

management issues or more basic research on environmental systems. This derives largely from the division of jurisdiction whereby university research is financed mainly by the federal government and almost all of the planning and management responsibilities for "environment", however defined, lie with provincial governments. In addition, there is a considerable division of responsibilities among agencies at both levels of government, in spite of recent attempts to combine operational programmes like those now under a new Ministry of Environment in Ontario and the federal Department of the Environment in Ottawa. A high proportion of all research funds in Canada is still spent on the physical sciences and engineering.

6. CRITERIA OF SUCCESS

The criteria so far invoked to assess man-environment studies are generally the same used for other academic programmes, and vary according to who wishes to judge what aspect of it. The programme readily meets its enrolment of students, having in the order of three or four times more applicants than are admitted into it. This is reassuring to the university administration.

The programme is only just entering its projected "steady-state" in numbers, whereby of the 60 students who enter in the first year, some 25 remain to graduate from the fourth year. Besides a certain number of students who are invited to leave the programme, particularly after the first year, the remainder of the attrition is for varied reasons. Some students transfer to other programmes when they find their interests focusing strongly in particular subject areas, just as others transfer into man-environment studies. Some leave university for a year or two to travel or to work at a job they find interesting, some have to go to work to earn income needed to complete their studies, and a few drop out with serious reservations about the worth of universities regardless of how programmes are set up and offered. Some of the most sensitive and perceptive youth are in this last category.

Student satisfaction is judged in a number of ways. In these days students are never slow to express dissatisfaction on particular points. Providing faculty members and the department chairman are open to hearing these, relatively minor situations can be corrected or modified before they escalate into confrontation scenes. In addition, a variety of questionnaire and polling devices have been used to assess perceptions and reactions to particular

courses and these have been used to modify approaches and content. It has been our experience that openness to this kind of communication and "feed-back" has contributed to extremely good faculty-student relations and has generated from students a number of positive and imaginative suggestions. Perhaps a particularly telling indication of student satisfaction is the informal reputation the programme and individual faculty achieve within the university, something which can be detected in a number of different ways including growing enrolments in courses and applications to enter the honours programme.

The first graduating class of ten students emerged from man-environment studies in the spring of 1973. Of these, seven went into full-time employment with government agencies, consulting firms, or community organisations, two went straight into graduate work and one will travel for a year before going on to graduate studies. Some of those taking full-time jobs intend to go on for graduate studies at a later date. It was of interest to note that all those who accepted full-time employment did so for jobs closely related to the subjects they had selected for projects during their third or fourth year of undergraduate study, and in several cases the jobs are with organisations they became associated with while doing their undergraduate projects.

Concerning faculty, there is no problem in locating people interested in joining man-environment studies although not all have the orientation deemed necessary for this particular programme. A small advertisement for a new position in the past year drew over 200 applications from throughout North America along with a few from Europe. Recruitment of new faculty has been made difficult because of stringent budget constraints within the university caused by declining student interest in some traditional areas of study and for which only modest allowances have so far been made for a "growth area" such as environmental studies.

The question of "credibility" is more difficult to assess. Our experience has indicated the desirability of making people in government, industry, and community organisations more aware of the nature of the man-environment programme of studies. In particular there is a need to stress the flexibility it gives for students to develop their own interests and skills in contrast to the quite stereotypic image often held for more structured university programmes. This is the view that assumes each "produces" graduates all having approximately the same knowledge and abilities, duly labelled and certified in the degree awarded. There may be initial

annoyance in discovering that environmental studies cannot "define their product" according to this industrial model of the university. The more sympathetic and enthusiastic response to the educational ideas expressed by man-environment studies has come to us from people whose occupational responsibilities require considerable interaction with other organisations, an array of professional and other specialists, or with the general public.

The dilemma remains, however, that the extent to which environmental studies wins credibility within the mainstream of accepted organisations in contemporary society, it may be losing it in areas which matter more. For many young people in particular, the concern over "environment" has given voice to fundamental criticisms of the basic ethics, institutions, and conventional values of the western world. The credibility of environmental studies therefore lies in the extent to which it becomes a successful vehicle for challenging the mainstream and providing viable alternatives to it. There are still those who believe this to be the central function of the university as well.

UNIVERSITY OF PARIS VII

DEPARTMENT OF ENVIRONMENT

Paris, France

by Jean-Marie ABILLON, Maître Assistant

1. WHO DOES THE TEACHING?

Subject teachers (or single-subject teachers)

a) At first-cycle level:(1)

- For teaching the basics of the fundamental subjects connected with the environment (biology, ecology, human sciences, geography, etc.): subject teachers who hold established posts at the university or teach on an hourly basis (rare) and are not necessarily environmental specialists.

- For the integrated teaching of the motivation and presentation of environmental problems for courses offered for 1973-1974: environmental specialists and professionals, responsible to university-based teachers.

- For briefing and introductory courses open to everyone (see Annex I): university teachers specialising in the environment, or professionals. Professionals participate in every case.

b) At second-cycle level:

With the emphasis placed on case studies and intervention methods, university teachers specialising in environmental problems and professionals share responsibility for the course.

Consultants are also called in to help with specific problems whether they be university teachers engaged in environment research or professionals working in this field.

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1) Undergraduate education. Includes first and second cycle.

c) To sum up: as studies proceed, increasing use is made of environmental specialists, university lecturers and professionals.

Selecting the teachers

a) Recruitment methods: (see Annex II)

i) Recruitment methods for teachers paid on an hourly basis:

- Pre-selection by the teachers working in the department, in certain cases by the students themselves;
- At second-cycle level students are largely free to choose the consultants; their choice has to be confirmed, however, by the teachers responsible for the course;
- Confirmation of the teachers thus chosen by the various monodisciplinary specialist committees, independently of the Department of the Environment.

ii) Recruitment methods for university-based teachers: on a voluntary basis.

iii) Recruitment methods for teachers invited to fill a vacancy in the Department of the Environment.

- Definition of the qualities required in the teacher (i.e. profile) by the Management Council of the Department (see Annex II: organisational structure of the Department).
- Relative assessment of the various candidates against this profile by the appropriate Committee of Monodisciplinary Specialists.
- Review of this assessment by the Multidisciplinary Recruitment Committee of the Department. If this committee does not agree with it, the matter is referred to the University Council for a decision.

This is a long process but no major problems have yet arisen. It tends to ensure that teachers with a good knowledge of their subject are recruited. Obviously it will have to be modified when the need arises to recruit teachers qualified in a combination of subjects, e.g. those coming from an environment course.

b) Criteria for selecting teachers:

As far as possible, the recruitment of non-university-based teachers, or those invited to fill a vacancy in the Department, is based on the following criteria:

- Motivation towards environmental problems;
- Specialisation in one aspect of the environment or certainty of specialisation in the near future;
- Ability for field work;
- Ability for group work;
- Previous or intended research on some aspect of the environment science.

Participation of non-university-based teachers (i.e."professionals")

a) Their place in the programme: Professionals are called upon:

- When their special subject is not represented in the university or the university cannot provide someone qualified to teach it (e.g. hydrobiology, photointerpretation).
- To open up the teaching to the outside world and bring in real-life environmental problems;
- When their experience is helpful to other teachers and students;
- When the originality of their ideas on environmental problems will clearly make a positive contribution.

Their participation takes place either in the official Departmental courses (particularly when techniques are being taught), or in the information and study seminars.

b) Relation of the "professionals'" contributions to those of other members of the university teaching staff:

Usually they teach under the auspices of established university teachers, but they may be invited to take responsibility for a particular area of instruction where university teachers are also engaged.

c) Their role in developing the curricula:

One of them (an architect/town-planner) sits on the Departmental Council that advises the university on the content of the teaching programme and any modifications that may be desirable. It is a pity, however, that such professional men and women do not make a larger contribution. Unfortunately, one can scarcely ask people working outside the university to attend meetings such as these which are very often long and offer no remuneration.

Qualities hoped for in future environmental teachers

The shortcomings of present-day teachers - no abilities in field work; difficulty in venturing outside their particular

subject or reluctance to do so; inability to integrate subjects and failure to do research on an aspect of the environment that might help its teaching -
all indicate too clearly the qualities required in a teacher of environmental studies, namely:

- Capacity for group work and thus a certain ability in group dynamics;
- Ability to integrate disciplines, which is inconceivable without some awareness of the concepts inherent in the various disciplines concerned;
- Research or professional experience in environmental work;
- Capacity for field work;
- Strong motivation towards the problems posed by the environment.

It is most likely that these qualities will be found only among students who have reached third-cycle level in environmental studies and intend to teach.

2. INSTITUTIONAL ORGANISATION

Organisational structure

a) Present structure: the structure of the Department itself is made clear in Annex II of the present paper. The general structure of the University and the role of its Environment Department have already been described in the OECD's "Environmental Education at University Level: Trends and Data", published in 1973, pages 169-177.

b) Desired structure: the present structure at first-cycle level, where teaching is organised by two university departments independent of the Department of the Environment, has led to great difficulties in the organisation of the teaching programme. The inclination nowadays is towards a specific first cycle (see Annex I) in which all compulsory courses are organised by the Department itself. What is wanted, therefore, is an autonomous organisation within the university, administering its own funds, responsible for its own courses and able to negotiate contracts with outside bodies.

c) Comments: there are still other constraints in the present structure.

- The pedagogical policy of the Department must be submitted to the University Courses Committee for consideration and to the University Council for approval. These two bodies comprise representatives of all the "Unités d'Enseignement et de Recherche" (U.E.R. - Education and Research Units) and of the university departments and so reflect a bias towards the traditional disciplines. This, to a certain extent, hampers innovation in teaching content (e.g. by an extension of integrated teaching).
- The teaching posts allocated to the Department are earmarked for specific subjects in the context of the general policy of the university. There may be (and this has already occurred) a conflict between departmental policy and university policy over the relative priority of subjects when teaching posts are being apportioned.
- New teaching posts are granted to the University by the Ministry of Education. The general shortage of posts means that the Department, with its new structure, has difficulty in securing an adequate number. This is especially the case because the University, which is completely free to distribute the posts it has been allocated between the UERs and the departments, is reluctant to acknowledge that integrated teaching and pedagogical innovation require more staff than the traditional approach.

Departmental structure in relation to teaching and research facilities of the university and outside bodies

To perform its teaching function, the department has at its disposal:

- Its own teaching posts - although, as previously stated, the specific subjects to which they are tied do not always meet its immediate needs;
- Teaching services provided by other UERs and university departments;
- A quota of additional teaching hours revised each year and approved by the University Council in the light of arguments put forward by the Department. These hours are used to remunerate both university-based teachers working full-time in other departments and outside teachers, e.g. professionals and consultants.

The Department calls on the help of other universities, particularly for field work and post-graduate teaching at supervisor level: the University of Caen, for example, provides facilities for first-cycle biology at its marine biology stations at Luc-sur-mer or Roscoff, and the University of Rouen for field work at post-graduate level.

It also enlists the help of non-university bodies such as departmental equipment directorates or land-use organisations (e.g. the study group on the new town of Vaudreuil in the Basse-Seine region) in teaching and to provide practical experience for students during the vacation.

It also calls upon the community and its representatives for classroom teaching (e.g. participation of local councillors in its "Knowledge of the Commune" course or logistic support and information in the end-of-the-year field training period (e.g. practical period at the end of the second year of the first cycle on the Plateau de Larzac in June, 1973).

Departmental structure in relation to the community at large

The community, represented, for example, by associations set up to protect the natural environment or defend local interests, calls upon the Department for technical assistance which is given as far as possible by teachers and students on a voluntary basis mostly outside normal teaching time.

The funds needed to give technical help obviously cannot be taken from the Department's budget which is granted by the Ministry of Education. Nor can the funds placed at the disposal of the teachers and students by the community pass through the official accounts of the Department. For this reason the possibility is now being considered of setting up a non-profit-making organisation under the Act of 1901. This would be independent of the Department and the University and would manage these funds itself.

The community can also promote the teaching of new subjects (e.g. "knowledge of the commune", created at the outset at the request of mayors and municipal councillors). Such teaching is done by the staff of the recurrent education scheme which has its own place in the university structure.

It is regretted that the inadequate facilities available to the Department prevent this very interesting aspect of its work being given all the attention it deserves.

Determination of a budget for the programme

The working budget is granted to the Department through the following procedure:

- The Ministry of Education allocates an overall budget to each university according to the number of students enrolled;
- The University Council distributes this budget among the UERs and university departments after studying their requirements and after consulting the Budget Committee on which each UER and department is represented (see Annex II). Departments can, however, obtain extra money from contracts made with bodies outside the university. These contracts are submitted for approval and verification by the University Council.

The criteria for determining and obtaining this budget are as follows:

- Number of students - credits (UVs) for which the department is responsible.
- Additional funds needed for new teaching methods, etc. (especially for field work).
- Funds needed to establish new services (new library, practical work facilities, own laboratories, etc.).

Locus of control for faculty reward system

- The university-based teachers are paid directly by the Ministry of Education.
- Teachers paid by the hour are approved by the Committee of University Specialists.

The Department Management Council distributes the quota of extra teaching-time allocated to the Department in accordance with the pedagogical policy it has adopted in agreement with its Pedagogical Committee and after consulting teachers and, in some cases, students.

Informing and counselling of students

a) Ways of informing: these are unfortunately few in number. They include a students' handbook, an information brochure about the Department, and introductory briefings to enhance awareness of

such matters as pollution, impairment of the environment, knowledge of the commune, landscaping and so on. Debates of general interest are also organised, for instance on the architecture of the university or the Rome Club report.

The need exists for a university periodical concerned with environmental questions which would comment upon general problems, publish the minutes of debates organised by the Department and give information on seminars and conferences on the environment in France and abroad.

A specialist library was set up two years ago and has been constantly growing. At present it houses about 700 books and brochures on the environment and subscribes to 15 magazines. It is open to students and the general public. It also collects theses and case studies written by students as part of their course in the Department or as personal exercises.

b) Counselling of students: this is done by teachers at the start of each semester when the students enrol and in the course of the year as the need arises. Contact between teachers and students is relatively close, at any rate more so here than in other walks of university life.

Two teachers are given the special task of running extra-university training programmes and, as far as possible, contact is maintained between the Department and the students engaged in them.

There is no special branch in the Department to deal with these matters.

3. COURSE CONTENT
(See Annex I)

Scope of "Environment Studies"

The aim of the "Etude du Milieu" (Environmental Studies) course , as it was called at the start, at Paris VII, was to equip students to analyse the various elements of an environmental problem and understand their interactions. Man, an essential and determining factor in the environment, occupied and continues to occupy an important place in this system.

After a first cycle of common core studies dealing with the basics of the various environment disciplines, the second cycle was designed to present three main topics: regional planning, pollution and the protection of the natural environment. In the

event, because of the small number of students (35) who reached the second cycle (inevitable in an experiment of this type), the only option it was possible to offer was the course on "regional planning" - the topic that, in any case, had been chosen by all the students. The corner-stone of this course was ecology, the concepts of which were extended to include the study of the social sciences connected with the environment.

The reform seen to be necessary in the programme, after three years of experiment, placed the emphasis on three topics:

- Ecology, with its applications to the human sciences and to town and county planning;
- Energetics;
- Pollution, nuisances, toxicology.

It can be reasonably hoped that the means available to the university will allow these topics to be dealt with as comprehensively as possible, starting in academic year 1973-1974. The basic learning needed for further study of these three topics is compulsory at first-cycle level. But here again, the options offered allow the student to concentrate on whichever he likes. In the second cycle students tackle each of them by studying actual cases and means of intervention. At the end of this cycle they should be trained environmental generalists.

Criteria for determining "essential content" and optional subjects

The area of knowledge covered by the above three topics has been determined by:

- The desire for an original approach to environmental study and the use of concepts that enable the basic disciplines, e.g. ecology, the science of energy, to be easily integrated.
- The desire to make optimum use of the facilities available in the university where such problems as pollution and toxicology, in particular, are being tackled by other UERs.
- The desire to emphasise the role of man in the environment and to present the social sciences on an integrated basis.

The "essential contents" are therefore:

- Ecology,
- Thermodynamics,
- How human societies function,

- Essential complementary studies: mathematical analysis, statistics, languages.

The optional subjects enable the student to deepen his understanding of the "essential contents" and to analyse environmental problems in the area of each of the three topics.

Conceptual basis for organising a multidisciplinary or interdisciplinary common "core" programme

a) Systems theory and simulations: systems analysis serves as a background for the teaching of UV NN 103 (mathematical analysis methods) where mathematical concepts that are indispensable to environmental analysis methods are presented within the general integrated framework of the systems.

Moreover, the presentation of simulation methods and techniques is part of the second cycle programme in which students can compile simulation programmes for the systems they are studying, for example a forestry ecosystem or an urban ecosystem. The concept of the ecosystem extends beyond a strictly biological meaning.

b) Themes or concepts

c) Energy, thermodynamics and entropy: these concepts, the basics of which are introduced in UV QA 106 (thermodynamics and the energy transfer) are applied to the biological or human systems at work in the environment, in UV GG 151 (application of thermodynamics to the environment), in the optional UVs concerned with the energy course and at post-graduate level teaching.

d) Ecology: the basics are provided in two first-cycle "UVs" ("units of value" or "credit points"), CC141 (Introduction to Ecology) and CC241 (Elements of Ecology).

The fundamental concepts of ecology (diversity, maturity, regulation) and their inter-relations are applied, at second-cycle level, to the study of biological ecosystems and the way in which human societies function.

e) Integrated themes: two themes designed to make the students appreciate environmental problems and motivate them to study subjects connected with the environment have been kept at first-cycle level. These concern water (UV GG 131) and air (UV GG 231).

The teaching programme proposed integrates chemistry, physics and physical geography and makes considerable use of case studies.

f) Languages: since 1972-73 the DYNAMO language has been in use in teaching the first year of the second-cycle. This language has enabled simulation problems to be tackled.

Integration of the natural sciences with the social sciences

At present this is difficult because principles of operation that relate to quantifiable and quantified parameters cannot easily be applied to unquantifiable parameters.

Social science study is offered wherever possible, however, in the light of general concepts such as entropy or the principles governing the functioning of ecosystems. Thus, for example, it can be shown that the laws combining the concepts of diversity and maturity in a biological ecosystem are also valid for a human system such as the urban ecosystem.

Use of local/regional illustrations and on-site demonstrations

a) At first-cycle level

- In the "sensitisation" UVs such as for example, GG131 and GG231 (Water and Air), GG 141 and GG241 (Study of Human Societies I and II).
- In multidisciplinary field-training programmes, in each first-cycle year.
- In the "sensitisation session" at the start of the course.
- During extra-university training periods with land-use planning bodies or laboratories available to students from the end of the first year.

b) At second-cycle level: here, greater importance is attached to field work. A limited geographical area is used as a basis for teaching. For the first second-cycle intake the area was the Basse-Seine region. For the second intake the region around a line drawn from Paris to the town of Fontainebleau was chosen. This area:

- Serves as a back-up to theoretical and practical teaching.
- Provides data for analysis by groups of students and teachers.
- Provides practical subjects for collective monographs as a logical conclusion to a course of field-based training.

Methods used for multidisciplinary and inter-disciplinary aspects of the programme

Integrated teaching in the Environment Department has so far been possible only on the basis of actual case studies - either in the classroom or in the field.

No method has yet been perfected to facilitate integration. Languages such as DYNAMO have only been tested in the comparatively narrow context of one course given by one teacher. This method has not yet been extended to other courses chiefly because it is relatively superficial.

When, for example, several teachers are involved in one course relating to an actual case they must not only have a good knowledge of all the ins and outs of their subject but a sufficiently precise knowledge of the other subjects involved. This requires preparatory work which is often very time-consuming.

Necessary innovations, as compared with classical pedagogic techniques

a) Field work:

- In the first cycle:
  - During the training periods at the end of the year, work for about one week in small groups on specific and even original topics, after class discussion of the problems arising in the region to be studied. These studies form the subject of student reports.
  - In the context of the practical training: periods at the marine biology stations at Luc-sur-Mer or Roscoff, field work on UV GG 111 ("Knowledge of the Commune").
- In the second cycle: see Section 3: Use of local/regional illustrations and on-site demonstrations.

b) Study of actual cases: often linked with field work.

For certain subjects (such as human sciences, pollution and nuisances) a large part of the students' education is devoted to writing a monograph on a topic suggested by student or teacher. This involves the student in a detailed investigation into the bibliography of the topic as well as contacts and surveys outside the university. The subject proposed is generally an actual case study.

In the second cycle this aspect is extended and represents practically all the second-year work, leading up to the preparation of an sub-thesis analysing possible means of intervention. Thus in 1973-74, the first group of post-graduate students (in their second year) will continue to study in small groups and in greater detail the five particular ecosystems of the Basse-Seine region:

Forest ecosystem:	Forêt de Brotonne
Urban ecosystem:	Rouen and the new town of Vaudreuil
Marsh-quarry ecosystem, rural ecosystem:	The "Bocage normand"
Brackish water and marine ecosystem:	Seine estuary

c) Seminars and lectures:

- In the first cycle:

  - Sensitisation session preceding the course.
  - Briefing session in certain sectors /such as GG 101 (Information on pollution and nuisances)/.

- In the second cycle:

  - Organisation of seminars in the first and especially second years: presentation of the basic concepts of ecology by an analysis of scientific books or articles in scientific journals, application to actual case studies. Reports and discussions on the results of research carried out by students, discussions about their problems and difficulties.

d) Aims of pedagogic innovations:

- To give the student a good command of written and spoken French.
- To train the student in group work.
- To train him in research work, both at the university and in outside organisations.
- To prepare him for a career.
- To facilitate outside contacts.

Role of laboratory experience

In the course of their work, particularly in the second cycle, students make use of the special laboratories in Paris VII (chemical pollution, plant ecology and its applications, animal ecology, pedology, physical geography, geodynamics, etc.) to analyse specimens collected in the field.

Except in the case of marine biology stations, practical work in the experimental subjects will be carried out on classical lines.

Use of and access to computers

In the second cycle: simulation and modelling of ecosystems, data processing, application of the "iso-efforts" method (Y.Friedmann in the Basse-Seine region. Use of computer C.I.I. 10010 in the inter-university information service.

Methods of evaluating student progress for various non-classroom learning components

Daily progress reports during the multidisciplinary field training periods in which teachers take part, and a general report at the end of the period.

At second cycle level, a review approximately every two weeks of the progress made by students, one afternoon a week, with all groups and teachers involved in the seminars present.

5. RESEARCH BASE

Research emphasis for different programmes for different target groups

Largely because of the lack of teacher-researchers working on environmental problems, the Department of the Environment has not yet been able to give research its necessary status. Nevertheless, one of its immediate priorities is to develop a high level of multidisciplinary and interdisciplinary research.

At the start of the first year of the second cycle in 1972-73, a small group of teachers set up a modest research project on two subjects:

- Simulation and modelling of ecosystems - the relationship between the concepts of diversity and regulation.
- Application of general concepts of ecosystems (diversity, maturity) to the way in which urban ecosystems work.

The same year a study began on an "environmental laboratory" and should be completed in October 1973.

Although the Department of the Environment considers that one of its main objectives is to promote its own multidisciplinary research, it has not yet given this research all the attention it deserves. The results already obtained from the above research programmes are, however, very promising and show that original research into the theoretical use of ecological laws and concepts can rapidly emerge with little outlay.

Role and use of student research

The Department of the Environment is trying to develop student research, supervised by teachers, starting at first-cycle level:

- Analysis of data collected in field work: for example, identification of the flora grazed by sheep on the Larzac plateau in the south of France /a matter in which the local "Institut National de la Recherche Agronomique (INRA)" (Agricultural Research Institute) has shown interest/.
- Student participation in small-scale research programmes for local communities, generally outside the teaching programme itself. However, an arrangement (ZZ 199) has been made within the framework of the UV system at Paris VII enabling a student to undertake any optional work which interests him over and above his normal training.
- Extra-university training periods during vacations.
- Student participation in the above-mentioned research programme: application of ecosystem concepts to the operation of urban ecosystems.
- The student's report submitted at the end of the second-cycle is in itself a small thesis on a precise theme. Students have to collect data in the field, analyse it, integrate it and offer possible solutions. The results of this work can then be placed at the disposal of outside organisations and local communities.

The role of such a research, in theory and practice, is to:

- Familiarise students with research work.
- Bring home to them the reality of environmental problems.
- Get them used to working on their own and in groups.
- Let future employers know, through published reports and other documents, what level the diplomates have reached.

The results of such research can be used by the local community and outside organisations and become the groundwork for further research by the Department.

Here again, with the slender resources at the disposal of the Department, these research activities except in the second cycle are relatively modest. The work-load in the first cycle is nevertheless fairly big and does not give students much time for such activities, whatever attraction they may understandably feel.

Definition of environmental research: basic research within existing disciplines versus "environmental consultancy" in the surrounding area

Basic research within existing disciplines is already being carried out in Paris VII and in other UERs and departments on such subjects as atmospheric pollution, applied plant ecology, pedology and toxicology. This research work requires great technological support which for the moment the Department neither has nor wishes to have. The Department is at present moving more towards theoretical interdisciplinary research: system study, simulation and modelling of ecosystems and application of ecological laws and concepts to the way in which human societies work.

Some teachers in the Department think that basic research in existing disciplines can only be done well within the monodisciplinary structures which already have great research potential. The role of the Department would be either to coordinate such research for dealing with particular environmental problems or integrate existing monodisciplinary studies on interdisciplinary lines.

Students should be involved as much as possible in "consultancy work" in the surrounding area. The lack of resources at the Department's disposal has meant that not all the demands made by the community can be met at present. This is, however, one aspect which the Department hopes to improve.

Finally, the University Scientific Council attaches particular importance to the development of multidisciplinary research in a number of fields, particularly the environment. It thus allocates part of its University research budget to financing multidisciplinary research programmes. The research policy of the Department therefore coincides with that of the University.

Effects of science policy on environmental research by universities

In France, the recently formed Ministry of the Environment

assigns part of its budget to environmental research on particular topics, such as water. This budget is generally distributed among large well-equipped research teams. Apart from this government contribution there is at present no scientific policy relating to this field of research.

In France at the moment the environment is a problem of policy rather than science, and conflicts of interest there are mainly resolved by the balance of power between the planners and the "planned".

6. CRITERIA OF SUCCESS

Enrolment of students, proportion graduating

The number of places in the Department is limited for the following reasons:

- It is a new experiment and therefore the number of students should be restricted.
- Possibilities of employment do not at present seem very numerous.
- The Department still suffers from a lack of resources.

From the very start many enrolment requests had to be turned down, even though the Department has never advertised its teaching programme.

A summary of the enrolment trend is given in Table I. It may be seen here that a fair number of students leave for other courses - most of them dropping out during the year, having enrolled out of curiosity. The drop-out rate is just as large in other university courses and is therefore not a "prerogative" of the Department.

Out of the thirty students who passed into the second cycle at the end of the academic year 1971-72, 22 had received the DUEL (Diplôme Universitaire d'Etudes Littéraires) for "Environmental Studies". Because of the options and equivalents they took, four of them received the DUES (Diplôme Universitaire d'Etudes Scientifiques) in chemical biology (but 10 others were in a good position to receive it in 1972-73) and five received the DUEL for geography. The eight students who failed to receive a diploma were nonetheless allowed to pass into the second cycle in accordance with the university regulations. It is necessary to get 80 per cent of the credits and compulsory to obtain the first cycle diploma during the first year of the second cycle.

Table I

ENROLMENT TREND IN THE DEPARTMENT DURING THE FIRST THREE YEARS OF THE COURSE

Academic year	1st year 1st cycle	2nd year 1st cycle	1st year 2nd cycle
1972-73	120	85 (62 + 23 ext.)	34 (30 + 4 ext.)
1971-72	- 28 90	- 3 33 (23 + 10 ext.)	
1970-71	- 7 30		

Note: The loss of students to other courses is given as a negative number. Students marked "ext." came from outside the environmental study course (from other courses at Paris VII or from other universities.

Student satisfaction

a) At first cycle level: it is difficult to say that students are fully satisfied with the teaching programme, either from the point of view of the course content or the pedagogics.

Up to now (see Annex I) the first cycle course was split into credits, many of which were shared with other courses (DUEL in geography and DUES in chemical biology, especially). While this method has the following advantages:

- Great flexibility as regards switching from one course to another,
- Reduction in teaching costs,

the "students justifiably complained that the lectures were not specific enough, even if the teachers did make the effort to adapt their lectures and practical work for the benefit of the environmental students in their classes"(1).

Furthermore, "these lectures were very often juxtaposed without sufficient integration"(1) and it was very difficult to co-ordinate the timetables of credit subjects in the second year.

The students have asked for:

- More co-ordinated teaching and especially more emphasis placed on integrated teaching,
- More lectures specifically on the environment,
- More emphasis placed on ecology,
- More field work, particularly in the monodisciplinary sector.

The teachers had long been conscious of these problems but the facilities allocated to the Department had hitherto not enabled them to give them the priority they deserved. The University now seems ready to act and the reform of the first cycle which it has approved (see Annex I) should satisfy the students as far as is possible.

b) At second cycle level: "The characteristics of the second cycle were in a way the reverse of those of the first cycle. The teaching programme in the second cycle was designed specially for students of the environment and called for group work and new

1) "The work of the Department of the Environment from 1971 to 1973". Report of 14th June 1973 to the Courses Committee by Professor René Heller, Director of the Department.

pedagogic methods, but its organisation left much to improvisation ..."(1) on the one hand because "this teaching programme, owing to its originality, is rather difficult to devise however devoted the teachers may be"(1), and on the other hand because great emphasis was placed on students' personal work and initiative.

The difficulties encountered at second cycle level are therefore due to:

- The new teaching methods,
- The fact that the students were irresolute and inhibited when finally given the freedom they had always demanded,
- Lack of resources,
- Shortage of teachers in certain subjects.

However, the overall result is by no means unfavourable and as yet no student in the first year of the second cycle has shown that he does not wish to continue along this difficult path.

c) Conclusion: the environment, a new and original subject, attracts many students who in general are strongly motivated, often politically. Their expectations are not always satisfied by the education they receive. Their criticisms are often constructive but they have great difficulty in understanding and accepting administrative constraints and those due to a lack of resources.

Employment

This is one of the most important questions and the Department considers it one of its priorities. Two teachers have been given the task of looking for openings but with less than a year to go before the first set of second cycle students is due to graduate they have not yet been able to establish anything definite.

One student, however, is already assured of a place when he leaves university and the way all have been welcomed by outside organisations when they are on their extra-university training is a good sign for the future.

A file will be kept for each student, indicating what studies he has done and what extra-university training he has had. The report written by the student in his second cycle will be taken into consideration in this dossier which should enable students to find employment quite easily.

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1) Heller, R., op.cit.

Cost-effectiveness

Environmental education is considered expensive:

- Integrated education, now well advanced in the first cycle and fairly extensive in the second, requires 50 per cent more teachers (minimum estimate) than traditional mono-disciplinary education;
- Field work required a large capital outlay from the University, which allocated 12,000 frs. in 1971, 32,000 in 1972 and 60,000 frs. in 1973. This budget should continue to increase until 1975 when it would reach its ceiling of about 120,000 frs.
- A special effort has been made to establish a specialist library. Since 1972, 43,000 frs. have already been spent on it. Now that a relatively large corpus (700 works) has been built up, spending should be considerably less in the future.

Extent and nature of student involvement and participation in the programme

As already mentioned, students enrolling in the Department are strongly motivated and often politically-minded. They are relatively argumentative and are ever ready to question the society in which the environmental problems they have to face arise. They are highly enthusiastic and impatient to seek the solutions to these problems themselves. Consequently they have difficulty in accepting the fact that they have to do a certain amount of basic "drudgery", especially when they do not see, or the teachers fail to make them understand, the relevance of certain subjects.

Unable to satisfy their immediate hopes they tend to supplement their studies with outside activities, becoming involved in associations protecting the interests of the community and forming research groups on the problems that interest them: the recycling of solid waste, for example, or the report of the Club de Rome.

Nevertheless, the students take little part in the management of the Department and their participation in the Joint Pedagogic Committee (Commission Pédagogique Paritaire - see Annex II) is somewhat erratic. For example, they did not vote in the elections to the Management Council of the Department as they did not wish to intervene in a sector where all important decisions are taken at the highest level (University Council and Ministry of Education). They preferred to reserve their energies for the Joint Pedagogic

Committee. "However, although the teachers nominated their representatives on this Committee the students considered that they could not assign unspecific terms of reference to annually elected representatives. They maintained their wish to participate but decided to leave it to the General Assemblies to appoint one or other member of the student body to represent the students on the Pedagogic Committee according to the nature of the problems arising"(1).

Such behaviour has proved as disappointing as most of the teachers had predicted. Nevertheless, the criticisms and desiderata of the students have been largely taken into account in the reform of the environment course which is due to come into effect in 1973-74.

The students are not always aware of the difficulties the Department has to face owing to lack of resources, particularly in regard to management. However, they are always prepared to help most of the teachers in their very difficult task and often show useful initiative in this connection so long as they do not feel that they are particularly involved in the decision-making process.

1) Heller, R., 1973, op.cit.

ANNEX I

SUMMARY OF THE COURSE IN ENVIRONMENTAL STUDY AT PARIS VII

A. Before the academic year 1973-74

See Environmental Education at University Level: Trends and Data, OECD, 1973, pp.169-177.

B. Starting from the academic year 1973-74

1. 1st cycle

a) Pedagogic organisation

- "Sensitising" period at the start of the course.
- Field-training periods more intensive than hitherto.
- Integrated education as far as possible.
- Part of the practical work for the various credit subjects organised "in the field".

b) Organisation of teaching programme (both years):
20 UVs (credit subjects) in all

- 6 "sensitising" UVs to be offered as soon as possible to all first-cycle students at the university:
  - CC 141 : Introduction to Ecology
  - CC 241 : Elements of Ecology
  - GG 131 : Water
  - GG 231 : Air
  - QA 106 : Thermodynamics and Energy Transfer
  - GG 151 : Application of Thermodynamics to the Environment
- 6 training UVs independent of the main subjects chosen by the student (see below):
  - GG 141 : How human societies function: I
  - GG 241 : How human societies function: II

- NN 103 ; Methods for mathematical analysis
- SA 101 : Introduction to statistics

- 8 analysis UVs in one of these three main courses to be chosen by the student:

  - Rural and urban ecology, biology, population genetics
  - Energetics
  - Pollution, nuisances, medicine, toxicology and the food industries.

There will be one consolidation UV in each main course.

- Two compulsory field courses: GG 199 and GG 299 which carry no specific credits.

2. 2nd cycle

a) First year

The same for all students, with three main courses:

- Rural and urban ecology, biology, population genetics
- Energetics
- Pollution, nuisances, medicine, toxicology and the food industries.

The courses deal with analysis and practical measures.

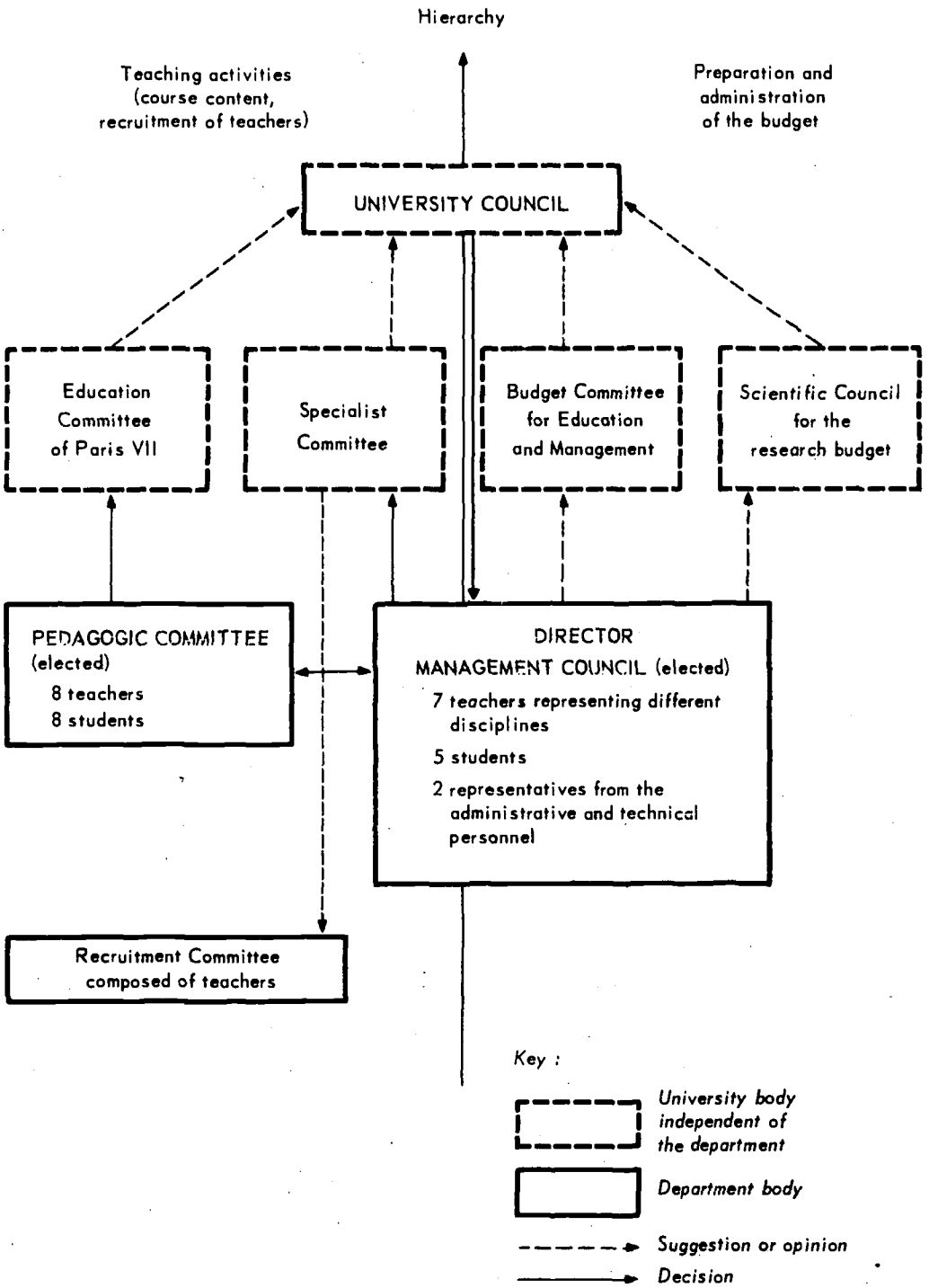
b) Second year

There are two complementary activities:

- The preparation of several collective reports
- Participation in multidisciplinary seminars (from one to three) in which students present and discuss the results of their research and the problems and difficulties they have encountered. Students must attend all seminars.

Annex II

ORGANISATIONAL STRUCTURE OF THE ENVIRONMENT DEPARTMENT AND ITS RELATIONSHIPS WITHIN THE UNIVERSITY



UNIVERSITY OF TOURS

CENTRE FOR HIGHER STUDIES IN RESOURCE MANAGEMENT AND PHYSICAL PLANNING(1)

Tours, France

by Jacques VERRIERE, Deputy Director

INTRODUCTION

The CESA was founded in October, 1969 by a group of teachers from the University of Tours with the object of training specialists in the environment and environmental management. Its establishment reflected an awareness of the environmental crisis that had resulted from the development of industrial and agricultural technologies and from changes in methods of land use and patterns of population settlement. The basic tenet of the founders of the CESA is that a human act is of no value on its own, but determines a series of chain reactions through which it has impact of one kind or another on the environment. The greater man's technical powers, therefore, the more important it is that every human activity should be conceived in the light of its context and of its possible repercussions on related sectors. The life and activity of human communities should, therefore, be seen as integrated systems.

Since the 19th century, however, science and technology have been subdivided into watertight compartments. Everyone is trained to plan his activity without regard for its side-effects, and this division into sectors has resulted, among other things, in increased waste discharge and pollution on the one hand and ill-adjusted individuals and misfits on the other. It is now essential, therefore, to consider the environment and its management as a discipline in its own right. It is urgently necessary to train environmental specialists who will attend to the balance of natural and man-made systems and this is the aim which the CESA has

1) Centre d'Etudes Supérieures de l'Aménagement (CESA).

set itself. To achieve it, the programme of interdisciplinary studies described below has been established. As will be seen, this breaks with the tradition of segregating the various branches of knowledge in separate compartments.

1. WHO DOES THE TEACHING?

Teaching qualifications

There are four types of teachers working together at the CESA:

a) University graduates specialising in disciplines we regard as "analytic" and which are not directly related to the environment. These may be fundamental scientists, such as physicists, organic chemists and mathematicians, or specialists in the techniques of processing or presenting data which covers statistics, computer science, graphic semiotics, cartography and modern languages;

b) University teachers specialising in disciplines we also regard as "analytic" but which have a direct connection with the environment. These include geology, climatology, soil science, biology, geomorphology, demography, sociology, economics and law;

c) University teachers specialising in disciplines that have a unifying effect, since they comprehend living space and systems as a whole. Here are included ecology and regional geography;

d) Practising planning consultants who are often attached to public authorities and include agronomists, architects, town planners, doctors and mining engineers.

Criteria for selecting faculty

Four criteria are used in the recruitment of teaching staff:

a) The candidate's interest in the CESA and conviction that an interdisciplinary approach to the problems of environment and environmental management is urgently needed;

b) Specialisation in one of the fields covered by the programme;

c) Qualities as a teacher;

d) Experience of planning problems (this applies mainly to the professional consultants).

Of these four criteria, we are convinced that the first is undoubtedly the most important. This is our conviction and it is constantly being confirmed by experience. Interdisciplinary

education calls for an effort of reappraisal, collaboration and co-ordination which entails an enormous task of constantly updating the very many meetings. It is only their belief in a philosophy of the environment that enables our staff to accept all these constraints and to carry out the work required of them.

Balance between knowledge and teaching ability

When the CESA was set up, much stress was laid on the competence of the teachers in their respective disciplines. Subsequent experience, however, showed that, given a certain level of competence, it was preferable to recruit staff who were prepared to place the emphasis rather on the teaching techniques involved in their work and to co-operate fully in integrating the different disciplines. In the early stages there was a tendency for CESA to engage a large number of staff so as to have the best specialist possible on each aspect of the environment, but we found that there was a considerable risk of fragmentation and the present practice is to have the disciplines (which, while different, remain interrelated) taught by a limited number of teachers.

Working arrangements with persons outside the University

These arrangements are made through contacts at different levels:

a) The Sponsorship Committee, which advises on the programmes, is composed of people from outside the University;

b) The Managing Board of the CESA includes three "outside members", all three of whom help with the teaching;

c) The teachers from outside the University take part in the general meetings of teachers which take place periodically;

d) Each year the practical details of courses are planned at meetings in which all those concerned take part, whether members of the teaching profession or not.

Finally, there are very many informal contacts which enable these people to keep in touch throughout the year. As long as those outside the university who help us with our teaching are keen on the CESA, the problem of contacts with them solves itself.

It is clear that in future the recruitment of staff will mainly depend on their degree of enthusiasm for the CESA.

2. INSTITUTIONAL ORGANISATION

From its inception the CESA has functioned as an autonomous and pluridisciplinary centre within the University of Tours and has stuck to this policy, recruiting its own staff and obtaining the part-time services of people belonging to other departments of the University. We have been under constant pressure to cut down our independent teaching activities and to function simply as an administrative service for sending our students to the different departments of the University to take specialised courses bearing on the environment. We have always successfully resisted this pressure. We consider that the training of our students cannot be provided by a combination of courses that have not been designed for them and not thought out as part of an overall plan. Experience constantly strengthens our conviction that a knowledge of the environment and its management must be taught at a fully independent pluridisciplinary centre which is also, if possible, interdisciplinary.

Autonomy does not mean solitude, quite the contrary. The CESA could not survive without calling on the services of very many teachers from the François Rabelais University and in fact we regret being part of a young, under-equipped university which is very often unable to provide us with the necessary infrastructure (teachers, laboratories, premises in general, budget and administrative staff). In practice the CESA is a department within one of the ten Units of Education and Research (UER) of the University of Tours. This Unit comprises the Environmental Science Department (CESA), the Geography Department and the Information Processing Department.

The autonomy of the CESA must also be defended against the community in general. Problems of environmental planning, in particular, inevitably have political implications, hence the necessity of having contacts with the authorities responsible for policy at the local level (municipalities), regional level and national level, while retaining complete freedom of judgment and expression. For this purpose a new publication, Les Cahiers du CESA, has recently been brought out. In this CESA students and teachers may freely express their opinions on any aspect of environmental planning. This is how the critical role a university should play will be preserved.

The inclusion of the CESA in the French university system, which is highly centralised and controlled by the Ministry of Education in Paris, undoubtedly leads to certain constraints.

a) From the teaching point of view, when the degree awarded is not recognised by the Ministry, the University is given no budget appropriation for providing the corresponding instruction. It is consequently obliged to use its own funds, which considerably limits what it can do. An example is our Etudes Universitaires du Milieu (university level environmental studies) diploma, given after the first cycle, i.e. the first two years of study. When, on the other hand, the degree is recognised, the University is given funds by the Ministry, but the pattern of instruction must follow a national plan. An example of this is our Master's Degree in the Science and Technology of Environmental Management (second cycle of our studies, corresponding to the third and fourth years at the CESA). Luckily the constraints imposed on the syllabus for this Master's Degree are relatively light.

b) As regards budgeting, it is the University that determines the budget for each of its UERs in accordance with "objective" criteria (number of students, unit cost of student according to course of instruction, etc.). Each UER then divides its budget up between its departments. The CESA's budget is thus directly determined from outside, so very often does not depend on the curricula; the curricula must be made to fit in with it. Similarly, teachers are paid according to sacrosanct scales laid down by the central authorities.

With the exception of occasional meetings, the French University system is hardly conducive to national or international co-operation. In particular the sabbatical year system does not exist in France and university teachers are unable to travel abroad for more than six weeks during the academic year. Consequently, any collaboration we might offer foreign institutions could not go beyond courses of lectures lasting a few weeks.

3. COURSE CONTENT

Scope of "environmental studies"

The CESA's objective is to train environmental specialists capable of throwing light on questions on which decisions must be taken by those responsible for policy. To this end, the syllabus has been divided into two two-year cycles.

The first cycle leads to the Etudes Universitaires du Milieu diploma, which is intended to give students not only a training,

i.e. a body of knowledge, but also a philosophy or an attitude of mind that will enable them to size up the environment in its complexity and underlying unity. This first cycle is limited to a study of the environment as it is, with its constraints and imbalances, while the second cycle is intended to prepare students for practical work, i.e. for environmental management proper. It takes the form of a Master's Degree in Science and Technology with very full curriculum and much emphasis on applied studies.

The philosophy that led to the creation of the CESA excludes any specialised approach to environmental problems. Instead, students must be made familiar with the different aspects and constraints of the environment, so that they will never be able to consider a particular aspect without immediately recognising all its implications and repercussions. Our belief is therefore that they should have no choice of subject of study before completing a long common core covering the whole of the first cycle and the first year of the second cycle. The very idea of environmental scientists specialising in any given field seems to us a contradiction in terms.

Content of first study cycle

The first study cycle is divided into five main sections:

a) Auxiliary subjects related to the fundamental sciences:

- Physics: energy, kinetic theory of gases, thermodynamics, electrical and electro-chemical phenomena;
- Chemistry: structure of matter, principal chemical functions, colloids, amino-acids, proteins, chromatography, infra-red analysis;
- Mathematics: ordinary functions, differential equations.

The purpose of these courses is naturally to teach students certain concepts that are essential for understanding the environment, but also, and perhaps mainly, to accustom them to the logical and close reasoning they will need so much in all their future work;

b) Basic data concerning the ecosphere: this subject covers particular aspects of the ecosphere, viz. the air, the soil, underground structures, water, producers, consumers, reducing agents and human physiology. It is traditionally a part of geology, physical geography, soil science and biology, and enables the student to arrive at the parameters for physical factors and the behaviour of living things;

c) Basic data relating to human activities: man (population, natural movement and growth, mobility, working population) and human societies (social, socio-occupational and cultural structures) economic activities: distribution factors (energy, raw materials, communications); a grounding in economics and law. These subjects explain the constraints imposed by man's past and present activities on any action affecting the man-made environment;

d) The relevance of all the above studies is made clear by general courses which knit together everything related to the functioning of the ecosphere, of ecosystems and of the different types of man-made environment. The courses help the student to understand the part played by the factors studied previously in the functioning of natural or man-made systems. They fall under two headings, but there is no strict division between them:

- Functioning of the ecosphere and ecosystems;
- Evolution and operation of man-made environments.

e) Finally, there are auxiliary courses of a technical nature to teach students how to process or present data. These include statistics, information processing and simulation, semiotics, cartography and modern languages.

Having received this training, students are ready to start the second study cycle leading to a recognised qualification.

Content of second cycle studies (Master's Degree in the Science and Technology of Environmental Management)

The first year is again planned as a common core. It leads to two different certificates on which study proceeds simultaneously, namely:

- Certificate C 1, in environmental management and protection,
- Certificate C 2, in human ecology.

The content of this common core is intended to provide students with the grounding required by all kinds of environmental managers, while the syllabus for the two certificates corresponds to two complementary aspects of man's relations with his environment. Thus C 1 teaches the principles, means and techniques of man's action on the environment, while C 2 shows how man is affected by his environment.

Syllabus for C 1

C 1 consists of three main sections which disregard traditional disciplines and their dividing lines, viz.

a) General principles of physical management and of the management of resources and activities:

- Problems of political economy raised by the overall management of the environment (policies for energy, resources, transport and population; comparative study of forecasting and planning policies and methods, systems of ownership, land use controls and uses of the environment);
- Management of natural resources (relative and absolute constraint, turnover, principles of recycling, and soil conservation);

b) Management of quality of life, case studies:

- Distribution and balance of activities, housing and accommodation, traffic and infrastructure, leisure;
- Basic techniques of town planning and architecture, civil engineering and hydraulic engineering;
- Consideration of non-quantifiable values: development of cultural and natural assets;
- Analysis and implementation of environmental management projects with plans, models, maps and simulation;

c) Techniques of expression and leadership:

- English
- Group leadership.

Syllabus for C 2

The final objective of all regional and resource planning is man. Every environmental planner must know how the quality of life influences man's physical and mental health, not only through changes in the physical environment (pollution and nuisances), but also through his psycho-somatic reactions to living conditions, conditions of work, housing, travel, mass media, etc. Certificate C 2 consists of two main sections:

a) Psycho-sociology and social medicine:

- Analysis of the effects of working conditions, of accommodation, housing, travel, transport and pollution, on man;
- Influence of activity rates and density of population;
- Social evils;

b) Human physiology and hostile factors:

- Stress;
- Dangers from chemicals;
- Dangers from bacteria.

The second year of the Master's Degree course comprises elective subjects. It, too, consists of courses leading to two certificates:

a) The course for Certificate 3 takes up the first six months of the academic year and enables students to be given theoretical instruction relevant to the subject chosen. There are three elective subjects which include some instruction common to all three. These are:

- Management, planning and administration of territorial communities in an urban environment;
- Planning and administration of territorial communities in a rural environment;
- Value of natural assets and man's heritage and their importance in daily life.

b) Certificate 4 is built up on a training course lasting from 10 to 15 weeks. This is given in an environmental management institute appropriate to the subject chosen by the student. In order to make the course more profitable to the student, the CESA collaborates with the institute in deciding upon the precise subject on which he will work. At the end of the course the student writes a report describing the conditions in which he has worked, giving a critical account of the study or project in which he has taken part and going more deeply into any aspect he considers particularly important. This report is submitted to a pluridisciplinary jury.

It is our intention that the best of the students who have taken the Master's Degree in the Science and Technology of Environmental Management should be able to complete a fifth year preparing

them for an Engineering Degree in the Science and Technology of Environmental Management. During this fifth year, the students would have as their subject a type of environment corresponding to a particular ecosystem: Mediterranean, tropical, humid, mountainous, etc. but this could only be organised with the help of close international co-operation. It would have to be possible to exchange students according to the characteristics of the environment in which the different teaching institutes were situated.

4. TEACHING METHODS, MEDIA AND MATERIALS

Given CESA's objective, we have to design teaching methods to facilitate the merging together of the different disciplines. It is, of course, always possible for an experienced teacher to give his class an interdisciplinary view of a phenomenon. However, everyone remains more or less a slave to habits acquired during his training in a single discipline (and, often, from his experience in only one discipline) so over and above the efforts required of each teacher, it is prudent to use methods of teaching or supervision that institutionalise interdisciplinarity. To this end we use the following:

a) We co-ordinate study courses as carefully as possible, so as to be able to set subjects for examination that are common to several courses.

b) Cross-roads: these are long (half day) sessions attended by a group of students and by several teachers representing different disciplines or points of view. Examples are pesticides as seen by an agronomist, an ecologist and an economist; urban transport as seen by a town planner, a sociologist and an ecologist, and so on.

c) Case studies carried out by working groups led by teachers are a more common practice. Students, mainly in the second cycle, are asked to write a brief on a specific environmental management project or recommendation. The brief is then submitted to several teachers each of whom criticises it from his own point of view. Case studies are extremely valuable, as they oblige students to draw on the different disciplines.

d) Field studies and courses are obviously the most perfect form of case study and the most conducive to interdisciplinary integration. Budgetary constraints oblige us to limit the number of such studies, but we organise them nevertheless, each major outing being led by several teachers representing different disciplines.

To encourage students to be creative, we have set up a CESA Workshop in which groups of students can prepare environmental management projects in response to possible requests from the responsible authorities. In this work they may ask for advice from teachers they think it useful to consult. The best projects prepared by students are published in the Cahiers du CESA.

These free or semi-free studies which can be carried out in groups are taken increasingly into account at the CESA in assessing a student's progress. A large part of the examination for the C 1 Certificate, for example, consists in preparing mini-projects in the field of environmental management.

5. RESEARCH BASE

The CESA was set up in such conditions of poverty that our initial concern was to meet immediate needs and give priority to organising courses of instruction. In the first stages, therefore, each of the teachers working at the CESA continued to do the research he had already undertaken in his own discipline. We believe, however, and our experience confirms this, that a centre for studies on the environment and environmental management which did no specific research would very quickly lose both its dynamism and its influence, and we are accordingly convinced that teaching must be supported by research work.

Furthermore, we feel that in the field of environmental management it would be a serious mistake to undertake only applied research at the request of the community. The critical function of a university calls for complete freedom of investigation, which is incompatible with commissioned research, so it is vital to undertake some fundamental research. For this purpose we have a project at the CESA which we hope to start as from the next university year. It will consist of interdisciplinary research into urban ecology as applied to urban centres of average size, the first test being the city of Tours and its conurbation. Such a project for studying the living conditions of town-dwellers as conditioned by their environment can bring together ecologists, geographers, demographers, climatologists, doctors, economists and others. Its all-embracing character led to the choice of this project by the Council of Tours University as the University's principal research activity.

As long as fundamental research is not neglected, it is possible to do a certain amount of commissioned research, and it is to the latter that we direct our students, mainly by way of mini-projects and work in the CESA Workshop. Some teachers act occasionally as advisers or consultants for certain environmental management operations affecting the town or district, but none of us is bound to participate on a regular basis in the work of any environmental management authority.

6. CRITERIA OF SUCCESS

At present the CESA has 300 students and we are gradually working up to a regular intake of 150 first-year students. The proportion of final successes is about one half of the initial intake. The main reason for limiting student numbers in the first year is the inadequate size of our teaching staff. We have about 500 student applicants for 150 vacancies and our students come from an area extending far beyond the Tours district, covering the country as a whole.

Recruitment of staff is somewhat difficult. Enthusiasm on the part of would-be students is coupled with reluctance on the part of candidate teachers, who are undoubtedly afraid that the very special character of our teaching may hold them back in their careers.

It would be presumptuous to state that CESA students are always fully satisfied with the instruction they receive. Being intensely involved, they are also very demanding. Moreover, as members of the CESA's (joint) Board of Management, they take part in preparing the curricula and on several occasions we have had to change the direction or emphasis of our teaching under their influence. Furthermore, owing to the inadequacy of our funds we are often unable to do the things we would wish to do, with the result that the degree of dissatisfaction among the teachers is at least equal to that of the students.

The experience of our first intake of students who will take their Master's Degree this year, gives us a fairly clear view of the avenues open to them. There are four main outlets: urban planning services (town-planning workshops and agencies), infrastructure administration work, rural management services and firms of private consultants.

It is not uncommon for the work required of our former students to be somewhat out of line with their training, especially in its

technical aspects, but this would not appear to be an insuperable obstacle so far as their futures are concerned. On the contrary, it strengthens our determination to provide them with a broad grounding rather than an assemblage of contingent and ephemeral technical knowledge.

7. RECURRENT EDUCATION

For the reasons given in Section 5, we have not yet been able to organise a recurrent education session suitable for members of the professions concerned with environmental management or other professions, but this is one of the things we intend to do. Some of our students who will be leaving the CESA this year have already drawn our attention to the desirability of having refresher courses for former CESA students. Here again, student pressure will perhaps be salutary in encouraging us to bring our establishment up to strength.

UNIVERSITY AND TECHNICAL INSTITUTE OF LUND

PROGRAMME IN ENVIRONMENTAL STUDIES

Lund, Sweden

by Lars EMMELIN

1. ORGANISATIONAL STRUCTURE

The Environmental Studies Programme (ESP) is an administrative unit under the governing body of the University. It was initiated in 1969 to organise interdisciplinary teaching and other activities within the environmental area that were of concern to the University as a whole. Its establishment was preceded by experiments with a course on environmental problems run in 1968 and an enquiry into the research on environmental problems carried out in the University.

The ESP is directed by a Board elected by the governing body of the University. On the Board are representatives of all the faculties of the University (humanities, science, social science, law, divinity, medicine, odontology and technology), the environment protection agencies, students, and unions. Its routine work is carried out by a small staff and the major studies programme is directed by a committee consisting of course teachers.

Aims of the ESP

The policy of the ESP is to be active at four levels in the university system in the following roles:

i) Problems of the environment should be integrated in all courses, being specifically related to their subject matter.

ii) The arrangement of short courses providing a general overview of the present problems and some factual knowledge of the bases for action in response to demands both by students and people outside the university.

iii) Experts on the various aspects of the environment must be trained within their own disciplines. Certain general areas of common interest to several disciplines, however, exist, and as these fall between existing institutional boundaries they are often neglected.

iv) Since decisions of great environmental consequence are often made by engineers, lawyers, administrators and other professionals in private or public service, a more thorough environmental education of professionals is needed. Study programmes for them will, however, produce neither "environmental experts" nor "generalists" in any other sense than that they will be able to handle environmental problems within their own field and be in a position to co-operate and communicate with specialists from other disciplines.

Major areas of work

As to the role (i) above, relatively little has yet been achieved by the ESP. In a situation where demands for change of course content are coming from many quarters and for almost all subjects, environmental problems have low priority with most educational planners. Nevertheless change in attitude is certainly taking place, due both to outside pressure and the involvement of teachers.

Within role (ii) the ESP is already offering a short programme of 10 points (equivalent to 10 weeks of full-time studies). This takes the form of evening classes and is open to both students and people outside the university with no formal entrance qualifications.

In role (iii) the ESP is at present giving a doctoral course in trace element analysis. This is one example of a course which is of interest to research students from many institutes and has no appropriate home within any one of them. Other courses are planned, e.g. one on remote sensing.

Other activities of the ESP are directed at this same level. The most important of these are interdisciplinary seminars, lectures on an ad hoc basis, and the publication of a catalogue of current research projects at the University. The catalogue also contains suggestions for further research at various levels. These have been submitted by organisations, government agencies, scientists, industries or private individuals, and worked over by the ESP staff who propose a suitable scientific level, the number of people required, the institute at which the research can be done, the possibilities

of funding, and so on. This catalogue is issued annually in Swedish.

Role (iv) is at present the major area of activity for the ESP, a study programme of one whole year (=40 points) being offered. As already said, this programme is run by the staff of the ESP and a committee of those who have the major responsibility for teaching the various courses.

Financially the ESP is separate from the institutes which do much of the teaching in the 10 and 40 point programmes. Money for the salaries of teaching staff is allotted on the basis of number of students and types and duration of courses, in accordance with standard national practice, by the Office of the Chancellor of the Swedish Universities. The cost of running the programme is carried by the common funds of the University.

Both programmes lead to a diploma. They can be incorporated in the primary university degree (fil.kand. - approximately equivalent to a bachelor's degree) made up of 120 points. The diploma is awarded on the basis of a written examination and acceptance of a thesis.

In a number of cases doctoral students have been permitted to include the 10 point programme in their studies. This is at the discretion of the individual professor supervising the student.

2. COURSE CONTENT

The course content for the 10 point programme is outlined in Appendix 1 and for the 40 point programme in Appendix 2. For some courses an indication of content is given by listing a number of key terms. It should be noted that 1 point is equal to one week of full-time studies and that 40 points is an academic year.

In the 40 point programme, the first 9 courses provide a variety of alternative ways to begin the studies. Each student has to choose 15 points from courses 1 - 9. For example, one could give course 1 - 4 to non-biologists such as engineers, lawyers, etc, and 3 + 5 + 6 + 7 to biologists. As alternatives, 8 and 9 can be taken by biologically oriented students who wish to specialise within their previous field.

Courses 10 - 14 are taken by all students of the programme and are taught in one class.

3. WHO DOES THE TEACHING?

A large proportion of the teaching staff for both programmes is recruited from outside the University. A practical involvement with environmental problems is a major criterion for choosing the teachers for the 10 point and for courses 10 - 14 of the 40 point programme. Courses 1 - 9, being more in the nature of introductions to areas within existing university disciplines, are considered to be more of a pedagogical matter. Teachers are recruited mainly on the basis of interest and ability to teach their own subject to a non-specialist audience.

The ESP has a very small teaching staff of its own - only those directly responsible for the educational administration of the programmes. The rest of the teaching body is either hired by the ESP for the actual teaching, or resources are transferred to a university institute in exchange for services such as teaching, use of laboratories, etc.

The advantage of this system is that the ESP is relatively free to choose teachers with respect to their individual interests, qualifications, involvement in environmental problems, etc. and in particular that it is not bound to recruit them from within the university.

4. TEACHING METHODS, MEDIA AND MATERIAL

The 10 point programme, which aims at giving a broad overview, has a series of lectures as its backbone. The superficial nature of this course is offset by literature, part of which is produced specially by the ESP. Since a large proportion (about 50 out of 300 students per year) of the 10 point students do not fulfil the formal requirements for university admittance, textbooks have to be in Swedish. This is also required for non-science students as concerns all technical, natural science and medical texts. The problem of finding appropriate literature for such a short programme has been partly overcome, as said, by the production of texts specially written for the courses by those who teach them.

A formal requirement of the course is that students should produce a written report. This is done under the guidance of a tutor and it has to be presented as the result of group work. Subjects for reports are suggested by tutors or by the students themselves. In the latter case the ESP staff then provides suitable

tutors for the subjects. Tutors come from both outside and within the University. The aim of the group work is always to treat a real problem, never an exercise. Group work done by students of different backgrounds on a common problem - in particular the joint writing of a report as the conclusion of the work - is considered a most important part of the learning experience of the programme.

The scope of the 40 point programme necessitates a fair amount of lecturing here also. But the moderate size of the class (a maximum of 48 - usually less) makes discussion and less formal styles of lecture more possible than in the 10 point programme (a class of 150).

Excursions - some for several days - laboratory exercises and project work assume proportions which by Swedish standards are fairly large, though more ordinary by North American or British standards. All in all the students are required to work harder than in most other lines of study - a full 8-hour working day in classroom, laboratory or in the field and further reading on top of that.

Production of teaching materials has been limited to the ad hoc production of papers, copies, working documents for the students.

5. CRITERIA OF SUCCESS

Initially the 10 point programme could admit only about half of the applicants, having an upper limit of 150 students who could be tutored each term. Presently the number of applications is in the range of 150-200 with a declining trend. Whether this is due to a generally diminished public interest in the environment (reflected e.g. in less space being devoted to such problems in the papers) or to an accumulated demand which has now been worked through in the first 3-4 years of the programme is impossible to judge.

The number of people attending from outside the University has been steadily increasing, in particular those with little higher formal education. The ESP considers this a most encouraging result. Indeed, the demand for programmes of this type has led to the establishment of others at many places in Southern Sweden. Local voluntary educational organisations have the administrative responsibility for these, and the ESP for the academic ones.

A problem of the 40 point programme has been that the present Swedish university system has only two levels - undergraduate, leading to a bachelor's degree and doctoral, which is concerned only with research. A large proportion of the ESP students, however, already hold their first degree and have had some vocational experience as well. They thus constitute a level that is not formally recognised in the present system. The fact that they deem it worthwhile to spend an entire year on non-specialist education in a situation where university education in general and non-specialist education in particular is held in fairly low esteem by large sectors of public opinion is considered a fair measure of success for the educational part of the programme.

Appendix 1

ENVIRONMENTAL STUDIES, 10 POINT PROGRAMME

1. Introduction . . . . . 2 points
   Ecology, environmental hygiene, genetics, pesticides, the work environment

2. Water pollution problems . . . . . 2 points
   Water resources, water pollution and control, lake restoration

3. Air pollution and noise problems . . . . . 2 points
   Air chemistry and meteorology, air pollution and control, noise problems

4. Waste problems, radiation problems, conservation . 2 points
   The solid waste problem, natural resource management. Radiation problems

5. Society and environment . . . . . 2 points
   Legislation, administration, physical planning, economics, international co-operation

Appendix 2

ENVIRONMENTAL STUDIES, 40 POINT PROGRAMME

INTRODUCTORY ALTERNATIVES (15 points)

1. Chemistry . . . . . 2 points
2. Physiology and medical introduction . . . . . 5 points
3. Earth science . . . . . 2 points
4. Ecology . . . . . 6 points
5. Economic resource allocation . . . . . 5 points
6. Physical and regional resource planning . . . . . 5 points
7. Administration . . . . . 2 or 3 points
8. Bio-statistical methods . . . . . 5 points
9. Systems ecology . . . . . 5 points

OBLIGATORY

10. Environmental hygiene . . . . . 5 points
    The human environment, radiation, biocides, solid waste, nuisances, the work environment
11. Conservation . . . . . 5 points
    Soil science, ecosystem management, land use, agriculture, forestry, wild life, landscape planning, conservation
12. Water pollution control . . . . . 5 points
    Water resources, pollution, effects of pollution, pollution control technology, fishing, lake restoration
13. Air pollution control and noise abatement. The inter-relationships of pollutants and pollution . . . . . 5 points
    Air pollution effects, control technology, economics, planning and legislation. Noise abatement technology - economics, planning, legislation

The interrelationship between pollutants and media: air, soil and water. The biosphere.

14. Society and environment . . . . . 5 points
Legislation, administration, economics, national physical planning, environmental politics - relationship to other sectors of society, international co-operation. (Part of this course is given as an introduction to the entire study programme.)

THE NEW UNIVERSITY OF ULSTER

SCHOOL OF BIOLOGICAL AND ENVIRONMENTAL STUDIES

Coleraine, United Kingdom

by Palmer J. NEWBOULD, Professor

The New University of Ulster includes five Schools of studies. Most, but not all, of the environmental education occurs within the School of Biological and Environmental Studies which runs, inter alia, degree courses in Environmental Science and in Ecology.

1. WHO DOES THE TEACHING ?

Within the School there are now 35 lecturing staff, roughly divided into:

Biology	15
Environmental Science	7
Human Geography	8
Psychology	5

The total undergraduate teaching load is about 60 units (see below).

While it is difficult to pin concise labels on these people, within the ecology/environmental science area, the following specialisms are represented.

Ecology 5 (plant ecology, animal ecology, ecological genetics, energetics, computer modelling)
Animal behaviour 1
Entomology 1
Freshwater biology 4 (phytoplankton, zooplankton, fish)
Geology 1
Physiography, geomorphology 1
Soil Science 1

Meteorology 2
Hydrology 1
Biogeography, quaternary ecology 1

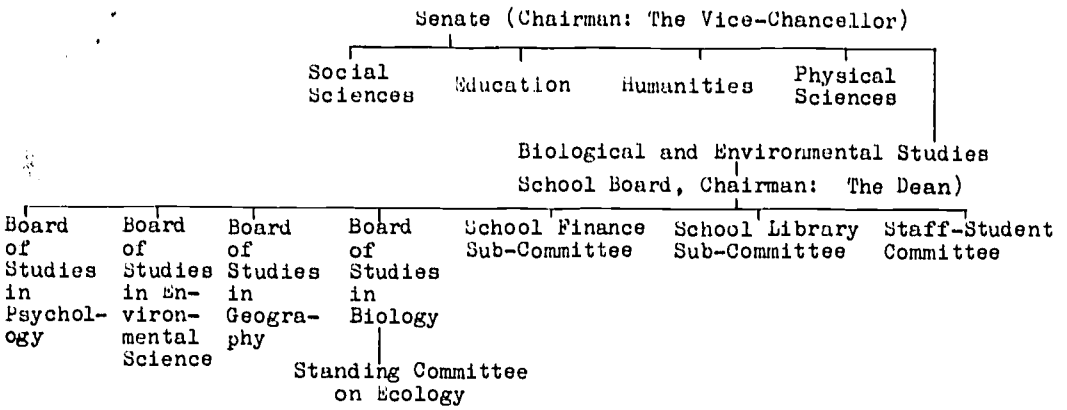
Further assistance with teaching comes in various ways. Colleagues in Physics, Chemistry, and Statistics provide units of study in their subjects especially designed for our students. Colleagues from other subjects may come and give small groups of lectures within our units - e.g. an Economics lecturer gives 4 lectures within the Unit in Conservation. The Vice-Chancellor, who happens to be an ecologist, gives a few lectures.

Going outside the University, a special relationship exists with the Ministry of Agriculture's Fisheries Research Laboratory where three of the senior staff are Honorary Lecturers and give a number of lectures and associated practical classes. Also a small number of professionals and colleagues is brought in from other universities, usually to provide single lectures or seminars. This is especially desirable where our own lecturers lack expertise, where students have made special requests which the school cannot cover, or where closer contact with the real life of the outside world seems desirable. Such seminars have a two way function - the outside expert learns more about the University.

The Professors, who were appointed first, were committed to the idea of a new University, to a School of Biological and Environmental Studies and to close staff-student relationships. Most of the other staff were appointed in fairly junior capacities, so that their ideas and commitment would grow up and develop with the institution. They receive some informal guidance, but no formal training in teaching methods. Another principle of selection was complementarity, so that some put more emphasis on research, less on teaching and some the other way round.

The School lacks an oceanographer which leaves a serious gap in subject coverage but feels that first-hand involvement in oceanographic research would be too expensive to support at present. There is an urgent need for an environmentally oriented systems analyst, to develop systems thinking as an integrating theme for the environmental science course, but no suitable applicant could be found. Currently, the possibility of one of the existing Environmental Science lecturers attending a one-year Masters' course in Systems Analysis at another university is being explored. In developing its thinking, the School was helped by a visit from a Professor of Systems Analysis from another University.

2. INSTITUTIONAL ORGANISATION



The major organisational unit is the School, and the way in which it fits into the University organisation, and is itself subdivided, is set out above. The control of expenditure, for example, within limits set by Senate, is a School function.

The Dean is ex-officio a member of all the Boards of Studies within the School and there is further overlapping membership. All teaching staff are members of the School Board and of the relevant Boards of Studies, which also function as Boards of Examiners, and report to Senate through the School Board. The Dean and the Chairmen of Boards of Studies are effectively elected by their respective Boards, but their appointments must be ratified by Senate. Each School Board includes two representatives from each of the other four School Boards. Boards of Studies, School Boards and Senate generally meet six times a year unless there is some special need for extra meetings.

At present there are four professors in the School. Each non-professorial member of staff is responsible for the discharge of his duties to a named professor. Final responsibility for teaching, research, standards, etc. in any subject rests with the Head of Subject who is appointed by Senate, and who is normally a professor. He is required to fulfil his functions in consultation with the relevant Board of Studies, of which he may or may not be Chairman.

Although there is a degree of ambiguity and shared responsibility the system has worked well in practice as a compromise between democracy and professorial leadership. Advantages within the environmental field include the flexibility of School as opposed to departmental structure. Effective discussion of e.g. course

content, teaching and examining methods occur both at Board of Studies and School Board level. Within the School such services as the general workshop, electronics workshop, drawing office, map library, reprint collection, office and secretarial services, stores, photographic studio, laboratory technician service, are all organised on a School basis. The Staff-Student Committee and the student Society both operate on a School basis. In practice the Dean and the Senior Technician both have considerable responsibility for the cohesion of the School.

Student counselling is done by advisers of studies, each student being referred by the appropriate Board of Studies to an adviser, on the basis of his or her application form. The student normally stays with the same adviser for three years. All professors and lecturers act as advisers, having perhaps six to ten advisees each.

The main shortcomings of this system seem to be the lack of formal links with other institutions, or with the local community, but now that the university is well established it may be possible to forge more formal links.

3. COURSE CONTENT

Students take six units a year, three in each of two teaching semesters.

Details of four of the major degree programmes are set out in the Appendix. The School tries to combine the flexibility of an American-style unit system with an appreciable element of progression and planned programmes and with a British-style classified honours degree including some synoptic examinations and external examiners. Most but not all units have pre-requisites and degree programmes have a core of compulsory units to which further optional units can be added. Some interchange between programmes is possible, as is taking some units missed in earlier years.

The ecology programme has grown out of the biology programme, and the first two years are very similar. Ecology seems to require more statistics, biology more chemistry. In the final year of the ecology programme a "levels of organisation" theme was adopted, dividing material into autecology, population ecology and ecosystem ecology, but this may be revised since the unit boundaries are not very clear.

In the Environmental Science programme, the underlying philosophy is to describe first the major environmental systems - e.g.

atmosphere (meteorology), lithosphere (geology), hydrosphere (hydrology), biosphere (ecology), secondly the interaction between systems - e.g. biometeorology, soil science or fluvial processes, and finally some aspects of the management, manipulation and alteration of these systems by man, e.g. planning, conservation, water resource studies. The School hopes to use the systems approach as a unifying theme. This programme is still evolving.

In determining essential contents, the School works back from the end point to see what pre-requisities are needed. Both ecology and environmental science programmes are firmly rooted in the natural sciences, with rather limited cross referencing to the social sciences. In both great use is made of the local situation, but some more superficial allusions are made to the global situation. The units on Ecosystems and on Conservation both embody a global perspective.

4. TEACHING METHODS, MEDIA AND MATERIALS

Since this is a relatively new university (opened to students 1968) the School is experimenting with a considerable mix of teaching and assessment methods. There is a fair measure of autonomy both within units, and within degree programmes, to choose one's own teaching and assessment methods. So there is diversity of practice. The number of staff involved in teaching a unit varies from 1 - 6, but there is agreement that 2 or 3 are optimal; 1 allows too much personal idiosyncracy to creep in and does not easily allow for double marking in assessment and examinations. More than 3 presents problems of co-ordination.

Main teaching methods are:-

i) Lectures. Duration 50 minutes; economical of teaching effort, especially where unit enrolment is 20 or more; audiovisual aids such as slides, film, film loops or videotapes are often used. Most units have two lectures a week, so that a student normally attends 6 lectures/week.

ii) Seminars. Duration 1 - 2 hours; involve 1 or 2 lecturers, sometimes more, with 6 - 16 students. A common pattern is for one student or more to give a short introductory talk followed by discussion in which both staff and students join. Useful for inter- or multi-disciplinary topics. A series of linked seminars are often used for case study documentation based on actual case studies.

iii) Tutorials. Duration 1 hour. Usually 1 lecturer and 2 - 4 students. Students commonly write essays, which the lecturer may mark and discuss with them. Helps to develop literacy and clarity of thought.

iv) Practical classes. Usually 3 - 4 hours, may involve laboratory work, map or aerial photo work, or short field outings to sites of interest. Lecturing staff may be supplemented by post-graduate demonstrators. Especially valuable for teaching the principles of scientific enquiry, practical methods and their shortcomings.

v) Field Courses. The School is well placed for half- or whole-day outings to sites of interest, and to see research in progress. Some units involve longer field courses. In the ecology programme one unit, Habitat Studies, consists of three one-week field courses, on marine, freshwater and terrestrial ecology respectively with some follow-up seminars afterwards.

vi) Projects/Dissertations. In all programmes a student project supervised by an appropriate member of staff is an important element. It usually involves the acquisition of original data. It gives a chance for the student to pursue some topic in depth and to learn some methods. It often involves statistical analysis of data, and sometimes computer modelling. The School has its own small computer (PDP-8) to which students have direct access. This has proved very successful.

Marking projects when submitted can be extremely difficult because of variations in the amount and quality of supervision and usually three staff members independently mark each project, referring it to the external examiner if they disagree seriously. Two or three days are now set aside for the students to give oral presentations of their projects to an audience of staff and students, which makes for easier assessment.

vii) Assessment. The basic aim of the School is to measure a wider spectrum of different attainments and abilities than is done by more traditional systems. In general most students are assessed by about 50 per cent cumulative assessment and 50 per cent examination. The examinations take place each June, and refer to units studied during that academic year, but the final examinations may also include some synoptic papers which certainly seem essential in a multidisciplinary course. An attempt was made to introduce data interpretation exercises into the exams but without great success.

Cumulative assessment takes many forms - essays, multiple-choice tests, practical exercises written up and submitted, book reviews, bibliographies, etc. Part of its value lies in its use for monitoring progress and providing feedback on progress to the student. It also tends to lessen examination tensions, and to benefit the consistent and industrious student who may not work well under time stress.

5. RESEARCH BASE

All members of teaching staff engage in research and the School is well equipped. Facilities include well equipped and serviced laboratories, scanning and transmission electron microscopes, an aquarium suite with facilities for fresh water and sea water, a sophisticated meteorological station, constant temperature and cold rooms, greenhouses, an animal house, controlled environment plant growth cabinets, 3 landrovers and other vehicles, a boat on Lough Neagh and a large transportable rubber dinghy, equipment for taking mud, peat or soil cores, map library, workshops and a PDP-8 computer. Within the University there is also a large computer, and also, in Chemistry, more sophisticated analytical equipment.

There are at present about 20 full-time research students, mainly studying for doctorates, and 4 senior research fellows. Research is supported by about 26 technicians in all.

A conscious effort is made to build up co-ordinated multi-disciplinary research teams and also to carry out a considerable element of research relevant to local environments providing always that its academic content looks interesting. Examples of major research efforts are:

i) Lough Neagh. There is a Freshwater Biology Research Laboratory situated on the shores of Lough Neagh, nearly 50 km from the main University campus. Lough Neagh is a large (383 km^2) shallow eutrophic lake. The research team there includes at present about 4 lecturers who spend part of their research time there, 5 postgraduates, 2 technicians and a boatman. This is likely to expand substantially soon because more research money has become available from the Northern Ireland Ministry of Development. Close research co-operation exists with a government research group also working on Lough Neagh. The research deals with many aspects of the ecology of Lough Neagh and its eutrophication including phytoplankton,

zooplankton, Chironomid midges, fish populations and the palaeo-ecology of the lake (especially over the last 1000 years) as revealed by the careful study of lake sediments. Northern Ireland is such a small country (1.6 million inhabitants) that it is fairly easy to persuade the Government to implement, or at least to examine carefully our recommendations.

ii) Coastal processes. A four-year study of coastal processes along the North Coast of Northern Ireland, especially those related to beaches and dunes, has recently been completed. As well as natural processes, the effects of sand removal by contractors and the effects of the over-use of dunes for public recreation have been studied. A report has now been submitted but it is too soon to know whether its recommendations will be accepted and acted upon.

iii) Catchment studies are in progress which may eventually link together meteorology, catchment hydrology, river ecology and fish populations, soil science, agricultural land use and mineral cycling in a forest stand.

Many environmental consultancy jobs have been carried out, sometimes by staff with or without technicians, or by graduate students, or by undergraduate students working under contract during vacations. Some of these jobs are concerned directly with water pollution.

A considerable element of basic research is also carried out but it is difficult to quantify the balance. It would appear that valid, well thought-out research applications to the Natural Environment Research Council are usually successful providing the applicant has or can get the academic/intellectual resources needed. NERC attempts to give priority to relevant and undersubscribed research areas, such as the ecological effects of named pollutants, but can only work within constraints set by the applications received.

Student dissertations sometimes produce interesting and useful research results but in general the School has been unable to exercise sufficient quality control to make full use of them. If a greater staff commitment were available for supervision, editing, collating, reprographic work, and passing research findings to the relevant branch of the executive perhaps greater use could be made of the research but this would be highly time-consuming. Some undergraduate research projects grow into doctorate topics.

The involvement of lecturers in research feeds back into their teaching and seems to be appreciated greatly by students.

6. CRITERIA OF SUCCESS

The current troubles in Northern Ireland broke out in October, 1968, the same month as the University opened to students. This makes it very difficult to apply criteria of success. It has been difficult to reoruit staff, postgraduates and undergraduates of high calibre throughout the ensuing period, and it still is. A few personal impressions are set out below.

In the recruitment of undergraduates the School has attracted a higher proportion of students from Britain to its environmental programmes than to the other parts of the university. This can be attributed to a shortage of comparable programmes in Britain and to the conservatism of the Northern Ireland schools. Over 90 per cent of the students coming in graduate. The staff are well qualified but it has been impossible to fill some posts which would certainly have been filled in Britain. It is generally acknowledged within the University that Biological and Environmental Studies students are generally satisfied with their courses, and the School receives some nice letters from ex-students. The usual quota of student dissidence, grumbles and apathy has been recorded, but also a high measure of constructive student involvement in the design and implementation of degree programmes and units of study. The vigorous nature of the student Society (the Praeger Society, named after a famous Irish naturalist, with a membership of over 200 in 1973, and a programme of 31 events) confirms this.

On the research side the Lough Neagh research has had an effect on sewage treatment in that area. The coastal research has already resulted in some dune reclamation by marram planting and may have further consequences. However, the recognition that the School is an environmentally oriented institution has brought with it criticism for not working on various local environmental problems and also for not becoming sufficiently involved in local conservation issues. In this respect it may be that the local community does not adequately understand the role of a university and that ways of increasing local involvement and thus mutual understanding should be sought. The School has attracted substantial research resources from government and other sources but has done less well within the university where its quest for relevance and innovation is viewed with suspicion. It comes under the same cost limits as other United Kingdom universities but the present shortcall of student numbers in the university (1,700 instead of 2,200) means that some staff and facilities are under-used, presumably reducing cost effectiveness.

Appendix

HONOURS DEGREE PROGRAMMES

	BIOLOGY	ECOLOGY	ENVIRONMENTAL SCIENCE	GEOGRAPHY
'A' levels needed for entry	Biol + 1 other science	Biol + 1 other science	2 Sciences (but including Geog) Biol + Geog very common	Geog + 1 other subject
YEAR 1	*Evolution, taxonomy and genetics *Form and function: plants *Form and function: animals *Introd. ecology Chemistry Statistics	*as Biology *Statistics Introd. geology or Introd. meteorol.	*Introd. geology *Introd. meteorology *Introd. ecology *Phys and chem for env. sci. Evol, taxon etc. Statistics Hum. Geog I Hum. Geog II	*Env. processes *Resources *Introd. Hum. Geog. I *Introd. Hum. Geog II
	PART	ONE	EXAMINAT	-IONS
YEAR 2	*Plant Kingdom *Animal Kingdom *Genetics *Cell Biology	*Plant Kingdom *Animal Kingdom *Genetics *Habitat Studies *Animal Behaviour	*Appl. geog. and planning *Geomorphology *Pleistocene ecology *Systems analysis in env. sci.	*Landforms *Rural habitat studies *Biogeography *Urban and industrial regions
YEAR 3	*Dissertation Growth and Development Parasitology Entomology Microbiology	*Dissertation *Autecology *Population ecology *Ecosystems	*Dissertation *Conservation Fluvial processes Biometeorology Soil Studies Water resource studies Sediments	*Dissertation Regional geog. - E. Europe - Tropics - Latin Amer. - Africa Agric. geog. Hist. and soc.geog. Ireland Social geog. Indust. geog.
PART TWO (I. E. FINAL) EXAMINATIONS				

See details in the following note.

NOTE

1. All students take 6 units per year for 3 years (18 units in all). It is possible to take some units (but not many) from another year.

2. Units marked * are compulsory components of the programme in which they are shown.

3. Change from one programme to the adjacent one is often possible (——►), or exceptionally so (-------►) but may require careful choice of optional units.

4. It is possible to take a few way-out optional units from other Schools of the University, or other parts of one's own School, especially in years 1 and 2.

5. In Year 3 it is usually possible to include some units from another programme, rather than to change programme.

6. Most units, but by no means all, have specified pre-requisites. Progression, in this sense, reduces flexibility.

7. Each programme can be taken concurrently with education over 4 years, usually involving 15 units from the programme as listed, and 9 education units, giving a subject degree and a teaching qualification.

8. Related degree programmes, using many of the units listed here but administered by other Schools of the University, include Human Ecology, History of Resource Management and Biological Chemistry.

UNIVERSITY OF EAST ANGLIA

SCHOOL OF ENVIRONMENTAL SCIENCES

Norwich, United Kingdom

by Keith M. CLAYTON, Professor

INTRODUCTION

The School of Environmental Sciences at the University of East Anglia began its sixth year in October 1973. Its foundation and aims were described in a paper given at Tours in 1971(1). This essay sets out to describe the achievements of the School over the last five years, and to provide a factual summary of what has been done. This is followed by a personal evaluation of the success of the School in creating a worthwhile and original enterprise. Particular attention is paid to the extent to which an interdisciplinary approach has been achieved using that term for the moment in its broadest sense.

1. WHO DOES THE TEACHING?

As was explained in the paper presented at Tours, the School is multidisciplinary rather than interdisciplinary. Nevertheless, many of the courses are themselves multidisciplinary in character, and some may in time evolve into interdisciplinary courses.

The size of the School, and the size of each course (i.e. the number of hours' teaching it involves) means that more than one member of staff is necessarily involved in teaching each option. As with so many features of university teaching, this is an inevitable result of the arithmetic of class size, course length

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1) Cf. Environmental Education at University Level: Trends and Data, OECD, 1973.

(and hours taught each week) and the staff-student ratio which is just a little worse than the national average. However, this situation has developed from the first few years when most courses were dominated by one teacher, and adjustment to the changed situation is far from complete. Each course is the responsibility of a convener and most of these operate as administrators, organising the teaching among the several staff convened. It would appear that few impose much intellectual leadership on the courses, and while some concensus on course content and approach emerges from discussion among the staff concerned with each course, so far no option has adopted a concept of team teaching such as that developed by the Open University. This, it can be argued, is the direction in which we ought to move, and thus a more integrated approach to each option would emerge. The greater complexity of increasing staff and student numbers will probably force a team approach on us before very long.

The recent situation is outlined in Table 2 which shows the number of staff involved in each option in 1972/73. The distinction between 2 and 3 is subjective, but reflects both the range of interests of the staff involved and the varying range of material covered in each option at the moment. Thus Hydrology includes ground water (hydrogeology) as well as channel flow; Geochemistry includes both sedimentary and igneous geochemistry; and Tropical Resources and Development covers both the physical environment and man's activities within it. The varying degrees of interdisciplinary spread in the options inevitably reflects the number of faculty teaching it, but the nature of each field has the greatest influence. Thus three of the options taught by three faculty (Oceanography, Quaternary Studies and Surface Processes) are organised as broad multidisciplinary courses in which the approaches of different specialists are studied and integrated into a multipronged attack on the field.

2. INSTITUTIONAL ORGANISATION

While most British universities are organised along departmental lines, the University of East Anglia started with a series of quite broad (and quite large) interdisciplinary schools. For several years these have provided self-contained courses for the normal three-year undergraduate course, and it has been relatively unusual for students to take courses outside their school of study. This has made the provision of broad courses relatively easy to arrange since the basis of a programme is a group of courses within

one school and the inter-relation of these is under the school's own control. As always when organisational innovations are adopted to meet particular problems (in this case the rather narrow outlook of the traditional department), other problems arise in their stead. In this case the difficulties of constructing courses between schools seemed to some to be an unfortunate corollary of the school system. To these who thought this way, the increasingly accepted, and no doubt undervalued, benefits of the interdisciplinary school seemed to be less substantial than the difficulties facing an inter-school interdisciplinary programme.

Despite these problems, which have been tackled in the new Course Unit System (see below), there have proved to be major advantages for the teaching of environmental sciences in the particular organisational pattern prevailing in East Anglia. First the school itself was encouraged to spread broadly across the environmental sciences, so that at the faculty level there is a wide range of interests and problems of communication across discipline boundaries which must be faced. Second, the virtual restriction of course choice by students to courses taught within the school meant that a greater exposure to our own ideas could be expected over three years than is possible in the typical departmental situation. Here typically a third of a student's load, mostly in the formative first and second years, consists of subsidiary courses taken outside the teaching unit. Third, the fact that course choice was from the school's offerings meant that the school would leave students real freedom in selecting their programmes and here freer choice is likely to mean higher motivation and harder work.

By chance, October 1973 was something of a watershed in the history of this new school. Our sixth year began with the school established in its permanent building and with its first year undergraduate intake at the planned maximum figure of just over one hundred. In bald figures about 375 undergraduates have now been admitted and nearly 150 have graduated after the three-year course. In the same time about 43 graduate students have registered for research degrees, and the School currently comprises 22 staff, 14 research associates with supporting staff of 26 technicians and secretaries and other administrative staff. At a time when university applications in Britain are falling in many subjects, applications from school leavers seem to be maintained at about 1,400 each year, and as a result of this competition, the qualifications of the entrants remain high.

No proper study has been made of why students decide to apply for the course. In part this may be due to rather poor information or reasons motivating such choices, but more important is the feeling that both in theory and practice the group of real interest are those who, though qualified, decide not to apply. The research design required to sample that group adequately is beyond the resources of the school.

The 1973-74 academic year also saw some change in the teaching pattern. When the School was founded, it fell in with the universal pattern in this particular university; a Preliminary teaching period of two terms followed by an examination for entry to the seven-term Honours programme. For a number of different reasons the Science Schools of this university have recently adopted a modular Course Unit pattern of teaching and examination, based on three Course Units each academic year. As luck would have it, the School's Honours programme was already based on three year-long courses each year, so the change has involved little more than adopting the new three-term Preliminary programme. With time it may involve the provision of courses for more students from other schools, while combined courses are already established with Computing Studies and Chemical Sciences.

Although the mechanics of the change to a Course Units System and common timetable have been relatively simple for the School, the educational implications may be considerable. In the first place the reduction of such mechanical difficulties as timetable incompatibility will allow easier choice of courses outside the School, and will be further encouraged by the freedom apparently allowed to those on joint degrees. Thus what has until now seemed to be liberal and unconstrained choice within the school may turn into unreasonable restrictions against shopping around for courses outside the school. It will not be easy to claim interdisciplinary breadth for a programme that takes in only four courses from Environmental Sciences, less than a third of our total. In the same way, there are already some constraints on the choice of options in Environmental Sciences from those taking joint degrees under the course unit system. If the courses they take with the School are to gell, they cannot cover too wide a range of the topics we teach; thus students combining chemistry with Environmental Sciences must choose from the following options only:

Geophysics
Hydrology
Meteorology and Climatology
Oceanography
Geochomistry
Soil Science

This restricted choice may eventually lead to a re-examination of the Course Units of which it is composed, and perhaps to an attempt to provide more truly interdisciplinary courses ourselves, rather than relying on the mere hope that interdisciplinarity will follow exposure to part of the Honours courses in Chemistry and Environmental Sciences.

There are even grounds for speculating on how long the interdisciplinary school can survive the free choice that seems to be offered by a Course Unit system. It would appear that so long as joint courses are in a minority, catering for somewhat special needs on a small enrolment basis (as they can), and so long as the mainstream interdisciplinary Honours courses keep up their numbers and retain a high status, then the schools will survive. But once the present interdisciplinary courses within schools decline, it seems hard to see what might keep them together. This is regrettable; any group of departments can co-operate to provide a Course Unit system, and in doing it they create at least an opportunity for interdisciplinary work. But if interdisciplinary schools bring about their own demise in the cause of inter-school programmes (and an increase in a lagging science enrolment) more is lost than gained.

3. COURSE CONTENT

The basic unit of Honours teaching (the second and third years) is a course that occupies one-third of a student's time for a full academic year. As indicated in my earlier paper, rather old-fashioned titles were deliberately chosen for most of these courses, on the grounds that innovation might end after inventing a new title, and more seriously that it would help employers (and thus the graduates) if the course titles gave an idea of the course content. Within these titles, and the very flexible arrangements of a British university, faculty have been left free to develop their own syllabuses, and to modify them with experience. Given the substantial size of the course, most have at least made an effort to cover a little of everything

that might fall within their course title, and if anything the courses overlap a little, rather than show gaps between them. No formal notice is taken of this at the teaching stage, although care is taken to rule out any overlap between questions in the different papers of the Final examination (each subject teaches to its own Finals paper). Some of the courses, despite their fairly conventional titles, involve co-operation between two or more rather different approaches; thus parts of geomorphology, sedimentology and soil mechanics contribute to Surface Processes. Nevertheless, most are single discipline courses (e.g. Soil Science, Meteorology and Climatology, Geophysics), although, as has already been explained, they are taught by more than one person.

In just one course a rather different pattern has emerged. Under the title "Environmental Planning and Pollution" several staff contribute case studies of problems of environmental planning and management. Each study runs for three weeks, the teaching pattern within that time being under the control of the teacher, although most are run on a discussion-seminar basis. Typical titles include: Coastal Erosion and Protection; Earthquake Prediction; Pollutant Pathways in the Ecosystem; and Recreation Pressures and National Parks. The course is available to third-year students only (unlike other options which may be taken either in the second or the third year) and is very popular, as Table 1 shows. Cohesion is provided by a compulsory introductory section concerned with concepts of value, utility, external economics and techniques of costing change in social and economic terms. There is also a series of interdisciplinary case-studies such as the Third London Airport, or the Tennessee Valley Authority.

The timetable of the School of Environmental Sciences, now common with the other Science Schools, is organised into a series of slots - a regular pattern of hours each week devoted to the same courses. Each slot includes eight hours each week, and within each slot the teacher is left free to arrange a pattern of lectures, seminars, tutorials and practicals (in the laboratory or in the field) to suit his own needs. There is, perhaps, a tendency to teach the hours just because they are there, and one effect seems to be the utilisation of the longer periods for practical classes, even in those subjects which might have been expected to make little use of such teaching. To some, at least, this could be seen as over-teaching, although the contact hours for each student are still less than those in many science and applied science departments.

In British universities, despite the enthusiasm of the Robbins' Report (1963), taught post-graduate courses are not particularly common or well supported. Those that do exist outside the 'new' (i.e. foundations of the early sixties) universities are rarely fully subscribed, so there have been serious national constraints on the establishment of new taught courses for post-graduates. Were national support (directly through the University, or indirectly through studentships awarded by the Research Councils) available, there is no doubt that by now there would be one or more taught courses (one-year MSc courses) in the School of Environmental Sciences. A lot of enquiries are received, particularly from graduates in other subjects who seek a conversion course to environmental sciences. Such a one-year course would most economically be based in part on some of the existing options in the School, but the problem here is that the University regards conversion courses with an appreciable element of undergraduate work as suitable only for the award of a Diploma, not a Master of Science qualification. Only time will show whether a conversion course leading to a Diploma will be seen as conferring an attractive enough qualification to maintain applications of high standard; to the School such a course for graduates of other sciences seems a most appropriate function for the School at the postgraduate level.

The School has also explored the provision of a limited amount of course work for its PhD students. Here again, attention should be drawn to the traditional pattern of rather independent research which has characterised the British PhD. The range of the environmental sciences makes itself keenly felt here, for in any one year there are few topics common to more than two PhD students. Usually several require courses in computer programming, and it is such courses already provided elsewhere in the University (mathematics and chemistry, for example) that tend to be taken, rather than courses within the School. On the other hand, PhD students can learn a good deal from each other about the aims and methods of research in the environmental sciences, and this is helped by a regular graduate seminar when students and others give discussion papers on their own research work or on techniques they are using.

4. TEACHING METHODS, MEDIA AND MATERIAL

On the whole British universities are conservative in their choice of teaching methods. Few show much interest in the effectiveness of their teaching, apart from the appreciable amount of feedback provided by close contact with individual students. Increased

student numbers without a matching increase in staff has tended to confirm the dominance of the lecture, despite a little rather amateurish flirting with such "labour saving" devices as TV and video tapes. From time to time distrust of the lecture, always a fashionable thing among academics, boils up to attempts to adopt other, more conversational, styles of teaching. At East Anglia the founding fathers of the University early adopted the idea of a discussion seminar of about 12-15 persons as the preferred teaching situation. However, Environmental Sciences was founded five years after the beginning of the University, and perhaps because of this it has felt relatively free in its choice of teaching structures. Each option, indeed each teacher contributing to an option, is free to choose the pattern of teaching preferred. Choice is no doubt affected by option size, but the extent to which a large class is broken down into smaller groups for seminars or discussions is decided by the individual lecturer without any interference from above.

Students have much the same freedom with free choice from among the options taught. After the first year students choose six courses from the options offered together with two or three courses taught in other schools. Although a few combinations are barred by timetable clashes (in general three courses are taught in each timetable slot, and the student is only able to take two of the three over two years) the total number of possible different combinations of six courses from those available is still around 1,000. In practice particular courses enjoy persistent popularity. The average (percentage) enrolment on each course over the last five years is given in Table 2, together with the variation from one year to another.

Patterns of choice across all courses must be analysed by computerised statistical techniques. A year or two ago Dr. John Barkham used a cluster analysis programme to investigate the patterns of choice of the students, and the programme has now been run again with the courses chosen by the first 193 students. Although a number of diagrams has been constructed, it is thought that Figure 1(1) summarises the pattern quite well. It is hardly surprising to discover that in an interdisciplinary school with free choice of options the pattern of courses taken in the school-leaving examination should influence to some extent the choice of options.

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1) See Appendix 1.

This analysis shows the extent to which choice is not constrained by past education. Taking the outer three clusters on the "arts" side and the outer five on the "science" side, we have almost equal-sized groups (46 and 45 respectively). The "science" clusters include 17 with arts subjects at A level (39 per cent) and the arts include 20 (44 per cent) with sciences at A level and no arts subjects. This is most encouraging, for one of the really important advantages of an interdisciplinary course such as Environmental Sciences was that it should allow students to reorientate themselves after the rigorous subject-streaming characteristic of British school examinations. Those who dropped science in the sixth form could have a chance to take it up again; that smaller number who took a traditional maths and science curriculum would have a chance to mix some "arts" courses in with their science if they wished. It seems that the School has offered these choices, and the cluster analysis suggests they have been quite widely taken up.

5. RESEARCH BASE

The separate headings of teaching and research are as convenient in this account as they are to the administrator seeking to allocate his resources. Nevertheless, the interaction between these activities which are as closely, and as complexly, related as man and his environment must be stressed. In addition, given the constraints, pressures and rewards of British universities in the 1970s, academic innovation and progress towards true interdisciplinarity are more likely to begin with research than with teaching. Indeed, in the opinion of the author, only if it begins in research is interdisciplinarity likely to be soundly based and academically viable.

Research is a very important activity in the School of Environmental Sciences, as was indicated above. Research students are usually with the School for three years (PhD) or two years (M.Phil). They come from a variety of other departments in addition to the School's own graduates (see Table 3) and a full list of the topics they have and are pursuing is given in Appendix 2.

There has been a good deal of discussion about the appropriate supervision for research students in a multidisciplinary school. There has in fact been a good deal of informal joint supervision, while in any case many students will seek out appropriate expertise among the staff. Recently this has been formalised by a move towards

the (American) concept of a supervisory committee, and now all PhD students have at least three advisers, although one of these acts as supervisor. Be that as it may, the formal decision was taken by a majority of the School Board and will be seen by many to institutionalise the aim of an interdisciplinary approach to the environmental sciences.

Research by members of faculty can be assessed in a rough and ready way by noting their publications over the last few years. On the whole they have pursued the interests they brought with them from previous employment in more traditional departments. It must be remembered that it is their published research which remains the critical measure by which their academic colleagues in other universities judge them and their new academic environment. In the pecking order of academia, faculty is rarely judged by academics in other departments of environmental science. Rather it is judged as a range of scientists of the environment in departments of geology, geography, biology, geophysics and so on, up and down the country, at home and abroad. For most of them, other than a few who take graduates from the School for further research, their only knowledge of the School is the quality of the research published. It would appear that they are impressed to discover that academic standards survive at all in a move towards interdisciplinarity, in the translation to a strange and uncertain environment. The academic view that specialisation and standards are causally linked is deeply engrained.

The larger-scale research activities of the School, often involving co-operation of several staff and the employment of post-doctoral research associates, are generally funded by research grants or contracts. A full list is given in Table 4. The acquisition of these funds represents an appreciable boost to research activity in the school. They fit well into the structure because the topics and the scale of the work both require the co-operation of several different people, and bring about in a most satisfactory way the integration of the research effort. As already suggested, it is here that interdisciplinary work is required and must be demonstrated in the research and in the Reports and other publications it gives rise to.

Particular comment should be made about the Unit for Climatic Research which was set up in January 1971. Despite the inclusion of an element for research support in the government university grant (which comes through the University Grants Committee), it is now very difficult to establish a research activity in a British

university if it does not contribute directly to undergraduate teaching. If this is to be done, outside funds must be sought. A number of possibilities for such research units have presented themselves, and one or two have been pursued in some detail. One critical criterion has always been the place of such a Unit within the range of interest of the School: if it is not reasonably central (and preferably with divergent links to a number of different members of teaching staff) it is likely to distort the overall emphasis of the School. Further, in so far as the School itself must contribute space, funds and goodwill to such a Unit, one that encourages integration is likely to fit in better than one which is in a peripheral position.

As conceived by the present Director, the Unit for Climatic Research was to be concerned with the study of past climatic change and of the causes of climatic change. This involves the assembly and assessment of a very wide range of environmental evidence (historico-social as well as scientific) and thus the Unit does mesh in very neatly within the School's interests.

One other activity with which the School has been associated is the series of seminars on the environment, organised by Professor Lord Zuckerman, the former Chief Government Scientist, who now holds a part-time professorial appointment in the University. Supported by the Ford Foundation, these seminars have brought together government officials, academics and members of international organisations to discuss environmental problems. Topics have included Pollution, Water, Traffic in the City, and Regional Policies. Although the seminars are published, the discussions at the seminar are confidential and enable those concerned with research and policy to understand each others' problems, quite apart from the value of the informal contacts promoted by a residential seminar of this type.

6. CRITERIA OF SUCCESS

It is exceedingly difficult to measure the success of a university department or course. There is the interest and application of the student to consider, his material success on graduation as measured by class of degree, the enthusiasm (and immobility?) of the faculty doing the teaching. Outside the University there is recognition and success in the graduate job market. Here, correlation between university training and the first job obtained

is often sought rather than an attempt to unravel the complex of factors that may determine later promotion - yet most university teachers would claim that they were teaching people to think, not simply providing them with a set of skills appropriate to a particular career. Even if the interdisciplinary course teaches them to think in a more effective way, how could this be measured?

For these reasons, two points only shall be discussed here, the actual output of the school in terms of graduates, and the pattern of first jobs obtained. Statistics of graduation are summarised in Table 5 - the low failure rate reflects the general situation in British universities with their selective admission system; even these few represent candidates who have rather deliberately opted out part-way through their course, rather than individuals who are incapable of passing work at degree standard. At the other end of the scale, there is a good proportion in the top two degree classes, although the number with First Class degrees has not been as high as hoped.

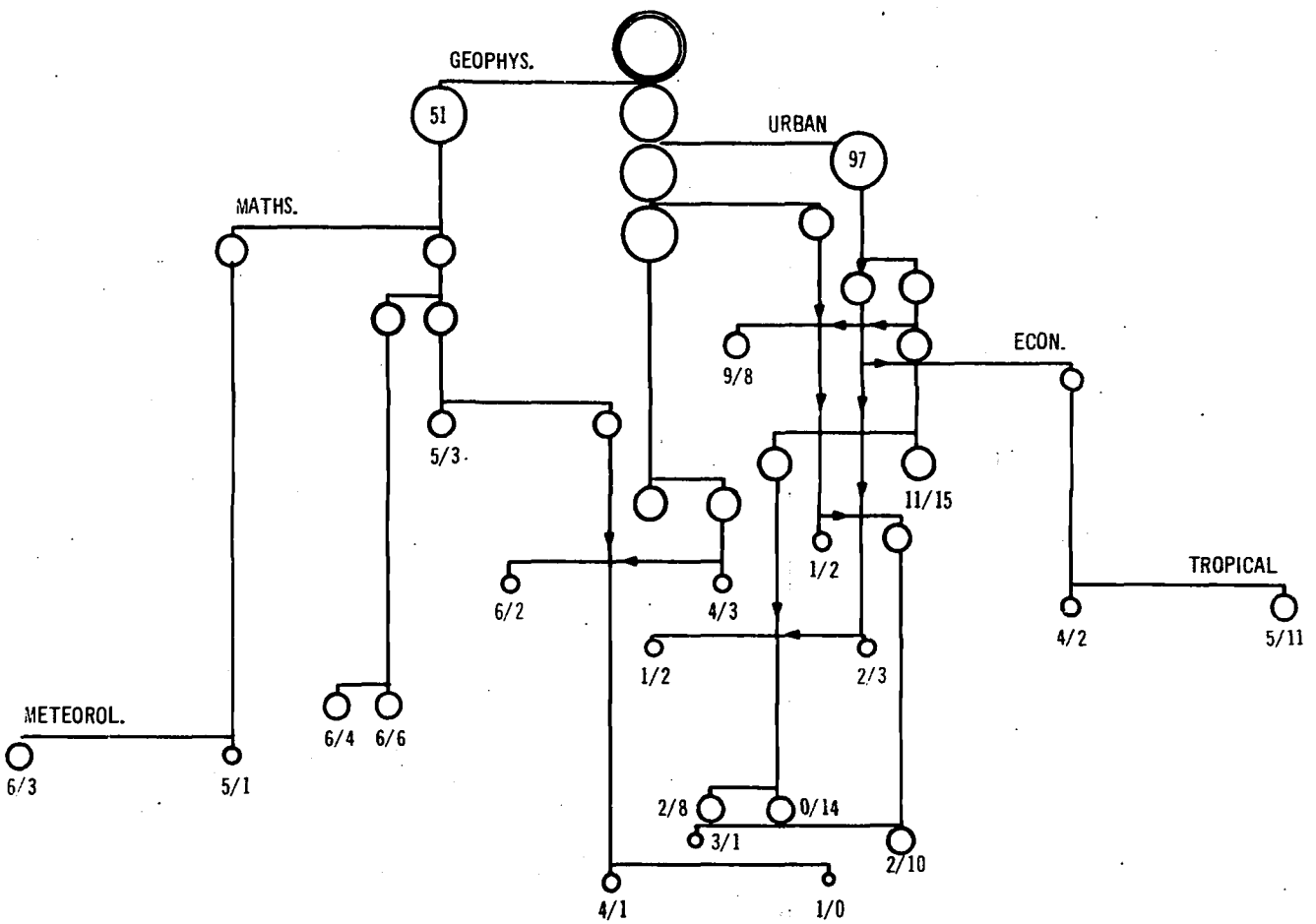
It is difficult to summarise the job situation effectively, partly because of the wide range of jobs, partly because of the tendency for many to go on to a further more specialised (and often vocational) training year before taking up permanent employment. A further slight complication is that some jobs are effectively barred to women (about one-third of graduates) - exploration geophysics for example. Finally the statistics summarised in Table 6 are inevitably incomplete since not all graduates report their jobs to us after leaving.

Figure 1

ENV. 69-73

OPTION CHOICES

(By each final cluster, Science/Arts, by " A level " subjects)



Appendix 1

Figure 1 shows the subdivision of the pattern of option combinations down to the twentieth step, producing twenty-one classes. The diagram is so arranged that at each step the positive indication of presence of an option leads the connection either left towards "Science" or right towards "Arts". The group without the option that provides the criterion for decision is placed immediately below its parent group. It must be stressed that the selection of "Science" and "Arts" trends is subjective (the hierarchy of subdivision is objectively determined), but as an indication of trends it is good enough for this description. The weightings given to options are as follows:

"Science" x 3	x 2	x 1
Geophysics	Meteorology & Climatology	Applied Earth Science
Geochemistry	Hydrology	Oceanography
Mathematics		Soil Science
		Computing

"Arts" x 3	x 2	x 1
Economic Geography	Tropical Resources & Development	Ecology
Urban & Regional Planning		Quaternary

These weightings are used to lay out the hierarchical tree created by the cluster analysis programme.

The clusters shown in Figure 1 have been taken down to the twentieth step simply because the groups that result are neither too large nor too small. In fact the last step produces the first single-person cluster in the analysis, who can, I suppose, claim to have studied the most significantly unique group of courses. His choice was Economic Geography, Geophysics, Meteorology & Climatology, Soil Science, Tropical Resources & Development and Urban & Regional Planning. He entered the School with qualifications on the Science side (Maths, Physics and Geography). It must be stressed that many of the students take combinations of options

which are unique: the analysis is concerned not to separate out these, but to group together groups of courses taken in the most significant way.

The diagram shows a tendency for choices to lie rather on the "Arts" side of the central position; not surprising when the table of course enrolments is consulted (Table 1). In part this is because the two most significant criteria (Geophysics and Urban & Regional Planning) separate out very different sized groups - 51 have taken Geophysics, of the remainder 97 have taken Economic Geography. There is a further shift over on the diagram with the 67 who have also taken Ecology, but this is largely to secure clarity in the diagram and might not always be thought of as an "Arts" shift. The same problem occurs in placing the 19 who are taken off at the third division on the basis of Tropical Resources & Development: these are placed close to the line of the main group of 97. All this group of clusters, totalling over 60 people by the bottom of the diagram, can be regarded as located in a "norm" position for the School, a little to the Arts side of our starting point. The original centre itself retains about 30 people, a few of them arriving back at that location by swings away and back again; as the three who counteract their choice of Urban & Regional Planning (after rejecting Geophysics) by omitting Economic Geography yet adding Geochemistry. Similarly the five on the bottom row counteract their swing "sciencewards" with Geophysics by then having chosen Urban & Regional Planning - and all but one of them omitting Economic Geography. This original central line has a further significance, for if we look separately at our arts (including "mixed") and science intakes (as determined by their "A" level grades) we find that while the arts intake divides left and right of the "norm" groups first described, the scientists divide evenly about the original line.

This means, of course, that the groups left of that line contain more scientists than those with Arts qualifications. In fact all the groups except for that with 12 people (which is equally divided) have more science students than arts, and usually many more. The group with 11 on the centre line has 10 with incoming science qualifications, the group of 6 well to the left again has only one who took an arts subject at A level. It is interesting to discover that the projecting wing of clusters on the arts side is far less dominated by arts entrants: admittedly the outlying cluster divides 11 arts to 5 science, but the 6 to the left have a majority of 4 arts to 2 science.

Table 1

OPTION CHOICES, BY YEARS AND 'A LEVEL' QUALIFICATIONS,
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA

	Total	69/70	70/71	71/72	72/73	73/74	% Science Students
Ecology	138	-	39	45	21	33	43
Env. Planning and Pollution	134	-	27	40	29	38	42
Urban and Regional Planning	127	18	31	34	24	20	38
Quaternary	115	15	21	18	29	32	46
Tropical Resources	114	-	48	18	19	29	33
Soil Science	103	25	-	36	15	27	34
Hydrology	99	20	16	17	22	24	59
Oceanography	93	20	25	13	19	16	55
Surface Processes	75	12	17	11	17	18	55
Economic Geography	73	11	11	17	18	16	36
Meteorology	65	-	20	8	8	29	80
Geophysics	61	18	6	9	15	13	65
Applied Earth Science	54	-	30	10	14	-	47
Computing	46	-	6	10	21	9	56
Geochemistry	39	11	-	7	9	12	72
Mathematics	28	-	5	8	4	11	81

Table 2

TEACHING PATTERN - HONOURS OPTION
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA

1. Taught by one member of staff only:
   Meteorology and Climatology

2. Taught by two members with closely related interests:
   Urban and Regional Planning
   Economic Geography
   Ecology
   Soils

3. Taught by two members with rather different interests:
   Hydrology
   Geochemistry
   Tropical Resources and Development

4. Taught by three members of staff:
   Geophysics
   Oceanography
   Quaternary Studies
   Surface Processes

5. Taught by 13 different members of staff:
   Environmental Planning and Pollution

6. Taught by staff in other schools:
   Computing
   Mathematics

Table 3

FIRST DEGREES OF GRADUATE STUDENTS
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA

Subject	No.
Architecture	1
Biology	3
Chemistry	4
Civil Engineering	1
Economic Geography	1
Environmental Sciences	7
Geography	20
Geography and Geology	1
Geology	9
Geology and Geophysics	1
Geology and Mineralogy	1
Mathematics	1
Mechanical Engineering	1
Natural Sciences	1
Oceanography	1
Oceanography and Zoology	1
Physics	2
Physics and Meteorology	1
Physics and Pure Mathematics	1
Soil Science	1

Table 4

RESEARCH GRANTS AND CONTRACTS 1968 - 1973
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA

Investigation	Amount £
Suspended and dissolved sediment load in the Upper Orinoco, Venezuela	763
Plio-Pleistocene marine deposits of East Anglia	10,449
Micropalaeontology of deep-sea sediments	26,473
Development of the new instrumentation in the Environmental Sciences	17,840
Literature survey in the field of geography and geology	3,816
Abstracts of British Geology and Current Titles	7,968
Study of sampling with special reference to the Soil Survey of Norfolk	7,347
Long-term biogenic contribution to ocean-floor sediments	6,828
Study of vertical shear near the sea floor in tidal currents	14,183
Study of hedgerow destruction in Norfolk	3,332
Coastal erosion	3,600
Mechanism of gaseous transfer across air/water interface (with special reference to SO_2)	2,204
Seismic refraction, Cyprus	3,473
Frictional layer of tidal currents	12,395
Unit for Climatic Research (climatic change)	59,200
Earth Resources Technology Satellite (ERTS A) contracts	16,640
Reconstruction of daily weather maps for 1781-85	2,575
Meteorological control of gas exchange across the air-sea interface	428

Table 4 (continued)

Investigation	Amount £
Quaternary history of Vestspitsbergen	870
Data for a theory of subglacial lodgement	7,130
Seismic studies in Northern Norway	3,994
Cyclicity in rainfall over S.E. England	7,100
Temperature regime of soils on Breidamerkursandur, S.E. Iceland	160
Rural water supply and sanitation in Developing Countries	5,000
Gibraltar-Azores research cruise	470
Comparison of structure of Troodos complex, Cyprus, with ocean crust models	3,385
Anglo-Polish Land Development Study	12,000
Daily and monthly historical weather charts	2,901
Land Evaluation methods, Malawi	7,302
Coastal sediment budget and offshore sediment movement, East Anglia	56,720

Table 5

SCHOOL OF ENVIRONMENTAL SCIENCES, UEA
CLASS OF DEGREE ON GRADUATION

	1971	1972	1973	Total 3 years
First	3	3	2	8
Upper Second	16	14	18	48
Lower Second	24	25	19	68
Third	4	9	5	18
Pass	-	-	-	0
Fail	1	-	1	2
Aegrotat	1	1	-	2
Total	49	52	45	146

Table 6

JOBS OBTAINED BY GRADUATES
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA
1971-1973

Environmental/vocational content:		
Planning offices	8	
Government science	7	
Industrial science	6	Sub-total 21
Educational/environmental:		
Postgraduate research	14	
MSc. and Diploma courses	11	
Teacher training	20	
Museums/libraries	4	Sub-total 49
Other:		
Industry, sales, advertising, management	13	
Secretarial training	5	
Government administration	2	
Nursing and social work	2	
VSO	3	
Other jobs	6	Sub-total 31
	Grand total known	101

Appendix 2

LIST OF RESEARCH TOPICS FOR M.Phil AND Ph.D
SCHOOL OF ENVIRONMENTAL SCIENCES, UEA

The technological frontier in Rural Water Supply for Developing Countries

Crops and soil structure with special reference to continuous wheat growing on Waveney series soils in Norfolk

Aspects of the chemistry of four East Anglian rivers

Soil Catena development in Forest and Savannah environments in Ghana

The retreat of unconsolidated Quaternary cliffs

Analysis of turbidity in relation to water movements in the southern North Sea

Dispersion, sedimentation and subsequent re-entrainment of fine particulate materials

Comparison of oceanic crustal models of the structure of the Troodos Massif, Cyprus

To test the concepts of stability and species diversity in the context of a complex woodland ecosystem

Simulation of hydrological systems

Current systems in coastal waters

The impact of urbanisation on the environment

An investigation of the late Quaternary of the East Coast estuaries

Factors controlling the concentration of dissolved phosphorus in natural waters

Evolution of a section of East Anglian coast in relation to waves and current

Surface processes on slopes

Glacial geology of north-west Norfolk

An investigation of the general circulation and flushing times of various sections of the Broads

The effect of light quality variation on the growth of Rubus fructicosus

A field study of the interaction between marine processes and man-made structures on the sea bed

Sediment, hydrological and chemical budget of a modern glacial lake

Petrology and geochemistry of ocean floor igneous and metamorphic rocks

An investigation of the diagenesis of estuarine sediments with particular reference to the partition and movement of heavy metals

The decomposition of leaf litter at Foxley Wood, Norfolk

An investigation of long-term variations of winds and currents in the North Sea

Industrial location

Physical properties of silicate materials at high temperatures and pressures

The soil catena

Oceanic Upper Tertiary benthonic Foraminifera

Factors influencing the engineering strength of glacial till

Conservation of natural resources

Interpretation of large scale geological structures by regional geophysics

A study of water and sediment circulation in coastal waters

Land use

Physical and ecological effects of major engineering works

The role of environmental factors in the formulation of rural planning policies in Britain

Sand dunes and coastal accretion, north Norfolk

Seismic, gravity and magnetic studies in Norfolk

The determination of the sulphur content in precipitation at a number of stations in East Anglia

The exchange of atmospheric gases across an air/water interface

Methodology of agricultural land evaluation in tropical areas

Identification of palaeoplate movements in British Isles by trace element analysis of volcanic rocks

Atmospheric oscillations

CHARLES COUNTY COMMUNITY COLLEGE

DEGREE PROGRAMMES IN ENVIRONMENTAL TECHNOLOGY

La Plata, Maryland, United States

by J.N. CARSEY, President

INTRODUCTION

The Charles County Community College (Maryland) has two programmes designed to train technicians and technologists for work in the environmental field. Both of these programmes lead to an Associate in Arts degree which involves the completion of approximately 60 semester hours of post-secondary college level work. The first of these programmes is called Pollution Abatement Technology and was begun as a formal programme in 1968 although federally-sponsored development of the curricula began in 1966. This programme is primarily designed to train second and third level technicians(1) to work in waste treatment plants in municipal, federal or state facilities. The second programme, called Estuarine Resources Technology, is more biology- than engineering-oriented and is primarily designed to train technicians to work on coastal waterways in a variety of jobs related to estuarine and terrestrial analyses. Estuarine Resources Technology received National Science Foundation support in 1969 and 1970 for curricula development and began classes in 1971.

Both of these degree programmes have encouraged a number of peripheral projects including teacher education workshops, specialised recurrent education laboratories and a host of short cycle training sessions related to the degree programmes. However, this

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1) United States wastewater treatment plant operators are classified into four main categories. Level 1 is an entry level position, earning about $6,500 initially. Level 2 requires some certification, more skills, more training, and is paid a beginning salary of around $7,400. Level 3 does some of the chores of a foreman, has to have a higher level of certification, and is paid a beginning salary of around $8,500. The Chief Operator Level 4 makes somewhere between $9,500 and $12,000 and requires more training and more skills.

paper will only address the degree programmes since they are the primary concern of the college and the theme of this paper.

Both programmes are unusual among community colleges of the United States despite the fact that several of the colleges have environmental technology programmes. This is because of the availability of considerable Federal Support to the college from both the Environmental Protection Agency and the National Science Foundation and the early development of the programmes.

1. WHO DOES THE TEACHING?

Pollution Abatement Technology

The instruction in Pollution Abatement Technology is performed in three general areas:

1. Unit processes;
2. Laboratory analysis; and
3. Unit process interaction.

While all of the instructors are capable of teaching in a multidisciplinary fashion, each normally instructs in his area of speciality such as:

a) Sanitary Engineering. There is a Sanitary Engineer in the teaching team who is a registered professional engineer holding the highest level certification as a water and wastewater treatment plant operator. This individual possesses 17 years' actual operational experience in the public works field and is considered an expert in treatment facility evaluation and unit process control.

b) Sanitary Chemistry. The Sanitary Chemist has an advanced degree in chemistry as well as actual experience in the performance of those analytical tests associated with the pollution control field. He has had experience in wastewater treatment plant operation and holds an operator's certification.

c) Environmental Health Specialist. This individual holds an advanced degree in environmental health and has knowledge of both unit operations process control of treatment facilities and of laboratory control. He has the ability to back up either the Sanitary Engineer or the Sanitary Chemist in their teaching jobs.

In addition, other divisions of the college are used for instruction in general education, mathematics, and the related sciences required by the curricula.

Estuarine Resource Technology

Estuarine Resource Technology is a "team taught" multidisciplinary teaching process. There are four primary instructors with backgrounds in:

a) Marine biology;
b) Fishery biology and chemical and physical instrumentation;
c) Physical estuarine analysis and biological field sampling;
d) Subprofessional work experience as a biology technician.

An important aspect of the course is that frequently the entire team is available as a group utilising effectively their collective knowledge and skill. Instructional reinforcement is a strong asset in a team teaching approach. As is the case in the Pollution Abatement Technology programme, other divisional professors are utilised to teach the general education, mathematics and non-specialised courses of the curricula.

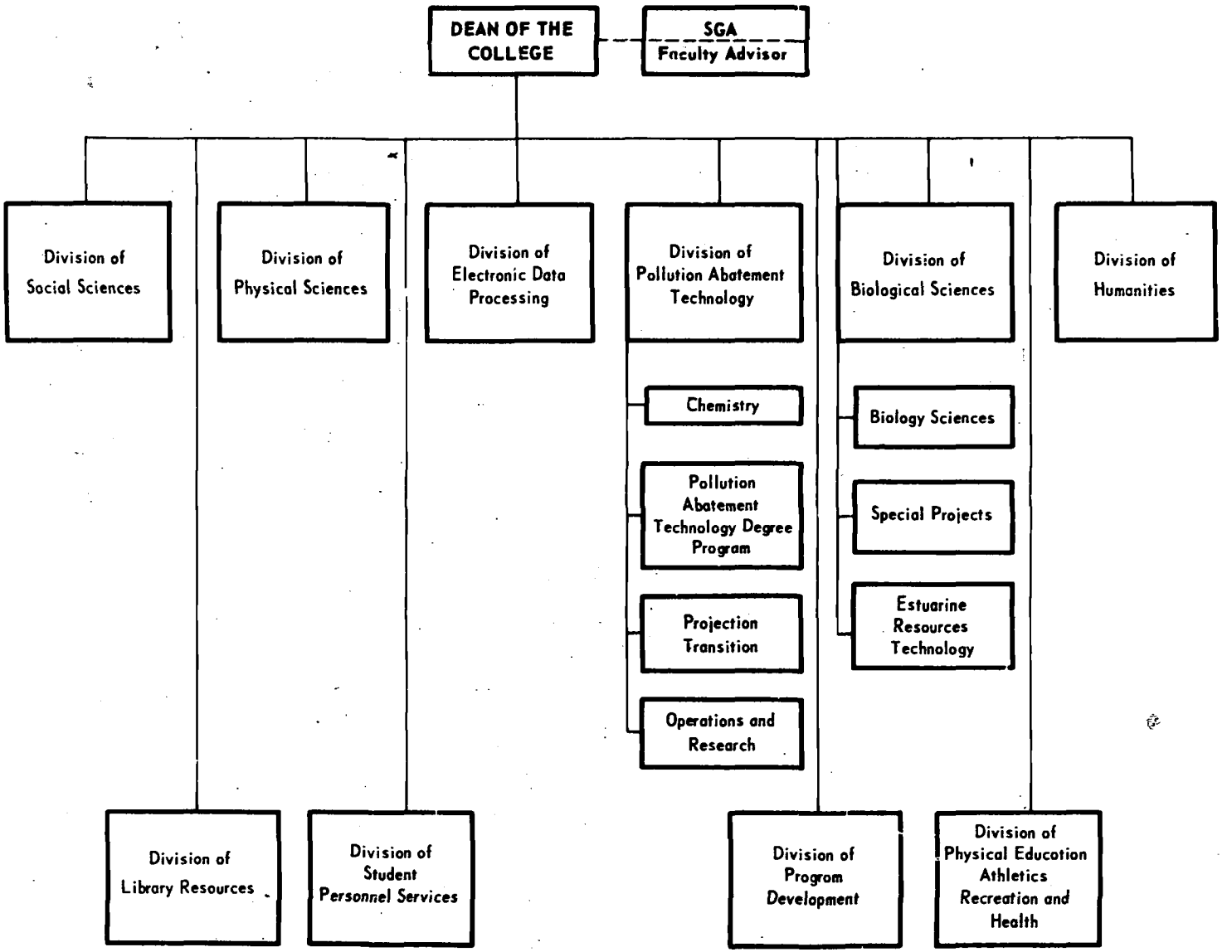
2. INSTITUTIONAL ORGANISATION

The college is organised with the President having a Dean of the College with division structures as shown in Table 1. It is interesting to note that the two environmental technology degree programmes are organised differently because of the history of the programmes and the personalities involved. Pollution Abatement Technology is a division of its own in which in addition to the concerns of the Pollution Abatement Technology Curricula there is also the chemistry department. The Estuarine Resources Technology programme is a department of the biology division. Both of the Division Heads (Biology and Pollution Abatement) report directly to the Dean of the College, and operate administratively under a council of directors and within such internal entities as the Faculty Senate. Because of the politically sensitive nature of both these environmental programmes there is more inter-reaction with the President of the College than might normally be experienced by other Divisions under the Dean of the College.

Pollution Abatement Technology

Internally, the Director of the Pollution Abatement Technology Division has four departments under him. In addition to his staff administrative assistant these four departments are the chemistry department; the Pollution Abatement Technology degree

TABLE I


DEAN OF THE COLLEGE
SGA
Faculty Advisor
Division of Social Sciences
Division of Physical Sciences
Division of Electronic Data Processing
Division of Pollution Abatement Technology
Division of Biological Sciences
Division of Humanities
Chemistry
Pollution Abatement Technology Degree Program
Projection Transition
Operations and Research
Biology Sciences
Special Projects
Estuarine Resources Technology
Division of Library Resources
Division of Student Personnel Services
Division of Program Development
Division of Physical Education Athletics Recreation and Health

programme department; Project Transition, and Operations and Research. Project Transition is a programme involving large numbers of students involved in specialised training under a Department of Defense grant. Operations and Research represents ad hoc programmes which are being directed by the Pollution Abatement Technology director, such as the operation of a municipal sewage treatment plant in a nearby community; doing specialised laboratory testing for state and federal agencies; and managing specially funded federal research grants.

The Chemistry department operates not only chemistry courses for the Pollution Abatement Technology programme but for all the other programmes of the college involving chemistry either as a required or elective subject.

Estuarine Resources Technology

The Estuarine Resources Technology degree programme is managed organisationally as a department within the Biology Division. Other departments within the division include:

a) Biology Sciences. This department administers all biology courses for the college including those required for Estuarine Resource Technology.

b) Special Projects. This department administers projects such as the summer teacher-training workshops as well as managing any research grants which might be attracted by this division. One example is a terrestrial analysis study funded by a utility corporation.

Pollution Abatement Technology

The conventional two-year degree programme for Pollution Abatement Technology is as follows:

Freshman Year	First Semester	Second Semester
Introduction to Environmental Health	4	
Air Pollution Programmes & Properties		4
Technical Mathematics I	4	
Technical Mathematics II		4
Chemical Technology I	4	
Chemical Technology II		4
Concepts of Biology	3	
Introduction to Composition or Composition and Rhetoric		
Business and Professional Speaking	3	3
	18	15
Summer Session		
Plant Practicum	4	
	4	
Sophomore Year		
Wastewater Treatment Unit Process Operations II	3	
Environmental Technical Laboratory		4
Applied Physics I	4	
Applied Physics II		4
Sanitary Chemistry	3	
Public Facilities Management		4
Report Writing	3	
Microbiology	4	
Water Safety		2
Industrial Waste Control & Management or Solid Waste Management & Macropollution		3
	17	17

The specialised courses are outlined briefly as follows. No attempt to outline general course work has been made.

PAT 101 - Introduction to Environmental Health (4)

An introduction to environmental health designed to teach principles of hydrology; water supply, purification, and distribution; sources of pollution - air, water, and solids. The characteristics of waste streams and general methods of abatement and basic treatment unit processes will be covered. 3 hours lecture, 3 hours lab.

PAT 103 - Wastewater Treatment Unit Process Operations (4)

A detailed study of unit processes in wastewater treatment. Normal operation conditions; abnormal conditions; as well as preventive and corrective maintenance practices will be discussed for selected units of composite model plant. Actual operation and maintenance of equipment by use of on-site training facilities is stressed. 3 hours lecture, 3 hours lab.

PAT 109 - Plant Practicum (4)

A supervised programme with emphasis on actual operation of unit processes previously studied with respect to normal operating procedures, indication of abnormal conditions, performance of preventive maintenance, as well as diagnosis of mechanical malfunctions and remedy of such malfunctions. 36 hours operations in plant site per week.

PAT 202 - Wastewater Treatment Unit Process Operations II (3)
Prerequisite: PAT 103

An indepth study of wastewater unit processes with particular emphasis on preventive and corrective maintenance procedures. The evaluation of mechanical indications of malfunctions of process unit and the correction of the malfunctions will be required. 2 hours lecture and 3 hours lab per week. Lab fee required.

PAT 203 - Environmental Technical Laboratory (4)
Prerequisites: PAT 101, 103 and CHE 202

Laboratory plant scale studies of the unit processes utilised in the wastewater treatment plant field. The interaction of the various unit processes of the composite model plant will be stressed.

Demineralisation and ion exchange; effect of coagulant aides on particulate matter; bacterial populations and disinfection; advanced waste treatment. 2 hours lecture and 6 hours lab. Lab fee required.

CHE 252 - Sanitary Chemistry (4)
Prerequisites: CHEM 120-121 or 150-151

A systematic study of laboratory procedures as applied to pollution abatement systems. Designed to develop an adequate understanding of theory and techniques of qualitative and quantitative environment chemistry: inorganic, organic, physical, and nuclear. Test results will be evaluated in reference to process control and design problems. The preparation and development of a technique notebook will be stressed. 2 hours lecture, 3 hours lab. Lab fee required.

BAD 260 - Public Facilities Management (4)

The purpose of this course is to set up procedures and techniques that can be applied in the management of municipal and public works. Emphasis is placed on planning, financing and personnel management in public works. Also street traffic control, street lighting, and possible management of airports will be highlighted. 4 hours lecture.

PAT 205 or 206 - Industrial Waste Control and Management (3)
Prerequisites: PAT 101, 103, and CHE 202

Industrial waste characterisation and quantity evaluation. Methods and applications of physical, chemical, and biological treatment. Laboratory analysis of industrial wastes. Report preparation. 2 hours lecture, 6 hours lab. Lab fee required.

Estuarine Resource Technology

Course	First Semester	Second Semester
Theory & Techniques of Field Sampling	3	
Principles of Estuarine Ecology		4
Concepts of Biology	3	
Technical Mathematics (MTH 150)	4	
Technical Mathematics (MTH 151)		4
General Chemistry (CHEM 120)	4	
General Chemistry (CHEM 121)		4
Composition & Rhetoric (ENG 101)	3	
Business & Professional Speaking (SPH 103)		3
	17	15
Sophomore Year		
Applied Estuarine Ecology (BIO 251)	4	
Estuarine Problem Analysis (BIO 252)		4
Microbiology (BIO 201)	4	
Report Writing (ENG 205)	3	
Instrumentation Laboratory (CHEM 155)		4
Introduction to Statistics (MTH 230)		3
Sanitary Chemistry (CHEM 252)	3	
Fishery Biology (BIO 210)	3	
Fishery Management (BIO 211)		3
Physical Education		2
	17	16

A brief description of each specialised course follows. Again, no attempt has been made to outline any of the general studies course work.

BIO 100 - Theory and Techniques of Field Sampling (3)

A practical introduction to the biological, chemical, and physical techniques and equipment used in estuarine research. Emphasis placed on field exercises and which also include instruction on small boat handling, rigging, use of 2-way radio, preparation and use of data forms and sample technical reports. 1 hour lecture, 3 hours lab.

BIO 107 - Principles of Estuarine Ecology (4)
Prerequisite: BIO 100

Emphasis on field exercises. Biological, physical dynamics of the estuary. Students will plan and conduct coordinated projects

in selected areas, utilising techniques and equipment to which they were introduced in BIO 100. Two 4-hour lecture/lab sessions per week.

BIO 105 - Concepts of Biology (3)

An overview of biology including a brief survey of plant and animal kingdoms. This course will include organisations of living matter, enzymes, metabolism, energy transfer, growth and reproduction, elementary principles of genetics and ecology. 3 hours lecture.

BIO 251 - Applied Estuarine Ecology (4)
Prerequisites: BIO 100 and BIO 107, or permission of instructor

Students will utilise training and techniques learned in Biology 100 and 107 in projects selected to support on-going estuarine investigations conducted by research agencies in the area. Detailed technical reports will be prepared and submitted to staff members of these agencies for evaluation. Two 4-hour lecture/lab sessions.

BIO 252 - Estuarine Problem Analysis (4)
Prerequisite: BIO 251

This course will be directed toward support of on-going research in the same manner as Biology 251, but emphasis will be placed on identification by the students of specific problem areas, and the design of effective investigational approaches. Detailed technical reports will be prepared and evaluated as in Biology 251. Two 4-hour lecture/lab sessions.

BIO 201 - Microbiology (4)
Prerequisites: BIO 101 or 102, or BIO 106

A course dealing with bacteria and other micro-organisms, their morphology, development, and function. Emphasis during the first part of the course will be placed on the fundamental concepts and techniques in microbiology such as isolation, cultivation, observation, morphology, physiology and nutrition. The second part of the semester will deal directly with sanitary microbiology. The relationship of microbial life to problems of water pollution and biological treatment will be stressed. 2 hours lecture, 4 hours lab.

BIO 210 - Fisheries Biology (3)

An introductory course emphasising comparisons of structure and function among and between the major groups of fresh-water and marine fishes. The course will be divided into three major study areas which will include diversity, classification, evolutionary relationships, basic structure, comparative anatomy and physiology, reproduction, embryology, food age and growth, and ecology of selected fishes. Special emphasis will be given to the fresh-water and marine fishes of Maryland and the Chesapeake Bay area. 2 hours lecture. 2 hours lab per week.

BIO 211 - Fishery Management (3)

A survey of the distribution and magnitude of marine and fresh-water fishery resources, factors affecting abundance and productivity, natural and artificial mortabilities, fishing gear and methods, study methods, and techniques of management. Emphasis will be placed on freshwater and estuarine species of Maryland. Field trips of representative areas will be conducted. 3 hours lecture, 2 hours lab.

4. TEACHING METHODS, MEDIA AND MATERIAL

Pollution Abatement Technology

Teaching methods include normal classroom lecture, laboratory performance of analytical tests, and field trips to various waste-water treatment facilities in the area. Teaching is based on specific behavioural objectives keyed to a composite model plant which incorporates the more advanced methods of treatment found throughout the United States and Europe.

Based on a specific behaviour for a particular unit process, i.e. a mechanically cleaned bar screen with bubbler control unit and grinder, a teaching module can be developed based on standard operating job procedures which include pre-startup inspection, startup procedure, routine operation, shutdown procedure, and preventive maintenance. Based on these requirements for the successful operation of the unit processes, the necessary educational background for the specific behavioural objective can be incorporated into an audiovisual module. In this manner, maximum amounts of information can be presented in an efficient manner.

The laboratory courses require that each trainee actually perform all the analytical tests specified by the staff. These

tests are those which are required by the National Permit Reporting Section of the Water Pollution Control Act of 1972 as amended and those analytical tests that the staff considers to be necessary to efficiently control the various plant unit processes.

Field trips are utilised in the early stages of the programme to introduce the trainees to the various pieces of equipment, as well as their location in the operational scheme. Later in the programme, field trips are utilised to study particular unit processes in conjunction with the specific behavioural objectives and the utilisation of the standard operating job procedures.

The standard operating job procedures booklets and the audio-visual modules assist in solving a serious problem in the pollution abatement technology field, as there is no textbook available as a teaching text.

The college uses a unique Singer-Carmondy Simulator for graphic presentation of the unit process under study. This simulator includes graphic presentation of the particular unit process, along with all controls, flow meters, and failure alarms. The simulator is equipped with a control console by which the instructor can vary the operating parameters, as well as override the trainee's actions. Efforts are now underway to incorporate the audio-visual modules with the simulator to produce a high degree of realism such as in the aircraft field.

The final but most important teaching method requires all trainees to work as an operator in a treatment facility for ten work weeks. During this time the trainees are expected to perform all operations which normally would be assigned to them if they were employed in that position. This inplant practicum assists the individual in obtaining workmanlike characteristics such as working rotating shifts and working in a public works organisational structure.

Estuarine Resources Technology

One of the most important aspects of the teaching methods for Estuarine Resources Technology is that the students meet one day per week for eight hours in a field exercise which simulates the kind of environment they would meet in a working situation. They meet at a field station about 20 miles from the college (on an estuary) and the class meets for a minimum of eight hours that day.

The first two-three hours in class are used as a lecture period in which a piece of equipment or principle is discussed.

During the lecture field exercises are reviewed and boat and work assignments are made. During this classroom period the weekly study sheets are reviewed and students have ample opportunity for questions. One week previous to an exercise each student is given a study sheet which contains five to ten questions to be answered and handed in in the following class period.

Following the lecture period the students go out on the water (regardless of the weather) and conduct the field exercise scheduled for that week. Due to the sometimes hazardous nature of these field exercises, an instructor is present on each boat during every exercise. Groups are kept as small as possible so that all students can receive ample opportunity to use the equipment on the boat. The usual student to instructor ratio on these field exercises is 5: 1. Examinations consist of questions from the lecture study sheet and an analysis of the student's ability to handle the field exercises.

5. RESEARCH BASE

Pollution Abatement Technology

Research performed by the Pollution Abatement Technology Department is based on practical application and evaluation of unit process equipment. This past summer, as part of the inplant practicum, the staff and trainees of the department collected hourly composite samples at the La Plata City Wastewater Treatment Facility for twenty-one consecutive days. These samples were analysed to determine the plant efficiency and the efficiency of the various unit processes. In addition, the effects of the utilisation of various chemical coagulants were incorporated into this study. This plant evaluation is noteworthy in that it is the first attempt to analyse the wastes in any treatment plant in Southern Maryland, let alone to thoroughly evaluate the performance of any treatment plant in the area.

Previous research projects were evaluations of the effective operation of various methods for polishing treatment plant effluents. These included a microstrainer, indepth filter and a continuous moving bed filter.

These research projects give the students and staff actual experience in conducting projects that would normally be expected of a wastewater treatment plant superintendent. They serve an additional benefit in training by illustrating the need for certain

operational routines to effectively accomplish any project. There have been many instances where the final evaluation of the project illustrated flaws in teaching methods; the staff was then able to go back and correct these situations.

Estuarine Resources Technology

One current research project is the monitoring of the Patuxent River in the area of the beaches to determine if sewage overflow from septic tanks is finding its way into the river. This project is being done for one of the county health departments by three students and one faculty member. In addition, the Estuarine Resources Technology department has done some terrestrial analysis work for one of the area power plants.

The research base for Estuarine Resource Technology is two-fold. One is the research base of the fields of biology, botany and microbiology. The other is in the newly evolving research base of the impact of man on his environment. In this case, man's impact on his estuarines. In the United States that particular base is apparently, and perhaps realistically, tied to man's quest for sources of energy.

General Comment

It is important at this point to interject an editorial comment. An unusual aspect of both curricula is the lack of virtually any form of research base for considering the training of environmental technologists through formalised post-secondary programmes, since this type of training has not been done in the United States prior to 1968. There is an urgent requirement for research on the impact, significance, and variety of these programmes in the United States at the present time.

6. CRITERIA OF SUCCESS

Pollution Abatement Technology

The impetus for this programme has been, and still is, the huge expansion of wastewater treatment plants in the United States; particularly in the Washington-Baltimore area, and the need for training new personnel for these plants as well as providing training for those already working in the field. In addition, there is the certain demand in industry and government for persons with this type of training within the enforcement and management side.

The one part of the College's project which has never been in doubt is the demand. A recent analysis in this region alone has shown that the College could easily place forty graduates a year for the next ten years.

It is always difficult to establish criteria for the immediate evaluation and success of any programme. In general, however, the success of the programme is based on three areas:

i) Whether or not the graduate continues on in the pollution abatement field, either by continuing his education in the field, or accepting gainful employment in the field.

ii) The level of responsibility and consequently financial remuneration that the trainee received, both immediately upon graduation and after two years in the field.

iii) Whether or not the trainee is successful in obtaining state certification as an operator in the water and wastewater field.

Based on the above criteria, the programme is considered to be an outstanding success in two areas. In three years only one graduate has not continued in the pollution abatement field. The average starting salary of graduates this past year was $8,900 per annum. Several graduates, after two years of experience, were receiving in excess of $14,000.

Half of those graduates who went to work in industry were employed in water quality control laboratories of power companies. The other group was employed by consulting engineering firms to work as field technicians in wastewater treatment plant startup, treatability studies, and industrial waste analyses. The primary emphasis in the programme as it enters the second half of its first decade will be to sharpen the recruitment process to the extent that to a greater degree the students entering the Pollution Abatement Technology degree programme will be those who seem to have a reasonably good chance of completing it. Recently developed goals for the Pollution Abatement Technology programmes for 1974-79 include forty to sixty entering freshmen each year, with sixty per cent of those receiving degrees.

Additionally, the College in 1973-74 has a certification programme in Pollution Abatement Technology which students may enter if they wish to go to work earlier, or are having problems with the two-year degree programme. It is an 18-hour programme and will ensure a certificated entry level (1) for persons who successfully complete it. Recruitment will be very seriously accelerated during this next five-year period.

Estuarine Resources Technology

Success of the programme is being judged by the successful completion of graduates from the programme for jobs in the water quality field. The first Estuarine Resources Technology class composed of eight students graduated in May of 1972. At the present time six of those eight students are employed in the field and two have continued on in four-year colleges seeking a degree in a related field. Employers hiring Estuarine Resources Technology graduates include Westinghouse Oceanagraphic and the Potomac Electric Power Company, both Maryland employers.

In 1971-72 eighteen freshmen and six sophomores entered this programme. The six sophomores were students who had enough of the basic courses to enter the specialised courses in their second year. Of the six sophomores, one left the programme, two transferred to universities to pursue their four-year degree, and three went to work at salaries of $7,900, $8,200, and $9,000. In 1972, of the eighteen freshmen who entered in 1971 sixteen remained. Seven of them, because of low academic loads the previous year, remained as freshmen in 1972-73. The other nine became sophomores. In addition to the seven freshmen who had been freshmen the previous year, twelve new freshmen were added to the programme, so that in 1972-73 there were nineteen freshmen and nine sophomores. Of those nine sophomores in 1973, six of them have graduated and have gone to work in the field of salaries ranging from $8,000 to $11,000. Three have not finished the programme and are staying on to try to complete in 1973-74. In 1973-74, there are about twenty sophomores and thirty new entering freshmen.

A primary objective of this programme is to keep the entry level of freshmen at around thirty. This seems to indicate a finishing degree group of fifteen and twenty per year, which reflects the job market which the College visualises in the Washington-Baltimore area for the next decade.

The primary emphasis in both of these programmes will centre around accelerated recruitment and more concise placement over the next few years. The need for technicians in the environmental field is a fact - the style of training will undergo change as those who go to work comment back to the institutions. This type of training also represents a good example of the concept inherent in lifetime learning and many of the technicians will continue to return for more education.

HUXLEY COLLEGE OF ENVIRONMENTAL STUDIES

A DIVISION OF WESTERN WASHINGTON STATE COLLEGE

Washington, United States

by Gene W. MILLER, Dean

Huxley College is primarily an upper division programme that focuses on problem-oriented study concerning man and his environment. It is an interdisciplinary college concerned with the physical, biological and social dimensions of environmental problems. The College was named for Thomas Henry Huxley, the father of the eminent British family of scientists and writers.

STATEMENT OF PURPOSE

The purpose of Huxley College is to discover, assemble, integrate and disseminate knowledge towards the resolution of environmental problems for the enhancement of human life. An "environmental problem" is considered to be any environmental condition which is perceived by man as being less good than it ought to be. Examples of environmental problems Huxley is concerned with include environmental degradation, resource exploitation, destructive land use, congestion, and ecosystem disruption and destruction. Other areas of investigation are energy and the utilisation of energy, population size and effects, physical and mental health, aesthetic form, wild-life conservation, open space utilisation, and the productive use of leisure time (recreation).

Towards this purpose, Huxley engages in the following academic activities:

i) The discovery of new knowledge or new ways of organising existing knowledge. Faculty members and students are engaged in research dealing with such topics as the effects of fluorides upon ecosystems; the ecological

effects of terrestrial and marine oil spills; water quality in nearby Puget Sound; and the development of environmental attitudes and value changes.

ii) The integration and assemblage of existing knowledge into more comprehensive systems, through activities such as courses, lectures, and media presentations, and through publications.

iii) The dissemination of information not only to students and faculty of Huxley, but to the entire Western Washington campus, the community, other environmental professions, and society in general.

iv) The application of knowledge and skills to environmental problems, to facilitate their resolution.

1. WHO DOES THE TEACHING?

Because Huxley College was formed to focus on man's interactions with his environment - physical and biological entities, social structure, and the cultural heritages that mould his responses - it offers multidisciplinary study encompassing all dimensions of environmental problems. In addition to traditional coursework the College is concerned with helping students develop professional skills and self-confidence. Problem-oriented study is therefore stressed at Huxley.

Most of the current activity at the College is devoted to undergraduate teaching. A successful programme of education must be flexible and dynamic to meet students' needs as well as social needs. The Huxley undergraduate programme has been planned to help a student develop the following qualities by the time of graduation so he or she can function to actualise his or her greatest potential:

i) A synthetic, holistic understanding of environmental studies, as well as adequate technical information for making responsible career decisions.

ii) Problem-resolving competence; i.e. competence in problem perception, definition, analysis, and synthesis.

iii) A sense of appreciation for quality in one's environmental surroundings.

iv) An awareness of individual and social ethics, including some foundation of a personal ethic.

v) An awareness of the cultural characteristics of this and other cultures, as those characteristics affect the environment.

Since courses and programmes housed in Huxley College are interdisciplinary, faculty represent many branches of professional training, i.e. sanitary engineering, anthropology, sociology, planning, ecology, biochemistry, oceanography, physics, economics, political science, marine biology, etc. Faculty are selected that have a commitment to environmental improvement as well as the background and knowledge to contribute effectively to an environmental programme. They have specialisation in some aspect of the environment, and interest and/or background in the general area of environmental studies. An important aspect of studies for Huxley students is problem orientation. Consequently, faculty must have an interest in applied field studies for the application of information gained by students in coursework.

Emphasis is placed on good teaching - the ability of the faculty to motivate students and assist them in the learning process. Faculty must have good knowledge of their area of specialisation; more emphasis is placed here than on credentials per se.

Adjunct faculty and resource people from industry, governmental agencies, and the community are sought to participate in programmes. Adjunct faculty may be responsible for courses, assist in courses, or participate in seminars. Guest resource people are brought in to cover specific subject areas for short periods of time. Co-ordination of their efforts within the programme is through the regular administrative structure: the Dean, the Curriculum Committee, and faculty responsible for particular courses. At the present time a radiobiologist from the Environmental Protection Agency, local city planners, and an industry engineer have input into curricula planning and teaching.

2. INSTITUTIONAL ORGANISATION

Huxley College is one of the three cluster colleges of Western Washington State College. The concept of cluster colleges grew out of the pressures that accompany the rapid growth which has occurred at the state-supported colleges and universities of Washington and from the concern that the intimacy in student-faculty relationships possible in a smaller institution would be lost in the effort to provide educational opportunities for increasing numbers of students.

Western Washington State College is determined to encourage students and faculty to work together as a community of scholars and to preserve advantages of a smaller institution.

As a cluster college, Huxley operates under the jurisdiction of the Board of Trustees and the President of Western Washington State College. For legal purposes it is a division of WWSC. Huxley students participate in the academic, administrative, and social activities of Huxley College; they receive their degrees from Huxley College, a division of WWSC. They are also members of the Western student body, may take part in all student activities, and have access to all library, computer, academic, athletic and recreational facilities at Western.

Huxley occupies the Northwest Environmental Studies Center, completed in 1973. Besides housing Huxley College, this building has classrooms and laboratories designed for environmental studies in air, water, and land systems.

Shannon Point Marine Center

Shannon Point Marine Center, located on Fidalgo Island, about 40 miles from the WWSC campus, is a laboratory and classroom facility geared to undergraduate studies for the use of students attending state-supported colleges in Washington. Huxley College marine resources students will use this facility for environmental problem study. The opportunity exists here for inter-institutional exchange of faculty and students.

Institute for Freshwater Studies

The Institute for Freshwater Studies was developed as a research and training facility for faculty and students at WWSC interested in limnology. It also serves the community by comprehensive studies on freshwater systems in the region and by its document holdings.

Huxley College Center for Environmental Education

The Huxley College Center for Environmental Education is an adjunct to Huxley College, designed to facilitate the growth and development of environmental education in Northwest Washington communities. Huxley students in environmental education work with Center personnel to strengthen community and public school environmental education programmes. The Center is supported by funds from the U.S. Office of Education. A Co-ordinator for Community Affairs

is a member of the Center. The motivation for community involvement originates here, and the Center serves as the means through which community programmes are implemented.

Faculty and Budgeting

Since at WWSC an entire college has a focal point on environmental studies, many problems are alleviated that would have to be confronted in a typical center or institute. Most faculty members have full-time appointments in the College. Some joint appointments between the College and other academic units tend to strengthen ties throughout the institution.

Huxley College is a semi-autonomous unit having, in general, control of its faculty reward system and regulation of its own curriculum. Huxley College committees are established in matters concerning personnel, curriculum, and policy.

The perplexing problem of crossing departmental boundaries in programmes of environmental studies has been alleviated in the College where faculty members with diverse backgrounds come together and work towards a common effort of implementing the programmes. Other problems have been alleviated by giving the Dean of Huxley College the opportunity to co-ordinate environmental studies on campus. This involves such environmental units as Shannon Point and the Freshwater Institute, and environmental education sites. With proper input from various departments and other colleges, this co-ordination tends to utilise all of the available talent on campus for environmental programmes.

As a unit of WWSC, Huxley receives its funding from the state. Funding is provided by established budgetary formulas based on student-credit hours, full-time faculty equivalents, and facility utilisation. Under these conditions, any developing academic unit in the State of Washington has difficulties in acquiring adequate funds for academic programmes and facilities. Funding has been the only really significant problem to date. Surprisingly, there has been no feeling of insecurity among a faculty not housed in traditional departments. It has been our experience at other institutions that such feelings have been quite marked.

Exchange Programmes

Exchanges of students and faculty are possible with other institutions. This next year, student exchange between Huxley and the University of Waterloo (Ontario) and Huxley and the University

of the Atlantic (Bar Harbor, Maine) will take place. Suggested guidelines for student exchange are as follows:

i) Students would visit another region of the country for an extended period of time (to be determined), learning about its environment and problems. This programme would be sponsored by host institutions which would provide the student with counsel and guidance. This counsel would be provided through a designated tutor. (Huxley College has a tutorial programme for its students.)

ii) The student should have a background in environmental studies and have some specific objective or area of inquiry in mind before leaving his resident institution.

iii) There would be some selection procedure at both the host and the home institutions to assure that the student has a specific objective and is prepared for the study. The host institution can help meet the student's educational objectives.

iv) The student would register at the home institution to avoid out-of-state fees, but evaluation of the programme would be made by both host and resident institutions.

v) The student could take courses at the host institution, but a certain segment of his time should be devoted to individual study and analysis. Evaluation of the project would be made by both host and resident tutors.

The main problem in an exchange programme seems to be registration. Ideally, the student would register at and pay host tuition fees. However, with out-of-state tuition requirements prevalent in many schools, the added expense makes exchange prohibitive for many. The second option, again ideally, would be a one-to-one exchange, with students registering at their home institutions and taking coursework and independent study at the host institution. To expect a one-to-one exchange each time, however, is probably not realistic either.

Advising and Counseling Students

Each student in Huxley is assigned a tutor to work closely with him in designing a programme and advising him throughout his study at Huxley College. No courses are scheduled on Thursdays, in order to allow students time for problem series involvement and

advisement by their tutors. Students with special counseling problems of a non-academic nature are directed to the WWSC student counseling service.

3. COURSE CONTENT

Graduate Degrees

Huxley College offers work towards an MS, an MA, or an MEd degree through selected departments of the College of Arts and Sciences. Joint programmes include specialisations in Environmental Planning through the Department of Geography, Environmental Education through the Department of Education, Human Ecology through the Department of Sociology/Anthropology, and Resource Ecology through the Department of Biology.

Undergraduate Degrees

All students coming into Huxley complete all-College requirements regardless of their area of concentration. The all-College requirements include core courses, problem series, and seminars.

Core Courses

Two courses are designed to give all students a common background in environmental concepts essential for comprehension of man, his natural and social environment, and his reliance and influence on the environment. Courses in biology and chemistry are recommended as prerequisites to these core courses. This core is taught by a team of six faculty that attend all lectures. The lecture section is large, but time is allowed for free exchange of questions among faculty and students. Small discussion sections, directed by individual faculty, meet three to four times weekly to focus on the lecture material. The first course, entitled Man, Society, and Environment, has three sections: Introduction to Environmental Problems, Historical Background, and Specific Problems and Solutions.

The first section provides an introduction to world-wide environmental problems. In particular, the problems and interactions of population, food supply, industrialisation, resource use, pollution, and social and political factors will be examined. Special attention is given to the status of these problems in the United States and the Soviet Union.

The second section is devoted to tracing the historical development of the physical environment and those ideas which have shaped present attitudes towards the environment. It begins with the creation of the universe and the geological and biological evolution of the earth. Emphasised next is the biological and cultural evolution of man, including the evolution of modern societies and the role of technology. The last part of this section deals with the nature of man, from the ideas of the Greeks to those of modern humanists, and also with ideas which have influenced man's understanding and relation to his environment.

The third section deals in detail with specific environmental problems and their solutions. It begins with a discussion of the basic concept of energy, energy conversion, and energy use. Then, sources and abatement of air and water pollution are considered, along with other types of pollution such as noise, thermal, etc. The course ends with a discussion of the economics of pollution and resource economics.

Man, Society, and Environment II has two sections. The first is a continuation of the last section of the first course and deals specifically with environmental problems and their solutions. The second section is a discussion of alternative futures.

The first section begins with an introduction to the organisation and functional aspects of ecosystems. Examples of some of these aspects - populations, agriculture, and aquaculture - are considered. An examination of human ecology, including social organisation, social institutions, minorities, the third world, modern value systems and the psychological nature of man is followed by the final topic in the first section, environmental simulation and modeling.

The second section begins with a consideration of the future prospects for the physical and life sciences and technology. The remainder of the section is taken up with considerations of how to effect the economic, political and social changes necessary to develop an environmentally sound future.

Problem Series

Students at Huxley College are expected to be motivated to carry out independent study pertaining to their educational objectives. The problem series is undertaken together with one or more tutors from the Huxley faculty and may consist of several individual problem investigations or a series of steps in a major investigation. It may take the form of a library, laboratory, or

community experience. The investigation, observation, and interpretation of the problem must be followed by the student's recorded statement (written, taped, filmed, or graphically portrayed) demonstrating his process of situation analysis and interpretation, his prognosis and his proposed steps to action. During the Spring Quarter all Senior students are required to present their problem series work in special seminar sessions.

Seminars

Seminars serve as a meeting ground for faculty and students. Students are encouraged to initiate and conduct seminars. Seminars allow detailed study of particular topics and serve to increase rapport between students and faculty from different concentrations.

Concentrations

Concentrations focus on recognised areas of environmental concern. Student programmes in the concentrations may draw upon a number of different disciplines for analysis. Concentrations are designed to prepare students for career opportunities. The following concentrations are offered:

Environmental Planning
Human Ecology
Environmental Education
Environmental Systems and Simulations
Environmental Administration
Ecosystems Analysis
Environmental Health
Marine Resources
Environmental Monitoring

Environmental Planning

Bringing the natural scientist's understanding of environmental systems to bear on problems of human organisation is the role of the ecology-based planner. He should understand the processes of both natural and social systems, and how they are integrated in time and space; the ways in which decisions are made and implemented, by both groups and individuals; and the tools and techniques of gathering, analysing and presenting information. Equally important, he should possess an aesthetic sense leading to harmony and unity in his surroundings.

The students' academic training will provide skills and insight for conducting basic technical studies for land use planning (classification) and regulation (zoning, standards, etc.). Students will also have a basic knowledge of design principles, the legal basis for planning, and current federal and state funding programmes. Above all, they will understand the dynamic interrelationships between the man-made systems and the natural systems.

In addition to the generalist background described above, students will have gained some in-depth knowledge of environmental impact statement review and analysis procedures and basin-wide pollution abatement planning requirements.

Human Ecology

The human ecology concentration is a very general one designed to expose the student to a wide area of inquiry. It touches on cultural ecology, the dynamics of human population, environmental psychology, social interactions, environmental education, and political action. To pursue the generalist goals of the concentration, a student systematically explores numerous fields of study for his intellectual and spiritual development. Perhaps foremost, he gains an understanding of the enormous complexity of human problems in modern society.

Enterprising and well-organised human ecology students have had little difficulty finding employment in federal agencies and local service organisations. The wide background of these students serves them well in addressing themselves to the variety of challenges they face in their chosen careers. The concentration allows many opportunities for self-enrichment, independent of career goals per se.

Environmental Education

The general objective of the concentration in environmental education is to provide students interested in educational roles of various types with an opportunity to obtain a basic understanding of the qualities of the environment in general and of the environmental education process in particular. A number of options have been developed within the programme which will allow students with varied interests opportunities towards diverse career goals.

The programme consists of several distinct parts. First, all students acquire a synthetic and holistic understanding of the content of environmental studies. Second, students examine the process of education from the environmental perspective; i.e. how

the environmental education process differs from other views of education, what ideas and methods are central to the process, and what specific techniques are available to facilitate the process. Third, the student learns the content and techniques essential to function in the professional role which he wishes to play. Courses may be taken in journalism, elementary education, disciplinary areas essential for secondary school teaching, recreation, media techniques, or other areas. Fourth, students participate in internships, a field practicum, or research.

Environmental Systems and Simulations

Environmental Systems and Simulations is an undergraduate programme designed to give the student a comprehensive view of environmental issues. The student approaches an understanding of environmental complexity by means of system simulation and model building. The primary purpose of the sequence is to provide a comprehensive understanding of subsystem interaction and recognition of parameter significance and sensitivity.

Environmental Administration

This concentration combines broad study of environmental problems with an examination of planning and administration techniques to deal with them. The concentration includes a block of coursework concerned with fundamentals of administration: organisation, economic and non-economic analysis for decision-making, and integrated experience with practical cases. Another block deals with dimensions of environmental problems, and expands the Huxley core programme with natural and social considerations. Electives provide greater depth for potential employment or advanced study. Graduates would fit usefully into planning administration work or into agencies dealing with health or development planning. They could work in industry or local government in the supervisory aspects of pollution compliance and control, especially analysis and evaluation, or even just as ecologically aware managers.

The concentration requirements satisfy all or most of minors in Economics and Business Administration, and introduce environmental or land-use planning. With proper electives, students would qualify for advanced study in those fields, law, or public administration.

Ecosystems Analysis

Man today is faced with many social, physical, and biological

problems. These problems are complex, touching on many environments and ecosystems. Solutions have generally been proposed from a singular point of view resulting at best in partial success and oftentimes causing other unseen difficulties, e.g. control of insect pests with DDT.

Viable solutions to these problems lie in the holistic understanding of the impact of man on the functional units of our biosphere, ecosystems. The concentration will focus on impacted ecosystems by comparative analyses of natural and man-influenced ecosystems. Field investigations, environmental impact analysis and modeling will be emphasised in the concentration. Consideration will be given to strategies for managing ecological systems.

Environmental Health

Environmental health refers to that aspect of public health that is concerned with those forms of life, substances, forces, and conditions in the surroundings that may exert an influence on man's health and well-being. Such topics as air and water pollution, food contamination, solid waste, overpopulation, and pesticides and radiation exposure are considered. The concentration provides information for students interested in advancing their knowledge and integrating the chemical, physical, biological and social aspects of man-environmental health relationships.

Marine Resources

Although the oceans are not an infinitely large source of food for man's increasing population, they do provide an important protein source that is presently being inefficiently utilised. World demand necessitates a more effective use of this food resource. Marine organisms are also important in yielding products used as resources for medicine and industry. These biotic resources are jeopardised by over-harvesting, by use of the ocean as a waste disposal medium and by the development of offshore oil production. The living resources, although not the only resource man uses from the sea, are the most important to man's present and probable future needs. To protect the potential of the oceans to produce biotic resources it is essential to understand the ocean's physical environment, the oceanic biota, and the ecological interrelationships of marine organisms. A use of the biotic potential of the sea that is consistent with an understanding of the dimensions of the marine ecosystem is the theme of this concentration of study.

Environmental Monitoring

The environmental monitoring concentration is designed to acquaint students with major procedures used by governmental agencies and industries to monitor pollutants. In particular, techniques used for measuring air, water (both fresh and marine), noise pollutants, and ecological parameters are emphasised. Students will take those courses in Huxley that consider the problem of pollution in environmental studies and those courses incorporating laboratory techniques. Students will take as well courses in chemistry that provide background in laboratory procedures.

4. RECURRENT EDUCATION

The Huxley College Center for Environmental Education is the community education component of Huxley College. The Center's philosophy and programmes are based on the assumption that the College must serve all citizens wishing further education rather than those who wish to enrol solely for college credit.

The programmes of the Center are diverse and, while there is a consistent environmental focus, serve a wide variety of target groups. Last year the Center served in a co-ordinative and instructional capacity for seminars, workshops, and courses for such groups as area teachers, U.S. Civil Service Commission, Skagit and San Juan County Planning Offices, various school districts, Whatcom County Parks Department, and the Wilderness Society.

Future involvement of the Center includes administration of a grant for community education awarded by the Washington Council for the Humanities; designing and implementing a community involvement strategy for the comprehensive planning programme in San Juan County; co-ordination of a series of Environmental Impact Statement workshops for elected and appointed officials in five counties; a series of one-day workshops on media production, Alpine Environment, and Alternative Futures; and an ongoing consulting service to area school districts.

The high point of this year's community programme was a short course, "Whatcom County at the Crossroads", designed to provide information on land use planning to county citizens. Co-sponsors included the Whatcom County Planning Office, Agricultural Extension Service, Farm Bureau, and Whatcom Community College. An accompanying series of ten articles on "Issues of Land Use" was printed in three area newspapers. The Center has received requests for similar short courses in Skagit and San Juan Counties.

Programme planning is based on continual survey of community needs through questionnaires and group meetings.

The environmental problems that confront the world today also affect individual communities. These problems must be understood and dealt with by all concerned individuals and citizen groups. Huxley students, with the co-operation of community participants, have organised a Huxley Environmental Reference Bureau (HERB). The goal of HERB is to provide free information relating to the environment on request from anyone or any group in Whatcom County or surrounding areas. Responses from local community groups as to types of environmental information which would best serve their goals are solicited. HERB is also interested in maintaining correspondence on a regular basis with any group or organisation which may be of assistance in the achievement of its goals. A HERB Recycling Center has been started; it operates mostly with voluntary help. This center is a pilot project that could later be used as a pattern for a community recycling center. Individuals are invited to aid in the recycling process by bringing all types of recyclable materials to the Recycling Center. These materials are sold to distributors, with proceeds used to improve the operation with a view to making the Center self-sustaining. The Huxley Environmental Reference Bureau and Recycling Center are currently co-ordinated by the Center for Environmental Education.

In 1970 the State Superintendent of Public Instruction identified the efforts of the Northwest Environmental Education Center (NEEC) as a state model which could provide other regions in Washington State with both plan and programme. NEEC is now advisory to the Huxley College Environmental Education Center. In 1972 the State Superintendent of Public Instruction housed an environmentalist in Huxley College as an adjunct faculty member and co-ordinator, to help with implementation of the State Plan in environmental education in the Northwest region.

5. CRITERIA OF SUCCESS

Huxley College has increased its student enrolment from 65 in 1970 to 175 in 1973-74. Approximately 75 per cent of the first class graduated and are now either in graduate school or pursuing careers. Of this group, about 35 per cent went on to graduate school, 40 per cent have positions in careers directly related to their studies at Huxley College; and 25 per cent are in activities not directly

related to their studies, i.e. military service, jobs not related to environmental studies, and travel.

Evaluation of both our on-campus and community-oriented programmes is continuous. Questionnaires, interviews, and special committees are used to supply input, and faculty and student retreats are held periodically to examine the goals of the College and how they are being met.

UNIVERSITY OF CALIFORNIA, IRVINE

PROGRAMME IN SOCIAL ECOLOGY

Irvine, California, United States

by Arnold BINDER, Director

1. WHO DOES THE TEACHING?

The following disciplines are represented on the Social Ecology faculty: environmental health, urban planning, law, biology, sociology, psychology, community medicine, and psychiatry.

The standards for selecting and advancing faculty are those typical for a major university in the United States - scientific and professional accomplishment, teaching ability, and service to the university and the broader community. However, since Social Ecology has such a strong commitment towards working with community agencies on social problems, the criterion of service to the community takes on a good deal more importance than in the case of a more traditional academic department. And since all students are required to spend a considerable amount of time in field work in some aspect of environmental problems, faculty members must establish ties with community agencies and professionals in the process of supervising these field study experiences.

Non-university-based professionals are used widely in the formal teaching curricula of Social Ecology in addition to their roles as work supervisors of the students during their field study placements. Non-university based professionals are selected in terms of a combination of course needs and ability profiles. For example, a course to be given in environmental impact assessment will be run by a team of professionals from local planning departments (municipal and county). These non-university professionals have no formal role in developing curricula but on an informal basis they can, and frequently do, have a good deal of impact. This informal role stems from the many discussions that continuously go on between the faculty of Social Ecology and the professionals

in the community. These mutual discussions influence the work experiences of students in the field as well as the development of curricula.

Throughout the teaching in Social Ecology, the strong interdisciplinary orientation is emphasised. Despite ultimate career objectives, for example, students are expected to attain a broad level of knowledge over such areas as planning, physical problems of the environment, social problems of the environment, and law. All teaching personnel in Social Ecology are urged to reflect and enhance that interdisciplinary perspective.

To keep up a high level of motivation for excellence in teaching, faculty members are evaluated by a committee of students. The student committee sends a report to the director of the programme containing the conclusions and recommendations of each such faculty evaluation.

2. INSTITUTIONAL ORGANISATION

The Programme in Social Ecology was established at the University of California, Irvine, in January 1970 to provide applied and interdisciplinary curricula for undergraduates in the environmental sciences. The orientation was towards community problems rather than scientific theory. The methods of teaching involve interdisciplinary courses, problem-directed courses, and active participation in the life of the community by students and faculty.

The Programme in Social Ecology fits into the campus organisation as follows:

The University of California, Irvine has five basic schools: Biological Sciences, Fine Arts, Humanities, Physical Sciences, and Social Sciences, and three professional schools: the School of Engineering, the Graduate School of Administration, and the College of Medicine. Each of the eight schools is headed by a Dean who reports to the Vice-Chancellor for Academic Affairs. The Programme in Social Ecology is not a component of any of these schools, but is headed by a director who reports directly to the Vice-Chancellor for Academic Affairs and who is a member of the Dean's Council. Moreover, since Social Ecology does not have separate departments, the director does the usual work of a chairman as well as that of a dean.

The Programme in Social Ecology has joint degree programmes with the School of Biological Sciences, with the School of Medicine,

and with the Graduate School of Administration. In addition, several members of the faculty of Social Ecology have joint appointments in other academic units, and several faculty members whose primary affiliation is in other academic units have joint appointments with Social Ecology.

Since the director of Social Ecology reports directly to the Vice-Chancellor for Academic Affairs, all budgetary and faculty assignment comes from the negotiations between the Vice-Chancellor and the Director. Social Ecology competes directly with the other units such as Biological Sciences, Social Sciences, and Engineering.

Innovative courses may be introduced either by faculty members or by students. If a student or a team of students would like to introduce a new course they may do so if they can get a faculty member to sponsor the course and monitor its organisation and presentation by the students.

3. COURSE CONTENT

The following is a sample of courses offered in Social Ecology which illustrate the environmental orientation of the Programme:

Introduction to Environmental Quality and Health

A preliminary survey of man's interaction with his physical and biological environments. Components included are: water, air, food, noise and housing. Included too are elements of environmental administration, environmental education, and consumer protection. The international aspects of these factors are examined.

Fundamentals of Ecology

An introduction to the basic concepts in ecology: populations, communities and ecosystems; the nature of diversity, stability, productivity, cycling and succession; resource utilisation and modeling; regulatory mechanisms in ecosystems and the ecological and social consequences of their disturbances.

Introduction to Planning and Public Policy

This course is intended to equip the students with the background necessary to pursue more advanced courses dealing with the analysis of metropolitan areas and the planning process. Objectives of the course: to expose students to the "seminal works" of the social sciences concerned with the city; to describe the models

of the city which have been derived from the seminal works; and to demonstrate the nexus between the social science models of the city and the urban policies pursued by the public sector in general and urban planning in particular.

Statistics and Data Analysis

The use of probability models and statistics as decision-making aids in Social Ecology. Included in the discussions are the classical methods of inference. Bayesian analysis, and methods appropriate for imperfect data.

Introduction to Human Development

This course presents an introduction to basic principles of human development from biological, psychological and sociological perspectives. An overview of life-span development is given and problems characteristic of the various developmental stages are discussed.

Principles of Social Ecology

Students are introduced to the ecological paradigm through a consideration of the classic and recent works in human, cultural, and social ecology. Emphasis is on the use of the ecological paradigm as an aid in analysing societal problems and prescribing for their amelioration.

Planning Practice

The course introduces the student to the operational techniques and procedures common to most public planning agencies and surveys the procedures peculiar to city, county and regional agencies. Also considered are the variations among states in planning enabling legislation.

Water Quality and Society

A survey of the chemical, biological, and sociopolitical aspects of water quality and their implications for society. Citizen attitudes about the recreational, agricultural, waste disposal, and other aspects of water utilisation and consumption will be reviewed. An emphasis will be placed upon the social decision processes which affect the allocation of water resources.

Air Quality and Society

Extensive studies of interactions between man and his environment have established beyond any possible doubt that behaviour is very sensitive to changes induced by external environmental factors in the body's internal chemical milieu. The objective of the course is to examine the short and long-term nature of such effects and the mechanisms underlying them, to consider methods by which the sophistication of present knowledge may be increased, and to assess the applicability of knowledge to public health problems.

The Limits to Growth

An examination of the present predicament of mankind in terms of limited natural resources, industrial growth, population expansion, increasing pollution, and per capita food production. The class will study the problems involved in equating growth with progress, especially as outlined originally by the Forrester models, and subsequently developed by the Club of Rome and M.I.T.

Biological Basis for Social Behaviour

Biological factors form a substantial segment of many of the behavioural problems dealt with by a social ecologist. Examples of behaviours discussed in this course include mental health, overpopulation and resultant pollution, and drug abuse. While lectures will stress the role of biological processes in these behaviours, resultant discussions will consider the relationship of a social ecologist to those behavioural problems mentioned as well as to additional topics.

Biology and Public Policy

Relation between biology and biological scientists and the formulation and execution of public policies. Topics such as population, delivery of health care, and pollution.

Problems of Metropolitan Areas

The course will cover a description of the major problems facing metropolitan areas, and of the forces generating those problems. Proposed solutions will be discussed.

The Public Sector

An introduction to concepts and principles necessary to understanding the role of the public sector in modern American society.

The course is taught primarily from the perspective of economics and prepares the student to assume more advanced course work in policy analysis.

Science and Public Policy

A seminar exploring "policy for science" (government support of scientific research and higher education in the sciences) and "science for policy" (government acquisition and utilisation of scientific inputs in the policy-making process). [Special topics include: government organisation relating to scientific mechanisms for generating science advice for various levels of government; allocation of resources for support of science and for public policy research; the relationship between science and technology; the nature of the scientific community and of scientific progress; the role of the university in contributing scientific inputs to public policy; trends and problems in the relationship of science and public policy.]

Environmental Psychology

The core issue of the course is the impact of the physical environment on individual and group behaviour. Three basic concerns are examined:

a) Environmental determinants of behaviour at the individual and interpersonal level;
b) Social planning and urban design; and
c) Methodological approaches to the study of environmental issues.

Human Sexuality

A broad survey of human sexuality encompassing genetic factors, physiological and anatomical development, customary and atypical forms of behaviour, reproductive processes and cultural determinants.

Noise Pollution

Introduction to sound and noise measurement, the auditory system, simple and complex auditory psychophysics, noise pollution.

Environmental Testing

The course will offer the students practical experience in the use of environmental survey equipment. The theoretical and

empirical bases of present environmental standards will be discussed. Field work will be conducted to test the quality of the environment in areas of particular interest.

Housing and Environmental Quality

Lecture and discussion exploring the diversity and complexity of the problems surrounding housing, housing quality, and environmental control. Special emphasis will be placed on developing a background in the fields of planning, urban economics, urban sociology, and other interdisciplinary foundations for a common language to be used in discussions.

Environmental Impact Studies

This course covers the new laws requiring the preparation of environmental impact statements before projects are allowed to begin. Conceptual framework and methods of analysis are reviewed through case studies.

Environmental Education: Human Habitat and Well-being

This course is specifically designed for teachers, education majors and those interested in applying an educational approach to the solving of environmental problems. Principles of Environmental Quality and Health are outlined. The students participate in developing educational models for action environmental education programmes for the schools and the community.

The Work Environment

An introductory course in the science and art of identification, evaluation and control of hazards prevailing in the work environment. The physical, chemical, biological, social and psychological factors affecting man in his working environment and as a member of the community will be explored. The course is required for field studies dealing with the work environment.

Specific Human Environments

The course discusses the basic environmental health and quality problems characteristic of such health care facilities as hospitals and nursing homes, educational facilities, penal institutions, day care centers, etc. and the societal factors involved.

Community Health: An Epidemiological Approach

An examination of the distribution and dynamics of human health problems on the community level and exploration of the principles and procedures of scientific investigation used to determine circumstances under which diseases occur or health prevails. The broadened scope of epidemiology including environmental, genetic, nutritional and social ramifications, in addition to the classical concern about infectious diseases and their role in social upheavals is surveyed.

Consumer Protection: Basis for Social Action

The course explores the interface between man's technological capacities and his existence as a consumer. Emphasis is placed on examining (1) the biological and chemical basis for the citizen's concern about environmental pollutants entering the food chain, e.g. pesticides, heavy metal and biological hazards; (2) the unwholesome practices on the food retail level that mostly affect the middle income groups and the poor.

Man, Food and Nutrition

Review and analysis of the usage of foods and the nutritional status of man, as indicators of his social ecology, principles of nutrition, the recent food trends in America, such as "health foods", and the effects of malnutrition and hunger on the physical, behavioural and mental development in man, are among the topics to be studied.

The Blighted Neighbourhood - Strategies for Change

The course will review the philosophical aspects, the historical and legislative developments, and analyse the theories and practices in dealing with the blighted physical environment in light of the dominating socioeconomic, biological and ethnic factors. Different methods ranging from the "bulldozer's approach" to change through social action will be evaluated with the purpose of selecting and recommending the most appropriate methods for future applications. National and international trends will be examined.

Environmental Law Research Seminar

The seminar will be divided up into four research groups, each group concentrating on an area of environmental concern. The

emphasis will be on legal theories and procedures to protect the environment, as opposed to focusing exclusively on the environmental problem from a natural science perspective. Federal and state protection of air and water quality, the problem of smog in Southern California, and private litigation to protect the environment are likely group topics. Several guest speakers will participate in seminar discussions.

Advanced Environmental Health

The course will involve an in-depth treatment of the theoretical and applied aspects of the complex relationship of the physical and biological environment to man. Those aspects related to preventive medicine and promotion of public health are emphasised. Principles of preparation of environmental impact studies, environmental health planning and methods of generating community support for environmental quality programmes are examined.

Biostatistics

Lecture and laboratory. Introduction to statistical analysis including discussion of sample size, distribution, test of hypothesis, types of error and significance, and level of confidence. Emphasis is placed on the use of statistics in public health and biological analyses.

Human Evolution

This course consists of three lectures per week; it surveys human evolution from the primate stage to the present. Topics covered include primate, hominoid and hominid evolution, various forms of Homo, cultural developments, settlement origins and society evolution. The emphasis in the course is on cultural evolution in terms of environmental influences.

Dynamics of Human Populations

This course focuses on the dynamics of human populations. Topics covered include natality, mortality, natural increase, in and out migrations, age distribution, life-tables, carrying capacities and optimum population levels, fluctuations in and regulation of population densities. Various computer models of population dynamics will be demonstrated and operated during the laboratory periods.

Planning Theory

The course will deal with "planning" in the generic sense as well as in the public sector, and urban planning. Topics will include: "Planning - The Ultimate Presumption?", "Planning - The Ideal Context", "Planning v. Democracy", "Planning - The American Context", "Planning is as Planners do", and "Is it Better to Have Planned and Lost, than Never to Have Planned at all?"

Analysis of Metropolitan Areas

Hypotheses concerning the nature and problems of metropolitan areas are tested using statistical data. The student is introduced to the census and other sources of descriptive data useful in understanding public sector attempts to control the dynamics of urbanism.

Design, Organisation and Operation of Community Information Centres

An exploration of the diverse needs motivating the establishment of community information centres; an assessment of the varied approaches taken in establishing these centres; an assessment of the actual impact of these centres; and a joint effort by the class to design an effective centre and to outline appropriate organisational and operational processes for the centre. UCI's Student Information Centre will be taken as a case for special attention.

The Consumer and the Law

A brief history of the law relating to consumer remedies and products liability. Detailed analysis of the scope of the problem with special emphasis on the impact this aspect of the law has upon society, the consumer, the manufacturer, and the poor.

Contemporary Environmental Issues

A discussion of selected contemporary environmental problems emphasising their impact on society with special reference to man's health and well-being.Analysis of causes of such problems and methods of solution will be explored. Problems discussed in the class will vary from year to year in response to current environmental issues.

Seminar in Demography

Examination of standard life-table parameters and methods of illustrating these graphically. Consideration of variations and fluctuations in fertility rates and their causes. Study of migration and its projection.

Law and Social Control

Through analysis of important historical controversies, the ability of legal institutions to deal with pressing social problems will be studied. The breaking of certain Indian treaties, desegregation, and reapportionment will be among the areas covered.

The conceptual base for organising the various disciplines in Social Ecology is presented to our students in the course Principles of Social Ecology during their freshman year. The conceptual base derives from the human ecology movement of the past 50 years.

Some of the courses from other academic units that have particular interest for students in Social Ecology are the following:

a) Biological Sciences

46 Problems in Population Biology
110 Human Reproduction and Sexual Behaviour
101D Psychobiology
101E Ecology
102E Genetics, Evolution, and Ecology Laboratory
159 Arousal and Attention
165 Population Ecology
166 Human Ecology
170 Evolutionary Processes
174 Behavioural Ecology
207B Attentive and Motivational Processes
207C Learning and Memory
243 Advanced Analysis of Brain and Behaviour
246 Advanced Analysis of Attentive Processes
213 Pleistocene Environments
214 Urban Ecosystems
215 Hominid Evolution
220 Seminar in Evolution
221 Seminar in Human Ecology

223 Seminar in Population Biology
265 Population Ecology
266 Human Ecology

b) Social Sciences

120D Cultural Ecology
120G Individual Decision Making
120U Structural Models of Behaviour
126R Psychology of Decisions
132U Conversation I
134K Transportation Theory
134N African Politics
138R Cognition and Language Development
141D Kinship and Social Organisation
189X Work in Modern Society
250U Theories of Behaviour Deviations

c) Administration

206 Manpower Utilisation and Labour Relations
207 Interpersonal Dynamics

The Programme in Social Ecology was conceived and developed for the purpose of providing direct interaction between the intellectual life of the university and the recurring problems of the social and physical environment. And since it was founded on the conception of man as a biological organism in a cultural-physical environment, the orientation is necessarily interdisciplinary. This orientation pervades the curricula which are aimed at equipping students to attack and solve environmental problems. In our context of usage, environmental problems include all aspects of man's relation to other men and to his social heritage on the one hand, and man's relation to his broader biological and physical environment on the other.

It is axiomatic in the Programme that learning must be applicable to the community and the community must serve as an auxiliary source of educational enrichment. Because the approach combines environmental education and community activity, the curricula of the Programme are organised by problem area, not by discipline or academic subject matter. The curricula are oriented towards producing a co-ordination between on- and off-campus experience, theoretical and applied learning, so that each enhances and enlarges the other. The Programme enables students to work effectively

on community problems in a variety of contexts, while simultaneously meeting the central goals of an undergraduate education. Students are free to choose their fields of assignment and their associated study programmes; required field study involves one course per quarter during the junior and senior years.

4. TEACHING METHODS, MEDIA AND MATERIALS

In operation, the curricula in Social Ecology are aimed at three classes of students. First, the Programme provides the context for educating people needed in professional capacities by various governmental agencies and industrial departments.

Second, the Programme provides the setting for preparing students for professional specialisation in schools of administration and law, as well as for graduate work in such academic units as social sciences and biological sciences. To illustrate, the curriculum is proving to provide excellent pre-law training.

And finally, the courses of study of the Programme are highly appropriate for educating students to become more effective and knowledgeable citizens because of a familiarity with community problems and the potential modes of solution, regardless of students' ultimate career objectives. For example, assignment to air or water pollution control agencies can be of great help to someone who chooses industrial management as a career.

By making most of its courses available to students majoring elsewhere on the campus, the Programme encourages the development of an environmental outlook among students whose primary interests are more traditional.

Field study plays a central role for the student in Social Ecology. It is desirable for a student to choose, over the quarters, several placements in his interest areas. Thus, someone specialising in environmental health might spend some time in health departments, air pollution control districts, or private industry. It is also recommended that he spend a quarter of two in an agency focusing on one of the other specialties in Social Ecology.

Before a student is eligible for field study he must take Principles of Social Ecology and the most relevant introductory course. Students specifically interested in the area of environmental quality and health should take Social Ecology, Introduction to Environmental Quality and Health, as a prerequisite. The major goals of these courses are to introduce the student to basic concepts and principles, and to help him begin to acquire specific skills and competencies in his chosen area.

There is a concerted effort to articulate classroom learning with learning in the field, where a student gains real-life, practical experience. Textbook discussions tend to revolve about pure problem types. In the real world problems come in confused, overlapping categories which sometimes defy classification. It is in the field that skeletal classroom concepts gain flesh and blood reality.

Field placement provides an opportunity to practise and further develop skills, and every effort is made to give the student progressively increasing responsibilities. The range of responsibilities for the students in placement is predetermined jointly by field agency and Social Ecology personnel.

Field placement provides each student with his own personal survey of many agencies in the community. After a normal tour in the field, a graduate of the Programme in Social Ecology should be in a more knowledgeable position to make job choices. Conversely, a variety of agencies have played a part in training future manpower which ultimately should not only reduce the usual ambiguity in their initial selection of new candidates, but also reduce later requirements for in-service training.

An important part of working in field agencies is the contact with agency personnel. Such contact provides for both the opportunity to observe and to try out professional roles, and the opportunity to learn at first hand the attitudes of those in the agency. With regard to selecting one's future employment such knowledge is invaluable.

Students spend about 10 hours a week at the field agency. In addition, they participate in a weekly seminar in which particular cases are reviewed, methods of assessment and intervention are explored and compared, community services and needs are evaluated, ethical implications are discussed, etc.

Field placement is not the sort of activity that one wants to grade in standard ways. Indeed, field placement does not lend itself to normal grading procedures. Yet it is essential to be able to notice and evaluate the occurrence and the nature of learning which is taking place. There are some administrative procedures which can be observed.

Evaluation has both good and bad connotations. On the one hand it may be viewed as an externally imposed method of "checking up", as a way of passing judgement; on the other hand it can be seen as taking notice of and gaining information about what one has learned and what remains to be learned.

With this in mind the evaluation scheme for field placement, evaluation not only of the student but the agency as well, has been outlined. In addition to quarterly papers and/or a running week-to-week account (say, a diary), the student is asked to rate the agency on a check list; at the same time the agency supervisor is rating the person in placement. Examples of these check lists are available from the departmental office. Further, the faculty field study supervisor will, in conference with the student, attempt to evaluate the student's experience and learning in the field to date. Student participation in weekly field work seminars is another ingredient in quarterly evaluation. And, as part of a larger effort, each student is asked to elaborate his goals and to submit a strategy for achieving them. Retrospectively each student is then asked to examine his agency experience and sort out which contributed to goal achievement and which experiences were obstructive.

It is our feeling that the multifaceted evaluation scheme outlined above will give students and faculty a clear picture of what is happening in the field.

The Programme in Social Ecology maintains a rather complete file of available audio tapes dealing with environmental matters (for example, those put out by the American Association for the Advancement of Science). In addition, the Social Ecology faculty maintains up-to-date catalogues of environmental films. In terms of hardware, Social Ecology owns a full array of film projectors and enough television cameras and CRTs for modest field work.

The following computers are readily available for our use:

Digital Equipment Corporation PDP 10 and SDX Sigma 7.

For advising and counseling students, there is a chief academic adviser who is the faculty member charged with supervising and co-ordinating all student advising. In addition, each student is assigned to a faculty member in Social Ecology for academic advising. Two staff members devote their full time to supplement the advising of the faculty member. These staff personnel check requirements, do degree checks, counsel potential transfers into Social Ecology, etc., as well as providing on-going counseling to our majors.

5. RESEARCH BASE

The following is a brief summarisation of recent faculty publications and current faculty research:

A. Publications

Ecology of Populations, The MacMillan Company, New York (1968).

Man and the Environment, The MacMillan Company, New York (1971).

Checklist of Orange County Flowering Plants, Museum of Systematic Biology Research Series, Number 1 (1968).

"Adaptations to aridity in the African Tropics", invited paper in Southern California Academy of Sciences Symposium), in press.

Contemporary readings in Ecology, Dickenson, Los Angeles (1969).

"The need for sub-college environmental education programs". Presented at 35th Educational Conference of the National Environmental Health Association, Portland, Oregon, June 26 to July 1, 1971. Journal of Environmental Health, Vol. 34, No.2., pp. 167-170, September/October 1971.

"Factors affecting aflatoxin toxicity: fat source". Presentation No. 226, the 44th meeting of the American Oil Society in conjunction with the World Congress of the International Society for Fat Research, September 27 to October 1, 1970. Journal of American Oil Chemist. Society, Vol. 47, No.7, July 1970.

The Open Door: Evaluative Report on a Walk-In Drug Treatment Center. San Gabriel, Calif. Family Counseling Service of West San Gabriel Valley, 1971.

"Social-psychological observations on urinalysis to detect heroin use". In Politics, Crime and the International Scene: An Inter-American Focus.

"Sexual Behavior: Research perspectives". In F. de la Cruz and G. D. LaVeck (Eds) Human Sexuality and the Mentally Retarded. New York: Brunner/Mazel, in press.

"On the distinction between density and crowding: Some implications for future research". Psychological Review, 1972, 79, 275-277.

"A social psychological model of human crowding phenomena". Journal of the American Institute of Planners, 1972, 38, 72-83; also adapted in Design and Environment, 1972, 3, 26-31; and reprinted in Materialien zur Siedlungssoziologie, P. Attenslander, ed., in press.

"Physical, social and personal determinants of the perception of crowding". Environment and Behavior, in press.

"The relation between micro and macro crowding phenomena: Some implications for environmental research and design". Man-Environment Systems, in press.

"Research and theory in social psychology pertinent to current problems in public health: General and annotated bibliographies". Council of Planning Librarians Exchange Bibliographies, in press.

An experimental approach to driver evaluation using alcohol drinkers and marihuana smokers. Accident Analysis and Prevention, 1971, 3, 237-256.

B. Current Research

"Checklist of Rhodesian Trees".

"Water relations of plants in Southern Africa".

"Systems Analysis in Taxonomy".

"Hybrid oaks in Orange County, California".

"Illustrated field key to Rhodesian trees".

"Revised checklist of Rhodesian trees".

"Participating in planning and implementation of the environmental health aspects of the Model Neighbourhood Program in the Willowbrook area of Los Angeles County".

"Children's personal space as a predictor of performance in crowded and uncrowded conditions".

"Effects of positively and negatively biased ecological materials in elementary school children's test performance".

As the Programme develops, it is expected that faculty and student research will more and more be responsive to community needs, from local, regional, and national perspectives. The Programme currently has four major laboratories; one in environmental health, one in environmental psychology, one in social processes, and one in perceptual processes.

The Programme is as yet not involved in research aimed at decision makers, but several proposals along that direction are currently being developed.

6. CRITERIA OF SUCCESS

When Social Ecology started in January 1970, it had a faculty of 1 and 20 students, and offered only the B.A. Since then it has grown at a rapid pace, reaching a faculty of 17 and a student body of 650 majors in the fall 1973. But those figures do not fully represent the success picture; since starting there has continuously been a waiting list of students requesting transfer into the Programme and over the years almost as many people have been refused admission as have been admitted as Social Ecology majors.

Social Ecology's graduate curricula start in the fall 1973.

Other indications of success are:

a) Within the past year the Programme in Social Ecology has been described in three major newspaper articles and in a national magazine (Newsweek).

b) The Programme has been used by Senator Moscone of the California State Legislature in a series of speeches as an example of an ideal approach to environmental education.

c) There are about 200 agencies available to our students for field study, and more volunteering for that category on a regular basis. Moreover, many of the students have been offered jobs within the agencies in which they did their field study.

7. RECURRENT EDUCATION

Beginning in the fall 1973 the Programme in Social Ecology will initiate a pilot project enabling people from the community to continue their education on a part-time basis. All curricula in Social Ecology will be available for these students in the late afternoon and early evening. It will be possible, by this programme, for students to upgrade their knowledge and skills as well as to earn either the B.A. or the M.A. degree.

UNIVERSITY OF WISCONSIN-GREEN BAY

Green Bay, Wisconsin, United States

by Edward W. WEIDNER, Chancellor

INTRODUCTION

The University of Wisconsin-Green Bay (UWGB) seeks to meet the educational needs of its students in ways that will be significant far beyond the bounds of the local region and in the context of the global concern for environmental quality.

There are two major aspects to the UWGB educational task. One responds to the cultural and occupational goals of the students who attend the University. The other responds to society's interest in problem solving in general, and preserving and improving the environment as a specific example of problem solving. The two parts of the UWGB educational task are obviously closely related.

In shaping the strategy for carrying out its educational task, UWGB began its planning in 1966 with certain assumptions about contemporary students. They have benefited from a better educational system than was available to their parents. They have been raised in a society of shrinking dimensions, of instantaneous communication, and of rapid worldwide travel. They have learned about many nationalisms, competing economic and political systems, and religious, racial and ethnic groups. Their world has been made immediate to them through television and other media in a way that was impossible for earlier generations. Many of them have demonstrated their unhappiness with traditional concepts of the university and traditional ways of teaching.

The majority of UWGB students come from northeastern Wisconsin, most of them from families in the lower to middle income range. These students have strong vocational interests. Many of them are initially attracted to UWGB by its proximity and resulting relatively low cost.

A substantial and growing number of UWGB students, however, are from outside commuting range. Approximately 40 per cent lived away

from home during 1972-73. In a relatively few years, members of this group should constitute a majority. For the most part, they are attracted to UWGB by the more innovative aspects of the academic plan and by its problem orientation and emphasis on environment.

A third student group is made up of returning adults, many of them attending on a part-time basis. Their interests range from the vocational to the esoteric.

UWGB sees itself as offering an educational experience that meets the diverse needs of all its students, and at the same time serves larger social ends. Not only does it aim to prepare students for the normal range of vocations, but it seeks to encourage them to become concerned with the contribution they can make to the improvement of the environment through their vocations. There is no reason why an education, thus conceived, cannot be equally valid for commuting students, those living away from home, and returning adults.

UWGB is not so much concerned with producing a new breed of environmental specialist as it is with producing graduates who are socially responsible and who are sensitive to social problems such as those of the environment, no matter what their vocations may be. This is not a modest goal. It implies a substantial alteration of certain traditional attitudes. It is these traditional attitudes, in such areas as governmental services, land development, business enterprise and the consumer economy, that have led to the development of the environmental crisis. If this crisis, or other crises, are to be resolved in socially beneficial ways, people must learn new ways of looking at the world and living in it.

In brief, UWGB asks students to commit themselves to the world, to other human beings, and to the relation of man with his environment. In turn, the University provides a flexible, innovative educational opportunity to make the commitment more effective.

1. INSTITUTIONAL ORGANISATION

A significant consequence of the focus on environmental problems appears in the academic organisation of the University. The traditional disciplinary department does not exist. In its place is the "Concentration", constituted of faculty members from a variety of disciplines who share an interest in a given set of environmental problems, such as those related to population growth.

Within the Concentration, individual disciplines and their development are viewed not as ends in themselves, but in terms of the contribution they can make to solution of the problems with which the Concentration concerns itself. An ecological focus is broadening and liberalising in its educational thrust. Disciplinary boundaries tend to restrict the understanding of any broad social problem. The study of environment intersects many disciplines and involves many branches of knowledge - the physical, biological and behavioural sciences and the humanities.

Concentrations are grouped into four "theme colleges". The College of Environmental Sciences emphasises the problems of the natural environment; the College of Community Sciences focuses on the processes by which man interrelates with his social environment; the College of Human Biology emphasises human adaptability to the social and physical environment; the College of Creative Communication centres on human identity - man's transactions with his cultural environment. To qualify for a degree, every UWGB student must associate himself with at least one Concentration and meet all of its requirements. Many students combine their Concentration work with professional and preprofessional study in a School of Professional Studies.

However, the basic organisational unit of the University is the Concentration. There are twelve of these, each offering an interdisciplinary degree programme focused on some environmental problem. Taken together, the Concentrations constitute the departmental structure of the University in terms of faculty, students, curricula, budgeting, and governance. Traditional disciplines are taught, but are organised only by committees (called Options) which are subordinate to the several Concentrations. In addition, the needs of students in special programmes such as those leading to professional certification and those emphasising remedial work are handled by special committees that do not have the high status a Concentration does. Student advising is handled on two levels: all university advising and counseling offices deal with general problems, and Concentration and Option advisers handle advising relative to specific academic areas.

UWGB is a member of a regional consortium of universities, and an autonomous member of a large, state university system. These groups encourage both faculty and student inter-institutional co-operation and exchange. In addition, UWGB participates in a national student exchange programme, and is developing faculty/student exchange programmes with universities in Europe and Mexico.

The novel organisational structure of UWGB has, as a counterpart, personnel and budget processes that are likewise different from most universities. Rather than being recruited, evaluated, and promoted by colleagues in his discipline, a UWGB professor relates to colleagues from many disciplines in a problem-oriented Concentration. It is the executive committees (all associate and full professors) of each Concentration that carry out these personnel functions.

All UWGB faculty candidates for the position of assistant professor and above are interviewed on the campus by faculty and students of the Concentration concerned. In addition, in most cases the Dean of the Colleges, the associate dean and faculty and students in related areas also meet the candidates. In senior level appointments, the Chancellor also interviews the candidate. The candidate's motivation and level of commitment to the UWGB philosophy and programme is carefully assessed as is the candidate's interest in relating this subject matter to problems of the environment. Evidence of potentially close teacher/student relationships is examined. Since UWGB takes a broad view of problems of the environment, it is not nearly so important that a faculty member's disciplinary interests be directly related to a problem of current interest, but rather that the individual be willing and capable of relating and interpreting his special area as it pertains to a broad range of problems.

Faculty members are also assessed in terms of their potential for relating to a programme which has as its basis the concept of relevant, applied work in the community. Those who would tie themselves to the laboratory or to the library exclusively are not likely to be acceptable candidates at UWGB. A balance between knowledge and teaching ability is, of course, important since we are primarily an undergraduate teaching institution. Equally important however is the faculty member's ability and willingness to cast himself in the role of number one learner as he and his students pursue solutions to real problems of broad community concern. The dogmatic theoritician is as unlikely to be comfortable in such a setting as is the activist zealot.

Primary evaluation of faculty effectiveness at UWGB takes place on the Concentration level. Faculty members are evaluated annually in terms of their teaching effectiveness, scholarly activity, service to the University in its development, and activities in community outreach. Concentration chairmen formally review these evaluations with each faculty member each year.

The Concentration executive committees are aided in their evaluation efforts by the Office for Educational Development (OED), which also develops evaluation procedures and carries out its own evaluation programmes in various areas of concern. The OED has developed procedures students can use to express their evaluations of individual courses and teachers. Many instructors make use of this form, and with the help of OED take counsel from information it provides. As an innovative institution, UWGB is probably more aware than many institutions of the necessity of evaluation. As a result of these procedures, UWGB has a faculty of excellent quality. Members of the faculties of the four theme colleges and the School of Professional Studies have the terminal degree or equivalent experience and training usually associated with their fields. Of the current group of instructors, assistant, associate and full professors, 145 hold terminal doctoral degrees, 14 hold terminal Master of Fine Arts or master's degrees and 13 have experience and training equivalent to one of these degrees, or are completing their terminal degree work. The rank of instructor is the pre-terminal degree rank.

Approximately 96 per cent of the full, associate, and assistant professors at UWGB have their terminal degrees which they earned at over 70 different institutions in the United States and abroad. Representatives from overseas include educators who studied at universities in Canada, England, Brazil, Germany, India and the Soviet Union. Nationally, the broad representation of the faculty is equally pronounced with over half the states represented.

In addition to the regular faculty, UWGB makes wide use of expertise in local business and industry through the services of community lecturers. Over 160 different individuals have acted in this capacity in UWGB's first four years of operation. They are appointed on an ad hoc basis and frequently meet with faculty and student committees to relate their skills and expertise to existing courses or to aid in the development of new courses and curricula especially appropriate to their skills. Looking to the future, expansion of the use of community lecturers is anticipated. For example, this is viewed as an important area for future co-operation between the local paper industry and the University of Wisconsin-Green Bay.

The problem-oriented, interdisciplinary Concentrations also play a key role in budgeting. Fundamentally, the Concentration chairman and his executive committee are given a lump sum budget which they can expend as they deem best. The disciplines (Options) have no budgets whatsoever, and exist at the pleasure of the Concentrations.

A form of programme budgeting is used to determine the amount of money each Concentration receives and the ways in which it is accountable for it. Among the aims of the programme budgeting system are the reduction of inequities among instructional units, increase of efficiency of instruction, reduction of unit costs of instruction, and provision of a mechanism for monitoring programme costs. Using past enrolment data and adjusting for anticipated enrolment increases, the number of student credit hours generated by each Concentration is determined. The average cost per student credit hour is then established for each course.

An academic salary base budget is established for each Concentration. This includes credit for faculty "loaned" to other units and debit for faculty "borrowed" from other units. Money is allocated on the basis of the enrolment achieved in Concentration courses. In addition, a sum of money is allocated to areas where programme development is the prime consideration. Once final budget determinations are made, the Dean of the Colleges distributes budgets to the Concentrations, where they are administered by the chairmen in consultation with their executive committees. The focus of budget control for the faculty is in the several Concentration faculty executive committees.

3. COURSE CONTENT

UWGB takes the subject of man's relation to his environment as its unifying theme and all courses of study are intended to relate to that theme. The theme includes study of the social, cultural and technological environments as well as study of biophysical milieus. The latter are the specific focus of two of our Concentrations: Ecosystems Analysis and Environmental Control. They offer undergraduate studies in both the theoretical aspects of ecology and the applied aspects of air and water environmental quality and resource conservation and utilisation.

Required studies at UWGB are minimal. Basically, they consist of a set of "all-university" requirements - currently four years of Liberal Education Seminars (6 credits each year) and a distribution requirement of 5 or more credits in each of the theme colleges.

A further requirement is that each student must select a Concentration (problem area) as a major. Not all courses for the major need come from the student's Concentration. The student may

"package" courses from other Concentrations or Options to count as part of the major programme.

UWGB offers an unusually large number of interdisciplinary courses. The three most common organising reasons are these:

a) Problem Focus

Many courses originate in the common concern of faculty from several disciplines with a specific environmental problem. Such courses represent points of intersection for several disciplines and are dominated by concern for dealing with the full implications of the problems addressed;

b) Thematic Focus

Several introductory courses draw related disciplines together to consider broad themes from varied viewpoints: e.g. the idea of community is such a theme for the "introduction to community sciences" course;

c) Conceptual Focus

Some courses seek to integrate study around concepts central to several disciplines: e.g. molecular structure in chemistry-physics courses, and the concept of "role" in the different social sciences.

Integration of the natural sciences and social sciences and humanities at the University of Wisconsin-Green Bay is effected basically on two levels: 1) through the fact that Concentration majors are problem focused, and must by their very nature integrate knowledge from the fields traditionally identified with the physical, biological, and social sciences and humanities; 2) through the fact that a variety of courses are also problem focused to fit into the established majors, and must therefore also draw on knowledge from the various traditional curricular programmes. Thus, though a student may take a "disciplinary course" which will complement his problem-focused Concentration, it is not possible for him to draw courses entirely from a single discipline. In pursuing an established Concentration major, he must, by nature of the programme, take several interdisciplinary courses designed to fit into that programme.

Integration of knowledge from the physical, biological, and social sciences and the humanities is also a basic element of student-devised majors. The University of Wisconsin-Green Bay provides each student with the opportunity of writing a personalised major if no existing major will fit his particular needs.

Although the established Concentration majors are each very flexible, there are some students whose programme aims cannot be satisfied by any of these twelve established Concentrations, and these students are allowed to design personalised majors with the help of an appropriate adviser.

The experiential component of learning is emphasised at UWGB in a variety of ways. The use of non-university experts in teaching brings important insights to the classroom. The emphasis of a problem focus for teaching, research and outreach activities provides a further dimension. But perhaps the way in which experiential learning is institutionally encouraged is best exemplified by a description of the programme of Liberal Education Seminars.

The academic core at UWGB is the Liberal Education Seminar (LES), a required four-year programme through which every student learns to relate the classic concepts of values to a present day ecological problem. As a freshman the student is introduced to the concepts of values, ecology and environment. As a sophomore he or she studies environmental problems of the Great Lakes Region, both in the classroom and by means of an off-campus project. As a junior the student expands this study in the United States and abroad in a comparative fashion. The senior seminar helps integrate what has been learned and helps the student explore the possible consequences of present day situations to future generations.

Specifically, the freshman seminar involves the student in the two central concerns of the University: values and ecology. The student is offered a choice of topics to be studied in lecture format and student-directed discussion. The topics emphasise man's values and their relation to contemporary ecological problems. Through lectures, discussions and assigned readings, the student develops competence in critical evaluation and written communication, and gains experience in group discussion.

Each theme college offers its own programmes in the sophomore seminar. The topics focus on environmental problems but vary with the theme of the college and the student's interest. The theory and methods learned in the first term prepare the students for practical application in an off-campus project conducted during the second term. This project may be undertaken individually or with a group. A report of results is required and may be presented orally, in writing, or in other forms which may be suited to specific situations.

As a junior the student studies environmental problems of a region other than northeastern Wisconsin or a culture other than

the student's own. The junior seminar is often related to the college Concentrations and varies widely according to the orientation of the Concentration and the interest of the students. The first term is devoted to a formal study of a specific region in preparation for a supervised student project in other areas of the United States or abroad during the second term.

The culmination of the programme, the senior seminar, is intended to be the capstone of the student's education at UWGB. It is designed to enlarge perspectives, analytical abilities, and interest in the enduring problems of self and society as they relate to political, social, environmental, aesthetic and ethical issues. The seminar is made up of students from various Concentrations and emphasises reflection, conceptualisation, broad perspectives and the implementation of knowledge.

Students begin by analysing common values and assumptions and synthesise them into a general conceptualised overview; return to the concrete by applying such conceptualisations to a variety of personal, cultural, societal and environmental issues; and finally, go beyond prior assumptions by examining the nature and quality of the human condition from new perspectives. This intellectual approach stimulates each student to identify and assess his own values, formulate a philosophical position, and develop an understanding of problems in their broadest dimensions.

Foreign and domestic exchange programmes, field courses, research projects, and the University Year for Action Programme which places students in a full-time working relationship with established agencies involved in antipoverty work, are some of the ways in which experiential education is provided at UWGB.

4. TEACHING METHODS, MEDIA AND MATERIAL

There are eight kinds of teaching methods at UWGB:

i) The conventional course, taught as a part lecture and part discussion session.

ii) The laboratory-studio course, with approximately double the class hours per credit in comparison to conventional courses and handled in a lab or in a studio.

iii) The large lecture, which makes little attempt at discussion, except for a few representative questions or exchanges between instructor and selected students.

iv) Credit for experience, a UWGB innovation at the sophomore and junior year, but parallel to what other universities do in restricted areas such as teacher training.

v) The seminar format, under which students take the initiative in presenting seminar discussions, and the instructor acts as an ever-present guide during a conventional three hours of class for three credits.

vi) The regular independent study type of course, under which individual students do individual kinds of things, under the occasional guidance of an instructor.

vii) Programmed independent study - non-mechanical, under which programmed independent study is available for small classes, particularly those under 10 or 15 students. Students proceed in a programmed way, the programme having been developed previously by the instructor. There is no mechanical reinforcement of this programmed independent study, and the students are expected to take initiative in the course, not the instructor. The instructor meets with the students at the beginning of the course, and perhaps every other week for an hour or so, the rest of the time. He obviously is available to answer questions if any come up. This type of course is not as frequent as the first six types already mentioned. However, interest in it is spreading, including a course offered by means of a Green Bay newspaper.

viii) Programmed independent study - mechanical, such as a recent television course on presidential elections. However, UWGB has not done as much in this area of programmed independent study as it might, using audio, video, and slide-tape techniques. The format is essentially similar to the programmed independent study - non-mechanical model, except for the advanced audio/visual, radio/video supplements.

Each student chooses his own course mix, and there are wide variations among students as to such a mix. On the average, about 35 per cent of student course selections are of conventional courses; 20 per cent large lectures; 30 per cent lab-studio, seminar, or credit experience; and 15 per cent independent study or programmed study.

The effectiveness of different teaching methods depends in part on the resources made available to the instructional staff. A wide variety of lecture hall, classroom, seminar, laboratory,

and studio facilities is available. In the field, several natural areas or sanctuaries are close at hand. Complementing these facilities are the services provided through the Office of Instructional Services. This office supports the efforts of faculty members by providing media and audio-visual services, computing and data systems and library support.

The staff of computing services supports the academic programme of the University, sponsored and unsponsored research for faculty members, and administrative requirements of University offices. Consulting services are available to students and faculty in such areas as programme design, software availability, programme testing and use of basic machines. A system of remote terminals is planned for installation later this year to further assist administrative and instructional activity.

The University's internal distribution of instructional materials over a network of audio and video facilities has won national attention. The network is the result of co-operative efforts between faculty and Educational Communications' staff. Microwave transmission, video tape distribution, cassette duplication and closed circuit distribution combine with television, audio, photo film and graphics to supplement an instructional programme which gives additional practical study tools in the emerging field of environmental studies.

Instructional television programmes and audio lessons are routed to classrooms and carrels on the main campus through a multi-channel switching system. Learning carrel installations are strategically located throughout the campus and the Library-Learning Center. They are focal points for audio-tutorial instruction in such subjects as algebra and physics. UWGB also provides the studios for public television Channel 38 serving northeastern Wisconsin under licence to the Educational Communications Board of the State of Wisconsin. Some of the time on this channel is available for UWGB programming.

A rapidly growing library collection provides approximately 180,000 books, 15,000 reels of microfilm, more than 500,000 microprint cards, and various other types of material essential for study and research. The periodicals' subscription list has about 2,700 titles with back files of most titles available on microfilm or in bound volumes. The library is a full depository for United States Government publications and for Wisconsin documents. The Canadian Government has designated UWGB as one of the few United States depositories for its documents. A complete set of United

Nations documents and selected documents of foreign countries and major international and domestic organisations are maintained on microprint. Full connections with other state libraries are maintained by teletype and by a weekly truck service, all part of a well-developed interlibrary loan system.

Strong working channels of communication are established between faculty and educational technology staff members who specialise in methods, media and materials. Instructors frequently submit their course syllabi to the media librarian for analysis of all media materials to coincide with principal teaching concepts. Faculty members visit the media librarian to discuss aspects of their courses which require audio-visual reinforcement. A corollary to this close working relationship is the policy of purchasing media materials only after appropriate faculty evaluation and analysis of the existing inventory have assured that a proposed purchase will complement materials already available. Attention is devoted to multidisciplinary applicability of each potential addition to the media library, as well as to the item's usefulness in self-paced instruction.

UWGB strives to maintain a sense of mutual trust and communication that encourages a faculty member to explore every conceivable avenue of course enrichment, every possible tie-in with other courses beyond his Concentration, and every mode of information transfer which will enhance course presentation. Beyond this attitude of willing exploration, it is important that professional educational technology consultation be available, as well as physical facilities to implement the plans jointly conceived by content and media specialists.

The University attempts to reach students at the most convenient hours and places of learning, ranging from home to office or automobile. Televised courses are transmitted to homes and other receiving locations such as a local correctional institution and a distant college campus. Recordings of these courses are made available on video cassettes which can be viewed in learning carrels at various campus locations. The portability of audio cassettes is emphasised as students check out recorded lectures to listen to on campus, at home, or in their cars. Through establishment of satellite learning centers in towns about 35 miles distant from Green Bay, the University extends its services to residents of the surrounding region.

Laboratory experiences range from traditional to innovative. In one case, video taping is used on location at the University's

Human Development Center to study early childhood learning techniques. Such taping is also used in training of student teachers as they present model lessons for critique by their peers. Training workshops are also provided by educational technology staff to develop skills among faculty and students in audio-visual equipment operation.

The Office of Computing Services operates a modern high speed digital computer for use by students, faculty and administrative offices. The staff provides consulting advice on systems and programming for a wide variety of users and applications. New courses in advanced programming, statistical computing and computerised regional planning teach students more sophisticated uses of the computer. Recent projects have involved students in the study of linear programming, simulation, river basin modeling, air pollution and respiratory disease analysis, city modeling, solid waste disposal, physiology, and other areas.

One student recently designed and programmed a system which summarises and analyses student course evaluation questionnaires. Another is designing a system to store and retrieve information on grants applied for and received by the University. Other students have analysed prison records, hospital emergency room admission records, and the economic aspects of Black/White fertility differentials. Research uses of computing facilities are equally diverse.

An introductory course to the social sciences has been developed by several of our younger faculty. This interdisciplinary course was developed with a massive media input (commercial films, locally-produced video tapes, audio tapes, and other materials) partly to facilitate the handling of a large number of students, and partly and most importantly to aid the student's understanding of the application of social science concepts to problems of the sociosphere. Films, tapes and reading materials provided the students with a common experiential background to facilitate ensuing discussions in the classroom. The materials chosen were generally the best available, and some had to be locally produced. Prior to using the materials in the classroom, faculty screening and discussion was used to evaluate quality. After introduction, student questionnaires were used extensively to determine whether the concepts were being transmitted and, where indicated, the materials were modified accordingly.

Student evaluation is the responsibility of the instructor, and while a fairly traditional system of letter grades is most frequently used as the final indicator, methods of evaluation of

students vary greatly. This is necessarily the case in an institution which allows students to plan their own Concentrations, encourages independent study, sponsors a learning community programme, emphasises community-based activities, provides a system of special petitions for waiver of requirements, grants credit on the basis of experience and examination, and generally allows and encourages flexibility in programme design.

5. THE UNIVERSITY AND THE COMMUNITY

UWGB cannot carry out its educational task in isolation from its community and region. The inherent logic of the UWGB academic plan requires pervasive and continual interaction with the regional community. To emphasise the importance of this interaction, UWGB calls itself a "communiversity". University classrooms are not confined to the buildings on the campus. Students and professors study, observe, and work in the community. In turn, members of the community come into the classroom and interact with faculty and students. There can be no sharp division between town and gown in a communiversity. Teaching is related to problem solving and decision making in a context of real environmental problems.

In the study of pollution of a river, or the decay of a downtown urban area, for instance, teaching, research and community outreach become related parts of a single intellectual function. Members of the larger community, students, and faculty must participate together in the entire process.

Another way in which UWGB broadens its involvement with the regional community is through its system of community advisory committees. In the fall of 1966, the help of local citizens was enlisted in planning and developing the new University. From that beginning there has evolved a variety of community advisory committees whose more than 200 current members help give substantial meaning to the communiversity concept.

Research is encouraged in both disciplinary and interdisciplinary problem areas, but emphasis is placed on applied and interdisciplinary research in the northeastern Wisconsin community that is relevant to broad material and worldwide problems. UWGB strongly emphasises community involvement in both its research programmes and curricula. Academic credit is regularly granted for course work involving community projects.

While UWGB is a problem-oriented university, it does not, as an institution, prescribe or recommend solutions for community

problems. It is a university, not a political organisation. It searches for the truth within a problem context. Then it is the role of community groups to take the initiative in local action and change.

An important part of the University's mission is a charge to meet the special educational needs of the area. The principal programme in service of this goal is that of continuing education. The continuing education programme at UWGB is implemented through the Office of Adult Education. The Director of the office is a member of the Chancellor's Advisory Group and reports directly to the Chancellor. The office is not an independent unit, as in many institutions, but is an integral part of the University. The office has responsibility for credit courses off campus, non-credit courses both on and off campus, conferences, seminars and workshops, media-based instruction that serves off-campus needs, and the open university - "University Without Walls" - programme.

Course offerings sponsored by the Office of Adult Education for credit are normally taught by UWGB faculty. Workshops and seminars are managed by a combination of UWGB staff and faculty. Para-professionals and an occasional Senior Distinction Student frequently assist workshops and panels of a non-credit type. Ad hoc faculty and guest professionals are often used to supplement regular staff members.

Professionals and other community members are encouraged to take advantage of offerings through convenient scheduling of courses during non-work hours and occasionally on weekends. Adult education personnel meet regularly with community advisory boards, community leaders, civic groups, and other organisations to assess needs. The office has recently completed a survey of a random adult population in northeastern Wisconsin with the same goal of identifying useful areas for programme activity.

Non-credit offerings cover such topics as the improvement of environmental quality; community and regional planning and development; economic and social development of northeastern Wisconsin; business, industrial, and labour management; recreation development, including planning and management of facilities and services; conditions of individual, family and disadvantage; and community cultural development. Other offerings cover professional improvement in the fields of education, business management and public administration, recreation and leisure, communication and social services. Non-credit offerings in literature, history, philosophy, music theatre, dance and the visual arts are available.

A wide variety of different organisational arrangements are required to serve the special needs of different target groups. Some examples of these special arrangements follow:

a) In-plant courses for workers in the paper industry,
b) Provision of day care facilities to enable parents to take advantage of course offerings,
c) Utilisation of space in a community centre to offer a nutritional course for women,
d) Use of a central city meeting room for a seminar in land transportation designed for community leaders and civic minded citizens,
e) A lunch hour seminar series aimed towards secretaries, office workers and women who are examining the job market,
f) Sunday evening scheduling of lectures, panels and workshops to enable greater participation by working adults,
g) Scheduling of a new series titled, Ornithology at Dawn, Wilderness Ways at Noon, the Stars at Night, to enable interested individuals to participate in environmental course work at a variety of times.

Special counseling is provided for the incoming or potential student to help explain possibilities for study which exist at the University. The special needs of returning adults are dealt with in personal and group situations. Special seminars such as one recently conducted to help women interested in returning to the job market are, in effect, counseling sessions. Once a returning student has overcome initial hesitance and has participated in course or seminar work, he is referred for further counseling needs to staff personnel in the Office of Student Services. The counseling efforts provided by the Office of Adult Education tend to be introductory and supportive in nature and are mainly directed to helping individuals assume or reassume a learning role. Frequent use of a small seminar format aids in developing a degree of friendship and personal trust important to the returning adult.

A summary of the goals of the adult education programme would reveal a high degree of concern with reaching towards and providing opportunities for the non-traditional student. By encouraging and providing maximum flexibility in the offering, enrolment, counseling and learning processes, the Office of Adult Education helps fulfil the University's commitment to provide lifelong learning opportunities for all members of the community it serves.

6. RESEARCH BASE

A problem-oriented approach to education provides many opportunities for research. More distinctive, perhaps, is the manner in which the problem-oriented approach helps unite professor, undergraduate student and community member in a common research enterprise. Basic and applied research in the environmental fields are encouraged at UWGB. The character and scope of research activities are well illustrated by examples of ongoing projects. A number of faculty from various Concentrations were asked to respond to the following seven questions:

i) What has been the main emphasis of your research; what has been the target area of study?
ii) What has been the extent of your use of students in research projects; what has been their role?
iii) Is your research typically more discipline-oriented or more related to interdisciplinary co-operation?
iv) How closely is your research related to communiversity projects and environmental problem solving?
v) Has any of your research been directed towards anticipating environmental problems before they reach crisis proportions?
vi) Have your teaching experiences had any effect on the research with which you are involved?
vii) Would you comment on the effect of national policy on environmental research by universities, i.e. level and manner of funding; co-ordination among funding agencies; priorities in the mission of the different funding agencies.

Typical responses to the first question indicated a fair degree of diversity and a high correlation with the major environmental problems existing in the geographic area served by UWGB. A selection of responses to the question follows:

Professor A

The main emphasis of my research has been the influence of water quality on the recreational use of water. The focus was on persons in population samples of heads of households and juniors and seniors in high school.

Professor B

My research efforts have been directed at three different but related problems:

a) Eutrophication of surface waters;
b) Effects of power plant operation on adjacent aquatic ecosystems;
c) Development of better methods for the analysis of nitrate and nitrite ions in surface waters.

Professor C

Several themes are evident: industrial development, especially as it relates to areas with high levels of unemployment; the economics of poverty, especially as it relates to Native Americans; and the economics of government reorganisation, especially as it relates to areas of sparse population.

Professor D

Main emphasis has been water quality problems of Green Bay and the Fox River.

Professor E

We are examining the severity of the health effects of the known carcinogen benzpyrene. The size of distribution of benzpyrene-containing airborne particulates is the specific area of consideration.

Responses to question (ii) indicated extensive use of student help in a variety of roles ranging from clerical assistant to research colleague. Comments from two different professors exemplify the full range of responses:

One Professor

Our three years of behavioural and attitudinal research could never have been completed without the assistance of undergraduate students. We have employed and worked with undergraduates in the following activities:

1. After an intensive training period, 35 students serving as interviewers and conducting 2,174 interviews;
2. Transforming data;
3. Coding data;

4. Computer programming;
5. Drawing samples;
6. Proofreading;
7. Conducting library research;
8. Gathering data from state and federal agencies;
9. Typing;
10. Making bibliographic studies;
11. Writing sections of research reports; and
12. Reviewing draft research reports of the principal investigators.

A Second Professor

In a study currently underway, I was able to identify an entire unit of the research to be initiated and completed by a student.

All of the faculty members interviewed indicated an interdisciplinary orientation in response to question (iii). Many of those interviewed indicated that while their interdisciplinary research relationships have normally been with colleagues in closely related areas, the recent trend of interaction has been co-operation, involving more wide-ranging combinations of the social, natural, and physical sciences.

One faculty member's response to question (iv) demonstrates very well the input-output-application process which is a central requirement of effective community-oriented environmental problem solving:

Every effort has been made to get as much input from community citizens and to get our results out in an understandable form they will make a difference in the region. Our work has been applied by planning officials in the five-county region in several ways.

Researchers generally reported that the work in which they are engaged is related to anticipating environmental problems before they reach unmanageable proportions. One professor indicated that he had done a planning study which assessed the impact which would probably result from the projected inundation of a large land area as a result of dam construction. Another professor who studied the influence of water quality on the recreational use of water commented on the fact that the elements of water quality which most influence human use are those which are easily understood. A conclusion of the research indicated that significant efforts in

environmental education would be needed to supplement simple reporting of bacteria counts, chemical pollutants, and other hard data. Some of the research being carried out is essentially of a monitoring nature, assisting in the establishment of environmental baseline data. Its implications for community action are indirect, depending on the nature of the data collected and the conclusions derived therefrom.

Respondents to question (vi) indicated a high degree of mutual reinforcement resulting from the combination of teaching and research experiences. One professor mentioned that many of his research hypotheses derived from his teaching, field, and recreational activities. Another mentioned the value of presenting ongoing research results to students, and a third commented that the students who are involved in working on the research project had profited greatly from the techniques and theory gained in the classroom.

In regard to national environmental research policy, several faculty members mentioned the lack of sensitivity of the federal bureaucracy, and the reactive character and short-time horizons of the agencies issuing the funds. It was generally felt that available funding did not provide predictable support for long-term ongoing research and that the funding structure was more suited to reacting to crisis than to the anticipation of problems before they occur.

The research programme at the University of Wisconsin-Green Bay continues to expand at an accelerating rate. As a whole, the faculty has a substantial commitment to the production of new knowledge and action-centered research which complements teaching in interdisciplinary programmes. It is particularly encouraging that the research programme has expanded at this rate in spite of the fiscal austerity which prevails at both the state and federal levels.

Most of the research, whether under the direction of an individual faculty member or a team of faculty members, is usually integrally related to the interdisciplinary mission of one of the Concentrations. In other words, the research programmes are taking on the character of the man-environment focus of the University. Even those programmes which are discipline-based, such as chemistry, have a decided environmental application component.

Student involvement continues to be a key characteristic of the research programme. Rather than denying the opportunity for creative research involvement at the undergraduate level, this

programme fosters that type of involvement and encourages students to take part in action-centered research programmes throughout their undergraduate career. Further, since many of the research projects are tied directly to environmental problems in the community or region, students find that research is a lively, exciting activity, tied to the real world, and not limited to the ivory-tower laboratory. The University's emphasis on field work through the Liberal Education Seminars fosters the kind of investigative bent which is appropriate to research programmes. It is anticipated that the level of student involvement will increase even further as the research programme matures.

In summary, the research programme at the University of Wisconsin-Green Bay continues to grow and to flourish. Although the University is still quite young, the research programme has expanded rapidly, especially through outside grants and contracts. Faculty members in the various departments are developing a broad basis for their investigations. It is apparent that the research mission of the University, properly conceived, can and should complement the teaching mission, while adding an exciting dimension of realism to the learning process.

7. PHYSICAL DESIGN AND OPERATION OF THE CAMPUS

The process of establishing a university totally concerned with the problems of man in his environment cannot be completely described without reference to the physical facilities which serve the primary university functions of teaching, research and community outreach. Following legislative authorisation in 1965, a site for construction of the new University of Wisconsin-Green Bay was designated. From the beginning, the design of the campus and its physical facilities was related to the emerging academic plan of the new institution.

Development of the campus site has been a continual process of study and interaction between the academic staff and the Office of Physical Facilities Planning. Consideration of natural area preservation, outdoor teaching lab locations, landscaping, path and trail development, exterior and interior buildings' design, energy consumption, transportation policies, and other environmental concerns have been central to the planning process.

The Planning Office has co-operated extensively with faculty, students and community groups in planning and implementing new

facilities and projects. Two significant examples of this co-operation are a community/lay citizen planning and zoning committee and a student/faculty committee, the Environmental Impact Board. The Planning and Zoning Committee is composed of the Chancellor, the University's Planning Director, the Mayor of the City of Green Bay, and other local officials. Its responsibility is to review the impact of the campus on nearby development. The Planning Director also sits as an ex officio member of the Environmental Impact Board, a group composed of faculty and students. The Board reviews the environmental implications of campus physical expansion. In addition, separate committees of faculty and students are set up to plan and review each major building project in which the University engages.

Also under review by the Environmental Impact Board and other committees are the operational activities of the Physical Plant department. The impact that Physical Plant activities have on the environment is substantial - e.g. use of chemicals in all departments, use of fertilisers and pesticides, site development activities, maintenance procedures of all types, pest control, solid waste and liquid waste handling procedures, recycling, leaf mulching, tree planting, energy consumption and other environmentally related activities.

Both the Physical Plant and Planning departments share their operating experiences with university classes and individual faculty members. Faculty are frequently called upon to lend their expertise to the analysis of operational problems. Through co-operation with course offerings and research projects, geologic profiles and plant inventories have been established for various natural areas on campus. The Planning Office is currently using professorial staff to provide interior design criteria for pedestrian concourse development. Students have been involved with the art department in designing and implementing wall treatments for campus buildings. Questionnaires have been circulated by professors to determine circulation patterns on campus. Results have influenced design criteria for future building projects.

Community reaction to campus design, an important factor in the success of the total institution, has been favourable. Campus initiatives in modifying energy consumption and transportation policies have also had a favourable impact.

To develop a new 600-acre campus with 12 major instructional buildings to serve an eventual student population exceeding 4,500 and employing 600 persons, is in itself a sufficiently complex

undertaking. When the university seeks to serve environmental goals, the task of ordering one's own backyard is even more demanding. Meeting the stipulated academic mission while serving the community and setting an example for sound environmental priorities is an exercise which demands co-operation. Campus planners and academics have worked closely with the Central Administration of the University of Wisconsin System, with student groups, community committees, local government, and regional planning agencies to insure that campus development occurs in an environmentally sound manner.

8. CRITERIA OF SUCCESS

Evaluating the success of a new institution with a stipulated mission of meeting the educational needs of its students in the context of the global concern for environmental quality is a demanding task. Just as long hours must be spent devising ways to implement non-traditional approaches to learning, the task of devising measures to assess results accurately is a difficult one.

The changing nature of higher education in the United States further complicates the effort. For example, a recent study carried out by the American Council on Education indicated that about half of the 34,346 students who were registered as college freshmen in 1967 had not completed their bachelor's degree in the "usual" four-year period. Fewer than one in ten of the students who had not completed the degree,however, considered themselves as permanent dropouts. A significant number indicated that they had stopped going to college only temporarily during the four-year period. About 20 per cent of those who had entered a four-year college or university had transferred to another institution at some point during the four years. These data and others indicate that traditional measures of "success", such as the proportion of students graduating within four years, may be extremely misleading.

There is increasing institutional emphasis on more flexible learning patterns. Some colleges have provided a "stop-out" semester for students who wish to take advantage of other types of learning opportunities not provided on the campus. Emphasis on credit by examination and credit based on experience is a further indication of the increased flexibility of the learning situation in the United States. And the open university concept has yet to reach its full potential.

There has been increased support of vocational-technical training programmes. New emphasis and value has been placed on a broader range of occupational activities than has ever been the case before. These and other factors combine to make the true meaning of enrolment growth, proportion graduating, years taken to finish degrees, and so-called "dropout rates" extremely difficult to assess.

Despite the moderating influences of the factors mentioned, the University of Wisconsin-Green Bay has continued to enjoy a modest rate of enrolment growth since its establishment. These figures are documented in Table I. Tables IIa and IIb provide an overview of the character of the UWGB student body in recent years. In IIa, for example, it will be noted that 20 per cent of our students are over 25 years of age. Table IIb indicates that about one-third took over four years to complete their baccalaureate education. More than one-fifth took over five years to reach the same level.

Employment of graduates and its relation to the training received is difficult to assess since UWGB provides a more generalised education which might benefit a graduate in a variety of endeavours. Alumni are generally satisfied with the education provided them, judging from the data contained in Table III. An 80 per cent response to this recent survey of 581 graduates indicated that 73.82 per cent were engaged in an activity related to their major, while 14.6 per cent were employed out of their field, and 11.58 per cent were not seeking employment or unemployed.

A further study of what the graduates of UWGB see as the educational benefits of their college experience was conducted in March of 1973. An attempt was made to contact all of the University graduates since 1970. With the help of a mail follow-up, 378 questionnaires were returned which represented 52 per cent of all those for whom there were forwarding addresses. In reviewing the results, it should be remembered that because the University was first established in 1969, all of the graduates approached were "transfer" students. None of them had pursued the UWGB curriculum for their complete college training.

The instrument that was used for the survey was a compilation of four of the Mini-Tests developed by the Center for the Study of Evaluation, University of California-Los Angeles. These four tests were designed to provide information regarding the educational benefits received in the following areas: Critical Thinking, Human Relations, Humanistic, and Vocational.

Table I

UWGB Enrolment Summary for 1968-1973

	Fall Semester					
Year	Freshmen	Sophomores	Juniors	Seniors	Specials	Total
1968-69	736	541	-	-	148	1,425
1969-70	845	483	367	126	160	1,981
1970-71	1,121	748	580	318	183	2,950
1971-72	1,148	925	685	475	298	3,531
1972-73	990	837	704	693	401	3,625

	January Interim					
Year	Freshmen	Sophomores	Juniors	Seniors	Specials	Total
1970	446	230	165	89	0	930
1971	429	331	352	204	29	1,345
1972	530	497	449	283	56	1,815
1973	531	498	470	457	104	2,060

	Spring Semester					
Year	Freshmen	Sophomores	Juniors	Seniors	Specials	Total
1968-69	623	575	-	-	132	1,330
1969-70	791	430	423	170	182	1,996
1970-71	1,043	704	557	308	181	2,793
1971-72	1,055	772	702	540	287	3,356
1972-73	896	743	669	766	441	3,515

	Summer Session					
Year	Freshmen	Sophomores	Juniors	Seniors	Specials	Total
1968	51	102	18	-	268	439
1969	65	81	70	24	338	578
1970	113	100	113	50	223	599
1971	112	120	144	194	437	1,007
1972	95	168	164	304	489	1,220
1973	(Breakdowns not available)					1,325

Table IIa

DISTRIBUTION OF STUDENTS BY AGE

Spring Semester (1972-1973)

Age	-16	16	17	18	19	20	21	22	23	24	25	25+	Total
Students	0	1	27	387	489	550	515	332	177	179	152	706	3,515
Percentage	0	.03	.77	11.01	13.91	15.65	14.65	9.45	5.04	5.09	4.32	20.08	100
Cumulative %	0	.03	.80	11.81	25.72	41.37	56.02	65.47	70.51	75.60	79.92	100.00	100

Table IIb

UWGB - College Career Patterns
June 1972 Graduates

Year	Graduates from High School			Started College		
	n	%	Cum %	n	%	Cum %
1969	1	.4	.4	7	3	3
1968	147	58	58.4	159	63	66
1967	29	12	70.4	30	12	78
1966	13	5	75.4	11	4	82
1965	11	4	79.4	12	5	87
1964	12	5	84.4	8	3	90
1963-'59	25	10	94.4	17	7	97
1958-'48	13	5	99.4	8	3	100
1947-	1	.4	99.8	0	0	100
(Total)	(252)			(252)		

Table III

ACTIVITIES OF GRADUATES

% = % of Respondents

	Total Graduates	Total Responding		Employed in field		Continuing Education		Peace Corps VISTA		Military Service		Not seeking Employment or Unemployed		Employed out of field	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
June and August 1971	168	147	87.5	87	59.2	31	21.1			6	4.1	9	6.1	14	9.5
December 1971	113	66	58.4	30	45.5	12	18.2	1	1.5	1	1.5	11	16.6	11	16.6
June 1972	255	216	84.7	104	48.1	34	15.7	1	.46	11	5.1	29	13.4	37	17.1
August 1972	45	37	82.2	19	51.4	5	13.5			2	5.4	5	13.5	6	16.2
Total	581	466	80.2	240	51.5	82	17.6	2	.41	20	4.3	54	11.6	68	14.6
				n = 344				% = 73.82				n = 122		% = 26.18	

Table IV presents the average responses for each of the four scales. A score of 4 indicates that the respondent felt that in thinking over his college experience, the extent of his progress or benefit in that particular area was "Very Much"; likewise, 3 indicates "Quite a Bit" of benefit, 2 indicates "Some" benefit, and 1 indicates "Very Little" benefit.

Table IV

AVERAGE RESPONSE OF UWGB GRADUATES FOR SCALES IN "EDUCATIONAL BENEFITS" QUESTIONNAIRE

Scale	Mean	Standard Deviation
Critical Thinking	2.67	.58
Human Relations	2.66	.62
Humanistic	2.63	.59
Vocational	2.55	.66

Table V gives the results of the survey by individual items. For ease of interpretation the responses of "Very Much" and "Quite a Bit" have been combined into one category while "Some" and "Very Little" make up the second category.

The three items for which the greatest benefit was perceived emphasised individuality and understanding and concern for others and their way of life. The area of second greatest concern included those items involving the skills of critical thinking: knowledge of the field, reasoning ability, analysis, and scepticism. Respondents perceived the same amount of progress in both their personal development and their social development with 66 per cent of the responses being either "Very Much" or "Quite a Bit".

The lower rating assigned to "skills and techniques directly applicable to a job" in the "Vocational" section is consistent with the University's goal of maintaining greater emphasis on those elements which contribute to broad flexibility, i.e. awareness, appreciation, critical thinking and background for continuing education.

Another measure of success is the quality of students and the quality of faculty members attracted to the institution. In both respects the record is impressive. Fifty per cent of the students come from the upper twenty-five per cent of the high school graduating classes. The student body comes from all parts of Wisconsin and all areas of the United States. It is a dedicated student body, heavily attracted by the academic plan.

Table V

PER CENT DISTRIBUTION ON INDIVIDUAL ITEMS IN THE "EDUCATIONAL BENEFITS" QUESTIONNAIRE

	Very Much and Quite a Bit	Some and Very Little
A. Critical Thinking		
1. Reasoning ability - recognising assumptions, making logical inferences and reaching correct conclusions.	69%	31%
2. Ability to see relationships, similarities and differences between ideas.	69	31
3. Understanding the nature of science, experimentation and theory.	39	61
4. Scepticism - ability to withhold judgment, raise questions and examine contrary views.	69	31
5. Quantitative thinking - understanding concepts of probability, proportion, margin of error, etc.	40	60
B. Human Relations		
1. Personal development - understanding one's abilities and limitations, interests and standards of behaviour.	66	34
2. Development of friendships and loyalties of lasting value.	45	55
3. Appreciation of individuality and independence of thought and action.	74	26
4. Social development - experience and skill in relating to other people.	66	34
5. Tolerance and understanding of other people and their views.	72	28
6. Appreciation of religion - moral and ethical standards.	27	73
C. Humanistic		
1. Awareness of different philosophies, cultures and ways of life.	71	29
2. Broadened literary acquaintance and appreciation.	52	48
3. Aesthetic sensitivity - appreciation and enjoyment of art, music, drama.	48	52

Table V (cont'd)

4. Writing and speaking - clear, correct, effective communication	56	44
D. Vocational		
1. Background and specialisation for further education in some professional, scientific or scholarly field.	59	41
2. Bases for improved social and economic status.	51	49
3. Vocabulary, terminology, and facts in various fields of knowledge.	70	30
4. Vocational training - skills and techniques directly applicable to a job.	36	64

The quality of the faculty has already been discussed. Suffice it to say that in addition to its qualifications and interest in innovative higher education, it has shown a kind of satisfaction by a very low turnover rate in both tenured and non-tenured positions.

Yet another way of judging success is the community's acceptance of the activities which have been undertaken in the name of the communiversity concept. The level of the university-community interaction is high. Local government bodies, regional planning commissions, social service groups, business groups, and private organisations have been eager to participate in joint projects and to apply the results of University research efforts. Further acceptance of the communiversity concept is indicated by the extensive participation of faculty members in community affairs and by the willing service of community representatives on University boards and committees.

Student involvement and acceptance in the community is evidenced particularly by the sophomore Liberal Education Seminar programme which stresses an off-campus experience during one semester. The programme has involved over 1,000 students and several hundred community agencies since its initiation in January 1970. The benefit to students and to sponsoring agencies seems to have been substantial. At least community acceptance of this endeavour has been marked.

Finally, the University has attracted substantial extramural support in its early years. This provides a measure of external acceptance of the institution by foundations and government agencies.

So far the results of the problem-focused educational plan at UWGB are promising. The first group of graduates to have participated in all four years of the curricular offerings left the University this summer. Their opinions and experiences will provide valuable feedback for programme assessment in the future. The goal of the institution has been to help develop citizens for tomorrow, and the extent to which UWGB has truly succeeded can only be measured there.

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