SIMON FRASER UNIVERSITY

MEMORANDUM

S.78.45

To Senate	From Senate Committee on Academic Planning
Subject M.R.M. - Master's Program in Natural Resource Management	Date 1978-04-20

Action taken by the Senate Committee on Academic Planning at its meeting of 1978-04-19 gives rise to the following motion:

MOTION

That the proposed Master's Program in Natural Resources Management leading to the Master of Resource Management Degree, as set forth in S.78-45, be approved and recommended to the Board for approval.

NOTE - Representatives of the Program Committee and of the Office of the Dean of Graduate Studies satisfied the Senate Committee on Academic Planning that the program proposal was well conceived, that the program had been thoroughly examined and that concerns raised by internal and external reviewers had been adequately addressed by the initiators of the program and the Graduate Program Assessment Committee prior to approval by the Senate Graduate Studies Committee on April 10, 1978. It has therefore been included as a new program in our budget submission to Council. Nevertheless, if approved by Senate and the Board, the M.R.M. program together with other recently approved programs will be returned to SCAP for advice to the President regarding relative priorities.

SIMON FRASER UNIVERSITY SCAP 78-9

MEMORANDUM

To Members, Senate Committee on Academic Planning	From Marian McGinn Assistant Registrar- Graduate Studies
Subject Master of Resource Management Program	Date April 11, 1978

Enclosed is the program for a Master of Resource Management degree. This program was approved by the Senate Graduate Studies Committee on April 10, 1978, and is now being forwarded to the Senate Committee on Acadmeic Planning for approval.

M. McGinn

SIMON FRASER UNIVERSITY

MEMORANDUM

To Harry Evans
Registrar

From Larry Thomas
Collections Librarian

Subject MASTER OF RESOURCE MANAGEMENT

Date 11 April 1978

The Assessment Committee has requested that the apparent differences between the Library and the proposers of the new program, in regards to the library budget, be resolved.

I can report that this matter has been discussed by representatives of the Library and the Geography Department, and we are now agreed that the budget proposed in G.S. 78.5, which specifies $5,000 for the first year and $2,000 for the second year, is necessary to provide adequate library collections.

Larry Thomas

LET:dcr

c: Mary Barker
Geography Department

Assess

SIMON FRASER UNIVERSITY, BURNABY, B.C., CANADA V5A 1S6
DEPARTMENT OF GEOGRAPHY, 291-3321

February 16, 1978

Dr. Jon Wheatley
Dean
Graduate Studies
Simon Fraser University
Burnaby, B.C.
V5A 1S6

Dear Dean Wheatley:

Here enclosed is a copy of the revised proposal for the program in Natural Resources Management. The suggestions of your Assessment Committee have been considered and changes have been made as follows:

(a) An additional social science course has been included (MRM 645);

(b) The chairmen of all departments with faculty involved in the program have been contacted;

(c) The budget has been put into a first and second year format as well as having certain line items changed.

Please feel free to contact any or all members of the Steering Committee if you need additional input.

Sincerely,

Michael C. Roberts
Chairman
Steering Committee
MRM Program

MCR/mgb
Encl.

SIMON FRASER UNIVERSITY BURNABY, B.C., CANADA V5A 1S6
DEPARTMENT OF GEOGRAPHY; 291-3321

March 1, 1978

Dr. B.P. Clayman
Associate Dean
Graduate Studies
Simon Fraser University
Burnaby, B.C.
V5A 1S6

Dear Dr. Clayman:

The Steering Committee of the MRM program contacted every chairman whose department is in some way involved with the program:

Dr. M. Mackauer	BioScience
Dr. B. Schoner	Dept. of Econ. & Comm.
Prof. K. Dixon	Sociology & Anth.
Dr. F. Quo	Political Science
Dr. N. Reilly	Math.
Dr. M.C. Roberts	Geography

All of these chairmen were supportive of the MRM program though they all expressed the point that it would have some impact on their departments. It was crucial, therefore, that the budget incorporated compersation to provide for replacements of their colleagues involved in the program. The proposed budget was mentioned to them to show that 1/4 or 1/2 time replacements were envisioned and explicitly accounted for.

Let me add a further comment on a somewhat different topic - student interest in the program, because members of the steering committee have been approached by potential students on and off campus enquiring about the status of the MRM. Just by word of mouth information there is an awareness of this program and a considerable desire to see it operational.

Sincerely,
Michael C Roberts
Michael C. Roberts
Chairman
Steering Committee, MRM

MCR/mgb

PROPOSAL FOR A MASTER'S PROGRAM

IN NATURAL RESOURCES MANAGEMENT

FEBRUARY 1978

M. L. Barker & M. C. Roberts
Department of Geography

J. L. Knetsch
Department of Economics & Commerce

A. L. Turnbull
Department of Biological Sciences

PROPOSAL FOR A MASTER'S DEGREE PROGRAM
IN THE MANAGEMENT OF NATURAL RESOURCES

This material has been prepared in accordance with requirements as outlined in the document "The establishment of new graduate programs" approved by Senate July 10, 1972.

a. JUSTIFICATION FOR THE PROGRAM

A two year Masters level program in Natural Resources Management is being proposed at S.F.U. This would be a professional program designed for individuals with experience in private organizations or public agencies dealing with resources, and for recent graduates in various disciplines related to natural resources management.

The intent is to offer individuals with primary backgrounds in separate disciplines such as geography, biology, forestry, engineering, planning or economics, an opportunity to take greater advantage of complementary subject matter and to develop increased familiarity and competence in the strategies, approaches and techniques of natural resources management.

(i) The role of natural resources in the B.C. and Canadian context: The impetus for this proposal came primarily from the growing recognition of the importance of natural resources to British Columbia and Canada, and the changing nature of policy and management issues. Increasingly, competitive and changing demands now characterize many natural resource problems. Public participation in allocation decisions, the role and fate of natural resource-based communities, conflicts over use of free-flowing streams, claims on resources by Native people and other groups, fair taxation, the use of natural resources as a tool for regional economic development, environmental quality, irreversibilities in resource commitments, and efficient utilization of resources over the long-term are among the types of issues now at the forefront of natural resources management.

Expertise in more traditional resource disciplines is and will continue to be needed. But increasingly it is being recognized that such experts might be more effective and productive if their experience and background could be supplemented by further participation in an academic program designed to allow a wider appreciation of problems and means to deal with them. This recognition of need is widely shared among natural resource organizations and professionals in the field.

(ii) Interest in the private and public sectors: In the summer of 1976 an outline of the proposed program was discussed with representatives from the provincial and federal resource agencies, environmental consultants and resource industries in B.C., and universities across Canada.

The results of this survey were: 1) encouragement to proceed and a strong indication that there is both a supply of participants and a demand for graduates; 2) agreement with the nature of the program; and 3) useful suggestions for modifications (which have since been incorporated). It was also clear that while the initial participation, in some instances in the form of agency sponsorship of students at full salary, might be a reasonable expectation, longer term participation will be dependent on the quality and usefulness of the program.

Representatives from the following organizations were consulted:

Environment Canada - Fisheries and Marine Service (Vancouver)
- Lands Directorate (Ottawa)
- Recreational Fisheries Branch (Ottawa)

Canada, Department of Regional Economic Expansion (Ottawa)
Canadian Office of Tourism
B.C. Pollution Control Branch
B.C. Department of the Environment - Land Management Branch
- Water Resources Service
- Environment and Land Use Secretariat

B.C. Forest Service
B.C. Department of Recreation and Tourism
- Deputy Minister and Assistant Deputy Minister
- Parks Branch
- Fish and Wildlife Branch

B.C. Institute for Economic Policy Analysis
MacMillan Bloedel (Vancouver)
Several Environmental Consultants in Vancouver
Faculty of Environmental Studies, University of Waterloo
Institute for Environmental Studies, University of Toronto
Westwater Research Centre, University of British Columbia

In particular, strong support was indicated by the B. C. Fish and Wildlife Branch and the federal Fisheries and Marine Service.

(iii) Employment opportunities: One indication of the potential success of this program is the demonstrated demand for graduates from the only existing MRM program in Canada, at the University of Manitoba. In British Columbia there is clear interest in hiring graduates from the proposed program as well as in strengthening the qualifications of existing personnel.

(iv) Faculty interest: The need for further academic opportunities in the natural resources has been recognized by several departments at S.F.U., most notably by Biological Sciences, Economics and Commerce,and Geography. Inter-departmental meetings on the advisability of an SFU initiative have taken place ...

over a period of some two years. Interest within the university community has subsequently broadened and includes the support of faculty in the Departments of Political Science, Sociology and Mathematics.

b. NEW POSITIONS NEEDED

This program has been designed to utilize, as far as possible, the available strengths of the faculty already at S.F.U. So although the number of new positions requested totals 3-3/4 only 1-1/2 positions will be new tenure tract faculty to be recruited from off campus.

(i) Director: This person would be able to teach at least one of the formal courses as well as partaking in the seminars; the position would be 1/2 time administration. This will be a critical appointment because the director will be responsible for: a) getting the program off to a solid start; b) establishing contact with provincial and private agencies; and c) maintaining the desired course sequence within the total offerings of S.F.U. programs. This will be a position needing a search of the same calibre as that used by the University for selecting a chairman.

(ii) A shared appointment between this program and Biological Sciences: The person selected would have a research and teaching proficiency in resource biology and would be responsible for MRM 611 and MRM 612. Since the program requires two new courses in the area of biology it would be impossible to staff this from present Biological Science personnel. The person selected must have a clear understanding of the biosphere not only from the viewpoint of biologist but also from that of a resource manager.

(iii) A sessional lecturer or visiting assistant/associate professor in natural resources law: It is hoped that we will be able to identify someone from the Vancouver legal community to teach the Law and Resources (MRM 641) course. This will be a quarter time position.

(iv) The other 1-1/2 faculty positions are all replacements for faculty from Geography, Economics and Commerce, Political Science, Mathematics and Sociology/Anthropology who will be seconded to the program for certain courses (or will have joint appointments).

(v) Secretary.

(vi) Technician: As the program grows and the various environmental courses (MRM 611, 612, 631, 632) and field trips are mounted there will be a need for a support staff person. This position will supervise the equipment; maintain the laboratories; assist in mounting and running the field program.

c. THE ESTIMATED BUDGET FOR THE PROGRAM

This submission is based on a full-time appointment of a Director; a half-time appointment with Bio Sciences (50% BioSc., and 50% Natural Resources Management); replacement positions for part-time use of faculty in Economics and Commerce, Geography, Mathematics, Political Science and Sociology; and a quarter-time position for a resources lawyer.

Budget

Faculty	First Year	Second Year
Director	$ 40,000.	$ 40,000.
BioSc. 50% time/MRM 50%	25,000.	25,000.
Faculty Replacement Positions (1-1/2 positions)	25,000.	37,500.
Lawyer (1/4 time)	8,000.	8,000.
	$ 98,000.	$110,500.
Support Staff		
Secretary	$ 12,000.	$ 12,000.
Technician	13,000.	13,000.
	25,000.	25,000.
Total Faculty & Staff Salaries	$123,000.	$135,500.
Other Costs		
Visiting Lecturers	1,500.	3,000.
Field Trips	2,000.	4,000.
Materials & Supplies	5,000.	5,000.
Miscellaneous Equipment	10,000.	5,000.
Library	5,000.	2,000.
Total - Other Costs	$ 23,500.	$ 19,000.

TOTAL COSTS FOR THE PROGRAM

Revenues (from fees)

12-15 First year enrollment	$7,200. - $9,000.
24-30 Second " "	$7,000. - 19,500
Student contributions to field trips	?
Grants for research - overhead	?

Contacts have been made with the Canada Council and NRC concerning the possibility of seed funding.

d. THE FIELD OF STUDY AND ITS CORE AREAS TO BE COVERED BY THE PROPOSED PROGRAM.

The field of study is the management of natural resources to maximize their benefits to society while minimizing harmful effects of their exploitation. Some concerns are: quantification of resource supplies and needs; estimates of productivity and sustainable yields of renewable resources; the nature of decision making; predictions of the impact of resource developments on the economic and social structure, the physical and mental health of people, and the recreational and aesthetic values of communities; estimates of possible damage to valued plants and animals; and evaluations of possibilities of repairing sites damaged by resource extractions.

The principal disciplines contributing to these areas include Economics, Biological Sciences, Geography, Political Science, Sociology and Mathematics. The academic merit of each of these disciplines is recognized by Simon Fraser University and each constitutes a discipline in which Simon Fraser excels. Separation of these disciplines into administrative and functional units arbitrarily separates sources of information that together are essential for rational resource use decisions.

This program is designed to transcend traditional discipline boundaries by two devices: (1) by creating a forum in which a variety of discipline trained individuals can meet, communicate, and learn to integrate disciplinary perspectives; (2) to provide formal training to students in disciplines other than those of their primary training.

In the resources field, in particular, it is important that an academic program stress problem-solving and critical thinking rather than focus primarily on subject matter (e.g. fisheries economics, fisheries biology). To this end, the program will stress modes of integrating and synthesising specialist approaches. It does not seek to make complete economists of social scientists, or complete biologists of engineers. But it intends to make economists, for instance, aware of the fact that there are legitimate biological constraints to ideal economic solutions, (and vice versa), and to permit economists and biologists to converse together, and with representatives of other disciplines, so that optimal solutions can be reached.

The program is aimed at students who already have a sound disciplinary training and are either presently working in some aspect of resource development, or are planning to do so.

There are other programs that endeavour to teach full courses of undergraduate studies leading to a first degree in resource management. These programs, we feel, contain the inherent danger of producing graduates with a mix of elements of many disciplines, but with little real expertise in any discipline. We feel strongly that interdisciplinary training depends first on achievement of at least one strong disciplinary background. Each member of a resource management team should be able to contribute a thorough knowledge of a relevant discipline, so that the contributions of that discipline are fully available to the team. Thus we have aimed this program at products of strong disciplinary training.

e. NAMES OF PERSONS TO BE INVOLVED IN THE PROGRAM

Faculty with ongoing involvement in the Core Program

B. R. Alspach	Mathematics
M. L. Barker	Geography
C. B. Crampton	Geography
A. Doerr	Political Science
N. Dyck	Sociology/Anthropology
J. L. Knetsch	Economics & Commerce
M. C. Roberts	Geography
A. L. Turnbull	Biological Sciences

Adjunct Faculty

R. C. Brooke	Biological Sciences
P. Copes	Economics and Commerce
E. J. Hickin	Geography
R. B. Horsfall	Geography
R. W. Mathewes	Biological Sciences
R. M. S.Sadleir	Biological Sciences

f. NAMES AND QUALIFICATIONS OF FACULTY PARTICIPATING IN THE PROGRAM

Brian R. Alspach
B.A. (Wash.), M.A., Ph.D. (Calif.)
Associate Professor
Research Interests: Combinatorics; graph theory; discrete optimization
Program Involvement: MRM 643 Mathematical Models in Resource Planning

Mary L. Barker
B.Sc. (London), M.A., Ph.D. (Tor.)
Assistant Professor
Research Interests: Resource Policy, Water resource management, Environmental psychology.
Program Involvement: MRM 601 Natural Resources Management Seminar I; MRM 646 Impact Assessment.

Colin B. Crampton
B.Sc., Ph.D. (Bristol)
Professor
Research Interests: Biophysical land evaluation; soil micromorphology; Arctic land-use.
Program Involvement: MRM 632 Terrain Evaluation

Audrey Doerr
B.A. (Sask.), M.A. (Carleton), Ph.D. (Carleton)
Associate Professor
Research Interests: Public policy processes
Program Involvement: MRM 644 Public Policy Analysis

f. Noel Dyck
B.A., M.A. (Sask.), Ph.D. (Manchester)
Assistant Professor
Research Interests: Social Organization, Contemporary Canadian Indians
Program Involvement: MRM 645 Resource Development and Communities

Jack L. Knetsch
B.S., M.S. (Mich. State), M.P.A., Ph.D. (Harvard)
Professor
Research Interests: Economics of natural resources, Resources Policy
Program Involvement: MRM 601 Natural Resources Management Seminar I; MRM 621 Economics of Natural Resources

Michael C. Roberts
B.Sc. (London), M.A. (Tor.), Ph.D. (Iowa)
Associate Professor
Research Interests: Hydrology of drainage basins, Fluvial geomorphology.
Program Involvement: MRM 631 Hydrology & Geomorphology of Drainage Basins.

Albert L. Turnbull
B.S.F., M.F. (U.B.C.), D. Phil (Oxon)
Professor
Research Interests: Population & community ecology; predation
Program Involvement: MRM 611 Resource Biology I
MRM 612 Resource Biology II

R.C. Brooke
B.S.F. (U.B.C.) M.F. (Yale), Ph.D. (U.B.C.)
Associate Professor
Research interests: plant ecology: vegetation-environment relationships, succession in forest, subalpine and alpine areas of B.C., forest and non-forest tundra regions.
Program involvement: adjunct faculty (MRM 611, MRM 612)

P. Copes
B.A., M.A. (U.B.C.), Ph.D. (London)
Professor
Research interests: fisheries economics
Program involvement: adjunct faculty

E.J. Hickin
B.A., Ph.D. (Sydney)
Associate Professor
Research interests: fluvial geomorphology; application of the principles of fluvial dynamics, sedimentology and hydrology to geomorphic problems.
Program involvement: adjunct faculty (MRM 631)

R.B. Horsfall
B.A. (Reed), M.A., Ph.D. (Johns Hopkins)
Assistant Professor
Research interests: environmental perception. Mental health in isolated communities. Advocate and co-operative planning.
Program involvement: adjunct faculty (MRM 646)

f. R. W. Mathewes
B.Sc. (SFU), Ph.D. (UBC)
Assistant Professor
Research interests: paleoecology, biogeography, plant systematics.
Program involvement: adjunct faculty (MRM 611, MRM 612)

R.M.S. Sadleir
B.Sc., Ph.D. (Western Australia)
Professor
Research interests: environmental assessments, wildlife resource studies, mammalian reproduction
Program involvement: adjunct faculty (MRM 611, MRM 612)

g. THE DEGREE RELEVANT TO THE PROGRAM

This will be a new professional degree: *Master of Natural Resource Management (MRM)*.

The program will be located in the Faculty of Interdisciplinary Studies.

h. THE DEGREE REQUIREMENTS

The basic program consists of 41 credit hours of which 4 hours are for workshop/seminar credit; 33 hours are for course credit and 4 hours are for research projects/practicum credit.

A sample program is included to indicate the course structure for one student. This sequence of courses will vary somewhat depending upon the student's background.

Sample Program

It should be possible for students with varied backgrounds and preparation in individual disciplines to satisfy the core requirements in each field and to fulfill the other degree requirements in the scheduled four semesters of full-time effort. An indication of how this might be accomplished by different individuals, and of the proposed sequencing of courses can be obtained by examination of sample programs.

Sample Program - no background in Biology, Economics or Geography.

An individual with no particular course or other preparation in any of the core areas will need to pursue the most structured program in order to meet the degree requirements. For some students it might be necessary for them to take Econ. 200 and Geog. 111 in the semester preceding enrolling in the MRM. While this will leave little flexibility, all of the areas can be covered within the prescribed time period.

FIRST YEAR

Fall

MRM 601-2 (Seminar I)

MRM 611-3 (Resources Biology I)

MRM 621-3 (Economics of Natural Resources)

MRM 631-3 (Hydrology & Geomorphology of Drainage Basins)

Spring

MRM 612-3 (Resources Biology II)

MRM 632-3 (Terrain Evaluation)

MRM 641-3 (Law and Resources)

MRM 643-3 (Mathematical Models in Resource Planning)

SECOND YEAR

MRM 642-3 (Regional Resource Planning)

MRM 644-3 (Public Policy Analysis)

MRM 645-3 (Resource Development and Communities)

MRM 646-3 (Impact Assessment)

MRM 602-3 (Seminar II)

MRM 699-4 (Research Project)

Sample Program - Economics, Biology or Geography Background

Individuals with backgrounds and/or previous course preparation in one of the core areas will be able to choose optional courses in the first two semesters. For example, in the case of economists, Econ. 200 and possibly MRM 621 (Economics of Natural Resources) would not be required and other courses in economics - e.g. fisheries economics, regional economics - might be substituted or alternatively courses from other fields could be included.

Students with previous experience in the other core disciplines would make analogous substitutions. The MRM courses would, however, be required of all participants in the program.

i. PROPOSED COURSES REQUIRED BY THE PROGRAM.

New courses

MRM 601	Natural Resources Management Seminar I
MRM 602	" " " "
MRM 611	Resources Biology I
MRM 612	" "
MRM 641	Law and Resources
MRM 642	Regional Resource Planning
MRM 643	Mathematical Models and Resource Planning
MRM 645	Resource Development and Communities
MRM 646	Environmental and Social Impact Assessment
MRM 699	Research Project

Courses built upon existing offerings

MRM 621 Economics of Natural Resources
MRM 631 Hydrology and Geomorphology of Drainage Basins
MRM 632 Terrain Evaluation
MRM 644 Public Policy Analysis

Course outlines attached (see Appendix A).

j. LABORATORY AND RESEARCH EQUIPMENT NEEDS

A combined seminar-open laboratory space is required. Research and teaching equipment needs are modest and have been costed in the budget(c).

Space requirements for the program are listed in item n.

k. SOURCES OF POTENTIAL SUPPORT FOR GRADUATE STUDENTS.

i. Sponsoring agencies. The survey carried out by Professors Barker and Knetsch in the Summer of 1976 indicated that a number of students (approximately 6-8 per year) would be supported by their employers, including both private firms and government agencies.

ii. Some of the students will be taking courses in the MRM program on a part-time basis and will not need support. It will be possible for some students to take one course per semester by taking time off from their regular employment.

iii. Fellowships. Once the program is underway approaches should be made to the major resource companies (MacMillan-Bloedel, Kaiser, Weldwood, etc.) for sponsored fellowships. The Federal Fisheries and Marine Service has raised the issue of offering a limited number of internships to students enrolled in the program.

iv. Personal Support. Some students will enter the program with their own sources of support.

v. It is quite likely that some of the students in this program could hold teaching assistantships in associated departments. This would be an ad hoc arrangement but could, conceivably, support two people per year.

vi. Canada Council and the N.R.C. will be approached for student support. If this is forthcoming it will probably be for a limited period.

1. A STATEMENT SIGNED BY THE UNIVERSITY LIBRARIAN SHOWING PRESENT LIBRARY RESOURCES AND FUTURE NEEDS IF THE PROGRAM IS IMPLEMENTED.

Included here:

i. Memo from L. Thomas, Library; and

ii. Copy of the letter to Dean Wheatley from M.C. Roberts (May 6, 1977) giving the Committee's response to his memo. (See Appendix B)

m. AN ESTIMATE OF ENROLLMENT

a) 12 - 15 in the first year.

b) 24 - 30 in the second year.

A large number of inquiries about the program have been received and this is a clear indication of considerable demand for the program. For the program to be successful only well qualified applicants will be accepted; as reflected in the enrollment estimates above.

n. SPACE REQUIREMENTS FOR THE PROGRAM

The ideal combination of space requirements is:

Director's Office	40 m^2
Secretary	25
Seminar/teaching laboratory	120
Research laboratory	80
Graduate student office space	100
Faculty offices (2)	50
Total space required	415 m^2

o. NAMES OF EXTERNAL ASSESSORS OF THE PROGRAM.

1. Dr. K. H. Hare
   Director
   Institute for Environmental Studies
   University of Toronto

2. Dr. W.R.D. Sewell
   Department of Geography
   University of Victoria

o. 3. Dr. P.E. Nickel, Director
Natural Resource Institute
University of Manitoba

4. Dr. D.A. Jameson, Assoc. Dean
College of Forestry and Natural Resources
Colorado State University

p. DURATION OF THE PROGRAM

The program should be reviewed after six years which will allow five cycles of students to have entered and graduated from the program.

q. CALENDAR DESCRIPTION

MASTER OF NATURAL RESOURCE MANAGEMENT PROGRAM

This is a professionally oriented, two year (four semesters) degree program designed for individuals with experience in public agencies or private organizations dealing with resources, and for recent graduates in various disciplines related to natural resources management.

The intent is to offer individuals with primary backgrounds in separate disciplines such as geography, biology, economics, engineering, forestry or planning, an opportunity to take an integrated sequence of courses from complementary subject matter fields so as to develop an increased familiarity and competence in the strategies, approaches and techniques of natural resource management.

The successful completion of the program will lead to the degree of Master of Natural Resource Management (M.R.M.).

ADMISSION

For admission requirements, refer to General Regulations section.

Individual students will vary in their preparation for the various fields involved in the degree program and, therefore, admission to the program might be conditional on the completion of certain undergraduate courses.

DEGREE REQUIREMENTS

The basic program consists of 41 credit hours of which 6 hours can be transfer credit. A further six hours of core courses can be replaced by other courses if the student has had the core courses elsewhere. That is, a student can transfer 12 hours of which six can reduce his total credit load to 35.

The required courses are as follows:

MRM 601-2 Natural Resources Management Seminar I

MRM 602-2 Natural Resources Management Seminar II

MRM 611-3 Resources Biology I

MRM 612-3 Resources Biology II

MRM 621-3 Economics of Natural Resources

MRM 631-3 Hydrology & Geomorphology of Drainage Basins

MRM 632-3 Terrain Evaluation

MRM 641-3 Law and Resources

MRM 642-3 Regional Resource Planning

MRM 643-3 Mathematical Models in Resource Planning

MRM 644-3 Public Policy Analysis

MRM 645-3 Resource Development and Communities

MRM 646-3 Environmental and Social Impact Assessment

MRM 699-4 Research Project

Appendix A

New Course Proposals

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Interdisciplinary Studies **Course Number:** MRM 601

Title: Natural Resources Management Seminar I

Description: The study of disciplinary and interdisciplinary approaches to natural resources planning, with an emphasis upon critically evaluating models and criteria of assessment.

Credit Hours: 2 **Vector:** 0-2-0 **Prerequisite(s) if any:** None

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 78-3

How often will the course be offered: Once a year

JUSTIFICATION:

During the first semester, individual students will be taking courses in a variety of complementary subjects. This seminar will bring all students together with a focus on integrating approaches to natural resources management.

RESOURCES:

Which Faculty member will normally teach the course: Directors & other faculty in program

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

COURSE OUTLINE

MRM 601 Natural Resources Management Seminar I

This seminar will be the first of two required of all participants in the Natural Resources Management program, and will be taken in the first semester of enrollment. The emphasis will be on the understanding and appreciation of the contributions and limitations of various disciplinary approaches to natural resources management and policy choices. Different goals and objectives of resources management will be examined as they are viewed by different interests and clientele groups. Attention will be directed towards study of the planning process and case studies will be examined with attention paid to integrating disciplinary and professional perspectives.

A series of resource management problems in particular instances will be used to examine the main issues. Among these will be a proposal to increase employment and economic development by altering valued coastal resources; a development of engineering works that will degrade environmental resources; and alternative timber policies. Emphasis will be on the identification of values and interests, and on what analyses and information can usefully be applied in the resolution of conflicts, and in choice of policies and plans. A wide view of social, legal and economic consequences of alternatives will be encouraged.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Interdisciplinary Studies **Course Number:** MRM 602

Title: Natural Resources Management Seminar II

Description: Advanced discussion of research and planning methodologies, with review and evaluation of student research in progress.

Credit Hours: 2 **Vector:** 0-2-0 **Prerequisite(s) if any:** all other course requirements completed.

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 80-1

How often will the course be offered: Once a year

JUSTIFICATION:

This is the second of two required seminars for participants in in the MRM programme. The seminar will be used primarily for advanced discussion of methodologies, and for the presentation and critique of student research projects (MRM 699).

RESOURCES:

Which Faculty member will normally teach the course: Director & other faculty in program

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competance of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

COURSE OUTLINE

MRM 602 Natural Resources Management Seminar II

This seminar will focus upon the assessment of research and planning methodologies, with the reporting and critique of student research projects forming an important component. A student research project (MRM 699) is a requirement for the MRM degree.

An emphasis of the seminar will be on the improved information for resources management and the extent to which different types of study and analysis can provide useful data. The timeliness, cost-effectiveness and nature of reporting the results of such efforts will also be examined.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: INTER-DISCIPLINARY STUDIES **Course Number:** MRM 611

Title: RESOURCES BIOLOGY I

Description: A review of population, community and ecosystem ecology. Planning, conducting and reporting of ecological surveys.

Credit Hours: 3 **Vector:** 3-1-0 **Prerequisite(s) if any:** 0

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 78-3

How often will the course be offered: Once per year

JUSTIFICATION:

This course is primarily for students with little or no experience in biological ecology or students who have neglected this subject for some years. It introduces them to modern ecological concepts and methods, and discusses objectives and methods of surveying biological aspects of environments.

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment

What are the budgetary implications of mounting the course:

One T.A. Mimeographic and A.V. services

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competance of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

MRM 611-3. RESOURCE BIOLOGY I

SECTION I - Biological Ecology - 12 hours

An intensive review of general ecological concepts with emphasis on populations, communities, and ecosystems.

A. Historical review: - ecology's beginnings, development, and present state; evolution of aims and scope of ecology

B. Autecology and Synecology: - individual and group relationships to environment

C. Populations: - population definition; Mendelian and population genetics; selection and adaptation; variation within and between populations

D. Population structure: - age distributions; age specific birth and death rates; life-tables; stable age distribution and growth rates

E. Population growth and regulation: - finite and innate rates of increase; population fluctuations; carrying capacity

F. Communities: - community structures; regulation; food, predation, competition, social interactions; density dependency

G. Ecosystems: - physical and biotic interactions; resource cycles; soil, water, nutrients, climate; trophic levels energy fixation; energy flows; succession, maturity, biomass relationships, productivity, standing crop.

H. Exploitation of ecosystems: - diversity and stability concepts; impoverishment.

I. Evolutionary considerations: - population and community evolution, heterogeneity and selection, niche; niche overlaps, niche breadth, survival strategies, r and t strategies, time minimizers and energy maximizers, optimization, some reservations

SECTION II - Ecological Surveys - 24 hours

A. Objectives and terms of reference: - scope and constraints of survey, optimal use, conservation, specific resource (game, fish, timber, restoration of degraded environments, water, recreation, minerals, etc., alternate uses, perturbations - natural or man made, predictions

SECTION II -

B. Pilot Survey (quick and dirty)

i what is there now
prior information: maps, photos, local experience, literature, previous surveys (timber cruises, mineral prospecting, game records)
observation: transects, quadrates, visual observation, counts, indirect evidence (feces, tracks, burrows, signs of feeding, bird calls, etc.)

ii what is known about what is there now
literature, local experience, etc.

iii assessment of pilot
rank inputs (or components)
identification of key systems, species or species associations

C. Main detailed survey

i establish priorities relative to time and budget

ii establish sampling systems
estimate variance
set precision and accuracy
design sampling method

iii administration of procedures
personnel, time, training
data recording systems

iv analysis and interpretation of data

v assessments, predictions, conclusions, recommendations

D. Survey report: - organization, brevity, coherence, simplicity, state conclusions clearly and emphatically.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: INTER-DISCIPLINARY STUDIES **Course Number:** MRM 612

Title: Resource Biology II

Description: Concepts of biological resources and resource management models. Examines some of the "classic" cases of mismanagement.

Credit Hours: 3 **Vector:** 3-1-0 **Prerequisite(s) if any:** MRM 611 or equivalent

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 79-1

How often will the course be offered: Once per year

JUSTIFICATION:

Many models for the management of fish, game, forest, and recreational site have been developed and are used. This course presents the principles that have been developed for successful models, and discusses the failings of unsuccessful models.

RESOURCES:

Which Faculty member will normally teach the course: New faculty appointment

What are the budgetary implications of mounting the course:

One T.A. Mimeographic and A.V. services. Funds for travel for 2 - 3 class field trips. Stipends for 3 - 4 guest lecturers.

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

MRM 612-3. RESOURCE BIOLOGY II

SECTION I - Present resource management models and assessments of their biological success.

A. General concepts

renewable resources
standing crop
productivity
biomass energy relationships
yields - underutilization
overutilization
optimal yield

B. Some resource management models

e.g. fisheries, game, forestry, recreation
short and long term evaluations
conflicts

C. Alternative management strategies and predictions of biological significance

D. "Catastrophic" alteration of environment, e.g. flooding, strip-mining, "dust-bowl", fire (use and misuse), introductions of exotic species

E. Technologies of "repair" of degraded environments

F. Evaluations of short-vs. long-term pressures of biological resources

G. Case studies - a critique of resource judgements and management, e.g. Peace-Athabascas.
Lake Erie
Nile River Basin
Tennessee coal
Ground-nut scheme
Ord River irrigation scheme
Whaling and sealing
East coast salmon
etc.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION: **MRM Programme**

Dept./Prog.: **Interdisciplinary Studies** Course Number: **MRM 621**

Title: **Economics of Natural Resources**

Description: **Application of economic theory to natural resources management problems, with a view to assessing existing and alternative policies. Topics include benefit-cost analysis, economics of preservation, pricing of natural resource services, alternative pollution control strategies and fisheries management.**

Credit Hours: **3** Vector: **3-0-0** Prerequisite(s) if any: **Econ. 200**

in cases of no previous background in Economics

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: **12-30** When will the course first be offered: **78-3**

How often will the course be offered: **Once a year**

JUSTIFICATION:

This course satisfies the minimum economics content for this core area of the MRM programme. The course will comprise the presently offered ECON. 362-4 with added requirements on term-paper, carrying graduate credit.

RESOURCES:

Which Faculty member will normally teach the course: **J.L. Knetsch**

What are the budgetary implications of mounting the course:

None, unless enrollment requires an additional section

Are there sufficient Library resources (append details): **Yes**

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

Course Outline

MRM 621 - Economics of Natural Resources

The course is primarily one of applied economics dealing with topics of natural resources and environmental quality. This involves the application of economic theory to natural resource management problems with a view of assessing existing and alternative resource management policies.

Case examples will be used extensively to illustrate problems, methods of analyses, and planning and policy implications.

Topics include the following:

I. Introduction and Historical

II. Welfare Economics

- Competitive market allocations
- Market failures and public interventions

III. Benefit-Cost Analysis

- Welfare Measures
- Benefit-Cost Criteria
- Benefit Estimation
- Multiple Objectives and Regional Development
- Pecuniary and Technological Externalities
- Discounting

IV. Demand Projections

V. Resource Rents

- Accrual
- Measurement
- Policy Implications

VI. Resource Preservation

VII. Environmental Impact Assessment

VIII. Pollution Control

Causes

Alternative Control Strategies

IX. Property Rights

Pollution Control Measures and Cost Responsibility

Expropriation

Compensation and Taking Issues

X. Pricing of Natural Resources Services

XI. Taxation

XII. Common Property

Fisheries

Other

XIII. Resources, Environment and Growth

Text and Readings:

J.V. Krutilla and A.C. Fisher, Economics of Natural Environments.

R. Dorfman and N.S. Dorfman, Economics of the Environment.

E.J. Mishan, Cost-Benefit Analysis, 1975 edition (Recommended).

In addition there will be a fairly extensive set of readings.

Exams, Essays, Exercises:

There will be a final exam and a midterm. A term essay will be required dealing with the application of economics. In addition there will be a series of exercises or problems.

SIMON FRASER UNIVERSITY

Graduate Course Proposal Form

CALENDAR INFORMATION: **MRM PROGRAMME**

Department: Interdisciplinary Studies Course Number: MRM-631

Title: The Hydrology and Geomorphology of Drainage Basins

Description: The morphology and evolution of drainage basins; analysis of surface and subsurface flow in the drainage basin; stream-hillslope erosion and sedimentation.

Credit Hours: 3 Vector: 2-0-2 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 When will the course first be offered: 78-3

How often will the course be offered: Once a year.

JUSTIFICATION:

To provide practical and theoretical knowledge of drainage basins which are fundamental divisions of the landscape used extensively in resource management planning.

RESOURCES:

Which Faculty member will normally teach the course: M.C. Roberts or E.J. Hickin

What are the budgetary implications of mounting the course: Half-time T.A.

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

Course Outline

THE HYDROLOGY AND GEOMORPHOLOGY OF DRAINAGE BASINS

This course is designed to provide empirical and conceptual knowledge of one of the most important elements of the physical landscape - the drainage basin. The lectures will be complemented by field trips, laboratory work and independent work on two instrumental drainage basins in Surrey.

Weekly Lecture Themes		Laboratory Sessions
1.	Review of the Hydrological Cycle and Classical Fluvial Geomorphology.	The definition of drainage basins on topographic maps and drainage nets.
2.	Continuation of the above.	Identification of floodplains and floodplain features.
3.	Measurement and Analysis of Surface Water Flow in a Drainage Basin.	Calculation of discharge using a current meter.
4.	Continuation of the above with emphasis on Flood Flows	Analysis of Flood Flows.
5.	Subsurface Flow.	Field trip.
6.	The Morphometric Analysis of Drainage Basins.	Morphometric Analysis of Selected Drainage Basins.
7.	Hydraulics of Streams.	Flume.
8.	Deposition and Sedimentation in a River Basin.	Air photo interpretation of floodplains and associated deposits.
9.	Erosional Processes - Stream channel.	Surrey Projects.
10.	Erosional Processes - Drainage basin slopes.	Surrey Project.
11.	Drainage Basin Chronology.	Surrey Project.
12.	Land Use and Drainage Basins.	Field trip.

Grading

This will be based on the following schedule:

Laboratory work & field reports	15%
Mid-term Examination	30%
Final Examination	40%
Short term paper	15%

Textbooks

The required text is:

K.J. Gregory & D.E. Walling, Drainage Basin, Form and Process, J. Wiley & Sons (Halsted Press), 1973.

READING LIST

Classical Fluvial Geomorphology

1. W.D. Thornbury, 1954, Principles of Geomorphology, Wiley: Chapters 5, 6, 7 and 8.

2. G.H. Dury (ed.), 1970, Rivers and River Terraces, MacMillan: Chapters 1 and 2.

3. L.B. Leopold, 1962, Rivers: Amer. Scientist, Vol. 50, No. 4, pp. 511-537.

4. W.M. Davis, 1954, Geographical Essays, Dover: Chapter 8.

5. L.B. Leopold, G.B. Wolman & J.P. Miller, 1964, Fluvial Processes in Geomorphology, Freeman: Chapter 11.

Hydrological Cycle - General Concepts

1. R.C. Ward, 1967, Principles of Hydrology, McGraw-Hill: Chapter 1.

2. M.E. Morisawa, 1968, Streams: their dynamics and morphology, McGraw-Hill: Chapters 1 and 2.

3. D.M. Gray (ed.), 1970, Handbook on the Principles of Hydrology, Nat. Res. Coun. (Canada), Section 1.

Subsurface Flow

1. J.D. Hewlett & A.R. Hibbert, 1963, Moisture and energy conditions withing a sloping soil mass during drainage, J. Geophys. Res., Vol. 68, No. 4, pp. 1081-1087.

2. R.Z. Whipkey, 1965, Subsurface stormflow from forested slopes, Bull. Int. Assoc. Sci. Hydro., Vol. 10, pp. 74-85.

3. M.J. Kirkby & R.J. Chorley, 1967, Throughflow, overland flow and erosion, Bull. Int. Assoc. Sci. Hydro., Vol. 12, pp. 5-21.

4. J.D. Hewlett & A.R. Hibbert, 1967, Factors affecting the response of small watersheds to precipitation in humid areas. In Sopper, W.E. and H.W. Lull (eds.), International Symposium on Forest Hydrology: Pergamon Press.

5. M.A. Carson & E.A. Sutton, 1971, The hydrologic response of the Eaton River Basin, Quebec, Can. J. Earth Sci., Vol. 8, pp. 102-115.

6. T. Dunne & R.D. Black, 1970, An experimental investigation of runoff production in permeable soils, Water Resources Res., Vol. 6, pp. 478-490.

7. T. Dunne & R.D. Black, 1970, Partial area contributions to storm runoff in a small New England watershed, Water Resources Res., Vol. 6, pp. 1296-1311.

8. D.R. Weyman, 1970, Throughflow on slopes and its relation to the stream hydrograph, Bull. Int. Assoc. Sci. Hydro., Vol. 15, pp. 25-33.

Morphometric Analysis of Drainage Basins

1. A.N. Strahler, 1975, Quantitative analysis of watershed geomorphology, Trans. Am. Geophys. Union, Vol. 38, pp. 913-920.

2. R.E. Horton, 1945, Erosional development of streams and their drainage basins: hydrophysical approach to quantitative morphology, Bull. Geol. Soc. Amer., Vol. 56, pp. 275-370.

3. S.A. Schumm, 1956, Evolution of drainage systems and slopes in badlands at Perth Amboy, N.J., Bull. Geol. Soc. Amer., Vol. 67, pp. 597-646.

4. M.E. Movisawa, 1962, Quantitative geomorphology of some watersheds in the Appalachian Plateau, Bull. Geol. Soc. Amer., Vol. 73, pp. 1025-1046.

5. A.N. Strahler, 1964, Quantitative geomorphology of drainage basins and channel networks. In V.T. Chow (ed.), Handbook of Applied Hydrology, Section 4, pp. 39-76.

Land Use and Drainage Basins

1. H.C. Pereira, 1973, Land Use and Water Resources in Temperate and Tropical Climates: Cambridge Univ. Press.

2. A.R. Hibbert, 1969, Water yield changes after converting a forested catchment to grass, Water Resources Res., Vol. 5, pp. 634-640.

3. W.E. Sopper & H.W. Lull (eds.), 1967, International Symposium on Forest Hydrology, Pergamon Press. (pp. 527-543.)

4. W.J. Schneider & G.R. Ayer, 1961, Effect of reforestation on streamflow in Central New York, U.S.G.S., Water-Supply Paper 1602.

5. A.R. Hibbert, 1971, Increases in streamflow after converting Chaparral to grass, Water Resources Res., Vol. 7, No. 1, pp. 71-80.

6. K.J. Gregory, 1974, Streamflow and building activity. In K.J. Gregory and D.E. Walling, Fluvial Processes in Instrumented Watersheds, Special Pub., No. 6, Inst. Brit. Geog.

7. M.C. Roberts, 1972, Watersheds in the rural-urban fringe, Nat. Symposium on Watersheds in Transition, A.W.R.A., Ft. Collins, Colo.

Drainage Basin Chronology

1. W.M. Davis, 1954, Geographical Essays, Dover: Chapter 8.

2. R.V. Ruhe & J.G. Cady, 1967, Landscape evolution and soil formation in southwestern Iowa, Tech. Bull. 1349, U.S.D.A., Soil Conservation Service.

3. R.B. Daniels & R.M. Jordan, 1966, Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa, Tec. Bull. 1348, U.S.D.A., Soil Conservation Service.

4. J.T. Hack, 1960, Interpretation of erosional topography in humid temperate regions, Amer. J. Sc., Vol. 258A, pp. 80-97.

5. J.T. Hack & J.C. Goodlett, 1960, Geomorphology and forest ecology of a mountain region in the Central Appalachians, U.S.G.S., Prof. Paper 347.

6. M.E. Morisawa, 1964, Development of drainage systems on an upraised lake floor, Amer. J. Sci., Vol. 262, pp. 340-354.

7. S.A. Schumm, 1965, Quaternary Paleohydrology. In H.E. Wright & D.G. Frey (eds.), The Quaternary of the United States, Princeton Univ. Press.

Erosional and Depositional Processes - Stream Channels

1. A. Sundborg, 1956, The river Klavälven, a study of fluvial processes, Geog. Annaler, Vol. 38, pp. 127-316.

2. L.B. Leopold & T. Maddock, 1953, The hydraulic geometry of stream channels and some physiographic implications, U.S.G.S., Prof. Paper 252.

3. L.B. Leopold & J.P. Miller, 1956, Ephemeral streams - hydraulic factors and their relation to the drainage net, U.S.G.S., Prof. Paper 282A.

4. L.B. Leopold & M.G. Wolman, 1957, River channel patterns - braided, meandering, and straight, U.S.G.S., Prof. Paper 282B.

5. J.R.L. Allen, 1970, Physical Processes of Sedimentation, Amer. Elsevier.

6. J.R.L. Allen, 1965, A review of the origin and characteristics of recent alluvial sediments, Sedimentology, Vol. 5, No. 2, pp. 89-191.

Erosional and Depositional Processes - Drainage Basin Slopes

1. M.A. Carson & M.J. Kirkby, 1972, Hillslope, Form and Process, Cambridge Univ. Press: Chapter 16.

2. R.F. Hadley & G.C. Lusby, 1967, Runoff and hillslope erosion resulting from a high-intensity thunderstorm near Mack, western Colorado, Water Resources Res., Vol. 3, pp. 139-146.

3. L.B. Leopold, W.W. Emmett & R.W. Myrick, 1966, Channel and hillslope processes in a semi-arid area, New Mexico, U.S.G.S., Prof. Paper 352G.

Surface Flow - Measurement and Analysis

1. M.C. Roberts & P.C. Klingeman, 1970, The influence of landform and precipitation parameters on flood hydrographs, J. Hydrol., Vol. 11, pp. 393-411.

2. M. Church & R. Kellerhals, 1970, Stream gauging techniques for remote areas using portable equipment, Tech. Bull. 25, Inland Waters Branch, Dept. of Energy, Mines and Resources.

3. S.T. Wong, 1963, A multivariate statistical model for predicting mean annual flood in New England, Annals Assoc. Amer. Geog., Vol. 53, pp. 298-311.

4. U.S. Depart. of Interior, 1967, Water Measurement Manual, Bureau of Reclamation, U.S.D.I.

5. Techniques of Water-Resources Investigations of the United States Geological Survey. Various dates.

Research Watersheds

1. R.C. Ward, 1971, Small watershed experiments: an appraisal of concepts and research developments, Univ. of Hull, Occasional Papers in Geography 18.

2. U.S. Dept. of Agriculture, 1964, Stream-gauging stations for research on small watersheds, U.S.D.A., Forest Service, Agricultural Handbook 268.

3. W.C. Ackermann, 1966, Guidelines for Research on Hydrology of Small Watersheds, U.S.D.I., Office of Water Resources Res.

4. Can. National Comm. for Int. Hydrol. Decade, 1966, Guidelines for Research Basin Studies, Nat. Workshop Seminar Proceedings.

5. Colorado State University, 1967, Research Data Assembly for Small Watershed Floods Part II, General Series 856, C.S.U., Expt. Station.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION: **MRM Programme**

Department: **Interdisciplinary Studies** Course Number: **MRM - 632**

Title: **Terrain Evaluation**

Description: **The extensive classification of a landscape based on geology, geomorphology, soils, vegetation, historic and current land-use, and the assessment of qualitative values as an aid to multiple land-use management.**

Credit Hours: **3** Vector: **2-0-2** Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: **12-30** When will the course first be offered: **79-1**

How often will the course be offered:

JUSTIFICATION:

This course pulls together such themes as soils, geomorphology, climate, etc. in an integrated framework for evaluation of the landscape.

RESOURCES:

Which Faculty member will normally teach the course: **C.B. Crampton, M.C. Roberts**

What are the budgetary implications of mounting the course: **$200.00 for field trips.**

Are there sufficient Library resources (append details): **Yes**

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

TERRAIN EVALUATION

Description

Extensive land classification and evaluation requires the development of the ability to understand the landscape from many specialist viewpoints; geology, glaciology, soils, vegetation, past and present land-use. The aim is to develop, as far as it is possible, a "genetic" classification combining in the most useful way aspects of all of these special approaches, and then to interpret this classification in terms of a selected objective, such as recreation, conservation (of any of a number of factors), or optimum land-use. The U.B.C. Forest Research Area will be used as the study-area for field work, and for comparison, examples of terrain evaluation in Australia, Canada and Europe will be examined. Terrain evaluation is the first step towards resource management in an area.

TEXT. Mitchell, C.W. 1973. Terrain Evaluation. Longman, London (U.K.).

OUTLINE

(To run concurrently)

Terrain evaluation technique:	Mitchell, 1973.
Examples of terrain evaluation:	CSIRO Land Research Series reports. Crampton, 1973. Hills, 1961.
Assessment of values relating to the landscape:	Krutilla, 1972. Coomber & Biswas, 1973. Stewart, 1968.

Terrain evaluation of U.B.C. Forest Research Area:

GRADING - End of semester report - 100%. However, the fieldwork, its interpretation and the "writing-up" will proceed throughout the course.

A complete air-photo coverage of the U.B.C. Forest Research Area is available for interpretation. In addition, surveys of the geology, soils, vegetation and microclimate of Burnaby Mountain and Belcarra Park are available as a local example.

MRM-632

Material on Reserve

C.S.I.R.O., 1963. General Report on the Lands of the Hunter Valley. Land Research Series No. 8. And all other Land Research Series Reports. Melbourne, Australia.

Crampton, C.B. 1973. Landscape survey in the Upper and Central Mackenzie Valley. Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 73-8. (I have additional copies).

Coomber, N.H. and Biswas, A.K. 1973. Evaluation of Environmental Intagibles. General Press, New York.

Hills, G.A. 1961. The ecological basis for land use planning. Res. Rep. No. 46, Ontario Dept. Lands and Forests, Research Branch.

Krutilla, J.V. ed. 1972. Natural Environments. John Hopkins University Press, Baltimore and London.

Mitchell, C. 1973. Terrain Evaluation. Longman, London.

Stewart, G.A. ed. 1968. Land Evaluation. Macmillan of Australia.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION: MRM Programme

Department: Interdisciplinary Studies **Course Number:** MRM-641

Title: Law and Resources

Description: Advanced study of legal interventions related to resource planning and environmental control. Topics considered, include planning law, administrative law, law of pollution control, legal aspects of land management, property rights, problems of managing common pool resources, and resource taxation.

Credit Hours: 3 **Vector:** _____ **Prerequisite(s) if any:** _____

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 79-1

How often will the course be offered: Once a year

JUSTIFICATION:

Students in the MRM programme must be exposed to existing and alternative legal frameworks relevant to natural resources management.

RESOURCES:

Which Faculty member will normally teach the course: New faculty sessional lecturer requirement

What are the budgetary implications of mounting the course: _____

Are there sufficient Library resources (append details): _____

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: **Departmental Graduate Studies Committee:** _____ **Date:** _____

Faculty Graduate Studies Committee: _____ **Date:** _____

Faculty: _____ **Date:** _____

Senate Graduate Studies Committee: _____ **Date:** _____

Senate: _____ **Date:** _____

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: INTER-DISCIPLINARY STUDIES Course Number: MRM 642

Title: Regional Resources Planning

Description: Theory and techniques of regional analysis and planning models and their application to key resource sectors.

Credit Hours: 3 Vector: 3-0-0 Prerequisite(s) if any:

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 When will the course first be offered: 79-3

How often will the course be offered:

JUSTIFICATION:

This course will examine the implications of the spatially fixed nature of most resource management allocation problems, and means for dealing with them.

RESOURCES:

Which Faculty member will normally teach the course: Future appointment

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

COURSE OUTLINE

MRM 642 REGIONAL RESOURCES PLANNING

Theory and techniques of regional analysis and planning models, and their application in the fields of land use, water allocation, mineral and forestry development, and environmental protection. A major emphasis is placed upon the examination of the economic structure of regions, location and spatial links, and the interrelationships between economic sectors within regions. Attention will be paid to anticipated changes in response to changes in the use or development of natural resources.

Problems and issues to be examined include:

(1) problems of resource towns;

(2) environmental conflict;

(3) taxation and constraints on resource use;

(4) relationship of regional development to transportation links;

(5) incidence of gains and losses associated with resource development proposals.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: INTER-DISCIPLINARY STUDIES **Course Number:** MRM 643

Title: Mathematical Models in Resource Planning.

Description: The application of mathematical models to natural resource allocation and management with emphasis upon linear programing networks and graphs and statistical applications.

Credit Hours: 3 **Vector:** 3-0-0 **Prerequisite(s) if any:** Math. 101

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: _____ **When will the course first be offered:** 79-1

How often will the course be offered: Once per year

JUSTIFICATION:

Modern resource management often requires the ability to carry out analysis of complex resource environments for which mathematical solutions play an important role.

RESOURCES:

Which Faculty member will normally teach the course: B. Alspach

What are the budgetary implications of mounting the course: _____

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

Mathematical Models in Resource Planning

I. Linear programming
   1. Review on solving simultaneous linear equations
   2. Graphing inequalities
   3. The simplex algorithm
   4. Examples of linear programming in the forest industry
   5. Examples of linear programming in resource allocation

II. Networks and graphs
   1. Graphs, directed graphs, and networks
   2. Food webs
   3. Pulse processes and ecological systems
   4. Examples of maximal flows in networks

III. Statistics

There will be no prescribed text for the course. Section I. will be primarily handled through notes. The reference for linear programming will be the book by Simmons. The reference for section II will be "Discrete Mathematical Models with Applications to Social, Biological, and Environmental Problems" by Fred Roberts (1976). The details of section III will be worked out in the near future.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Interdisciplinary Studies **Course Number:** MRM 644

Title: Public Policy Analysis

Description: A theoretical analysis of alternative policy approaches to major issues facing society. A practical analysis of the structures and processes surrounding major contemporary policy issues and an examination of the nature and substance of those policy issues. Particular emphasis will be placed on resource management issues.

Credit Hours: 3 **Vector:** 2-1-0 **Prerequisite(s) if any:**

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 79-3

How often will the course be offered: Once a year

JUSTIFICATION:

MRM students will be exposed to the political and administrative environment within which public policy is formulated at the federal, provincial, and local levels of government in Canada. The existing course Pol. 451 deals with the theory and the processes and substance of policy making in these respects. MRM students will be required to complete graduate level projects and participate in special graduate tutorials on resource management questions in addition to Pol 451 requirements

RESOURCES:

Which Faculty member will normally teach the course: A.D.Doerr, other members, Department of Political Science

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details):

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

MRM 644 - COURSE OUTLINE

Course description

The purpose of this course is to provide students with an understanding of the theoretical basis of public policy making and a practical appreciation of the structures and processes by which policy issues are defined and public policy is made. Substantive policy issues will be explored with a view to understanding how the system really works and the results that can be obtained from it. Particular emphasis will be placed on resource management issues.

Required Reading

G.B. Doern and Peter Aucoin (eds.) The Structures of Policy-Making in Canada (Toronto: Macmillan, 1971).

G.B. Doern and V.S. Wilson (eds.) Issues in Canadian Public Policy (Toronto: Macmillan, 1974).

Requirements

Students should have prior knowledge of or experience with Canadian political institutions and federal-provincial relations. Readings and class participation will be strongly emphasized. Students will be required to complete class assignments, prepare and present a graduate level project in the area of resource management policy issues and participate in special graduate tutorials.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: INTER-DISCIPLINARY STUDIES **Course Number:** MRM 645

Title: Resource development and communities

Description: Examination of the impact of resource developments on communities in Canada. The course prevents an overview of the social organisation of resources-based communities and an analysis of the participatory process in decision-making in resource management.

Credit Hours: 3 **Vector:** 3-0-0 **Prerequisite(s) if any:** None

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-15 **When will the course first be offered:** 79-1

How often will the course be offered: Once per year

JUSTIFICATION:

This course is primarily for students with little or no formal experience in the field of community organisation and community impacts of resource development.

RESOURCES:

Which Faculty member will normally teach the course: N. Dyck, R.B. Horsfall

What are the budgetary implications of mounting the course:

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: Date:

Faculty Graduate Studies Committee: Date:

Faculty: Date:

Senate Graduate Studies Committee: Date:

Senate: Date:

RESOURCE DEVELOPMENT AND COMMUNITIES

Course Outline

Objectives

To examine the impact of resource developments on communities in Canada. The course will present an overview of the social organisation of resource-based communities and an analysis of the participatory process in decision-making in resource management.

Structure of the Course

1. The Social Organization of Resource-based Communities.
2. The Relationships between resource-based communities and the larger social, political and economic systems.
3. The impact of resource development on community organisation.
4. Models of the participatory process.
5. Nature of "public"; problems of representativeness.
6. Credibility of participatory efforts.
7. Case studies: to illustrate a variety of problems and methodologies.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Interdisciplinary Studies **Course Number:** MRM 646

Title: Environmental and Social Impact Assessment

Description: Evaluation and application of current methodologies for social, economic and environmental impact assessment.

Credit Hours: _____ **Vector:** 2-0-2 **Prerequisite(s) if any:** _____

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 79-3

How often will the course be offered: Once a year.

JUSTIFICATION:

This course is designed to provide training in a key area of resources management. Approaches covered in the course are applicable to the evaluation of resource projects.

RESOURCES:

Which Faculty member will normally teach the course: _____

What are the budgetary implications of mounting the course: _____

Are there sufficient Library resources (append details): _____

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved: Departmental Graduate Studies Committee: _____ Date: _____

Faculty Graduate Studies Committee: _____ Date: _____

Faculty: _____ Date: _____

Senate Graduate Studies Committee: _____ Date: _____

Senate: _____ Date: _____

COURSE OUTLINE

MRM 646 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The course focuses upon the evaluation and application of current methodologies for social, economic and environmental impact assessment. The nature of impacts considered include:

(1) biophysical (disturbance of physical and biological systems)

(2) economic (regional economic impact, distribution of benefits and costs)

(3) social (population displacements and relocations, demographic impacts provision of community services, and impacts upon community cohesion and life styles)

(4) cultural (impacts upon historic and archaeological heritage)

The course will address the following:

(1) an evaluation of current methodologies with an emphasis upon developing criteria and techniques of assessment;

(2) a critical examination of current methods and approaches used in preparing impact statements and the use that is made of them for planning purposes.

(3) the development of techniques for monitoring biophysical, economic and social change;

(4) a review of the legal framework for impact assessment, and the place of impact studies in the planning process;

(5) the application of specific methodologies and techniques to specific resource development problems in southwestern British Columbia.

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: Interdisciplinary Studies **Course Number:** MRM 699

Title: Research Project

Description: A research project dealing with a specific problem in resource administration or allocation, resulting in the preparation of a formal paper.

Credit Hours: _____ **Vector:** _____ **Prerequisite(s) if any:** all formal course requirements completed

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 12-30 **When will the course first be offered:** 80-1

How often will the course be offered: Once a year

JUSTIFICATION:

The research project is intended to develop the student's ability to conduct applied interdisciplinary research on a specific problem of resources management or allocation.

RESOURCES:

Which Faculty member will normally teach the course: Each project to be approved by the Director. Faculty supervision appropriate to topic selected.

What are the budgetary implications of mounting the course: _____

Are there sufficient Library resources (append details): Yes

Appended: a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved:

Departmental Graduate Studies Committee: _____ **Date:** _____

Faculty Graduate Studies Committee: _____ **Date:** _____

Faculty: _____ **Date:** _____

Senate Graduate Studies Committee: _____ **Date:** _____

Senate: _____ **Date:** _____

SIMON FRASER UNIVERSITY

MEMORANDUM

To: M. Roberts
Head, Geography Department

From: Larry Thomas
Collections Librarian

Subject: LIBRARY ABILITY TO SUPPORT THE RESOURCE MANAGEMENT PROGRAMME

Date: 19th April 1977

As this proposal is interdisciplinary -- involving economics, geography, biology, and mathematics -- it has been passed to the librarians responsible for the development of these collections to determine if current holdings are sufficient to provide the materials which would be required in the new programme.

They have reported unanimous agreement on our ability to support those courses which are similar to courses currently being offered, i.e. the biology, economics, and geography courses. (Specifically: 611, 612, 621, 631, and 632.)

Also, the math course (643), though new, would seem to present no difficulties for the Library.

The remaining courses in the programme do give rise to certain concerns which I would like to detail briefly.

1) 642, Regional Resource Planning, may require government documents which we do not have.

2) The literature on public administration (644) is large; though we have some materials there has been no concentrated collection building in this area to date.

3) 645, Public Participation, though drawing upon invited speakers, clearly touches upon the socio-political aspects of exploiting natural resources, and this too is a sizeable literature.

4) 641, Law and Resources, in addition to requiring, potentially a large body of materials, also brings us into an area where unit costs are higher than for many other fields. Publisher's Weekly (Feb. 14, 1977) reported that U.S. prices were $19.19 per volume for 1976, some $3 above the average for all disciplines. It is our impression that Canadian law materials have yet a higher average cost, and the UBC Law Library informs us that $50 for a new journal subscription is common. This too is a new collecting field for the SFU Library.

It seemed to us that the question of possibly relying on UBC, especially in the case of law materials, had to be looked at somewhat carefully. A discussion with one of the UBC law librarians provided the following points of information in regards to resources and environmental law:

1) The literature is very large.

2) As the journal subscriptions are expensive it would probably be necessary to rely on photocopied articles as an alternative to SFU building its own collection.

3) UBC is reviewing its services to people outside their university community and may be introducing significantly higher fees for photocopying, borrowers cards, and other services.

4) $5,000, a figure we suggested, would be adequate in their opinion to buy a basic monograph collection and some photocopying of articles.

5) As SFU students in criminology and economics are already making substantial use of their Law Library, they are inclined to discourage the presence of more SFU students in their stacks should the number in fact be about 15 to 20.

The above observations are offered in support of our opinion that approval of this new programme should entail a special grant for additional library resources, and that the date for implementing the courses should be set to allow sufficient time for the acquisition and processing of these materials.

At this stage and until the proposal itself has been given more definition it is difficult to quantify costs. The observation that $5,000 would be barely adequate for the course on Law and Resources suggests that this figure would be less than an absolute minimum as materials would be needed for some of the other courses too.

Larry Thomas

LET : dcr
c.c.: D. A. Baird
T. C. Dobb

SIMON FRASER UNIVERSITY, BURNABY, B.C., CANADA V5A 1S6
DEPARTMENT OF GEOGRAPHY; 291-3111

May 6, 1977

Dr. J. Wheatley
Dean of Graduate Studies
Simon Fraser University
Burnaby, B.C.
V5A 1S6

Dear Jon:

I am enclosing a copy of the proposal for a Master's degree programme in the Management of Natural Resources.

You mentioned in your letter to me, after reading an early draft of this proposal, that there was no specific course on research methods. That is so. However, research methods will enter the programme in several courses (MRM 621, MRM 631, MRM 632, MRM 642, MRM 643 and MRM 645) as well as being explicitly dealt with in the third workshop (MRM 603).

Larry Thomas gave a detailed response (see Section 1) to the question concerning availability of library resources for the programme. The figure quoted of $5,000 is regarded as a reasonable figure for the library purchases during the first two years of the programme. However, after checking with Drs. Barker and Knetsch the Committee believes that several of the issues raised by Mr. Thomas are not as serious as implied by his memo:

MRM 642 - Dr. Barker maintains that the library holdings of government documents is adequate.

MRM 644 - The library holdings must be reasonably adequate as public administration is handled by two departments (Commerce; Political Science) already.

MRM 645 - This literature is adequately enough covered by the journals and books acquired for the sociology and psychology departments.

cont'd..2

MRM 641 - The basic source for law literature is to be found in the Natural Resources Journal published by the University of New Mexico School of Law; S.F.U. takes this journal. Further, the library has both the U.S. and Canadian Statutes dealing with environmental law. This course will address federal and provincial statutes on resources and the constitutional restraints that apply and, in this context, the library holdings are fair. Both Drs. Barker and Knetsch point out that specific issues of the Canadian law journals will have to be purchased but subscribing to such journals will be unnecessary.

In short, the holdings in our library are much better than the picture painted by Larry Thomas though some upgrading will be necessary.

If I may add a personal note I think this programme is a most worthwhile one for the University to be involved in since it will be one that reflects the very powerful role played by the resource industries in British Columbia. The University will be providing a professional degree in an area that is not covered adequately by the universities of British Columbia.

The following would be people to contact if you need direct input during your evaluations:

Dr. M.L. Barker - Geography
Dr. J.L. Knetsch - Economics
Dr. A.L. Turnbull - BioSciences
Dr. M.C. Roberts - Geography

Sincerely,

Michael

Michael C. Roberts
Chairman

MCR/mgb
Encl.

THE UNIVERSITY OF MANITOBA

NATURAL RESOURCE INSTITUTE

WINNIPEG, MANITOBA R3T 2N2

December 2, 1977

Dr. Bruce Clayman
Associate Dean
Graduate Studies
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Dear Dr. Clayman:

I have enclosed a report on the proposed master's program in natural resource management at Simon Fraser University. I hope you will find the report useful. If any questions are raised please feel free to call me.

Yours truly,

Paul Nickel

Paul E. Nickel
Director and Professor
Natural Resource Institute

PEN/mk

I am pleased to submit the following report on the proposal by Simon Fraser University for a master's program in Natural Resource Management. The material describing the program has been reviewed by myself, Professor Thomas Henley and Mr. Ian Gillies of the Natural Resource Institute. Our observations on the proposal are based upon the experience of the past four years with an interdisciplinary program in natural resource management here at the University of Manitoba.

The justification for a two year master's program in natural resource management is clearly stated and it has been our experience that graduates from such a program fill an extremely important need within the present Canadian context. Graduates with recognized expertise in one particular discipline and with an additional interdisciplinary perspective on resource management problems are well equipped to take up jobs in both the public and the private sectors. Most of our graduates are employed by the public sector, mainly by the government of Manitoba. (See appendix A on graduate employment) The major private sector opportunities lie with consulting firms. In past years graduates have experienced little difficulty in finding education related employment although, of course, the job situation is presently a bit discouraging for all university graduates.

If it is assumed that job opportunities will arise more or less as they have in the past there should be little trouble experienced in placing the projected number of graduates from the Simon Fraser program.

There are several areas where we feel the proposed program could be improved. These areas are:

(i) Academic Program

In the resource field in particular it is important that an academic program stress the general themes of problem solving and critical thinking rather than focus primarily on subject matter related to resources. The importance of problem solving skills in resource management was noted at a recent meeting of the Natural Resource Institute's graduate association. Problems in resource management are continually changing and effective resource managers must be equipped with the skills to identify and offer innovative solutions to emerging problems.

The team approach to problem solving has proven to be an appropriate vehicle for developing communication skills and skills in small group dynamics. Both of these skills are virtual necessities for contemporary resource managers and should be stressed in evaluation of course work and by building in special seminars and workshops in communications and organizations. The team approach better prepares the student for job situations where work is generally done as a member of a group. On this point, it would be ideal if the physical environment existed at Simon Fraser to facilitate the process of group interaction among students, the director, support staff, and associated instructors. Additional benefits in terms of group bonding, increased mutual assistance between students, and friendships built

between students which persist after graduation from the program also arise from establishing the program in a supporting physical environment.

The research project (MRM 699-4) needs to be carefully structured to define a clear process through searching for a problem, writing a research proposal and, finally, completing the research report. In our experience this process is an essential core of the program that serves several purposes.

(a) The process synthesizes the student's course work and tests the tools and techniques learned through application to an actual resource problem.

(b) The research process produces a report that is useful to a client group with a problem in resource management.

(c) The research process provides an outreach from the university to the larger society and also contributes to inter-disciplinary exchanges within the university. At the Natural Resource Institute each student's research is assisted by an advisory committee which draws on experts from the university and from government and private industry. Including individuals from resource agencies and various public groups has been a very useful method for facilitating the flow of information between university departments and between the university and the larger community.

In addition, the goodwill established through the research process can be considerable and may assist in attracting future research projects and funds.

A description of the Natural Resource Institute's practicum process is enclosed as appendix B.

A final remark on the course MRN 643-3. In our experience mathematical modelling has proven to be far less useful than a solid grounding in statistics and applied mathematics for business decisions. There seems to be a considerable gap between the mathematical models developed in academia and those analytical techniques used in business and government. If the thrust of the proposed program is to provide training useful to resource managers in the field, the orientation of the course on mathematical modelling might be reviewed.

(ii) Admissions

Criteria for admissions are an important aspect of the program since it is to be expected that applications will exceed available positions. We concur wholeheartedly with your view that candidates should have a strong background in one discipline. However, we also feel that some diversification within the first degree program is important and in our program we insist on some background in economics, statistics, political studies or history, geology and biology. Usually it is possible to obtain these pre-requisites as options in the first degree program. Other admission criteria used by the Institute include related work experience and an acceptable grade point average.

The criterion of work experience is especially important. To a large degree, the quality of the proposed program will depend on the students enrolled. Students with considerable work experience in the field tend to make a more sophisticated contribution in seminars and course work. They tend to be more self-directed than students who apply directly from undergraduate work. Thus, program administration is made easier and it is likely that the example set by students with work experience will improve the overall quality of the program. In addition, the network of contacts built up by students with work experience is invaluable in building strong links to prospective employers and sources of expertise that can be tapped for research and instructional purposes. We would suggest that every effort be made to attract applications from persons with some working experience in the resource field and even that some goal for the proportion of students with previous work experience be set.

(iii) Staffing and Administration

The quality of the teaching staff in the proposed program appears to be excellent. However, we feel that there could be more emphasis upon economics, public policy and administration in government and business. In this regard, we would suggest that people with skills in economics, administration and public policy should be better represented in the ranks of the program's associated instructors.

The administrative structure proposed appears adequate to support the program at the stated enrollment level.

In conclusion, we would make the following recommendations:

1. The academic expertise should be broadened to place more emphasis on public policy, economics and adminstrative techniques.
2. The research project should be developed as a core exercise within the program and a more-or-less formal structure for the research process should be specified.
3. Effort should be directed at establishing links to the larger community in order to promote goodwill, open access to information and financial support and to facilitate the placement of graduates.
4. The physical environment for the program is important and should provide for frequent interaction among staff and students.

I hope these brief remarks have been of some use to you.

APPENDIX A

NATURAL RESOURCE INSTITUTE GRADUATES *

A reliable indicator of the M.N.R.M. program's effectiveness is the employment of Natural Resource Institute graduates in the past. The diversity of employment opportunities is clearly reflected in a survey of occupations of past graduates. The Institute has produced 62 graduates since the first graduating class in 1971; at present 34 graduates are employed in Manitoba, 13 are employed in other provinces in Canada, a number have returned to their native countries, and a number are continuing their education in universities in Canada and the U.S. It is apparent that Institute graduates are fulfilling needs in the field of natural resource management.

1971

Bernard Bitner	Resource Planner, Yellowknife, Northwest Territories
John Burch	Extension Forester, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Ron Kabaluk	Senior Coordinator of North-East Manitoba Development Initiative. Special ARDA Program. Manitoba Department of Northern Affairs, Winnipeg
Dave Tomasson	Assistant Manager, Special Programs Co-ordination and Administration, Department of Northern Affairs
Andy Miles	Coordinator Special ARDA Program. Manitoba Department of Northern Affairs, Winnipeg

*This list includes all graduates up to 1977. In addition, a number of former students who have not yet submitted their practica are employed in resource related jobs.

Doug Luckhurst	Medical Student. University of Manitoba, Winnipeg
Romeo Princic	Resource Economist, Environment Canada, Vancouver
1972	
James Barlishen	Environmental Consultant Environment Canada, Environmental Protection Service. Edmonton.
Donna Keates	Occupation Unknown
Don Kowal	Supervisor of Commercial Fisheries Manitoba. Department of Renewable Resources and Transportation Services
Manchoi Kwan	Returned to Hong Kong
Iraj Sharis	Returned to Iran
Dan Topolinski	Resource Economist, Environment Canada, Fisheries and Marine Services, Freshwater Institute, Winnipeg Institute, Winnipeg
Kelvin Whalen	Biologist. Environment Canada. Environmental Protection Service. St.John's,Newfoundland.
1973	
Alan J. Hunt	Executive Secretary, Public Utilities Board, North West Territories
Steph. Stephansson	Biologist. Environment Canada. Fisheries and Marine Services, Yellowknife
Erkki Vuori	Impact Biologist, Schultz International Limited. Vancouver
1974	
Solomon Aremu	Returned to Nigeria
Ronald Bailey	Director, Department of Indian and Northern Affairs, Water Management Division, Ottawa
Bill Barto	Comprehensive Land Use Planner, Planning Division. Manitoba Department of Renewable Resources and Transportation Services, Winnipeg

Lorne Colpitts	Wildlife Habitat Specialist. Wildlife programs. Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Bruce Friesen	Environmental Impact Assessment, Alcoa Industries. Australia
Thomas Henley	Assistant Director, Natural Resource Institute, University of Manitoba, Winnipeg
Don Kotak	General Manager. Krazy Kar Krushers. Saskatoon
Carl Wall	Comprehensive Land Use Planner, Planning Division, Manitoba Indian Brotherhood, Winnipeg

1975

Mike Bridges	Library Management, University of Alberta
Barbara Burton	Occupation Unknown
Doug Boyd	Resource Policy Evaluation Specialist. Interdisciplinary Systems Limited, Winnipeg
Douglas Chekay	Resource Management Specialist, Parks Branch, Manitoba Department of Tourism, Recreation and Cultural Affairs
Ian Gillies	Research Associate, Natural Resource Institute, University of Manitoba, Winnipeg
Alison Hine	Ph.D. student, School of Natural Resources University of Michigan
Norman Howe	Ph.D. student, Agricultural Economics, University of Manitoba, Winnipeg
Betty Leitch	Executive Secretary, Manitoba Water Commission, Winnipeg
Donald Leitch	Special Assistant to the Premier, Province of Manitoba, Winnipeg
Lorna McKerness	Planning Officer, Environment Canada, Fisheries and Marine Services, Regina
Bruce Ramsay	Resource Economist, B.C. Research Institute Vancouver

Les Sherwood	Technical Representative, Alchem Ltd.
Neville Ward	Regional Fisheries Biologist, Ontario Ministry of Natural Resources
Brian Wilkie	Park Planner, Parks Canada, Winnipeg
1976	
Ian Anderson	Economic Research Analyst, Prov. Consumer Affairs
Glenn Bampton	Sales Representative, Xerox Canada Ltd., Winnipeg
Douglas Cable	Project Officer, Canadian Employment and Immigration Commission
Kenneth Davidson	Resource Economist, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Philip Eyler	Land Use Planner, Manitoba Indian Brotherhood Winnipeg
Norman Harburn	Chief Naturalist, Parks and Recreation Branch City of Winnipeg
Colin Holbrow	Special Projects Team, Ducks Unlimited (Canada)
Dale Johnston	Feasibility Planner, Engineering Services and Construction Division, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Louis Legal	Student, Faculty of Education, University of Manitoba
James MacPherson	Resource Consultant, James F. MacLaren Ltd., Winnipeg
Gladys Pirt	Contract Researcher, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Lorimer Thompson	Resource Extension Officer, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg

1977

Richard K. Baydack	Temporary Resource Planner Interdisciplinary Systems, Winnipeg
Gordon L. Brown	Resource Consultant, Western Research and Development Co. Ltd., Calgary,Alberta
Sam S. Chow	Manpower and Economic Analyst, Policy and Planning Branch, Manitoba Department of Northern Affairs, (The Pas)
William P. Elliott	Executive Director, North American Wildlife Foundation,Delta Research Centre, Manitoba
Gregory M. Goodwin	Resource Consultant, Norenco Ltd. Winnipeg
Graham P. Latonas	Parks Planner Manitoba Department of Tourism and Cultural Affairs
John D. Neilson	Fisheries Specialist , McLean Consulting
Robert D. Ross	Naturalist, City of Winnipeg
Ralph F. Smith	Executive Council, Government of Saskatchewan, Regina
Helen T. Soudek	Research Associate, Natural Resource Institute, Winnipeg

APPENDIX B

DRAFT SUPPLEMENTARY REGULATION DESCRIBING THE PRACTICUM PROCESS

2.4 The Practicum Research Process

The regulations governing the Master of Natural Resource Management Degree require that every candidate for the degree shall submit a Practicum. This is in place of a thesis, which is the normal requirement for the Master's degree in other programs.

2.4.1 Practicum Definition

The memorandum which established the N.R.I. in 1968 defined the practicum as:

> *"A research project dealing with an actual problem in resource administration or allocation resulting in the preparation of an official report. Requirements are met either by working in a government or private agency on a selected and approved topic, or by independent work within the Natural Resource Institute."*

2.4.2. Purpose

The practicum is central to the teaching program at the N.R.I. It is an interdisciplinary research report on a resource management problem done in conjunction with agencies and individuals at the University of Manitoba and in the larger Canadian community. The practicum topic must be approved by the Director and may include independent work within the Natural Resource Institute.

The practicum is intended to be a field study report that deals with a problem in resource management. The practicum serves a 3-fold purpose:

i. It develops the student's ability to conduct applied interdisciplinary research on an actual problem of resource management or allocation.

ii. It meets his academic requirements, and

iii. It demonstrates his effectiveness as an employee.

Each student will attempt to obtain employment on a resource task, during the inter-year summer session of the program. The work done in the summer will with the employer's consent, form the basis of the practicum report.

2.4.3. Interdisciplinary Aspects

The student will be expected to bring to bear upon the preparation of the Practicum, knowledge gained in the course work as well as the practical experience derived from work in the field. Emphasis should be on the inter-disciplinary aspects of the situation under study and solutions should be tested against the following criteria:

i. economic feasibility
ii. technical feasibility
iii. political feasibility
iv. administrative feasibility
v. ecological feasibility

2.4.4. Procedures

A set of working procedures has been developed in association with the practicum process. While the following procedures are those normally followed, the Director of the Institute may alter these at his discretion.

i. The student, in conjunction with staff at the Institute and interested people at the University, in government or in the private sector, develops a topic for inter-disciplinary research on a resource management problem. The topic will lead to the development of a detailed research proposal completed in the student's first year, (part of the Institute's course 56.710 Research Planning and Strategy). Approval of the research Proposal by the Director is required prior to beginning the data collection phase of the research process.

ii. The student will identify persons who could make a valuable contribution on an advisory committee to supervise the applied research process. The Director's approval on selection of committee members is required. Members selected will be formally invited by the Institute to sit on the advisory committee.

iii. The advisory committee shall have the following structure:

a. The Director will sit on all advisory committees and will chair the oral examination. In some cases, the Director may participate in a committee as a regular member, in which case his designate will assume the role of the Director. In addition to the Director, the committee shall consist of no less than three members, one of whom must be a member of the Faculty of Graduate Studies from a faculty other than the Natural Resource Institute and who will ensure that the regulations of the Faculty of Graduate Studies are followed.

b. The student will select one member of the committee to act as a senior advisor.

c. Both academic and non-academic members of the committee shall either be recognized experts in the subject area of the practicum or shall possess a special knowledge which makes their participation appropriate.

iv. The student, in consultation with the members of the committee, will proceed with research on the problem and will produce a draft report for circulation to the committee members.

v. Committee members will provide constructive criticism of the first draft and will recommend changes necessary for a final draft. The student, having incorporated the advice of the committee, will circulate a final draft. The senior advisor of the committee will notify the Director of the acceptance of the final draft and a date for an oral examination of the report will be set.

vi. The oral examination will be an open meeting, with the exception of the period where practicum acceptability is to be considered. The format of the oral examination follows:

a. The oral begins with the Director's description of the format.

b. The oral generally takes one to two hours. The student begins with an oral summary of the practicum research. The balance of the oral is taken up with questions from the committee.

c. After the committee has had the opportunity to test the student's knowledge on the research process and the practicum topic the Director will suggest that the student and other non-committee members leave the room and the acceptability of the practicum will be considered.

d. The committee will assess the acceptability of the practicum on a pass/fail basis. The decision is by majority vote. If the decision is pass, the committee members will sign the acceptance form. Conditional acceptance is possible where minor revisions are to be made. In such a case, the Director will reserve his signature until satisfied that the revisions have been made. If the decision is fail, the committee will indicate required revisions and offer suggestions which will assist the student in a subsequent oral examination. Only two attempts at the oral examination are allowed. A second failure will result in a requirement to withdraw from the program.

REVIEW OF SFU PROPOSAL FOR AN INTERDISCIPLINARY PROGRAM IN NATURAL RESOURCES MANAGEMENT.

Introduction

The management of natural resources in Canada has presented the nation's universities with an important new challenge: the development of specialist programmes which also provide a broad appreciation of the field as a whole. No wholly satisfactory response has emerged so far. Either the programmes that have been offered have been focussed on a single resource - such as water, forests or fisheries - or they have been founded mainly on one discipline - such as biology, law or economics. The ventures at the Universities of British Columbia, Manitoba, Toronto and Laval provide illustrations. What is needed is a programme that covers several resources, facilitates specialization in a discipline of the student's choice, yet offers training in the basic elements of related disciplines. Such an offering needs to be organized around a core of courses to be taken by all students and a series of options that enable them to broaden their overall perspectives and skills.

The proposed programme goes a long way towards meeting these requirements. It is sound in concept, imaginative in content, and probably realizable in practice. It appears to have the backing of several key disciplines - notably biology, geography, and economics. There appears to be interest in the proposal, not only on the part of students now at the University but also on the part of a number of federal and provincial government agencies. The potential clientele may be even wider.

While this reviewer is favorably disposed towards the proposal, he believes that there are several ways in which it could be strengthened. Suggestions are offered below as to possible deficiencies and ways in which the latter might be remedied.

1. Involvement of Particular Disciplines

A programme of Natural Resources Management Studies should probably involve as a minimum the Departments of Biology, Geography,

Economics, Political Science, and Sociology. Depending on the specific contributions to be made, it could also benefit from the involvement of the Departments of Mathematics and Chemistry. The present proposal clearly indicates a high commitment from Biology and Geography. Only one professor, however, from Economics would be involved, albeit an individual with an international reputation in the field. No specific commitment is made by Political Science or Sociology. These latter deficiencies are unfortunate, since some understanding of the policy-making process, public administration, public participation, and social impacts of resource development would seem to be critical dimensions of a resource manager's training. Concrete proposals for faculty and courses on the foregoing matters should be solicited from Political Science and Sociology and incorporated into the Programme. Encouragement should be given to Economics to increase its commitment.

2. Quality of the Graduates

The Programme's success will depend in large part on the calibre of students that it attracts. Experience elsewhere in resources studies and environmental studies programmes has shown that the most effective ones have been those which have demanded a somewhat higher level of entry than that required for normal programmes at the University. It should be sufficiently high to ensure that there is something special to be gained from qualification in such a programme but no so high as to turn all potential candidates away.

To an important extent the proposed programme will attract mainly the more highly motivated and committed students, who have already done well in their 'home' discipline. Many of them will also be more mature, and may have had several years of experience as resource managers. The question of quality of candidates, therefore, may not arise. Even so, a statement that a higher than normal entry level is expected, and that certain prerequisites must be fulfilled, will give the Programme both stature and protection.

3. Need for Graduates

Evidence from a variety of sources, including annual reports of

government agencies, reports of the Science Council of Canada, and statements of executives of firms in the private sector, often point to the need for more broadly trained resource managers. The dossier describing the Programme refers to this demand but provides little concrete evidence of it. Some additional material made available to this reviewer indicated that a number of government agencies had shown an interest but again there were no detailed accounts of the kinds of training that would be most useful, nor the potential demand for plans in the Programme. The Steering Committee should be encouraged to obtain such evidence by contacting federal and provincial government agencies, as well as firms in the private sector. It is believed that this could be accomplished relatively quickly through the contacts already established.

Attention should be paid in particular to the kinds of taks that graduates from the Programme might be expected to perform. Among these might be such matters as:

- environmental impact assessment
- technology assessment
- resources planning
- resources management
- policy analysis

Comments might also be made on the 'home' disciplines that are especially in demand by government agencies and the private sector in the resources field.

4. Administrative Structure

The ultimate success of a Natural REsources Management Programme will depend in large part on its organizational structure. Unfortunately, little is said about this in the dossier. Some very helpful comments were made, however, in the on-site visit. It appears that the present thinking visualizes a Programme, headed by a Director, advised by a Steering Committee, and supported by faculty from a number of contributory Departments. The Programme would be under the jurisdiction of the Faculty and late Disciplinary Studies.

The most critical element in the entire structure is probably

the Director of the Programme. This should be an individual who has a considerable reputation in the resources field as a scholar, and who has had administrative experience in organizing ventures of this kind. He or she should have a deep sense of commitment to this area of study and should have the ability to convince other bodies of its value. Preferably he or she should have had experience or have contacts in the field of government and with private industry in resources management. It is essential that such an individual should have great facility in working with people from a wide variety of disciplines.

Such qualifications are highly demanding and it is probable that the list of potential candidates of the required calibre in Canada will be somewhat restricted. There are such individuals, however, in a number of Canadian universities in the disciplines of Geography, Political Science, Psychology, and Biology. They would need to be induced by the prospect of initiating an exciting new programme which would have adequate secretarial, technical and other support, and a salary commensurate with the individual's experience and opportunity costs elsewhere. Assurance would have to be given that the Director would be able to have a major influence on the shaping of the eventual Programme, and that he or she would be given adequate resources to travel to obtain additional support and to recruit needed faculty.

The Programme would be of interest to several bodies outside the University. The ideas of these bodies should be actively sought, perhaps through an Advisory Committee or Council, such as that which was established to assist the Westwater Research Centre at U.B.C. in shaping its programmes. This would not only furnish an invaluable source of counsel but also an avenue of communication to potential students who might join the Programme.

While there is no explicit statement on the point, it seems that the Programme would be mainly a daytime venture, with courses offered in the period 8:30 - 5:30 p.m. The potential market for it, however, could be extended considerably by offering some of the courses in the evening.

5. Course Offerings

It is clear that considerable thought has been devoted to the design of a core programme and a series of related optional course. In broad terms, the offerings seem ideal, It should be recognized, however, that concepts and needs change over time, and consequently, there should be provision for alterations in the Programme over time. A periodic review, say every 4 or 5 years, should be built into the programme.

There are some courses that might be offered more efficiently as two parts rather than as joint ones. A case in point is the one on Regional Resources Planning and Environmental Impact Assessment. Perhaps this course might be offered as two courses: one on Resources Planning, of which Regional Resources Planning would be a part; and another on Impact Assessment, covering economic, social, and environmental ettects of resource development.

6. A Resource Studies Institute

A Natural Resources Management studies programme would be enriched by a closely allied research programme. The latter might not only encourage a wide involvement of faculty but may also furnish additional sources of financial support. Experience has shown that the most successful resources management and/or environmental studies programmes have been those in which there has been a substantial research component. The Steering Committee should be encouraged to consider the possibilities of applying for a development grant from one of the major funding bodies, such as NRC or the Canada Council to undertake a major inter-disciplinary programme of studies on resources management. A logical outcome might well be a Resources Studies Institute.

W. R. Derrick Sewell
Professor
Department of Geography
University of Victoria

4 November 1977

SIMON FRASER UNIVERSITY

Proposed Masters Program in Resource Management

Commentary by F. Kenneth Hare

General

The proposal addresses itself to a problem faced by all Canadian universities today : how does one create useful interdisciplinary degree programs that meet real social needs directly? The answer it comes up with is also similar to others. A small group of believers in a small number of disciplines tries to entrain sceptics from other areas. I sympathize greatly, because that is what I have to do myself.

Resource management is obviously one of Canada's major professional areas, but it is rarely recognized as such. Instead one finds foresters, agriculturists, biologists, geographers, economists and self-trained amateurs holding the managerial jobs. Everyone knows that a mixture of skills and training is required, but it is usually held that these are best acquired on the job, rather than in a university.

Simon Fraser's venture is one of several that attempts to alter this apprenticeship idea. Most schools of forestry have been trying to broaden their curriculum in this direction, and some — Toronto, for example have actually put together masters' programs in resource management; so has Wisconsin's College of Agriculture (or rather the research institute that grew out of it — Irving Fox at U.B.C. knows the story). But Forestry and Agriculture both have their own gardens to tend, and in any case tend not to attract the kind of student who will profit most from interdisciplinary training. I also know of one attempt — Toronto again — to mount such a program within a business school.

I agree with the proponents that if such training is to be attempted at all, it should be at the graduate level, and that the entrants should have a firm grounding in one of the contributing disciplines.

Provided that the University is able to make the new appointments mentioned, I see no reason why the proposal should not be accepted now. In summary my recommendation is a rather cautious "go ahead."

The expertise will be sufficient, if afforced as suggested, but no more than sufficient. There are some things about the listing of staff that puzzle me. Why does the proposal say that only physical geography can contribute? In the first place Mary Barker is a behaviourist, not a physical geographer. And in the second there are many aspects of geography that ought to contribute. Why are so few geographers apparently involved?

I'd be happier if the biologists included one or two with more obvious signs of deeper involvement in resource-related studies, and would welcome more input from specialists in recreation and its offshoots.

A heavy burden is going to fall on Professor Knetsch's shoulders. There should be a major input from the economists into this problem. His background among the RFF resource economists is correct for this kind of program — but my experience with economists is that they always have so much to do, and so many opportunities of doing their own thing, that it is hard for them to function well in team efforts of this sort.

Much will depend on the Director, and his field of specialization. Presumably he will be cross-appointed to a parent discipline. Speaking from personal experience, I'd say that he'll have his work cut out to keep up the program's momentum.

The quality of the graduates will depend on the standards of admission, and on the degree of commitment of the various staff members to the new program. I see no reason why they should not compete with those from the small number of competing centres.

The number of graduates needed is not, in my judgement, very large. Presumably the various provincial resources and lands departments will continue to draw most of the entering staff from specialist groups (like forestry, mining engineering, economics, ecology) rather than from this kind of interdisciplinary grouping. It has been well said — if in exaggeration — that the only civil servants needing interdisciplinary training of this sort are deputy-ministers! But there is a slow demand for graduates in resource utilization or environment, and this is more true of the western provinces than the east. This demand will continue, and may even slowly expand.

The stated objectives are presumably to lay on the program that has been designed — and if given the go-ahead, I'm sure that the team named can do it.

Administrative structure hardly arises. There will be a Director, and a group of instructors. I presume that the Faculty of Interdisciplinary Studies will have some kind of supervising committee. My own Institute has a Management Committee on which representatives of the contributing departments sit. We find this useful, but guard our prerogatives as regards initiatives, and relationship to the Graduate School.

Overall, I'd say that this proposal fails to fire me with enthusiasm, but that it should go ahead if SFU is satisfied that the proponents really mean what they say. I know only one of them at all well — Mary Barker, whom I supervised when she was an honours student, and encountered again here when I came to Toronto. If she has had a significant hand in the proposal, and if she proposes to throw her weight into it, then my cautious approval becomes less cautious. She could well direct the program.

F. Kenneth Hare

College of Forestry and Natural Resources
Office of the Dean

Colorado State University
Fort Collins, Colorado
80523

September 5, 1977

Dr. Bruce Clayman
Associate Dean of Graduate Studies
Simon Fraser University
Burnaby 2, British Columbia

Dear Dr. Clayman:

I have read the outline for your proposed interdisciplinary Master's program in natural resource management with considerable interest. Comments on your specific questions are as follows:

1. Academic Expertise. Those faculty members listed are heavily concentrated in the biological disciplines, although there does seem to be a good representation of the biological disciplines listed. The listed faculty are very deficient in the social, managerial and mathematical areas, but the core courses listed in the curriculum indicate that some of these faculty members will have input to the program. It would be very helpful if the faculty members in these latter areas could be drawn more closely into the program, much in the same fashion as the biologists.

2. The graduates of the program, as it presently is outlined, will clearly be of inferior quality to those produced by leading institutions in integrated natural resource management. The major deficiency is that the students do not have experience with any mechanism for integrating the various fields to which they are exposed. This is always the most difficult aspect of any such program; because it is so difficult, it clearly needs attention. The program that you now have outlined does present the students to a number of different disciplines, but provides no means for them to bring the disciplines together.

   In our experience in such areas, we have found three approaches useful in establishing the necessary interdisciplinarity within the students. These are:

   a. Algorithmic
   b. Experiential
   c. Psychological

   The algorithmic aspect of integration relies upon mathematical procedures which incorporate the inputs from the various disciplines. The most useful mathematical procedure that we have

found is a mathematical programming technique, such as linear programming. We have found, however, that a multi-objective programming, such as goal programming, is even more helpful for students in the natural resource fields. I note that there is a letter attached to the material which was prepared by Dr. Brian Alspach, of your Department of Mathematics, commenting on the lack of a course in optimization. Our experiences indicate that Dr. Alspach is certainly correct; however, the number of techniques that he would propose to include in his course has been very confusing to students operating at this level. Instead of treating the whole array of optimization procedures, we have found it more useful to deal only with linear programming and goal programming. This does place at the students' disposal a sufficient mechanism for bringing together the various inputs.

To cover the experiential aspects of integration, we have found it very useful to do project-oriented studies where the students work in teams. Each team is made up of the various disciplines that are involved in bringing the information together. The students are rated primarily upon their ability to work with the team. We find that this procedure points out the need for team work in integration, and also points out the students' ordinary learning experience in college does not readily apply itself to integrated resource management projects. Students come to realize that a whole new area of skills needs to be developed.

The third area is psychological. It appears clear to us that students who are ordinarily attracted to strict disciplinary approaches and who do well in these approaches are not necessarily those best suited for integrated resource management procedures; students with a more social outlook rather than the aloofness of science seem to do much better. We have not developed a satisfactory testing technique for identifying these students a priori, but do feel that it is an important area of consideration.

3. The need for graduates in this area is strong and is increasing. It is true that most young people in their professions need disciplinary expertise in order to get their first job and to perform well during the first few years of their professional careers. Advancement into higher-level positions, however, very often depends upon a broader background, such as you are attempting to give in this natural resource management program.

4. As presently outlined, the program is not likely to meet its stated objectives primarily because of the lack of emphasis on integrating mechanisms as outlined above.

5. The administrative structure is apparently satisfactory as far as the professional people are concerned. It does not appear to me, however, that there is need for a field technician in this program. A field technician indicates that the program is based upon biological disciplines only; these would be involved in field studies rather than a broader range of disciplines including the social sciences, etc.

   A more likely need for technician support would be in the computer science area. I would anticipate that you will find that some computer model will be required to provide a common language point for all of the disciplines involved, and some computer support will certainly be required.

Under separate cover, I am sending you a series of models that we have developed to deal with natural resource management problem areas, such as you will be addressing. One of these, "Feedback," provides a general framework for the others and a brief outline of the other procedures. Of the individual procedures, the one titled "Goal" has been most useful in classroom teaching efforts towards natural resource management.

In summary, I would emphasize that your outline seems to work from the premise that natural resource management is a collection of biological sciences, but that social sciences may somehow be involved in the questions. I would urge you to take the viewpoint that natural resource management is an integrative science which happens to include biological sciences as one aspect of the overall question. Rather than having the program outlined by biological scientists, as it appears to have been, I would suggest that you visit closely with people who are actively involved in the natural resource management field, and get their input into designing the overall program. Specifically, I would urge that you include some quantitative integration mechanism, such as mathematical programming, as a core part of your program.

Sincerely yours,

Donald A. Jameson
Associate Dean

DAJ:ew
Enclosures (separate cover)

REPORT ON THE PROPOSAL OF SIMON FRASER UNIVERSITY FOR A MASTER'S PROGRAM IN NATURAL RESOURCE MANAGEMENT

by

Paul E. Nickel, Director and Professor
Tom Henley, Assistant Director and Assistant Professor
Ian Gillies, Research Associate
Natural Resource Institute
University of Manitoba
November 27, 1977

I am pleased to submit the following report on the proposal by Simon Fraser University for a master's program in Natural Resource Management. The material describing the program has been reviewed by myself, Professor Thomas Henley and Mr. Ian Gillies of the Natural Resource Institute. Our observations on the proposal are based upon the experience of the past four years with an interdisciplinary program in natural resource management here at the University of Manitoba.

The justification for a two year master's program in natural resource management is clearly stated and it has been our experience that graduates from such a program fill an extremely important need within the present Canadian context. Graduates with recognized expertise in one particular discipline and with an additional interdisciplinary perspective on resource management problems are well equipped to take up jobs in both the public and the private sectors. Most of our graduates are employed by the public sector, mainly by the government of Manitoba. (See appendix A on graduate employment). The major private sector opportunities lie with consulting firms. In past years graduates have experienced little difficulty in finding education related employment although, of course, the job situation is presently a bit discouraging for all university graduates.

If it is assumed that job opportunities will arise more or less as they have in the past there should be little trouble experienced in placing the projected number of graduates from the Simon Fraser program.

There are several areas where we feel the proposed program could be improved. These areas are:

(i) Academic Program

In the resource field in particular it is important that an academic program stress the general themes of problem solving and critical thinking rather than focus primarily on subject matter related to resources. The importance of problem solving skills in resource management was noted at a recent meeting of the Natural Resource Institute's graduate association. Problems in resource management are continually changing and effective resource managers must be equipped with the skills to identify and offer innovative solutions to emerging problems.

The team approach to problem solving has proven to be an appropriate vehicle for developing communication skills and skills in small group dynamics. Both of these skills are virtual necessities for contemporary resource managers and should be stressed in evaluation of course work and by building in special seminars and workshops in communications and organizations. The team approach better prepares the student for job situations where work is generally done as a member of a group. On this point, it would be ideal if the physical environment existed at Simon Fraser to facilitate the process of group interaction among students, the director, support staff, and associated instructors. Additional benefits in terms of group bonding, increased mutual assistance between students, and friendships built

between students which persist after graduation from the program also arise from establishing the program in a supporting physical environment.

The research project (MRM 699-4) needs to be carefully structured to define a clear process through searching for a problem, writing a research proposal and, finally, completing the research report. In our experience this process is an essential core of the program that serves several purposes.

(a) The process synthesizes the student's course work and tests the tools and techniques learned through application to an actual resource problem.

(b) The research process produces a report that is useful to a client group with a problem in resource management.

(c) The research process provides an outreach from the university to the larger society and also contributes to inter-disciplinary exchanges within the university. At the Natural Resource Institute each student's research is assisted by an advisory committee which draws on experts from the university and from government and private industry. Including individuals from resource agencies and various public groups has been a very useful method for facilitating the flow of information between university departments and between the university and the larger community.

In addition, the goodwill established through the research process can be considerable and may assist in attracting future research projects and funds.

A description of the Natural Resource Institute's practicum process is enclosed as appendix B.

A final remark on the course MRN 643-3. In our experience mathematical modelling has proven to be far less useful than a solid grounding in statistics and applied mathematics for business decisions. There seems to be a considerable gap between the mathematical models developed in academia and those analytical techniques used in business and government. If the thrust of the proposed program is to provide training useful to resource managers in the field, the orientation of the course on mathematical modelling might be reviewed.

(ii) Admissions

Criteria for admissions are an important aspect of the program since it is to be expected that applications will exceed available positions. We concur wholeheartedly with your view that candidates should have a strong background in one discipline. However, we also feel that some diversification within the first degree program is important and in our program we insist on some background in economics, statistics, political studies or history, geology and biology. Usually it is possible to obtain these pre-requisites as options in the first degree program. Other admission criteria used by the Institute include related work experience and an acceptable grade point average.

The criterion of work experience is especially important. To a large degree, the quality of the proposed program will depend on the students enrolled. Students with considerable work experience in the field tend to make a more sophisticated contribution in seminars and course work. They tend to be more self-directed than students who apply directly from undergraduate work. Thus, program administration is made easier and it is likely that the example set by students with work experience will improve the overall quality of the program. In addition, the network of contacts built up by students with work experience is invaluable in building strong links to prospective employers and sources of expertise that can be tapped for research and instructional purposes. We would suggest that every effort be made to attract applications from persons with some working experience in the resource field and even that some goal for the proportion of students with previous work experience be set.

(iii) Staffing and Administration

The quality of the teaching staff in the proposed program appears to be excellent. However, we feel that there could be more emphasis upon economics, public policy and administration in government and business. In this regard, we would suggest that people with skills in economics, administration and public policy should be better represented in the ranks of the program's associated instructors.

The administrative structure proposed appears adequate to support the program at the stated enrollment level.

In conclusion, we would make the following recommendations:

1. The academic expertise should be broadened to place more emphasis on public policy, economics and adminstrative techniques.
2. The research project should be developed as a core exercise within the program and a more-or-less formal structure for the research process should be specified.
3. Effort should be directed at establishing links to the larger community in order to promote goodwill, open access to information and financial support and to facilitate the placement of graduates.
4. The physical environment for the program is important and should provide for frequent interaction among staff and students.

I hope these brief remarks have been of some use to you.

APPENDIX A

NATURAL RESOURCE INSTITUTE GRADUATES *

A reliable indicator of the M.N.R.M. program's effectiveness is the employment of Natural Resource Institute graduates in the past. The diversity of employment opportunities is clearly reflected in a survey of occupations of past graduates. The Institute has produced 62 graduates since the first graduating class in 1971; at present 34 graduates are employed in Manitoba, 13 are employed in other provinces in Canada, a number have returned to their native countries, and a number are continuing their education in universities in Canada and the U.S. It is apparent that Institute graduates are fulfilling needs in the field of natural resource management.

1971

Bernard Bitner	Resource Planner, Yellowknife, Northwest Territories
John Burch	Extension Forester, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Ron Kabaluk	Senior Coordinator of North-East Manitoba Development Initiative, Special ARDA Program. Manitoba Department of Northern Affairs, Winnipeg
Dave Tomasson	Assistant Manager, Special Programs Co-ordination and Administration, Department of Northern Affairs
Andy Miles	Coordinator Special ARDA Program. Manitoba Department of Northern Affairs, Winnipeg

*This list includes all graduates up to 1977. In addition, a number of former students who have not yet submitted their practica are employed in resource related jobs.

Doug Luckhurst	Medical Student. University of Manitoba Winnipeg
Romeo Princic	Resource Economist, Environment Canada, Vancouver
1972	
James Barlishen	Environmental Consultant Environment Canada, Environmental Protection Service. Edmonton.
Donna Keates	Occupation Unknown
Don Kowal	Supervisor of Commercial Fisheries Manitoba. Department of Renewable Resources and Transportation Services
Manchoi Kwan	Returned to Hong Kong
Iraj Sharis	Returned to Iran
Dan Topolinski	Resource Economist, Environment Canada, Fisheries and Marine Services, Freshwater Institute, Winnipeg Institute, Winnipeg
Kelvin Whalen	Biologist. Environment Canada. Environmental Protection Service, St.John's,Newfoundland.
1973	
Alan J. Hunt	Executive Secretary, Public Utilities Board, North West Territories
Steph. Stephansson	Biologist. Environment Canada. Fisheries and Marine Services, Yellowknife
Erkki Vuori	Impact Biologist, Schultz International Limited. Vancouver
1974	
Solomon Aremu	Returned to Nigeria
Ronald Bailey	Director, Department of Indian and Northern Affairs, Water Management Division, Ottawa
Bill Barto	Comprehensive Land Use Planner, Planning Division. Manitoba Department of Renewable Resources and Transportation Services, Winnipeg

Lorne Colpitts	Wildlife Habitat Specialist. Wildlife programs. Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Bruce Friesen	Environmental Impact Assessment, Alcoa Industries. Australia
Thomas Henley	Assistant Director, Natural Resource Institute, University of Manitoba, Winnipeg
Don Kotak	General Manager. Krazy Kar Krushers. Saskatoon
Carl Wall	Comprehensive Land Use Planner, Planning Division, Manitoba Indian Brotherhood, Winnipeg

1975

Mike Bridges	Library Management, University of Alberta
Barbara Burton	Occupation Unknown
Doug Boyd	Resource Policy Evaluation Specialist. Interdisciplinary Systems Limited, Winnipeg
Douglas Chekay	Resource Management Specialist, Parks Branch, Manitoba Department of Tourism, Recreation and Cultural Affairs
Ian Gillies	Research Associate, Natural Resource Institute, University of Manitoba, Winnipeg
Alison Hine	Ph.D. student, School of Natural Resources University of Michigan
Norman Howe	Ph.D. student, Agricultural Economics, University of Manitoba, Winnipeg
Betty Leitch	Executive Secretary, Manitoba Water Commission, Winnipeg
Donald Leitch	Special Assistant to the Premier, Province of Manitoba, Winnipeg
Lorna McKerness	Planning Officer, Environment Canada, Fisheries and Marine Services, Regina
Bruce Ramsay	Resource Economist, B.C. Research Institute, Vancouver

Les Sherwood	Technical Representative, Alchem Ltd.
Neville Ward	Regional Fisheries Biologist, Ontario Ministry of Natural Resources
Brian Wilkie	Park Planner, Parks Canada, Winnipeg

1976

Ian Anderson	Economic Research Analyst, Prov. Consumer Affairs
Glenn Bampton	Sales Representative, Xerox Canada Ltd., Winnipeg
Douglas Cable	Project Officer, Canadian Employment and Immigration Commission
Kenneth Davidson	Resource Economist, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Philip Eyler	Land Use Planner, Manitoba Indian Brotherhood Winnipeg
Norman Harburn	Chief Naturalist, Parks and Recreation Branch City of Winnipeg
Colin Holbrow	Special Projects Team, Ducks Unlimited (Canada)
Dale Johnston	Feasibility Planner, Engineering Services and Construction Division, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Louis Legal	Student, Faculty of Education, University of Manitoba
James MacPherson	Resource Consultant, James F. MacLaren Ltd., Winnipeg
Gladys Pirt	Contract Researcher, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg
Lorimer Thompson	Resource Extension Officer, Manitoba Department of Renewable Resources and Transportation Services, Winnipeg

1977

Richard K. Baydack	Temporary Resource Planner Interdisciplinary Systems, Winnipeg
Gordon L. Brown	Resource Consultant, Western Research and Development Co. Ltd., Calgary, Alberta
Sam S. Chow	Manpower and Economic Analyst, Policy and Planning Branch, Manitoba Department of Northern Affairs, (The Pas)
William P. Elliott	Executive Director, North American Wildlife Foundation, Delta Research Centre, Manitoba
Gregory M. Goodwin	Resource Consultant, Norenco Ltd. Winnipeg
Graham P. Latonas	Parks Planner Manitoba Department of Tourism and Cultural Affairs
John D. Neilson	Fisheries Specialist , McLean Consulting
Robert D. Ross	Naturalist, City of Winnipeg
Ralph F. Smith	Executive Council, Government of Saskatchewan, Regina
Helen T. Soudek	Research Associate, Natural Resource Institute, Winnipeg

APPENDIX B

DRAFT SUPPLEMENTARY REGULATION DESCRIBING THE PRACTICUM PROCESS

2.4 The Practicum Research Process

The regulations governing the Master of Natural Resource Management Degree require that every candidate for the degree shall submit a Practicum. This is in place of a thesis, which is the normal requirement for the Master's degree in other programs.

2.4.1 Practicum Definition

The memorandum which established the N.R.I. in 1968 defined the practicum as:

> *"A research project dealing with an actual problem in resource administration or allocation resulting in the preparation of an official report. Requirements are met either by working in a government or private agency on a selected and approved topic, or by independent work within the Natural Resource Institute."*

2.4.2. Purpose

The practicum is central to the teaching program at the N.R.I. It is an interdisciplinary research report on a resource management problem done in conjunction with agencies and individuals at the University of Manitoba and in the larger Canadian community. The practicum topic must be approved by the Director and may include independent work within the Natural Resource Institute.

The practicum is intended to be a field study report that deals with a problem in resource management. The practicum serves a 3-fold purpose:

i. It develops the student's ability to conduct applied interdisciplinary research on an actual problem of resource management or allocation.

ii. It meets his academic requirements, and

iii. It demonstrates his effectiveness as an employee.

Each student will attempt to obtain employment on a resource task, during the inter-year summer session of the program. The work done in the summer will with the employer's consent, form the basis of the practicum report.

2.4.3. Interdisciplinary Aspects

The student will be expected to bring to bear upon the preparation of the Practicum, knowledge gained in the course work as well as the practical experience derived from work in the field. Emphasis should be on the inter-disciplinary aspects of the situation under study and solutions should be tested against the following criteria:

i. economic feasibility
ii. technical feasibility
iii. political feasibility
iv. administrative feasibility
v. ecological feasibility

2.4.4. Procedures

A set of working procedures has been developed in association with the practicum process. While the following procedures are those normally followed, the Director of the Institute may alter these at his discretion.

i. The student, in conjunction with staff at the Institute and interested people at the University, in government or in the private sector, develops a topic for inter-disciplinary research on a resource management problem. The topic will lead to the development of a detailed research proposal completed in the student's first year, (part of the Institute's course 56.710 Research Planning and Strategy). Approval of the research Proposal by the Director is required prior to beginning the data collection phase of the research process.

ii. The student will identify persons who could make a valuable contribution on an advisory committee to supervise the applied research process. The Director's approval on selection of committee members is required. Members selected will be formally invited by the Institute to sit on the advisory committee.

iii. The advisory committee shall have the following structure:

a. The Director will sit on all advisory committees and will chair the oral examination. In some cases, the Director may participate in a committee as a regular member, in which case his designate will assume the role of the Director. In addition to the Director, the committee shall consist of no less than three members, one of whom must be a member of the Faculty of Graduate Studies from a faculty other than the Natural Resource Institute and who will ensure that the regulations of the Faculty of Graduate Studies are followed.

b. The student will select one member of the committee to act as a senior advisor.

c. Both academic and non-academic members of the committee shall either be recognized experts in the subject area of the practicum or shall possess a special knowledge which makes their participation appropriate.

iv. The student, in consultation with the members of the committee, will proceed with research on the problem and will produce a draft report for circulation to the committee members.

v. Committee members will provide constructive criticism of the first draft and will recommend changes necessary for a final draft. The student, having incorporated the advice of the committee, will circulate a final draft. The senior advisor of the committee will notify the Director of the acceptance of the final draft and a date for an oral examination of the report will be set.

vi. The oral examination will be an open meeting, with the exception of the period where practicum acceptability is to be considered. The format of the oral examination follows:

a. The oral begins with the Director's description of the format.

b. The oral generally takes one to two hours. The student begins with an oral summary of the practicum research. The balance of the oral is taken up with questions from the committee.

c. After the committee has had the opportunity to test the student's knowledge on the research process and the practicum topic the Director will suggest that the student and other non-committee members leave the room and the acceptability of the practicum will be considered.

d. The committee will assess the acceptability of the practicum on a pass/fail basis. The decision is by majority vote. If the decision is pass, the committee members will sign the acceptance form. Conditional acceptance is possible where minor revisions are to be made. In such a case, the Director will reserve his signature until satisfied that the revisions have been made. If the decision is fail, the committee will indicate required revisions and offer suggestions which will assist the student in a subsequent oral examination. Only two attempts at the oral examination are allowed. A second failure will result in a requirement to withdraw from the program.