

**An Evaluation and Restructuring
of the Master's Program
at the Natural Resources Institute,
University of Manitoba**

by

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An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

PREAMBLE

Managing change in the academic curriculum, in what is taught and how it is learned, must rank among the top 21st-Century management challenges for higher education. Universities today often find it easier to build buildings and increase endowments than to bring about fundamental improvements in the teaching and learning processes (Boyatzis, Cowen, and Kolb, 1991, p. 65). The University of Michigan's National Center to Improve Postsecondary Teaching and Learning states that curriculum revision currently takes an average of five years to complete. If we assume that the programs thus revised are not revised again for 5 to 20 years, we see that currently the fundamental knowledge base communicated to students changes in a 10- to 15-year cycle. This is too slow for the pace of the 21st Century (Boyatzis, Cowen, and Kolb, 1991, p. 65).

Academic program change has been characterised by the following terms: slow, idiosyncratic, externally driven, ever present, and parochial. These aspects of program change are acceptable when: (1) the economy is stable and employment high, and rapid or massive program change is not crucial because there may not be a perceived need for change; (2) society's expectations for higher education are low, as before World War II when college graduates made up a low percentage of the total workforce; (3) the knowledge base is stable, and the content of the program is unchanging; and (4) higher education is growing significantly and can nurture change without threatening established programs, as in the 1960s when institutions could easily change their academic programs by simply adding new faculty and new program

directions (Seymour, 1988, p. xix).

Most of the conditions that support this slow and evolutionary process of change does not exist today. Most notably, the dynamics in the world economy have contributed to increased public dissatisfaction with college outcomes. Seymour (1988) states that growth in enrolments for institutions of higher education has slowed, and therefore institutions are not routinely expanding their curricula. This lack of growth has contributed to a stagnation within the faculty. The viability of an aging conservative faculty is compounded by rapid developments in new teaching technologies, as well as significant increases in the growth of the knowledge base in many scientific areas (p. xix).

Seymour (1988) suggests that there is a consensus developing that colleges can no longer tolerate being dependent upon program change brought on by individual inspiration or idiosyncratic evolution. Institutions need be concerned about their organizational structure, leadership, and procedures to ensure that effective program change will occur (p. xix).

The effect of external conditions on higher education institutions and the need for program change has been well documented by many national reports. Seymour (1988) suggests that the ability to respond, to change, and to adapt may be the distinguishing trait between those institutions that continue to prosper, and those that don't (p. xix).

"Program evaluation" has been used extensively in higher education. In the most general sense, evaluation is "a study that is designed and conducted to assist some audience to judge and improve the worth of some education object" (Stufflebeam and Webster 1980, p. 6). A slightly more specific definition has been offered as well: "The term evaluation implies value judgements about the strengths and weaknesses of academic programs and, in addition, provides descriptive

information about them" (M. Clark 1983, p. 27). It is possible to differentiate among four types of evaluation according to their aims:

1. Planning, or development evaluation is undertaken to determine needs or deficiencies and to devise objectives or goals to meet these needs.
2. Input evaluation aids in making decisions about how to use resources to attain program goals.
3. Process evaluation provides continuing or periodic feedback so that those responsible for program planning and operation can review and possibly alter earlier decisions.
4. Output evaluation assesses the attainment, at the end of a project or at appropriate stages within it, of those goals [that] are self-contained and of those [that] are preliminary to entering another stage (Dressel 1976, pp. 15-16 in Seymour, 1988, p. 29).

Most definitions and uses of "program evaluation" or "program assessment," therefore, refer to the application of various procedures to judge the quality of ongoing academic programs.

For the purposes of this paper, "program evaluation" will be used in the following context:

The process of specifying, defining, collecting, analyzing, and interpreting information about designated aspects of a given program, and using that information to arrive at value judgements among decision alternatives regarding the installation, continuation, modification, or termination of a program (Craven 1980, p. 434).

INTRODUCTION

All organizations must periodically stand back and reassess what they have accomplished so far and what they need to do next. This requires an analysis of the organization's activities, their means for achieving past successes and a need to find a balance between the aspirations, and expectations of all their client groups. In the case of the Natural Resources Institute (NRI), "clients" include students (past, present, and future), the research communities, the public and private sectors, the general public, and the University as a whole.

The Central Administration at University of Manitoba is presently undergoing an intense evaluation and is reassessing what they would have done differently if they were able to turn the clock back ten years. The evaluation is entitled: "Draft Plan 2000: Towards a New University of Manitoba". The evaluation is in the form of a strategic development plan formulated by the Central Administration. The plan highlights some of the conditions and challenges that most Faculties, Departments, and Institutes are faced with at the present time. The draft document states that as the University of Manitoba approaches the 21st Century it faces a complex set of challenges created by: unrelenting demands and inadequate resources, conflicting federal and provincial interests, the competing goals of maintaining accessibility and preserving quality, public ambivalence about whether higher education is a right or a privilege, disagreement about the relative importance of teaching and research and about whether universities are primarily instruments of economic development or are meant to serve broader social and cultural purposes, the conflict between elitism and egalitarianism, and the attempt to maintain a generalist perspective in an increasingly specialized world. Given these challenges, it will be essential that

the NRI, as part of the University, articulate explicitly and coherently the strategies it intends to use in its pursuit of its aims, objectives and distinctive role within the University of Manitoba.

Factors Affecting Future Developments of the University and the Natural Resources Institute

Draft Plan 2000 suggests that the context for future development of the University of Manitoba has both external and internal aspects. These aspects are important to define because every department within the University is affected by them. External factors consist of: economic, social, demographic, educational, and accountability. Internal factors consist of: mission and role, faculty and staff, students, programs, academic support services, administrative support services, quality assurance, quality improvement and accountability.

External Factors

Economic

The national and provincial economies are burdened by large and growing deficits resulting from low revenue growth relative to spending levels. The problem has been aggravated by a prolonged recession and a slow recovery marked by large scale restructuring and job losses in many sectors. As a result of restructuring of the economy generally and cutbacks in the public sector, university graduates are no longer being readily absorbed into large corporations, governments, or the education, health and social service systems. Despite this, the numbers of students seeking university degrees remains high in Manitoba. Total revenues were stagnant in 1993-94 and are forecast to increase by 2.5%, 2.8%, and 2.9% in 1994-95, 1995-96 and 1996-97 respectively. The Manitoba Government is determined to reduce the deficit to zero by 1996-97 through expenditure restraint and some increase in taxation. Program expenditures (including

expenditures on universities) were reduced by 2 % in 1993-94, and were forecast to decrease by 1 % in 1994-95 and to be held constant in 1995-96 and 1996-97 (p. 2).

Social

Despite the financial constraints, public expectations of the University remain high. The public expects the University maintain and even expand accessibility, improve quality, keep pace with advances in knowledge, respond to the need for highly qualified personnel and expertise and provide up-to-date facilities and equipment. Universities are not only affected by society's increased concern with issues of equity, they are expected by many to take a leadership role in promoting equity. The public remains ambivalent about whether higher education is a right or a privilege and about whether universities are primarily instruments of economic development or are meant to serve broader social and cultural purposes (p. 2).

Demographic

The progressive increase in the proportion of elderly in the population will place increasing pressure on health and social service systems, and encroach on resources available for education and other programs. In Manitoba the proportion of young people coming from the aboriginal community is increasing steadily (p. 2).

Educational

The population wishing to pursue post-secondary education is diverse in terms of age, life experience, economic status and cultural and ethnic background. Moreover, the high school leaving population is more heterogeneous in terms of levels of preparation for pursuing post-

secondary education than was formerly the case. Community colleges are unable to accept many students who are interested in their programs. As a result students are attending the University who do not have the level of preparation necessary to succeed (p. 2).

Accountability

Contemporary concerns about institutional accountability stem mainly from economic pressures, including industrial restructuring and its effect on employment opportunities, constraints on the fiscal capacities of governments, increased costs to students and fiscally-based restriction on access to university programs. These concerns go beyond matters of fiscal responsibility and sound management of physical assets and human resources to include the question of how well universities live up to social expectations (p. 2).

Internal Factors

Mission and Role

Draft Plan 2000 also states that the most important internal factor shaping the University's activities is its institutional mission. By virtue of its commitment to original scholarship and research in addition to education and training, the university is distinguished from other kinds of institutions of post-secondary education. By the extent of its graduate and professional programs and the geographic reach of its programs the University is distinguished from its sister institutions in Manitoba (p. 2).

Faculty and Staff

The University has several loci of exceptional academic strength but the overall academic and support staff base, and the pace of faculty renewal, has been weakened by prolonged restraint and successive budgetary shortfalls. The particularly severe erosion of the support staff

complement, among other reductions, has compromised the infrastructural support for continuing faculty members. This has seriously impaired the University's ability to remain competitive with comparable universities in other provinces and in other parts of the world as evidenced by a progressive decline in the standing of the University in terms of funding from the research granting councils. It has also impaired the ability of the University to meet employment equity targets in a timely fashion (p. 3).

Students

The heterogeneity of the student body has already been referred to. Students today are on average older and more likely to be pursuing part-time study than was formerly the case. Increasing numbers of students with excellent high school records, who have the financial ability to do so, are leaving the province to pursue university study. Student retention rates are relatively low in some programs either because admission standards are too low, so that students are admitted who are inadequately prepared to handle university level work, or because financial and other pressures require some students to withdraw or prolong their studies (p. 3). In the area of accessibility, the Roblin Commission recommends that universities change their teaching schedules to accord with the requirements of part-time learners (University Education Review Commission, p. 36).

Programs

The University has an extensive array of programs and courses. Major revisions of these occur on a more or less regular basis in the professional faculties and schools. There has been no major reform of programs and courses in the general arts and sciences in recent years although dissatisfaction with these programs tends to be the target of much of the criticism

levelled at university education nowadays. There is a significant mismatch between the deployment of teaching resources and the needs of students as reflected in course registration patterns. Academic program administration is seen by many as excessively complex. Program and instructor effectiveness is impaired by large class sizes coupled with inadequate student preparation. Use of special program delivery strategies such as co-operative education and distance education has been building relatively slowly. Jurisdictional concerns are contributing to a lack of significant progress in reforming the academic schedule and designing new and more flexible arrangements to meet the changing needs of students (p. 3).

Academic Support Services

Academic support services such as library, computer and laboratory services have been under an increasing strain due to increased demands and inadequate funding. This has resulted in increased opportunity costs for both faculty members and students (p. 3).

Administrative Support Services

Administrative support services have also been under an increasing strain not only as a result of underfunding but also as a result of increased demands. As with certain academic and academic support units, the increased demands relate to the increase in student numbers. However, administrative support services must also cope with increased demands imposed by new government regulations. Certain support services have become uneconomic requiring significant restructuring (p. 3).

Quality Assurance, Quality Improvement and Accountability

The University has developed and is in the process of implementing the quality assurance, quality improvement and accountability mechanisms usually found in the contemporary North

American university. These usual mechanisms, however, may not be sufficient to achieve the optimum outcomes from the deployment of increasingly scarce resources. Moreover even those that exist are not linked effectively enough to the management and development of programs

(Draft Plan 2000, p. 4).

OBJECTIVE

The purpose of this paper is to evaluate the NRI program in order to set the conditions for a restructuring. The first question that needs to be addressed is: Why do we need to evaluate and restructure the NRI at this time? There are many answers to this question. Firstly, The University of Manitoba, as well as other Canadian universities are in the early stages of major changes and are looking to find better ways of doing things in many areas of which some are accessibility, technological developments, economic development, and equity issues. The University of Manitoba specifically is in the midst of a major restructuring as evidenced by a Draft Plan 2000 which has every unit in the University looking at the factors affecting future development at the University and requesting that administrators plan ahead in accordance with those factors. Secondly, the public is not satisfied with the work of the universities in Canada. This statement has recently been illustrated by an article in the Maclean's magazine entitled: "A Measure of Excellence" which ranks Canadian universities. Brian Segal, senior vice-president of MacLean Hunter, publisher of Maclean's in Toronto, and a former president of the University of Guelph, stated that "the public has not joined the battle for better university funding because it views the university as self-serving; serving the needs of faculty and staff, rather than students and society" (Wicks, 1993). Universities all over Canada are now responding to comments like this one and on articles criticising the work of universities. Thirdly, if it is a reality that curriculum revision currently takes an average of five years to complete, and that the fundamental knowledge base communicated to students changes in a 10 to 15 year cycle (as noted previously), the NRI must review curriculum and other program functions if it wants to keep pace for the 21st Century. Fourthly, if the NRI does not have the

ability to respond, to change, and to adapt with the external conditions that are now present, the Institute may not continue to prosper as it has in the 70's and 80's when economic and other conditions were not favorable. As stated previously, all organization must periodically stand back and reassess what they have accomplished so far, and need to assess what they need to do next. The NRI had an external review five years ago, however, that review is now outdated. It is now time to re-evaluate what the Institute has accomplished to date and to plan ahead for the everchanging future. If the NRI faculty and administrators do not do this, someone else that is better organized and more ambitious may. As stated by the University of Minnesota (1986)

"The organization that takes charge of its own future by defining important social needs and filling them has the possibility to maintain its autonomy, enjoy public support, and at the same time provide deep rewards and satisfactions for its members as the organization helps them to accomplish their own goals. The organization that drifts, without focusing on its energies, is likely sooner or later to become part of the agendas of others who are better organized and more ambitious (p. 1).

or more crisply stated: "plan or be planned for" (Ackoff, 1981, p. 50).

The second question that needs to be addressed is "What would warrant a restructuring of an academic program?" There may be several grounds on which to base a restructuring of the NRI program. First, the Institute has evolved over the past 25 years, as will be outlined in the historical overview section of this paper. Second, the practice of resource management has changed. There is greater competition among resource managers, there is now a greater awareness of environmental degradation, sustainable development is on the rise, and the technical competence that resource managers need now is higher than it used to be in the past. Third, the University as a whole has changed. University governance is changing constantly, and what was important 25 years ago may no longer be as important. For instance, the strategic plan of the University of Manitoba 25 years ago is considerably different than what it is today.

This was pointed out earlier in relation to the Draft Plan 2000 in which the University of Manitoba stipulated internal and external factors which are present today that were not 25 years ago. Fourth, public finance has changed. Governments are now faced with an increasing deficit that causes them to cut budgets and funding to education budgets, which in turn affect the resource management programs and their ability to deliver an effective program. Essentially, economic conditions require that Universities do more with less.

NRI program will be evaluated based on its history; the current program and its strengths and weaknesses; similar resources management programs in Canada and the United States; and the needs and wants of past and present students, the University, and society in general. The question that will be addressed throughout this paper is whether the Institute will have the ability to respond, to change, and to adapt to a fast changing, diverse and complex world. And if so, what would the best approach to respond, to change and to adapt, be?

In this evaluation, the structure and conduct of other institutions offering similar programs in Canada, the United States and elsewhere have been examined. The NRI program has been discussed informally with senior people in Government, Industry, and the Consulting Profession, Special Interests Groups and Academic institutions, as well as past and present directors, faculty, students, and others associated with the NRI. I obtained results from a survey conducted in 1987 from the entire body of graduates which addressed their professional retrospective view of their education at the NRI, and have informally discussed the NRI program with many new graduates and current students since this survey was conducted. I interviewed one of the founding members of the NRI, Prof. David Young who has provided me with invaluable information as to the initial objective of the NRI program.

Throughout this paper, suggestions for improvement of the NRI Program will be recommended based on information that is presented related to internal and external views. A complete list of recommendations will be reiterated in the "Discussions and Conclusions" section.

Criteria for a Successful Academic Program

A graduate program in any university is thought of as successful for many different reasons. One reason may be the success of graduates getting jobs, or simply their completion of their program. Another may be to just keep the program afloat through recessions, and the like.

Van Cleve Morris (1981) highlights a list of criteria that could be useful to assess whether a program is successful or not. They are:

- the national reputation of the faculty;
- the calibre of teaching they are known by;
- the amount of external funding they generate;
- what the accrediting agencies say;
- the overall estimate of outsiders from comparable or better institutions;
- the employability of its graduates;
- the testimony of those who benefit from its community services; or
- who employs its alumni (p. 269).

At the present time, it is difficult to assess whether the NRI program is successful or not. It would seem logical at this time to prepare for an external evaluation in order to get an outside

view of the Institute's successfulness. For example, in the last five years, we have attained 2 new faculty members (one is the Director). They may have brought more (or less) to the Institute as far as reputation is concerned. Or, without a formal evaluation of teaching, we don't really know the calibre of teaching that exists amongst the faculty. And, we know that external funding has increased in the last 10 years, but has it increased sufficiently? This information could be obtained, as a starting point, from an external evaluation of the program.

Recommendation 1: That an external review of the NRI program be done.

How to Restructure an Academic Program

In attempting to restructure or transform an existing program, it is important to look at other programs that have restructured their programs successfully. The New Weatherhead MBA Program is one of these programs. Boyatzis, Cowen, and Kolb (1991) identify seven important principles which guided them and their colleagues through the revision of the MBA program.

1. **The objectives of the new program should reflect the concept of "added value" from all stakeholders' perspectives.** The value-added concept, which assumes that the program can contribute more to students' development and growth, caused faculty to focus on what students were learning, rather than what the faculty was teaching. This perspective focused on how the Weatherhead MBA experience was contributing to improving students' knowledge and skills. It did not assume that the current program did not add value to students' capability, but that we could aspire to have an even greater impact. This was a major departure from the conventional wisdom exemplified by the expression, "If it ain't broke, don't fix it!"

There were many stakeholders whose views needed to be considered in the process of revising the MBA program: potential applicants, students, alumni, faculty, administrators, prospective employers of graduates, community supporters, and donors. While the perspectives of each stakeholder group were different, it was assumed that all stakeholder groups would have to be excited about the changes and perceive their added value. For example, prospective and current students are interested in the impact of changes on their employment prospects. Donors, on the other hand, are more concerned with community and national reputation. All stakeholder groups consider educational goals, outcomes, and responsibilities as important.

A challenge during the process was to avoid settling for the lowest common denominator of changes that all groups would accept and to strive for a design that was exciting, distinctive, and effective. Frustration with previous attempts at change and horror stories from colleagues at other institutions created a heavy blanket of low expectations that threatened to extinguish the fires of innovation. The "me too" approach toward an MBA education was discarded, and a concerted effort was made to develop a truly distinctive MBA program (p. 67).

2. Focusing on desired learning outcomes facilitates discussion within and among stakeholder groups. An orientation towards learning outcomes encourages viewing students and their potential from a holistic perspective. It focuses attention on the student's knowledge and abilities (that is, skills and personal characteristics) at the point of graduation. Desired learning outcomes become a focal point for discussion among people from different groups with different values and different responsibilities

concerning the student. The orientation and discussion of outcomes often leads to a discussion of outcome assessment. The questions are raised, "What are the capabilities of our graduates in terms of knowledge, and abilities? Are they prepared to enter, or re-enter, the work force? Are they capable of the continuing learning necessary for the world of tomorrow? As soon as the measurement outcome appears in discussions, measuring these same characteristics at point of entry into the program becomes an issue. The outcome assessment approach thereby leads to an acknowledgement and respect for the students' expertise and experience at the time of entrance into the program (p. 68).

3. Faculty should see themselves as "managers of learning" rather than teachers.

This principle requires a shift of control from the faculty as sole director of the educational process to a student-centered approach to learning. When students' learning becomes the primary objective, students must have more control over the learning process. They will want to move at a pace and direction suitable to their individual backgrounds, past experiences, personal learning styles, and so forth. Respecting this diversity of capability and allowing for the diversity of future career interests requires that the program be responsive to the unique learning needs of each individual.

The shift of attention from what is taught to what is learned encourages an overview of the whole MBA program, not merely the courses in it. The shift of the role of faculty members from teachers to managers of learning leads to a shift in the faculty members' thinking, from an exclusive focus on their discipline to a focus on the role their discipline plays in management jobs. The program involves courses, but also relationships with students and other faculty members, extracurricular activities at school

and activities at work. All of these experiences are opportunities for learning and development. This shift in perspective also raises the need for integrative learning. Courses are often effective vehicles for specialized learning, but they may not be appropriate vehicles to foster integration of learning. In the new program we sought to help students find perspectives to integrate what they are learning in different courses, activities to link theory and practice, and opportunities to understand themselves and articulate their career direction. Vehicles for integrative learning are especially useful for currently employed MBA students. Whether full-time or part-time, students often do not have the time or the opportunity to explore what they are learning in their current jobs (p. 69).

4. Professional graduate education should be liberalizing for the students, getting them to think about issues and situations in new and novel ways and to develop habits of the mind that stretch and expand their capacity to think and act creatively.

Many of us are concerned about the increasing vocational and specialized nature of not only professional education but of higher education in general. As the world becomes increasingly complex, and as organizations operate in vastly different markets, cultures, and economies, managers must be able to think in highly complex, global ways. The natural tendency of professional education is to socialize the person into the profession. This process involves learning to think and act like a person in the field and learning the values and norms of the profession. While this socialization is a valuable aspect of becoming a professional and the goal of every eager aspirant, any profession can become so specialized in its jargon, values, and norms that it excludes innovative thought,

sensitivity to new situations, and the learning skills necessary for continued professional growth and development. Since managers must work with people, and the work force is becoming increasingly diverse in most countries, management education should be liberalizing and expand students' views about the global society in which we live (p. 69).

5. The new program should use state-of-the-art adult learning technologies.

Eight adult learning technologies were considered by the faculty during the curriculum change process: competency-based assessment, learning contracts, learning teams, experience-based learning, lifelong learning, machine technology (computers, video), credit for prior learning, and advanced professional studies. The early discussion of new program possibilities began with the acknowledgement that the faculty should strive to adapt and adopt new methods of learning, especially those developed for use with adult students. Adult students have some, or often a great deal of, work and life experience. They have well-developed values, opinions, and thought processes for dealing with issues at work or home. To learn a different way of thinking, these students must be given the opportunity to examine their current way of thinking; assess its value, costs, and benefits; explore the new way; and determine its relevance or potential in their lives or work. In professional education, the aim is to help them interpret their experiences and learn new and hopefully better ways to approach these situations in life and work. They must unlearn some past practices, or possibly relearn approaches discarded earlier in life (p. 70).

6. The curriculum change process should be led by the faculty. Of all of the stakeholders, the faculty is involved in the school and program for the longest duration

and has the greatest impact on student learning. If the faculty does not see the benefits and feel the excitement of the change process and the new program, it will be doomed to death from apathy. The faculty must be involved in and primary leaders of changes in the new program to ensure its real implementation, as contrasted to a change in labelling and packaging without a change in content and process of education. To operationalize this, the faculty leadership, the elected Faculty Council, appointed an MBA Objectives Committee comprised of senior faculty and representatives of the schools's six departments. Its charge was to develop a consensus program proposal in coordination with other stakeholder groups for approval by the Faculty Assembly (p. 71).

7. **The proposed program should be resource-consistent with the current program.** Since no increase in enrolment was expected or desired, the school's budget would remain relatively the same. In addition, with two-thirds of the faculty tenured, it was clear that whatever program components were identified and developed, they would be implemented primarily by the current faculty. Thus, the current budget and the current faculty would have to be capable of implementing the new program (p. 70).

The process that took place in the revising of the MBA program was as follows: All stakeholder were involved in the process; participation was a key factor; patience and perseverance were key elements in the process; Deadlines were imperative, Committees and sub-committees were set up to brainstorm ideas; the old MBA program changed from one program to two MBA programs: the regular program requiring 60 hours of coursework, and a short program requiring 42 hours; and, information about the progress of the committees was

made available to all faculty and administrators through progress memos and presentations at all faculty meetings.

After the new MBA program was revised, applications for admission went up 90%.

HISTORICAL OVERVIEW

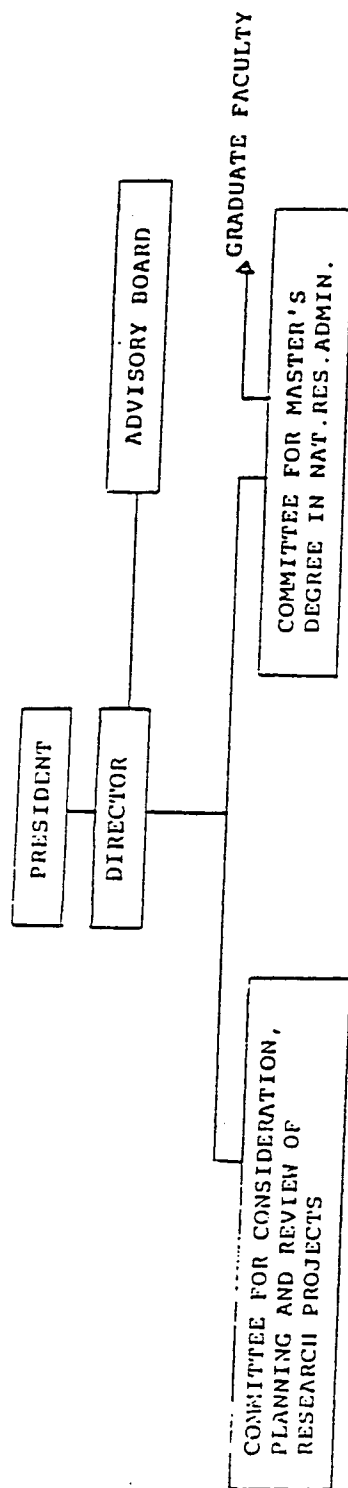
The NRI was created in 1968 in response to a demand for trained personnel in the field of resource management. At that time, the main goals were to establish the Institute and have it become an integral part of the University system. Figure 1 provides the initial blueprint (April 1968) for the NRI which contains an organizational chart and duties of committees at the time together with the membership of the NRI advisory, academic, and research committees (1970). The NRI was in a development phase from 1968 through to 1977 (Table 1). During this period, the Institute had a graduate class of approximately 47 students. In 1971-72, the Institute had 12 pre-master's students, which was the most ever accepted into the pre-masters program during two academic terms. The staff/student ratio in the 1976-77 academic year was approximately 1:12. Prior to 1974-75, the NRI was largely supported by University funds. In 1974-75, the bulk of its operating funds came from external sources, and only a core amount came from the University's operating budget. The Directors through the development phase were Sol Sinclair and Paul Nickel. Throughout the developmental phase, little time was devoted to student relationships because the administration and faculty were concentrating on major research projects, were developing policies and procedures that would begin to give the NRI program credibility, and were participating in outreach activities and attending public meetings.

During the operation and revitalization phase, the NRI made a name for itself in Manitoba, and other parts of the country. Its emphasis and focus changed to beginning to recognize the needs of graduate student, improving teaching within the program, and improving the credibility of the program inside and outside the University. At the operational and implementational phase (1978-1991), the Institute leadership seemed to recognize the

Figure 1

Blueprint of the NRI in April, 1968

NATURAL RESOURCES INSTITUTE



- (1) ADVISORY BOARD - would include representatives of university, government and other organizations
- would assist the Director to establish the policy of the Institute
- (2) COMMITTEE FOR CONSIDERATION, PLANNING AND REVIEW OF RESEARCH PROJECTS - would assist the Director in deciding which of the interdisciplinary projects relating to resources development which are suggested by members of the Advisory Board, by external agencies, or by members of the university should be undertaken by the Institute. The committee would assist the Director to assemble "task forces" appropriate to these projects, would help to establish terms of reference of these "task forces", and would review reports of these "task forces". Also the committee would be useful in advising the Director on the funding that would be appropriate to the projects that are undertaken.
- would include, amongst others, persons with administrative responsibility for major group projects relating to resources research plus representatives of resource-oriented departments of the University and of government (from which task force members might be drawn) for degrees
- (3) COMMITTEE FOR MASTER'S DEGREE - would supervise curriculum and recommend students
- (4) DIRECTOR - in addition to the responsibilities implicit in the above diagram, the Director would be a member of the several existing resource-oriented interdisciplinary groups and would play an important coordinating role in that way.

COMMITTEE MEMBERS

NATURAL RESOURCE INSTITUTE

ADVISORY COMMITTEE

Dr. M. Cormack, Manitoba Department of Agriculture
- Dr. H. E. Duckworth, Vice-Pres. (Academic), U. of Manitoba
Dr. J. C. Gilson, Agricultural Economics, U. of Manitoba
Dr. W. Johnson, Freshwater Fisheries Institute
Dr. K. Kristjanson, Manitoba Hydro
Mr. Christian de Laet, Canadian Council of Resource Ministers
Mr. W. W. Mair, Manitoba Department of Mines & Natural Resources
Dean D. K. Moir, University of Brandon
- Mr. J. J. Murta, Carman, Manitoba
Mr. Alan Scarth, Q.C., Wildlife of Manitoba Foundation
Mr. Carson Templeton, Templeton Engineering
Dr. H. D. B. Wilson, Department of Geology, U. of Manitoba
- Dr. H. E. Welch, Department of Zoology, U. of Man. - Chairman

ACADEMIC COMMITTEE

Dr. D. T. Anderson, Department of Geology, U. of Manitoba
Dr. G. F. Atkinson, Department of Statistics, U. of Manitoba
Dr. J. C. Gilson, Dept. of Agricultural Economics, U. of Manitoba
Dr. J. Gray, Department of Economics, U. of Manitoba
Prof. Cameron Harvey, Faculty of Law, U. of Manitoba
Prof. Peter Laut, Department of Geography, U. of Manitoba
- Dr. D. L. Rennie, Department of Sociology, U. of Manitoba
Dr. C. R. Santos, Department of Political Science, U. of Manitoba
Dean L. H. Shebeski, Department of Agriculture, U. of Manitoba
Dr. R. J. Stanton, Dept. of Computer Studies, U. of Manitoba
Prof. R. H. Vincent, Department of Philosophy, U. of Manitoba
- Dr. H. E. Welch, Department of Zoology, U. of Manitoba
Dr. Sol. Sinclair, Director, N.R.I. - Chairman
Dr. H. H. Saunderson)
Dr. H. E. Duckworth) ex officio

RESEARCH COMMITTEE

Mr. Lloyd Brooks, Manitoba Dept. of Mines & Natural Resources
Dean C. H. C. Edwards, Faculty of Law, U. of Manitoba
Dr. J. C. Gilson, Dean, Graduate Studies, U. of Manitoba
Dr. R. A. Hedlin, Department of Soils, U. of Manitoba
Dr. A. G. Kristjanson, Department of Sociology, U. of Manitoba
Prof. Michael Laub, Department of Economics, U. of Manitoba
Dr. R. Newbury, Dept. of Civil Engineering, U. of Manitoba
Dr. H. E. Welch, Department of Zoology, U. of Manitoba
Dr. H. D. B. Wilson, Department of Geology, U. of Manitoba
Dr. Sol. Sinclair, Director, N.R.I. - Chairman
Dr. H. H. Saunderson)
Dr. H. E. Duckworth) ex officio

Winnipeg, Manitoba
February 16, 1970
/vgm

Table 1
Evolution of the NRI

PHASE	1968 -1977 DEVELOPMENT PHASE	1978 - 1991 OPERATION AND REVITALIZATION PHASE	1992 - IMPLEMENT AND MATURITY PHASE
DIRECTOR	Sinclair/Nichol	Henson	Berkes
ASST. DIR	Henley	Henley	Henley
FOCUS & EMPHASIS	Policies Procedures Practicum	Credibility in and out of Univ. Quality program	Recognition at highest level fed/prov./nat. Quality program
ADMINISTRATIVE FOCUS	Innovative Outreach	Worked in and out of Univ.	Maintain credibility. Enhance program Increase profile
TEACHING	teacher centered	student centered rigorous program 54 credit hours plus practicum	student centered less coursework 42 credit hours plus practicum
GRADS PER YEAR	8/9 per year	18 per year	22 per year
STUDENT NETWORK	Minimal network	Powerful network (approx. 280)	Powerful network (approx. 280)
ACADEMIC	no degree offered	MNRM degree	MNRM degree
FACULTY RESEARCH	Major research and projects	Little research	Increasing research
FINANCIAL	no baseline (\$250,000 soft money)	full baseline \$350,000 81 Reces- sion	full baseline \$350,000 1991- recession

importance of developing a good relationship with its students - past and present, and also recognized that if the students were to be competitive in the current market, they needed to be taught in a rigorous interdisciplinary program.

As a result, an emerging graduate network was developed throughout this phase whereby the graduates of the Institute and the faculty kept in contact. The Canadian Association of Resource Managers (C.A.R.M.) was developed through this period where graduates of the NRI convened on a regular basis to keep in touch with natural resource issues and each other. The graduates were the key strength of the NRI program and this network, sometimes referred to as the NRI Mafia¹, is very important to the NRI. The graduates in the network help to support the new students in the program by giving lectures related to their past practicum research experience, by giving advice and moral support to new students, and by helping students in any way they can to attain the same goal that they once had - to get the MNRM degree and a productive job. Some graduates were in positions which enabled them to hire new graduates from the Program or to provide funding for research topics. The help and support that the Network provided, not only helped the students in the program immensely, but also supported the program itself.

The NRI leadership recognized that if students were to be competitive in the current market, they needed to be well diversified and be taught in an interdisciplinary program. The program consisted of 54 credit hours plus a practicum. The program was rigorous for the students as well as for the faculty. The Institute leadership succeeded in making the program

¹ The NRI network is sometimes referred to as the 'NRI Mafia' because they are active and influential in all levels of government. It is often said that if governments were to change, a new NRI Mafia would occupy the positions that the old NRI Mafia once occupied. This is mainly because the NRI network has the NDP, the Liberal, and the Conservative political parties covered.

rigorous, and the students succeeded because they were in great demand once they graduated. At that time, over 90% of graduate students were employed shortly after completing their MNRM degree.

To improve the credibility of the Institute, the Director (Henson) and Assistant Director (Henley) worked diligently, one inside the University and the other outside the University. They were both successful. Dr. Henson was an active member of many committees on campus, and developed credibility through his hard work. Meanwhile, Prof. Henley made contacts with agencies, the public and private sector, other universities, provincial, national, and international organizations, to meet his goal. Research by the Director, Assistant Director, and the faculty of the NRI was minimal throughout this period because of the increase in graduate students (15/yr) (Table 2 and Figure 2). As student numbers increased, so did consulting, advisory and committee work for the Director and Assistant Director, and the faculty.

The period between 1978 and 1991 was a very stressful period financially for the NRI. The recession of 1981 threatened the life of the NRI because the University administration threatened to reduce operating. The Institute only had \$135,000 in operating funds available at the time, and could not have survived a cut. Other Centres and Institutions that offered comparable programs to the NRI did not survive the financial hardships that the recession brought and were forced to close. The NRI program managed to survive despite its financial hardships. The University did not reduce NRI's operating budgets even though most other University departments' budgets were reduced. There may have been two reasons for this. The first, may have been that the NRI was the only unit to offer a graduate degree (MNRM).

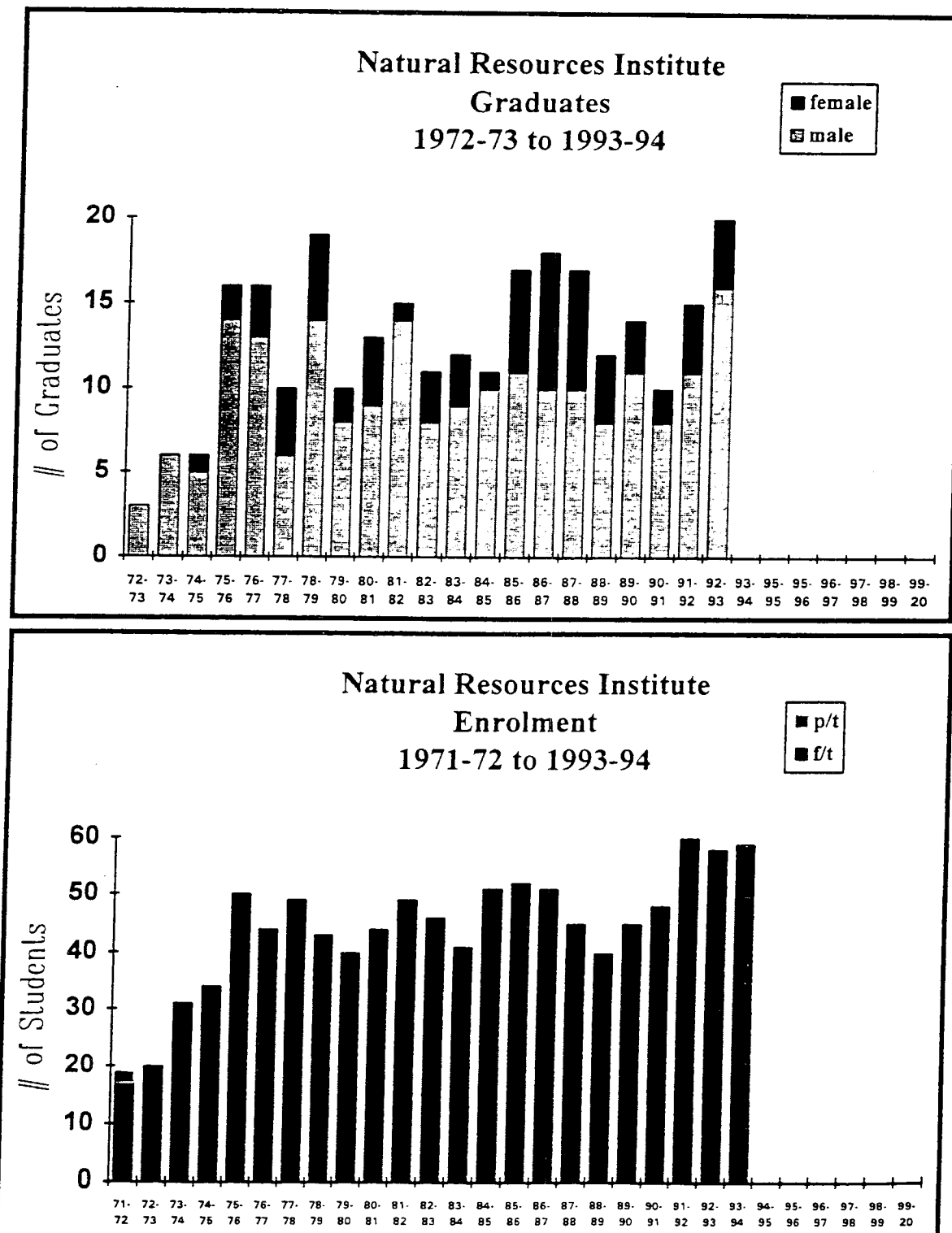
Table 2

NATURAL RESOURCES INSTITUTE
STATISTICS
1971-72 to 1992-93

YEAR	GRADUATES						STUDENT ENROLMENT				ACADEMIC FACULTY			FINANCIAL										
	M	F	T	T	F	P	T	T	O	A	L	T	P.M.	OCC.		AC AD.	SPEC. ACAD.	TOTAL ACAD.	L.U.	STUD. STAFF RATIO	OPERATING EXPENDITURES for the Fiscal Year Ending March 31	ANNUAL AUTHORIZED RESEARCH FUNDS	SPECIAL FUNDS EXPENDITURES FROM EXTERNAL SOURCES ending Mar. 31	RESEARCH EXPENDITURES FROM EXTERNAL SOURCES ending March 31st.
														FT	PT									
1992-93					50	8	58	0	0	1	0	4	.39					4.39	10.33	4.39				
1991-92	11	4	15	52	8	60	1	0	0	2		3.2	.53					3.73	10.66	3.73	466,800	226,724	28,776	
1990-91	8	2	10	40	11	51	7	1	0	1		3.2	.2					3.4	9.50	3.4	321,093	95,324	1,304	175,106
1989-90	11	3	14	36	9	45	5	1	0	0		3.2	.2					3.4	8.33	3.4	309,371	123,790	4,833	147,978
1988-89	8	4	12	34	6	40	2	2	0	1		3.2	—					3.4	7.16	3.4	256,518	161,650	4,537	136,159
1987-88	10	7	17	39	6	45	3	0	0	1		3.3	—					3.3	8.00	3.3	261,051	141,889	0	125,139
1986-87	10	8	18	41	10	51	3	0	0	0		3.3	—					3.3	9.33	3.3	260,627	135,149	157	158,119
1985-86	11	6	17	45	7	52	3	1	1	1		3.3	—					3.3	9.33	3.3	238,324	181,591	2,343	120,644
1984-85	10	1	11	40	11	51	2	1	1	1		3.3	—					3.3	9.50	3.3	228,925	123,878	0	164,255
1983-84	9	3	12	31	10	41	2	0	2	0		3.3	.39					3.69	7.66	3.69	226,475	113,814	0	105,581
1982-83	8	3	11	34	12	46	5	0	4	1		3.1	.67					3.77	8.66	3.77		95,327		
1981-82	14	1	15	30	9	39	7	0	2	2		3.1	.67					3.77	7.33	3.77		49,840		
1980-81	9	4	13	33	11	44	5	0	1	2		3.1	.75					3.85	8.33	3.85				
1979-80	8	2	10	32	8	40	2	0	2	3		2.4	1.24					3.64	7.33	3.64				
1978-79	14	5	19	35	8	43	3	1	4	2		2.3	1.12					3.42	7.83	3.42				
1977-78	6	4	10	42	7	49	3	0	0	3		2.3	1.12					3.42	8.83	3.42				
1976-77	13	3	16	36	8	44	0	1	3	2		2.3	.6					2.90	8.00	2.90				

Figure 2

Trends in NRI Enrolment and Graduates



Secondly, it is believed that the central administrators at the University of Manitoba began to accept the NRI as a legitimate learning unit. The University administration turned 'soft monies' (budget only), into to 'baseline funding'. This was a major breakthrough for the NRI.

After 1991, the emphasis and focus of the Institute appeared to change again. The emphasis appeared to be for the faculty to publish more, and for the students to do less course work. The program changed from 54 credit hours plus a practicum to 42 credit hours plus a practicum. The pre-requisites for the program no longer were required to be completed as part of the core program. The Pre-Masters's program was eliminated (1992). This was done mainly to reduce the pressure on enrolment quotas and to reduce the time faculty and administrators had to spend with the students in the Pre-Master's program.

During the time period after 1991, the objective of the program moved towards trying to raise its profile at the highest levels of government - Provincial, Federal and International. The NRI 'Mafia' were still in key positions in governments, however, there was still a great deal to be done in relation to undergraduates in other disciplines learning about the program. Dr. Berkes, who was appointed Director in 1991, tried to raise the Institute profile by becoming involved in seminars, workshops, conferences and outreach strategies locally, nationally and internationally. Visiting professors were invited to the Institute for the first time since its inception (mainly due to lack of space in the previous facilities). The visiting professors provided the University community with countless seminars and workshops. The NRI faculty were also encouraged to devote a considerable amount of time toward outreach activities.

The financial picture after 1991 looked better than it had in the past. Even though the existing recession forced the University to cut NRI's operating budget, the Institute was in better

shape financially than it has ever been. Grant funding almost doubled, thus allowing the faculty and leadership to use grant funds for student support instead of relying on operating funds. Besides the financial aspects, the Institute has never been in such a good all around position considering student, faculty, and overall success. Even with a decrease in coursework, the Institute has continued to produce graduates that were scientifically educated in resources management, who were resourceful, and who could compete effectively in today's markets and in all sectors of society. The Institute was also able to increase faculty numbers (by two), increase its profile, increase its recognition, and increase the overall quality of the program.

David A. Young, one of the founding members of the NRI and long-standing adjunct professor, student advisor, and member of several NRI committees recently summarized the last 25 years of the NRI in the latest issue of the NRI Bulletin. One cannot fully comprehend the history of the NRI without reading his insightful retrospective.

The Natural Resources Institute was created in response to a demand for competence. In the mid sixties evidence of conflicting resource uses was everywhere among us. Hydro-electric development was flooding Chemawawin and Moose Lake in northern Manitoba, parks were being carved from forest reserves and farmlands. Drainage and water diversion projects were splitting communities and defeating popular politicians. There were engineers doing drainage and building dams. Agronomists were pushing pesticides and herbicides and fighting for and against irrigation. Economists were the champions of growth and progress. The works of gurus Marsten Bates and Rachel Carson were on the bookstands and the future of DDT was being debated. As the trees fell and the waters rose and the bugs and the birds were poisoned the decision makers and planners found the knowledge and skills of their resource managers, mostly foresters and biologists, inadequate to the emerging challenges of changing social and ecological paradigms. Managers of a new kind were needed; people with some understanding of political systems and social organization, some knowledge of ecology, people able to understand both the engineer and the economist. A few American schools were offering professional degrees encompassing these disciplines, but no Canadian

university had a faculty or facility capable of meeting the demand.

So we made one. We began with a paper describing a model based on the Conservation Department of the School of Natural Resources at the University of Michigan, partly because two of three of us had studied there. The Deputy Minister of Mines and Natural Resources, Stuart Anderson, and the Minister, Sterling Lyon, agreed with the concept and gave it an enthusiastic push. The University provided Clay Gilson who brought with him the considerable resources and experience of the Faculty of Agriculture. The Ford Foundation provided a significant nurturing grant and in the course of about three years the NRI was created.

It was an odd creature; an Institute and not a Faculty, it would offer a graduate program where no undergraduate program existed. Under the guidance of Dr. Gilson and Dr. Sinclair, both agricultural economists, the orientation was strongly pragmatic, directed to the study of real problems and the search for practical solutions. And from the Faculty of Agriculture came the awareness of a clientele, an understanding that the students and staff of the new Institute should work closely with the professional community. Through employment and research the students and the staff should be at least as close to the community as to the academic world. They would be located on campus for the benefit of association with the established faculties and the use of library and other facilities but their research work would be directed as much by working resource managers as by pedagogues, and the measure of progress and accomplishment would be judged as much by the standards of the professional community as by those of the academics.

The educational process would consist mostly of stirring and challenging. Students from diverse academic backgrounds and from several countries and cultures would be brought together and challenged to address and solve problems and concerns drawn from the struggle of resource managers to protect and preserve the environment while meeting emerging demands for space, energy and materials. It was the notion of originators of the program that, confronted with real problems and provided with the resources of the University, the students could teach themselves. They could draw on conceptual frameworks learned in a wide variety of undergraduate programs, and by working in groups and teams, they would learn from each other. The staff would offer guidance and orientation by means of frequent counselling and by providing a few core courses. The main emphasis of the program would be on applied research and practicum preparation under the guidance of professionals drawn from the community at large.

Some three hundred graduates have tested the system and they are everywhere to be found engaged in a considerable variety of professional activities. They are widely dispersed. Many have returned to their own countries; in Canada there are concentrations in Winnipeg, Ottawa and Calgary, but there are others scattered across the country. They are engaged in research and analysis, in administration, in various phases of conflict resolution, in journalism and communication and in management and

direction. A few have pursued academic careers and several have been admitted to the bar. They are employed in transnational corporations and government at all three levels, in crown corporations and NGOs, by tribal councils and other aboriginal organizations. Several have established their own businesses or consultancies. Many seem to rise with remarkable speed to positions of considerable responsibility. It would be interesting to compare their careers to those of graduates of other management programs.

The Institute has provided interesting challenges to the four directors and the academic staff who have found themselves guiding the research and analysis of students with backgrounds in a wide range of disciplines, most of which the staff have never studied, and seeking from business, government, and other institutions, research opportunities and financial support to integrate the students into the professional community. The staff have been more entrepreneurial than academic and have guided the preparation of research reports to meet the standards of business and government rather than those of the academic community. Competence and significance of the accomplishments of the students and graduates have more often been recognized and judged in the popular media than in refereed journals, and staff have occasionally been mildly chided by their academic colleagues for lack of orthodoxy. On the whole, though, relations with the University at large have been tolerably pacific.

For 25 years the leitmotif of the program has been management for change. An ever increasing human population and an ever growing economy causing ever expanding resource demands on a finite environment make change the nature of reality for the resource manager. For twenty five years the constants have been the presence of change and the accelerating pace of change. The themes seem as appropriate now as they did in the late sixties. The program of the Institute is probably as relevant to reality today as it was then. The next twenty five years should be interesting.

(1993/94 NRI Bulletin)

OVERVIEW OF THE NATURAL RESOURCES INSTITUTE

Natural Resources Institute

The NRI is a teaching and research unit of the University of Manitoba led by a Director who reports to the Vice President (Academic). The degree, Master of Natural Resources Management (MNRM) is administered by the Faculty of Graduate Studies. As part of the University of Manitoba, the NRI offers a program of graduate study which attempts to teach resources management skills leading to the (MNRM) degree, to conduct useful research in current problems of natural resources management, and to provide a forum for examination of resource issues and thus raise the level of public awareness. The graduate program is interdisciplinary, consisting of a core of resource management courses offered by NRI staff, and complemented by a variety of courses offered by other departments on campus including Law, Economics, Geological Sciences, Zoology, Agricultural Economics, and Geography to name a few.

The Institute is represented on the Council of Deans and Directors, and has observer status on the University Senate. The NRI is represented on the Council and the Board of the Faculty of Graduate Studies, various committees of the Faculty of Graduate Studies, and many other Boards and Committees at this University. In short, the Institute is fully integrated into the governance of the University. The University of Manitoba Organization Chart (Figure 3) depicts the hierarchy of the University system and shows the reporting routes the NRI takes.

Organizational Chart of the University of Manitoba

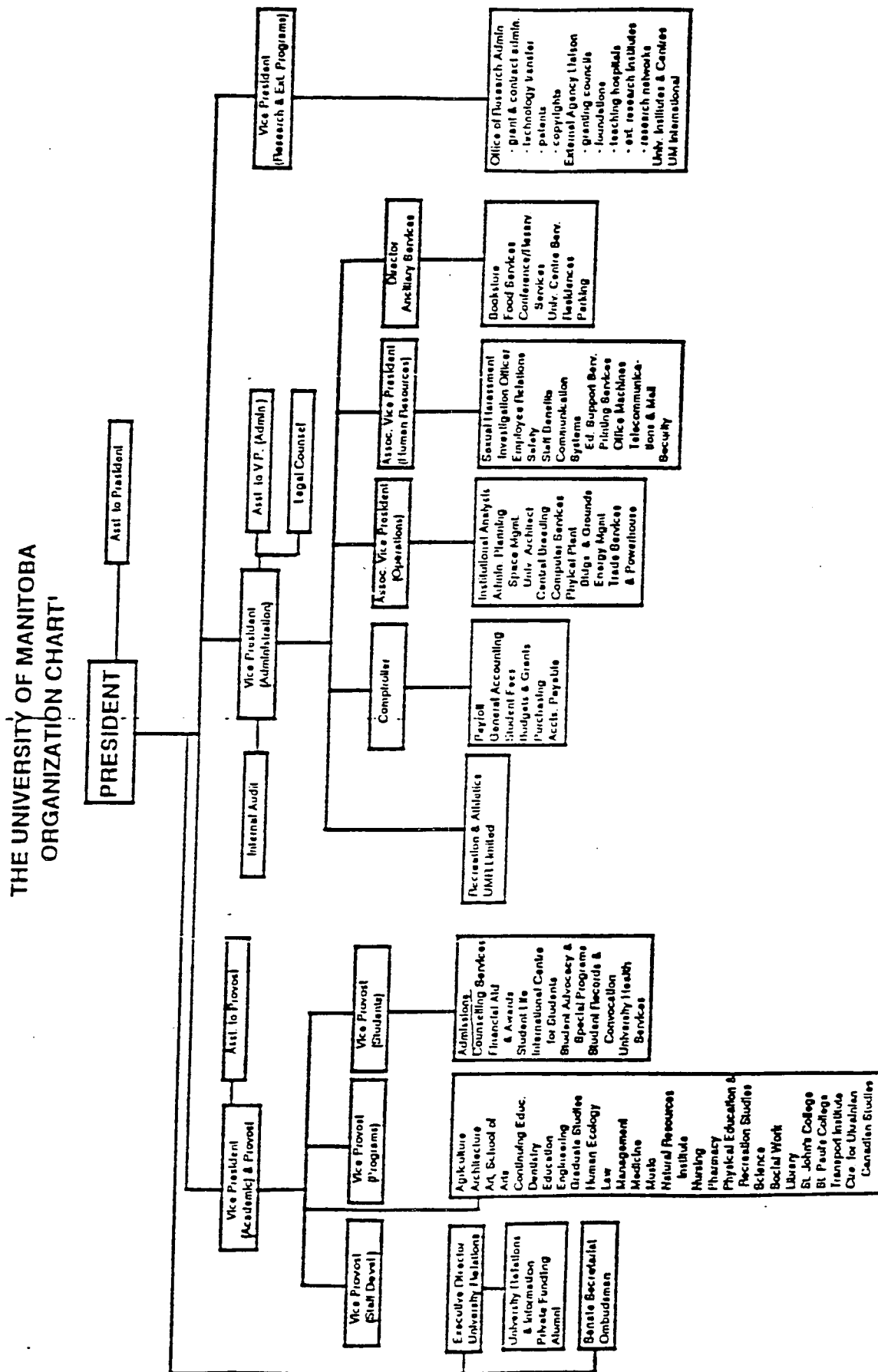


FIGURE 1

(1) Effective 91/12/19

Mission

The Mission of the NRI is as follows:

The complexity of environmental, economic and social issues relating to natural resources is beyond the scope of any single discipline. The Natural Resources Institute, established in 1968, offers an applied program. It is an interdisciplinary graduate unit which emphasizes problem-solving skills, maintains close working relations with resource management professionals, and offers broad-based education, with an area of strength in the human dimensions of natural resources management (NRI 1994 Multi-Year Plan).

Mandate

The mandate of the NRI is:

1. to teach interdisciplinary resource management skills leading to the Master of Natural Resources Management (MNRM) degree;
2. to conduct applied research in natural resources management; and
3. to provide a forum for the examination of resource use issues and thus raise the level of public awareness and contribute to public policy.

In carrying out this mandate, the NRI has developed a teaching program, an applied research program, and an outreach program to communicate knowledge and to contribute to policy in the area of natural resources, thereby contributing to the well-being of the people of Manitoba, Canada and the world (NRI Multi-Year Plan).

Goals

To fulfil its mission, NRI seeks:

- a) to provide excellence in applied graduate education in the field of natural resources;
- b) to foster a learning environment conducive to professional development and to the intellectual and personal growth of students;
- c) to extend knowledge in the field of natural resources by conducting applied research and original scholarship of the highest quality;
- d) to serve the community directly by making its expertise available to agencies and institutions;
- e) to provide a bridge between resources available within the University and problem-solving needs of society; and
- f) to provide a forum for critical inquiry and debate in resource policy, while protecting academic freedom and intellectual independence (NRI Multi-Year Plan).

Role

According to the NRI's 1994 Multi-Year Plan, the NRI is active in education, research and outreach. Its strength and expertise cuts across a number of resource fields; it is in the area of human dimensions of natural resources management, including natural resources policy, sustainable development, institutions, decision-making processes, community-based resource management, co-management, traditional ecological knowledge, habitat management, environmental stewardship and multi-stakeholder processes.

The Institute plays a distinctive role at the University of Manitoba through its interdisciplinary activities and its participation in networks dealing with natural resource and environmental issues in Manitoba, Canada and internationally. It is the only school in Manitoba conducting graduate teaching and research specifically on natural resources; hence it has contributed to natural resources management in a provincial setting.

The Institute serves all parts of the Province, including urban areas, rural areas and northern regions. It serves full-time students as well as professionals upgrading their skills as part-time students. It serves students from a number of disciplines related to natural resources, for example those with undergraduate degrees in biology, geography and economics. Through workshops and seminars, the Institute reaches a diversity of publics beyond the university setting.

The Institute is distinctive because of its close linkages with resource management professionals in government and industry. All graduate student research committees at the Institute include both University academics and resource management practitioners. Professionals

representing agencies and groups which range widely from Provincial and Federal departments, to NGOs and aboriginal groups, serve as clients to students conducting practicum research towards the Master of Natural Resources Management degree at the Institute.

Through students, their faculty advisors and other University of Manitoba faculty on graduate student committees, the University makes its expertise available to the community for addressing natural resource problems. In turn, the University benefits from the participation and perspectives of government and industry professionals in the education of graduate students. The research process at the Institute is highly interactive, and students learn to address real problems, to write research proposals, and to interact with clients and other members of the research committee. Employability of the Institute's graduates is a significant benefit of the unique program (NRI Multi-Year Plan).

Accountability

In recognition of its mission, goals and role, the NRI is accountable for:

- i) facilitating access to its program for as many students as meet its admission requirements and as can be accommodated and effectively educated with available resources;
- ii) responding to evolving needs in postgraduate-level education in Manitoba and Canada in the field of natural resources;
- iii) providing a program with a reputation of excellence in graduate education in natural resources;
- iv) conducting applied, interdisciplinary research that meets society's needs for problem-solving in natural resources; and
- v) providing an environment for work and study that fosters the employability of students upon graduation (NRI Multi-Year Plan).

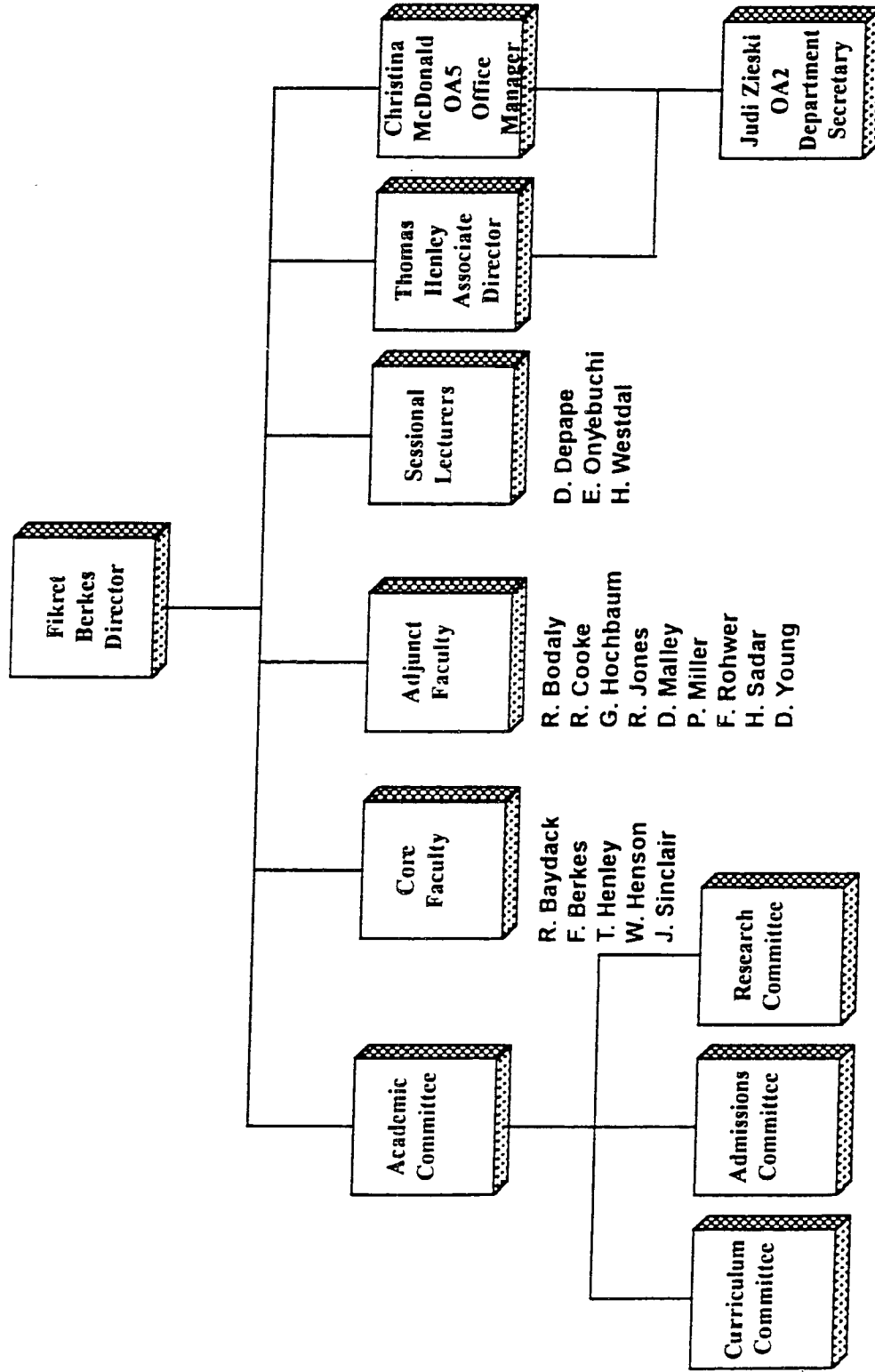
Administration, Faculty, and Staff

The leadership persons at the NRI are its Director and Assistant Director. The other players at the Institute consist of three full-time professors, nine adjunct professors, and two support staff (Appendix B). The NRI Organizational Chart (Figure 4) depicts the hierarchical

Figure 4

Natural Resources Institute

Organizational Chart



structure of the unit.

The full time faculty and staff meet weekly to organize the schedule of meetings and plan the work of the Institute. The faculty review the progress of each student research project on a monthly basis and review all transcripts each term.

The adjunct faculty contribute to teaching and student research direction. Faculty loads are heavy. The formal teaching assignments of each faculty member may appear to be on the light side. However, the requirements of student research and consultation together with client contact combine to make the total teaching effort heavy. Each practicum research project requires at least as much time as Masters thesis direction. Each faculty member advises approximately 15 students at all times, as well as serving on committees for other students in other University departments. Most of the faculty are actively involved in outreach and research activities.

Teaching Program

The primary objective of the teaching program is to educate prospective resource managers to understand the complex nature of natural resource problems and to develop the analytical skills necessary in the search for solutions. This involves building upon the solid base of students' previous education in a particular discipline. The degree program, of two academic years duration, is interdisciplinary in nature. Institute students learn about the process of problem definition, assessment and evaluation of alternative solutions, and problem redefinition. In addition to course work, the student is required to present a practicum (a research project dealing with an actual problem in resource management and planning).

The practicum is designed to synthesize the student's learning in other courses and to

provide field experience in planning and conducting applied research. The practicum is guided by two courses in Research Planning and Design which provide an overview of scientific method and research activities in many fields of resource management. These courses concentrate on the development of a research proposal. The proposal is essentially a blueprint for the practicum research project.

The Institute program integrates special seminars, conferences and field activities with courses. A number of courses draw heavily on contacts in government and the private sector for presentation and discussion of important topics. Through contact with outside experts, university staff, and through critical self-evaluation, the Institute's teaching program has continued to evolve.

The academic work of the Institute is closely integrated with that of other parts of the University. Many students augment their core curriculum through course work in other faculties. In this way, each student is able to acquire academic strength in their chosen area of specialization. This widely based body of expert knowledge, held by the students, adds diversity and richness to the program.

MNRM Program

The M.N.R.M. program consists of the following four requirements:

1. **69.703 Practicum**
(This requirement carries no credit-hour value.)
2. A Total of 27 credit-hours consisting of the following:
 - 56.601** Introduction to Natural Resources Management (3)
 - 56.709** Research Planning and Design I (3)
 - 56.710** Research Planning and Design II (3)
 - 56.714** Topics in Natural Resources Management I - Policy Development (3)

- 56.715** Topics in Natural Resources Management II - Environmental Assessment (3)
- 22.741** Biological Resources Management II (3) See note (a) below.
- 18.447** Natural Resources Economics (6)
- 45.329** Natural Resources Administration and Law (3)

3. A minimum of 6 credit-hours chosen from the following:

- 56.711** Northern Field Seminar (3)
- 56.712** Mineral Resources (3)
- 56.713** Energy Resources (3)
- 22.740** Biological Resources Management I (3) See note (a) below

4. A total of 9 credit-hours of electives chosen under the following guidelines:

(a) 22.740 is designated for students with insufficient ecology background. Students will be required to take 22.740 for entry into 22.741 if they do not already have the equivalent of at least one full-year course in Ecology at the undergraduate level.

(b) An area of strength may be developed by a student who normally has undergraduate background in that area. In consultation with the faculty advisor, areas of strength may be developed in any subject area relevant to Natural Resources Management.

(c) Alternatively, students may cover the breadth of the field of natural resources, by taking all of the courses listed under requirement 3 above, and choosing further courses from the list of electives.

(d) Courses at 100 and 200 levels cannot be counted towards the 42 credit-hours required by the NRI program.

See Appendix C for a description of core courses and electives.

Admission Requirements

The NRI Program is open to students holding a four-year degree in natural or social sciences, or its equivalent recognized by The University of Manitoba, and who can meet the admission requirements to the Faculty of Graduate Studies and the NRI. Experience in the resource management field is desirable.

The following courses, or their equivalents, are pre-requisites for admission to the M.N.R.M. program: Statistics (5.221 or 5.210/211); Microeconomics (18.245/246, or

18/61.239 and additional course work, with the permission of the instructor). Applicants with deficiencies in course prerequisites may be allowed, on approval of the Director, to complete these requirements after admission to the M.N.R.M. program.

Students

There are presently approximately 70 full-time and part-time graduate students enrolled at the NRI.

The student body organizes itself informally. It elects representatives of both years who serve on Institute Committees. It meets periodically to discuss direct concerns and, through its representation, presents suggestions, briefs, requests and sometimes grievances to the Director.

Student representative are active in many committees of the NRI including Admissions, Academic, Research and Publication, Curriculum, and others.

Graduates

Since the founding of the Institute and the graduation of the first class in 1971, there have been over 300 students who have completed the requirements for the degree, Master of Natural Resources Management. The Institute is in contact with its graduates at least once a year (mailing of the NRI Bulletin). The Institute maintains records of employment so far as possible of all the graduates.

The graduates of the Institute continue to be notably successful in entering their chosen areas of professional activity; they are found in industry, government, consulting, planning professions and in pursuit of higher academic degrees.

Though the M.N.R.M. may be regarded as a career degree, some students undertake

Doctorate work. The rate of acceptance in good programs achieved by these students is high. The rate of completion of the doctorate is also high though there are few examples to yield meaningful statistical comparisons with the graduates of other professional Masters programs.

As stated previously, the graduates at one time had organized themselves into an incorporated Association (C.A.R.M.). However, this association is inactive at the present time.

NRI Research Profile

Student Research

Research at the Institute can be divided into two categories, student practica and faculty research. The student research is the central component of the Practicum. Practica are initiated either by students or by staff members at the Institute; arrangements are made for students to research a particular resource problem. The practicum is a written research report prepared to address a practical problem or issue in natural resource management. The practicum is generally considered equivalent to a Master's thesis in terms of scope, span, and rigor.

Student practicum projects address a broad range of issues in the natural resource sector and are generally funded by government and private agencies. It is primarily through this research process that links are created between the Institute and our client community. Practicum committees draw from a wide range of on-campus and off-campus expertise. The Institute continues to demonstrate that the university community has the people and the expertise to contribute solutions to complex problems in the field of resources management. Moreover, the practical experience gained by the Institute students is invaluable in the education of professional resource managers.

The research process at the Institute is highly interactive, and students learn to address

real problems, to write research proposals, and to interact with clients and other members of the research committee.

The Practicum

Within the framework of course 69.703 (Practicum), each student is required to plan, conduct, report and defend a project of applied research. The guidelines for this work are reproduced in Appendix D. The core courses 56.709 and 56.710 (research planning courses) are devoted to preparation for this research undertaking.

On acceptance of the Research Proposal by the faculty advisor and Director, an advisory committee is appointed. This consists of the faculty advisor of the student, an independent expert, and a client representative.

The advisory committee meets to review the proposal and detailed plans for the investigation. This meeting is normally held in the latter part of the first year. At this stage, some modification and refinement of the research proposal is required. The aim of the meeting is to direct, advise and to launch the student on the investigation. Field work or other research activity is usually done in the summer following completion of first year course requirements.

After discussion and review between faculty advisor and student, the advisory committee meets a second time to consider the first draft of the practicum. The draft is examined in detail and the student instructed and advised on further work.

The third meeting of the committee is called to hear the defense of the document. After acceptance, completed practica are filed at the NRI, in the University Library, and in the National Library in Ottawa.

A listing of practicum titles is presented in Appendix E. It will be obvious that a considerable range of research projects are undertaken by NRI students.

Student reaction to the practicum experience varies widely. Based on the student survey (1987), student concerns ranged from having no difficulty at all following the process to students complaining about their lack of understanding, purpose and procedure of the process. Some students were also concerned about the process of funding and finding appropriate clients.

By far the largest student concern was (and still is) the weight of work required for practicum completion. There are no credit hours assigned to the task, however, the task must nevertheless be completed in order for the requirements of the degree to be met.

Faculty Research

Faculty research is carried out on a variety of topics. Areas of strength include natural resources policy; living resources; environmental assessment; sustainable development; northern resources and native peoples; resource planning and administration. Major faculty research projects, with graduate student participation, are carried out in the areas of:

- waterfowl habitat conservation and management, program and policy evaluation;
- sustainable development of Northern Manitoba and comparative studies with the Russian North;
- environmentally and culturally appropriate economic development based on natural resources;
- community-based natural resource management, co-management of fish and wildlife, and common property resources;
- waste management, particularly waste reduction; local government and environmental decision-making.
- the dynamics of the policy process.

Results of faculty research projects are published in the scholarly media, national and international journals, and presented at scholarly conferences. Applied aspects of these studies also become the subject of policy reports.

A new committee (Research and Publications Sub-committee), recently struck to evaluate NRI's research program, made recommendations to encourage students to publish more, and for faculty to set the example by leading research projects and programs. The committee's report initiated discussion on rethinking NRI's traditional emphasis on teaching and student practice, perhaps to strike a new balance between the faculty time allocated to teaching and to publishable research.

The faculty also produce, intermittently, policy and position papers and scholarly contributions. Faculty serve on Boards and Commissions and are involved in drafting fundamental legislation.

According to the Institute's Director, the Institute is one of the oldest units in Canada active in natural resources and environment research and teaching, and has contributed to the training of an appreciable number of professionals, administrators and other practitioners active in natural resource and environment fields in Manitoba and elsewhere, both in the public and the private sector.

The Institute's mandate includes applied research, education and outreach. NRI's strength and expertise cuts across a number of resource fields, and includes sustainable development, natural resources policy, institutions, decision-making processes, community-based resource management, co-management, traditional ecological knowledge, environmental stewardship and multi-stakeholder processes.

Sustainable development, which includes environmental, economic and social objectives is, and has been in a general sense, the guiding principle for research at the Institute. As such,

the Institute has a key role within the University of Manitoba which has identified Sustainable Development as a priority area for research. In addition to core faculty, the NRI draws on the expertise of a number departments and of adjunct faculty from various agencies involved in sustainable development. The NRI is active in a number of natural resources fields and geographic areas, including Manitoba natural resources, the prairies, wildlife habitat, environmental assessment and urban environmental management. In addition to the existing areas of strength, two areas have been identified for development emphasis: northern resources and international development. In March of 1994, the Institute received a Sustainable Development Award of Excellence from the Manitoba Round Table on Environment and Economy which raised the profile of the Institute in several areas, one of which was the University community.

Northern Resources

The NRI has made a substantial commitment and contribution to northern resource management issues. Applied faculty research has included involvement in the work of the Northern Manitoba Economic Development Commission; the North Central Transmission Line Project; Great Whale impact assessment; land use, wildlife harvesting and culturally sustainable development in James Bay; and Hudson Bay bioregion traditional knowledge and sustainable development.

Student research has focused on land use by aboriginal peoples in Northern Manitoba, co-management of natural resources, and wide-ranging problems such as gravel pit rehabilitation, environmental legislation in mining, waste management, "no net loss" policy in habitat management, parks planning, endangered species conservation, valuation of non-consumptive

uses of wildlife, and waterfowl habitat conservation and policy evaluation.

Many of NRI projects are carried out in partnership with other agencies. For example, the Cross Lake harvesting and consumption study represents a partnership of the Government of Manitoba, Manitoba Hydro and the Cross Lake First Nation. It is an interdisciplinary project, involving students, faculty, consultants and local community field researchers, and is undertaken in collaboration with the Faculty of Human Ecology.

International Development

Many countries of the world have problems of environmental sustainability due to resource shortages and environmental susceptibilities, as in erosion, droughts and floods. Many "natural disasters" are in fact human-made, and have to do with the unsustainable use of natural resources.

The NRI has relevant expertise in habitat management, impact assessment, waste management, sustainable development planning, and common property resource management. In September 1991, the NRI organized and hosted an international conference on common property resources, with 300 participants from 34 countries. The NRI faculty and students have been involved in international projects, including land use and wildlife in Kenya and Zambia; hydroelectric development in Thailand; coastal resources management in the Caribbean, Turkey and Bangladesh; comparative studies of local-level environmental management in New Zealand and Canada; and comparative studies of resource use in Russia and Manitoba.

An example of international, interdisciplinary partnership is NRI's project on the sustainable development of mountain watershed ecosystems in India and Canada. This project

is carried out jointly with the Department of Geography and two partners from India, the University of Delhi and the Indian Institute of Science. As well, the project has the collaboration of the Winnipeg-based International Institute of Sustainable Development, and the Department of Anthropology at the University of Manitoba (NRI Research Profile).

Outreach/Service Activities

The third element of the Institute's mandate is the provision of a Public Forum for the discussion of issues, ideas and initiatives in the resources management field.

The NRI is involved as a high-profile participant in a number of areas that pertain to its outreach mandate for natural resources management in Manitoba. These areas included sustainable development, Northern development, environmental assessment, waste management, and wildlife habitat management.

In the last year, the NRI took the lead and organized a one-day workshop on Sustainable Development Partnership in Manitoba. Several NRI faculty and former students offered a one-day workshop on environment and business at UM's downtown campus. NRI faculty gave a number of seminars elsewhere. As well, several guest lecturers were invited to give seminars at NRI.

As part of teaching, faculty bring to the Institute senior Manitoba Officials who meet students for informal presentations and discussions. The Institute is visited periodically by various government Ministers of the day. Each faculty member is individually active in scholarly and professional organizations (see Appendix F for an example of a Faculty Annual Report).

Administrative Activities

Academic Committee

This Committee deals with long-term planning, curricular review, student concerns and other submittals and policy advice and advises the Director on matters pertaining to the functions of the Institute. It also serves to strike subcommittees on Admissions, Appeals, Discipline and various ad hoc task forces.

The Committee membership is given in Appendix G. It includes the Institute Faculty, student representatives, members of other Faculties teaching core courses, and Adjuncts. It meets biannually, or as called.

At the present time, one of the Academic Committee's agenda items consists of having the core course offerings reviewed by the Curriculum Review Sub-Committee.

Curriculum Review Sub-Committee

This Advisory Committee reviews the curriculum for the MNRM degree. The Committee advises and recommends changes in programming to the Director and the NRI Academic Committee. The Committee membership is given in Appendix H. It consists of the Director, 1 student representative, one former graduate student, and four members (faculty and adjuncts) of the NRI Academic Committee and meets on an ad hoc basis.

The Curriculum Review Sub-Committee is presently active in reviewing the core curriculum for the M.N.R.M. degree. The student representative has distributed surveys to current students in the program requesting feedback as to what the core courses should be at the NRI. The major comments concerned the required prerequisites, the lack of methodology taught

and the need for some type of management courses. Other concerns consisted of International students being exempt from the NRI Law course because it specifically deals with Manitoba legislation and may not be pertinent to their situations. The Committee has not made their recommendations to the Academic Committee at this time. However, the Committee will report to the Director and the Academic Committee before the new academic year starts in September 1994.

Research and Publications Sub-Committee

This Committee deals with NRI faculty and student research functions. The committee membership consists of the Director, an NRI faculty member, a faculty member from another department (who also sits on the Academic Committee), and the NRI's second year student representative. Present agenda items consist of finding ways in which faculty and students can publish more in refereed journals.

Admissions Sub-Committee

The Admissions Sub-committee meets frequently during spring and early summer and admissions are made in the form of a recommendation to the Faculty of Graduate Studies.

Admissions Sub-committee membership consists of the faculty and Director of the NRI, one NRI student representative, members of other faculties at the University of Manitoba, and three adjunct faculty members.

The following criteria are used by the Admissions Sub-committee in the selection of graduate students:

Requirements:

1. Minimum Grade Point Average of 3.0 (most recent 60 credit hours)
2. Four year (or equivalent) degree

Other Considerations:

- Work Experience
- References
- Degree/Program
- Letter of Intent
- Area of Research Interest
- Written Work
- Diversity of the Student Body

The Institute receives admission applications almost all year around. The Sub-committee recommends for admission approximately 35 students each year anticipating a 20-25 person enrolment.

For the 1994-95 Academic year, 27 students were recommended for acceptance out of approximately 100 applications. Out of the 27 students, 23 have either registered or are planning to register for the fall term. Approximately 6 students who meet the requirements for the program are kept on the 'hold' list waiting for positions if applications are withdrawn.

Advisory Committee (no longer in existence)

The NRI used to have another Committee which advised the Director on policy issues for the Institute. This Committee was called the "Advisory Committee" and its function was to advise and recommend policy for the Institute. The Advisory Committee was initially made up of ten members including a Chairman with representatives from the University, government and other organizations.

Appeals

Student appeals regarding final grades must be directed through the Student Records Office to the Director, who in consultation with the instructor of the course, shall assess all relevant materials and reach a decision.

Student concerns regarding the academic program, including practica, oral examinations, disciplinary issues, and any other matters relating to Institute regulations or procedures should first be submitted to the Director for decision. Appeals of these decisions should be made to the Student Appeals Committee (a sub-committee of the Academic Committee) for decision. The Student Appeals Committee has the following structure: the two student members of the Academic Committee and three Faculty Academic Committee members, one of whom will act as a non-voting chairman, except in the case of a tie. If the problem cannot be resolved by the Student Appeals Committee, the matter may be directed to the full Academic Committee for decision. Further appeal may be made to the Board of Graduate Studies through the Dean of Graduate Studies. Higher appeal mechanisms are available. Students considering formal appeals at any level can consult the University Student Advocates Office or the office of the Ombudsman.

At the present time, there are no formal student complaints that the NRI is dealing with. There were, however, formal student complaints given to the Director that the entire student body drew up in the early part of 1994 having to do with faculty favouritism to certain students and unfair grant and contract administration.

These concerns were brought to the attention of the Institute Faculty and some steps were taken to alleviate these concerns. For example, the Faculty decided that all grant and contract

positions for graduate students researchers should be posted so that all students could have equal opportunity to apply.

NRI's Response to University of Manitoba Strategic Plan Initiatives

The NRI, in its Multi-Year Financial Plan (1993 to 1998) submission to the Budget Advisory Committee discussed the current strategies that are underway now and in the next five years concerning recruiting graduate students and faculty, program accessibility and flexibility, total quality management initiatives, strengthening strategic alliances, and evaluation strategies. These themes were initially emphasized as being important initiatives for the University of Manitoba in the next decade. The submission follows:

Theme i) By actively recruiting outstanding undergraduate and graduate students, and creating a satisfying learning environment for them, to make the University of Manitoba the institution of first choice for perspective students.

The NRI has put in place:

- student involvement in design and delivery of courses
- better liaison; lecturing to senior undergraduates in related departments
- cross-Canada distribution of NRI material
- specifying admissions criteria and raising admission standards

The NRI is planning the following:

- to improve the quality of recruits further by (a) raising profile of NRI in scholarly activities and outreach, (b) obtaining more research support, fellowships and (c) high-profile adjuncts
- to better define areas of strength of NRI
- to improve liaison further (Bulletin & poster distribution; lectures)
- to raise admissions standards further
- to investigate the feasibility of a video on NRI

The NRI needs help from the University for the improvement of Graduate Fellowship opportunities.

Theme ii) By creating policies, procedures and incentives to enhance the ability to recruit outstanding faculty and support staff.

The NRI has put in place:

- course relief and (small) internal research grant to new faculty member
- faculty and support staff training opportunities with computer applications

The NRI is planning:

- ongoing faculty and support staff training in computer applications
- targeted funds to improve NRI's gender balance (see under Special Initiatives)

The NRI would welcome a University-wide Affirmative Action program, along with the means to improve NRI's gender balance.

Theme iii) By the introduction of new kinds of organizational elements, and delivery methods (including through the use of advanced technology) to overcome constraints on accessibility and flexibility of university programs.

The NRI has put in place:

- education that aims for excellence in written and oral communication, and professional skills such as proposal writing
- program review that resulted in reduction of required courses, increased choice, improved student-centred learning through project courses
- two project courses, Agenda 21 (spring 1993) and Waterfowl Ecology and Management (summer 1994); three new courses, Impact Assessment (1992), Policy Development (1992) and Sustainable Development (proposed 1993) that further cut across disciplines and natural resource areas
- NRI seminars and one-day courses both at the University and off-campus
- computerized mailing lists; practica lists

The NRI is planning:

- improving opportunities to impart greater skills in
 - * computer applications, software and technology
 - * sustainable development decision-making
 - * land-use mapping & GIS applications
 - * co-management and community-based management
 - * multi-stakeholder groups and environmental stewardship
 - * mediation and negotiation in resource management
 - * small-business management and consulting

- ongoing revision of program to increase flexibility and choice
- courses offered through Continuing Education
- use of flexibly scheduled block courses
- feasibility study in use of distance education technology, teleconferencing and satellite teaching
- further computerization of office functions
- upgrade/new software (GIS, scanners, plotters), aiming for compatible/uniform software

Theme iv) By simplifying and streamlining existing organizational structures, and academic and administrative policies and processes, including through the use of modern quality improvement strategies, to free up time and resources for more effective use.

The NRI has put in place:

- an interdisciplinary program that now has a 25-year track record; demonstration of how teaching and research can be organized to cut across disciplinary organizational structures
- a process to empower faculty and support staff for a greater role in running NRI
- more authority to support staff for dealing with certain administrative matters

The NRI is planning:

- an annual procedures manual to increase planning efficiency and computerizing it
- further empowering faculty and support staff, and reducing hierarchical decision-making

Regarding University action, the NRI sees the development of a graduate program in Environmental Science an important positive step to consolidate the University's strength in this area, for example, in making the University more competitive in Green Plan applications. The NRI sees a major role for itself in such a future program in the area of human dimensions of environmental management, including policy and planning. The NRI is prepared to play a role in a re-organized University structure to deal with Environmental issues.

Theme v) By forming or strengthening strategic alliances amongst professors, programs, units, institutions and sectors (i.e. universities, industry and government) to enhance the scope of teaching and research opportunities, to optimize use of resources and promote interdisciplinary synergies.

The NRI has put in place:

- strategic alliances in the context of student practicum committees
- strategic alliances in the sustainable development area in Manitoba

- linkages to environment and sustainable development programs across Canada, on behalf of the University
- linkages with organizations involved in native and northern issues

The NRI is planning:

- programs in environmental management in two areas:
 - (a) Co-management of Northern Resources and
 - (b) Environmental Security and Sustainability (see section on Special Initiatives).

Theme vi) By linking evaluation of unit performance to explicit institution-wide and unit-specific goals and objectives to promote coherent program development and delivery.

The NRI has put in place:

- a mission statement consistent with and complementary to overall University goals and objectives
- an admissions policy and procedures to ensure the selection of the most qualified candidates consistent with Faculty of Graduate Studies policy.
- establishment of administrative procedures for the evaluation of teaching, research, and outreach on an annual basis consistent with University policies.

The NRI is planning:

- to more carefully evaluate and relate the availability of personnel and financial resources to each of our key functions and to develop this ongoing monitoring in anticipation of broader changes within the larger university community.

Theme vii) By establishing subsidiary enterprises to provide options for the development of teaching, research programs and services that can not be appropriately accommodated within the regular University framework.

The NRI has put in place:

- a major contract proposal, in partnership with a consultant and Dept. of Foods and Nutrition, for applied resource management in Cross Lake

The NRI is planning:

- to pursue other private sector partners to carry out work in the two proposed new program areas, Co-Management of Northern Resources and Environmental Security and Sustainability.
- graduate fellowships, especially in the areas mentioned above (NRI BAC Submission, 1994).

INTERNAL AND EXTERNAL VIEWS OF THE NRI PROGRAM

Past Internal and External Program Reviews

Since its inception in 1968, the NRI has had two opportunities to stand back and assess what has been accomplished. The first evaluation was an internal review by the previous director, Dr. W.R. Henson in 1987. The second was an external review by Dr. J.P. Kimmins in 1989.

The 1987 internal evaluation addressed whether the NRI met a need in society which was consistent with University goals and standards; whether the overall educational effort was planned in an effective manner; what the Institute's particular strengths and weaknesses were; what changes in the field should have the Institute been prepared to meet; and whether the Institute could at that time continue to make progress in a time of financial constraint.

The Kimmins Review, completed in 1989, addressed similar questions. Kimmins addressed the role of the NRI within the University of Manitoba; Manitoba; and Canadian Society; the Human resources of the NRI including academic and support staff, students, and their relationship; the Curriculum; and, Facilities and Equipment. Twelve recommendations resulted from this review (Appendix A)

Both the Kimmins Review and the Internal Evaluation by Dr. Henson led to the same conclusion: that the University of Manitoba had a valuable academic unit in the NRI. Both documents repeatedly stressed that the NRI has been significantly underfunded relative to its role within the University and the needs of the Manitoba and Canadian Society, which has limited the Institute's ability to achieve its three major objectives equally -- teaching, research and

service.

Since 1989, the recommendations put forth by the two program reviews were taken into consideration when administrations were planning for NRI's future. For instance, in regard to Kimmins' recommendations, the following has been accomplished:

- One FTE academic position was awarded to the NRI;
- One additional administrative support person was added to assist in the area of budgeting and administration of contracts;
- The social interactions between faculty, staff and students have been on the increase due to new NRI facilities which include a large common room;
- The core curriculum was reviewed and as a result, the Pre-Master's program was eliminated and core credit hours reduced;
- The computer room has more equipment now than it had in the past;
- The practicum requirement is now under review to include the preparation of a manuscript for submission to a professional, technical or scientific journals; and
- Visual displays and posters are now decorating the walls of the Institute in order to enhance public relations.

The Students View of the NRI Program (Past and Present)

When an academic program is being evaluated, it is necessary to look at the "supply side" of the program. "Supply" simply refers to past and present students in the program. It is important to look at past student successes and failures and present student interests, expectations, wants and needs (David Young, interview).

Academic staff and employers from outside of the NRI speak well of NRI students. The NRI Internal Review suggested that NRI students perform well in courses across campus. The Review also suggested that NRI students were well prepared academically for high ranking employment positions once they graduated from the program. The suggestions surfaced from the student survey completed before the self-study of the NRI (1987). In order to make an accurate conclusion at this time, it would be essential to obtain another student survey from recent graduates of the program. The survey/questionnaire would assess the academic quality of the students past and present. The survey/questionnaire would also be helpful in determining future course requirements in the present Master's program and would also help to determine if there was a need for a degree that would target professionals already working in the field (ie. a one-year Master's degree emphasizing coursework), or a Ph.D. program.

Recommendation 2: That a questionnaire/survey be sent to all NRI graduates (approximately 300) in order to determine the necessity of altering course requirements and changing the structure of the NRI program.

The Faculty/Institute's View of the NRI Program (Past and Present)

The Faculty at the Institute, or the Institute itself may have other reasons for offering the courses that they do, and running the program as it is being run. The Faculty may have motives for doing the research that they are doing.

The Faculty views of the NRI program seem to be varied. Some faculty members consider the program to be "good" just the way it stands. The phrase that comes to mind is "If it ain't

broke, don't fix it!" The reasoning behind this statement is that over 300 graduates have received the MNRM degree and moved on to related employment. In addition, the Institute has a reputation, and is known for the competence of graduates and their ability to compete for jobs at the highest level. Therefore, any transformation or restructuring of the program by reducing core-credit hours, offering an undergraduate degree, professional degree or Ph.D., would be a risky endeavor for the Institute. The argument follows along the lines that an undergraduate degree would reduce the interdisciplinary nature of the program and could possibly "stereotype" students, and the undergraduate program may act as a "sieve" for the present MNRM degree. The M.N.R.M., alternatively, would then act as a "feeder" for the Ph.D. program. Faculty members in this line of thinking also highlighted the fact that other units similar to NRI have ceased to exist, whereas the NRI has survived and graduates prospered. The recent difficulties that U.B.C. is experiencing because of restructuring were given as an example of what could happen if the NRI were to restructure its program.

Other faculty members have an alternate view. They consider the program in need of restructuring in order for students to be able to compete in society and for faculty to be able to do more research and publish more. Some faculty members suggested that the NRI develop an undergraduate program in order to better prepare NRI Master's students for the outside world, reduce the core-credit hours in the MNRM program to around "33" and to design a Ph.D. program emphasizing research interests for students finishing their M.N.R.M. degree, which is now thought by some as a terminal degree. Some faculty also believe that the NRI should transform the present MNRM program into a professional Ph.D. program, and possibly change the Master's program into a one-year effort without a thesis requirement.

The University (U of M) View of the NRI Program (Past and Present)

The University of Manitoba may have another view of the NRI program. It is important to look at the broader university-wide requirements and interest in the NRI's pursuit for excellence.

The Mission of the University of Manitoba is "to create, preserve and communicate knowledge and, thereby, contribute to the cultural, social and economic well-being of the people of Manitoba, Canada and the world" (Draft Plan 2000).

Advanced graduate study is a key element in the mission of the University of Manitoba. The University fundamental goal in the Graduate Studies area will be to work on attracting well-prepared graduate students (Draft Plan 2000, p. 14). Plan 2000 states that Manitoba provides the lowest level of graduate student support per capita of any Western Canadian province. As a result, financial assistance for graduate students at the University is the lowest in Western Canada, in terms of both the number of awards available and the value of these awards. The lack of adequate graduate student support severely hampers the University's ability to retain the brightest of its own graduates as well as to attract outstanding graduates from other provinces. Inadequate financial support also affects the quality of the graduate experience, unduly prolonging the programs of many graduate students. Researchers must use large portions of their research grants to support graduate students, thereby reducing funds available for technical support, supplies and equipment. As a consequence, the lack of adequate graduate student support also adversely affects the University's research productivity and, in turn, its research competitiveness.

In the next five years, the University of Manitoba intends to do the following in order to facilitate attracting well-prepared graduate students:

- devote increased resources to the support of graduate students by doubling the amount of fellowship funding available from operating funds, in real terms, within five years or less;
- target graduate student support as a major focus in private fundraising;
- initiate discussions with provincial authorities on the enhancement of the Duff Roblin Graduate Fellowship program to attract excellent graduate students from Manitoba and elsewhere in Canada to our University;
- require units to "protect" special academic funds for the provision of teaching assistantships as a pre-requisite to offering graduate programs;
- limit graduate enrolments to areas of demonstrated excellence in research, scholarship and creative work and on the basis of student financial and other support, except in those master's degree areas which have a professional orientation and where research is not a significant element;
- define clear research, scholarship, and creative work components of undergraduate programs and discourage "pre-masters" programs and encourage participation of undergraduate students in research projects through employment opportunities and thesis projects;
- ensure all students are fully informed of scholarship and fellowship opportunities;
- encourage faculty members to actively recruit prospective students through their disciplinary and professional network;
- profile "fast-track" and direct entry admission to doctoral programs; monitor and evaluate student progress in programs and enforce adherence to program time limits through a graduated fee structure beyond time thresholds;
- institute regular evaluation and "accreditation" of faculty members involved in graduate teaching and research; and,
- ensure that graduate student receive adequate opportunities to prepare themselves for teaching roles.

In light of the goals of the University in relation to graduate education, the following recommendations for the NRI should be implemented:

Recommendation 3: That the new faculty member at the Institute be provided with some teaching release time in order to assist in establishing programs of research. Possibly a teaching assistant funding by operating monies, could be one approach.

At the present time, the new faculty member at the Institute is teaching two half-courses in the NRI core curriculum, and is spending a considerable amount of time in their preparation. In addition, the new faculty member is doing an extensive amount of research related activities with students and for his own academic purposes. In order for this faculty member to keep pace with teaching and research requirements, it would be advantageous to have some teaching release time provided in order to establish programs of research.

Recommendation 4: That the Institute obtain several entrance fellowships in order to keep new best students in the Province and in the program.

The Institute, in the last admissions process, has lost at least four excellent students because they were provided with entrance fellowships at other universities. In order to attract excellent graduate students from Manitoba and elsewhere in Canada, the Institute will have to secure entrance fellowships for these students.

Recommendation 5: That the institute ensure that all students are fully informed of scholarship and fellowship opportunities;

NRI students need to be fully informed as to the scholarships and fellowship opportunities that exist in Manitoba, Canada, and Internationally. All scholarship and fellowship notifications should be posted for students, and the student representatives should be made aware of what is available.

Other units at the University have proposed special initiatives in the area of "Environment". The Department of Agriculture and Food Sciences have proposed an Environmental Science and Land Resource Management Program -- interdisciplinary graduate program. The Department of Architecture has proposed the development of a program of teaching, research, and service in Planning and Design of Sustainable Human Environments with Science, Engineering, and the NRI.

These proposals by other units within the University suggest that other units wish to form alliances with the NRI in its teaching, research, and service functions. The following is recommended in that regard:

Recommendation 6: That the Institute inform itself of proposals from other units within the University, as a first step in its attempt to change, to respond and to adapt to a changing world.

External Views of the University/NRI Program

In an attempt to restructure the NRI, it is important to highlight what the external views of the program are. For example, what do the employers of NRI graduates demand. What must students be able to do upon their completion of the MNRM degree? In turn, what must the NRI change in its curriculum in order to meet these demands. Have the standards of resources management changed in the last 25 years. All these questions must be addressed before a restructuring can be proposed.

Teer, Hodgdon, Thomas, Torgerson (1990) highlight the changes in the form of new laws that have occurred in the last two decades in the United States that affect the future of resources and the future of resource management education. The number of new laws has been staggering

-- the National Environmental Policy Act, Endangered Species Act, Marine Mammal Protection Act, Federal Water Policy Act, Federal Water Pollution Control Act, National Forest Management Act, Food Security Act of 1985 and the Clean Water Act Amendments of 1986 are just a few. In addition, hundreds of local laws have added new dimensions to conservation, to say nothing about the proliferation of legal decisions affecting the resource and how it is used (126).

Teer, Hodgdon, Thomas, and Torgerson (1990) state further, that trends in human population numbers and distributions, along with their associated environmental impacts and resource allocation problems, pose continually changing problems and will require greater participation of professionals at all levels -- local, state or provincial, federal and international. With a global population of 5.2 billion predicted to increase a billion in each of the next three or four 12-year periods, conservation has to take on different dimensions to succeed (p. 126).

Schmidly, Adelman, and Greene (1990) address what employers require from resources management graduates. They suggest that state and federal agencies for entry-level wildlife professionals commonly include the following qualities: (1) understanding the fundamental biological sciences, emphasizing "whole animal biology" and ecology; (2) knowledge of fauna and flora, emphasizing wildlife populations and habitats; (3) understanding of conservation and management principles and practices; (4) knowledge of the scientific method, experimental design and sampling procedures; (5) familiarity with scientific literature and capability to retrieve scientific information; (6) computer literacy in word processing and analysis, management and summarization of data; (7) skills in critical and independent thinking, planning and problem

solving; (8) skills in oral and written communication, public speaking and public relations; (9) management skills stressing employee supervision and budget preparation; (10) ability to operate and maintain equipment, scientific instruments and sampling gear in both field and laboratory; and (11) the ability and motivation to perform as a professional for the public, the resource and the agency (p. 140). These requirements are generally similar to those specified for fisheries positions. The main differences are in specific knowledge or techniques related to fish or wildlife (Adelman et al. 1990 in Schmidly, Adelman, and Greene, 1990).

Silvy and Novel (1990) suggest that employers continue to seek graduates with traditional skills to assume responsibilities which are increasingly non-traditional. Although managers deal largely with interdisciplinary projects which require knowledge of socioeconomic principles and skills in organization and interpersonal relationships, position announcements indicate preference for knowledge of natural resource ecology and skills in field operations. The employer must ensure that the employee can grow into the type of professional responsibilities that will be encountered (p. 120).

In order to meet the demands and requirements of employers, Teer, Hodgdon, Thomas, and Torgerson (1990) believe that university resources management programs must be dynamic and forwardlooking as the only way to position graduates to take full advantage of the opportunities and challenges before them and the only way they will be able to perpetuate wildlife resources and meet public expectations (p. 126).

Teer, Hodgdon, Thomas, and Torgerson (1990) believe that it is not only the Universities' responsibility to teach students, but that agencies should also share the responsibilities. Universities and agencies share the responsibilities of making this expansion from research-

oriented curricula to research/management orientation curricula. Such activities require basic skills in the acquisition and analysis of data, evaluation of actions, synthesis of information, formulation and execution of management action, ability to operate effectively in teams, and to deal in the arena defined by law, regulations and politics. Social, economic, political and cultural backgrounds define problems.

When called to question on such grounds, university faculties often defend their curricula and educational stratagems by saying that meeting the needs of employers is merely vocational training and that emphasis on basics of management is below the dignity of a science curriculum. "Their curricula are often so crowded as to prevent breadth and flexibility for other needs" (p. 236).

Such arguments, according to Teer, Hodgdon, Thomas, and Torgerson (1990) are narrow. They believe that university faculty should pay closer attention to what practising managers do on a day-to-day basis. They should be aware of what agencies need and educate students to meet those needs, yet continue to stress science as fundamental in deciding policies and strategies in management.

Teer, Hodgdon, Thomas, and Torgerson (1990) also suggest that education in the resources management field should include cross-over curricula between departments. Curricula should be flexible so that targets of students and needs of employers can be accommodated. Economics, political science, public policy, sociology, conflict resolution, law, administration and even cultural anthropology (especially in Third-World countries) are areas of increasing value in natural resources conservation.

Schmidly, Adelman, Greene (1990) suggest that in upper-level and especially graduate-level programs, the scope of the students's world should be enlarged. Provincialism in subject and geography has kept many minds from addressing the larger issues that engage our world and threaten wildlife resources (p. 132).

They believe it important that university programs should have a complement of faculty members with experience in conservation agencies. Too often wildlife and fisheries departments are staffed with individuals with little or no experience in management. With new diplomas and fresh from their own research interests, they are long on science but lacking in the application of it (p. 132).

Schmidly, Adelman, Greene (1990) believe that a salting of faculties with at least some veterans of the management "wars" could go a long way toward influencing students as to what is necessary in successful management careers. Management agencies could make such faculty available on a rotating basis through exchange programs that could, simultaneously, expose young faculties to the day-to-day realities of life on the management line. Retired agency people would likewise provide needed real-life experiences to students who strive to understand what is expected of them when they graduate. Sabbaticals for faculty members to gain management experience rather than conduct research is another opportunity to broaden university education programs (p. 132).

Schmidly, Adelman, and Greene (1990) state that university education must do more than just provide a student with the technical qualifications needed for employment. A university education should provide a student with a general education in the humanities and basic sciences, bolster independence and creativity, and create a continuing desire for additional learning (p. 133).

Schmidly, Adelman, and Greene also believe that curriculum and educational programs must be adjusted to meet the full range of values that society assigns to wildlife resources, and must incorporate the new developments and methodologies emerging from holistic resource management, conservation biology, restoration ecology and social-impact assessment. Schmidly, Adelman and Green state further that the resources management curriculum must embrace more concern for threatened and endangered species, and for shrinking global biodiversity.

Nielsen, Knuth and Helinski (1989) suggest that graduate students need more exposure to the human dimension, even at the cost of some research experience. Most masters graduates will move directly into positions of management authority and responsibility. They must learn the principles of human-dimension disciplines so they can use them later in unexpected settings (Romm 1984 in Nielsen, Knuth and Helinski, 1989). They must also learn the practical realities of their work; graduate courses at Virginia Tech and New Mexico State, for example, include agency staff who can breathe life into the concepts. In fact, students in the "Fisheries and Wildlife Planning" course at Virginia Tech have attended this conference and had working lunches with federal and state planners. Students at Cornell study the federal environmental policy process during special intersession courses in Washington (Wilkins et al. 1989 in Nielsen, Knuth and Helinski, 1989).

Silvy and Novel (1990) state that the Master's degree should have a greater emphasis on training -- developing the technical competencies needed for professional effectiveness. Some disagreements still prevail concerning what is "proper" training at the graduate level. After more than a decade of debate and trail-and-error, the Southeastern Section of The Wildlife

Society has implemented a graduate accreditation program to identify those institutions which supposedly are capable of producing highly-trained professionals at the Master's level. Rather than specify the courses which should be offered, this program examines human and fiscal resources, experience of faculty, and placement records of graduates. This approach has allowed university programs to maintain their individuality and flexibility, thereby producing graduates who are not necessarily stereotypes. The profession generally has wrestled with the accreditation issue for over 50 years, but has chosen to retain the stance (and effects) of dealing with professional competence through certification programs.

Schmidly, Adelman, and Greene (1990) suggest that the information-transfer objective in our curricula should be shifted to emphasize processes rather than facts. They suggest further that the best way to serve students is by exposing them to a cadre of critical ecology, evolution and genetics courses, developed around a perspective of management and conservation theory, and coupled with the necessary skills to become better citizens of both the scientific and global communities. They believe that students must be taught to think and read critically, and to employ a variety of interdisciplinary problem-solving approaches to their work.

Schmidly, Adelman, and Greene (1990) state that there needs to be a better dialogue among professionals associated with state and federal natural resource agencies and university educators. They suggest further that universities should provide mechanisms and compensation for agency personnel to participate in their academic programs. Several mechanisms, ranging from adjunct or joint faculty appointments to assignment on curriculum committees are available for universities to involve agency personnel in their instruction programs.

University educators and natural resource professionals must work together to produce new

and workable approaches to strengthen education in the training of professionals. An open dialogue among university educators and resource professionals is essential (p. 143).

Silvy and Novel (1990) discuss the debate between research and non-research programs. They suggest that a continuing, perhaps justified, criticism of the advanced graduate's capability is the strong bent toward research, when so frequently professional employment will be principally resource management. They state further that although some universities provide degree opportunities in non-research, "professional" degrees, which combine coursework with a managerial internship, relatively few Master's candidates choose this alternative. The arguments that the thesis option is a proven commodity and that the non-thesis degree is likely to be viewed as terminal (precluding further graduate degree candidacy) prevail in the minds of potential graduate students. On the other hand, professors may be less inclined to advise non-thesis students, whose work will not likely lead to another scientific publication (p. 123).

Clark (1990) reported on a study recently completed and conducted by the Department of the Interior's National Park Service, titled "Resource Management: A Study of Selected Problems and Solutions." The purpose of the study was to define resource management and to conceptualize the typical manager's roles and functions within an institutional setting, be it public or private. The actual research search for coincidence between what managers actually do and what they are prepared, through their education, to do. The study, which took 16 weeks to complete, identified and examined, by survey, four selected topic areas that had been identified in the study proposal request and validated through subsequent literature searches. The four topics included resources management in the private sector; resources management in the

government sector; education, training, and research practices and trends; and current and future job markets.

Clark (1990) reported that the surveys were designed to elicit data about current job functions, role, and scope of responsibility; preparation, education, and training; years in employed capacity; relationship to management; job purpose; effectiveness of prior education and training; major barriers to job performance; recommendations for graduate and undergraduate education and training programs; and operating environmental ethics in the workplace.

According to Clark (1990), the study revealed that in the private sector, respondents indicated that although they themselves and/or their employees possessed the basic skills for good management, the institutional factors with which they dealt often constrained the application of those skills. In the public sector, the barriers included: political and philosophical; bureaucratic, administrative, and time related; personnel management problems; knowledge and education; and research and development. Clark believes it is significant that in both the public and private sectors, institutional barriers constitute the number one constraint on resource management effectiveness, according to the managers. Furthermore, knowledge and education constraints either did not exist, as in the case of the private sector, or were lower in priority, in the case of the public sector.

Clark (1990) states that the two issues which surfaced in regard to educational constraints mentioned by managers were: First, the politicization of resource decisions demands managers who possess strong capabilities in people management. Second, effective managers must possess a sound knowledge of systems management methodologies. Clark (1990) noted that the study

specifically reports: "Individual resource managers are expected to possess an extremely wide range of skills and knowledge. In order to perform the broad spectrum of duties that resource management entails, resource managers must be managers, planners, problem solvers, politicians, and researchers. The enormous demands on the resource manager's skills and knowledge are compounded by the rapid rate of change that occurs in the field. New legislation and regulations are constantly being created, new scientific discoveries are made, and social and political crises occur -- all of which affect the resource manager's job" (p. 265). The study also reported that "nonscientific knowledge transfer is equally important". The report suggested that many resource managers come into their job with scientific or technical backgrounds. As they assume positions of greater responsibility, they need additional skills in personnel management and supervision, finance planning, and other general administrative areas. For instance, weaknesses in written and oral skills were the deficiencies most frequently cited by the federal employees that were contacted. These skills are becoming increasingly important as resource managers interact much more frequently with the public. Similarly, several respondents said there is a great need to teach resource managers human resource management as an integral part of their overall curriculum, whether an undergraduate, a graduate, or a continuing education program.

Lending credence to this observation, Clark (1990) quotes Daniel Henning's statement that resources managers "must recognize that the majority of their problems are basically human ones, and solutions, therefore, are more in the realm of social science than in a particular biological discipline. Decisions are basically concerned with management of people's behaviour

to natural resources, rather than the natural resources per se."

Based upon interviews with academicians and examination of selected programs, survey findings revealed that: Because of the many different roles that resource managers have to fulfil, there is no one specific ideal academic preparation for jobs in resource management. A number of programs can adequately prepare students for jobs in this field; There is no agreement among universities about which areas of study should be included in the core curriculum of resource management education programs. There is also no consensus on approaches and methodologies for teaching and learning about resource management; Universities are searching for new ways to satisfy the national need for better trained people to enter resource management jobs; and education and training programs will need to be improved and must respond to future trends (p. 266).

Clark (1990) states that there are numerous educational and training opportunities available to people who will be entering or who now hold positions in resource management. The educational context and philosophy of these programs range from highly specialized technical training, such as mining engineering, geology, biology, and chemistry, to broad-based interdisciplinary programs, such as environmental science and natural resource management.

Clark (1990) notes that the lack of a consensus as to the ideal academic preparation for resource managers is a reflection of the diverse nature of the roles and responsibilities of resource managers. Some argue that the flexibility of interdisciplinary programs is an asset. Others, however, argue that there is a clear need for more rigid requirements. Clark also notes that some people maintain that an ideal academic preparation must provide a sufficient grounding in ethics. They view ethics as an essential part of education because of the important role values

play in making decisions about the lives of future generations.

Clark (1990) also notes that because of the diffuse and broad nature of environmental resource management, there is controversy as to the subject areas that should be included in a resource management education program. The general subject areas most frequently mentioned included: values and ethics, ecology, environmental effects, environmental indicators, environmental impact assessment, methodology, modelling, monitoring, growth and its implications for the future, economics of the environment, environmental law, administrative processes, and actor/role interactions (p. 267). Clark notes that many educators believe that these subjects will prepare student adequately for careers in resource management and enable them to effectively interact with scientists and technologists, policy makers, and the public. Others feel that an ideal academic preparation must develop the interpersonal/human/public relations skills of resource managers. Moreover, as one study respondent explained: "Resource managers need to learn how to understand and cope with uncertainties and how this can be translated into policy that is not destructive to the economy."

Clark (1990) quotes Matthews who states that "Perhaps the greatest challenge of professional education in environmental management is to develop the generalizable contexts along knowledge, cultural, decision, and role categorization. These must be broad enough to be useful for more than one specific environmental problem. On the other hand, the context cannot be so broad that the amount of time and energy required to obtain the needed knowledge and insights would be prohibitive for any given person or that the coverage would necessarily be so superficial that it would be of little practical value to a manager". Clarke notes that many

people content that interdisciplinary training is lost on people who are not firmly grounded in at least one technical area. Faculty and administrators claimed that there are inherent weaknesses in interdisciplinary programs; for example, students do not develop a sufficient depth of understanding in any one area. As one respondent remarked: "The environmental science programs currently offered are 'chop suey.' Students are not learning in depth, nor are they learning how to be circumspect. The programs do not provide the students with sufficient expertise in a least one discipline. In certain instances, students have too much latitude in the choice of courses and independent study." In other words, Clark states, academic preparation has become too general, while the trend in resource management has become more dependent upon teams of specialists. Clark concludes that this reinforces the need for specialist training, and states further that the complexity of resource management issues demands that more technical expertise be developed in a wide range of areas. Furthermore, Clark states that regardless of the approach or the techniques currently used to train resource managers, many people recognize that changes and improvements need to be made for universities to keep pace with the national resource management manpower needs of the future.

Clark (1990) addresses the future resource management education trends. They are: the need for a futures perspective; the increased importance of citizen participation in the decision-making process; the increased controversy over resource management decisions; and the necessity for a broad approach to problem resolution.

Clark (1990) points out what universities and program reviewers can do to prepare the graduate for the trends that are developing and to prepare them for the real world. Clark suggests that academics should examine what they are teaching. They should ask the following

questions: "Does it make a contribution to the operational functioning of the resource manager? Clark states that more often than not, the orientation is toward the environmental assessment. And with this comes a need to have a sense of operational, societal values.

Clark suggests that the entire focus of the program be examined. She asked if there is a realistic focus on the politics of the job?

Clark also suggests that examiners ask themselves if they are inculcating an environmental ethic in which the bottom line is the protection, management, and wise use of ecosystems so that graduates have at least a benchmark. When it comes to critical decisions, does the ecosystem get fair treatment?

Lastly, Clark also requests that academic ask themselves if their approved methodology and program spirit is reflective of an interdisciplinary view of the world, in which human actions and natural systems are in fact a continuum of responds to diverse stimuli.

Clark (1990) states that thoughts should provide initial guidance for preservice program review. She also states that it would be more effective to include an operational resource management from business and industry and from government on the curriculum review committee, as they can "tell how it is" and provide more guidance and support than can academia at a time when events are moving rapidly. Ultimately, Clark adds, the goal is to produce a professional cadre of people with special knowledge uniquely suited to manage our natural systems in harmony with our human needs. She states that a concerted effort among affected parties can accomplish this goal (p. 271).

It is difficult to fully comprehend what employers of resource managers really want and

need, and programs that are in place now have a huge task ahead of them in trying to keep up with the changing trends.

It is also very difficult to determine what employers of NRI graduates require without finding out directly from them what their expectations are. NRI graduates are unique from other resources management graduates in many ways. For example, no curriculum studied matches that of the NRI curriculum and the practicum process is very different from other institutions.

Recommendation 7: That the NRI survey employers of NRI graduates in order to fully grasp what they expect of NRI graduates and what they expect of the NRI curriculum.

The literature presented above specifies the do's and don't of graduate resources management programs. The NRI is currently doing what the literature states is required in order to obtain successful graduates that meet the needs of future employers. The NRI is currently involved in partnerships with resource employers, however, these partnerships are not sufficient enough for the benefit of the students in the program. What seems to be needed is more resources management employers involved in the program, whether it be in a seminar series format, course lecturers, workshops, co-op programs, or field trips. Perhaps a way to begin would be to set up (again) an NRI Advisory Committee which would include members from government, agencies and the like, as has been suggested by Clark. Also, it may be advantageous for faculty to spend a considerable amount of time in resource management agencies in order to become informed as to the agencies problems.

The report on post-secondary education in Manitoba (also known as the Roblin Commission Report) also made it very clear that linkages between government agencies and universities need

to be promoted in order to better prepare students for real-world activities, problems and issues. The report stated "Particularly in the area of science and technology, there is a need to build links between universities and industry. The private sector must communicate its research and educational needs to the universities. Greater opportunities must be developed for technology transfer between universities and industry (p. 55).

Recommendation 8: That the Institute set up an Advisory Committee in which members from government, resources agencies, and others can meet to discuss policy issues and also to keep in touch with employers needs and wants from NRI graduate students.

Recommendation 9: That the NRI arrange sabbaticals, not only for research purposes, but for spending time in natural resource agencies. This would provide faculty with the exposure to agency problems and perspectives that they require.

SIMILAR RESOURCES MANAGEMENT PROGRAMS

Before we can come to any conclusions on the past and present program, it is crucial to look at similar resources management programs in order to form comparisons or even contrasts in order see what they are doing now, and what they have done in the past. Sometimes, just being able to identify programs that still exist after 25 years is a basis on which to draw conclusions and recommendations.

There are many programs in Canada and the U.S. that are similar in aim and scope to the M.N.R.M. program at the NRI. Some of these programs were developed around the same time as the NRI. However, some have evolved from "Institutions" to "Schools" and "Faculties" offering more than a Master's program in resources management. Some programs have evolved from simply offering masters programs to offering undergraduate, masters, and doctoral programs. Some institutions also offer programs with varying lengths, ie. one and two year programs, while others offer professional and non-degree programs to meet varying demands.

In the following section, nine programs similar to the NRI have been abstracted as to the number of faculty, prerequisites, number of credit hours, course offerings, and so forth. The order in which the programs appear is random, and should not be viewed as one being more suitable than the other. A table at the end of this section will summarize the nine programs.

YORK UNIVERSITY

FACULTY OF ENVIRONMENTAL STUDIES (1968)

Faculty:

3 Professor Emeriti; 1 University Professor; 16 Professors; 23 Associate Professors; 14 Assistant Professors

The Program:

The Faculty of Environmental Studies was established in 1968, offering the degree of Master in Environmental Studies (MES). The Faculty now offers two new degrees: a Bachelor in Environmental Studies (BES) and a PhD in Environmental Studies. The program is designed to develop professional and scholarly competence in understanding and responding to environmental problems and issues. Its approach is interdisciplinary and offers a wide range of graduate study opportunities leading to the degrees of Master in Environmental Studies (MES) and Doctor of Philosophy in Environmental Studies (PhD). "Environmental Studies" is defined broadly to encompass natural, built, organizational, and social environments.

Prerequisites:

To be considered for admission to MES graduate work, an applicant must normally have completed an undergraduate degree programme at a recognized university, with not less than a "B" academic standing.

For Admission to the PhD program, normally, the standard is a Masters degree.

Meeting the minimum admissions requirements for either the MES or PhD programme is not a guarantee of acceptance for admission. Successful applicants will be selected on the basis of scholarship, experience, interest, and accomplishments, as well as the resources of the Faculty and space limitations.

The admissions processes for MES and PhD applicants are separate. Applicants wishing to proceed to the PhD programme after completing their MES degree must apply separately at the appropriate time; admission to the MES programme is not a guarantee of admission to the PhD programme.

All MES and PhD applicants must show evidence of strong interest in, and suitability for, their desired field of study. As well, they must demonstrate their capacity to undertake graduate work in an interdisciplinary, individualized programme.

Part-time:

The MES programme is one which is best pursued on a full-time basis. However, a limited number of part-time applicants will be considered. Those applicants seeking part-time admission should be currently working full-time in an area directly related to their chosen field of study in the Faculty. Part-time applicants will be asked to guarantee the equivalent of one full day per week of attendance at the University for course-work and advising, and must register full-time for one semester of residence at the Faculty for course work, preferably the first semester of study.

MES Program Requirements:

To obtain the MES Degree, a student must complete satisfactorily 40 course units of work, including up to 10 course units of field experience. A "course unit" is the weight given to a particular study activity. For example, seminars are generally taken for one course unit, workshops are usually taken for two course units, and individual directed studies and field experience are taken from one to five course units depending on the nature of the work involved. The maximum number of course units that can be taken in any term is five.

Length of MES Program:

The length of the programme varies depending on the requirements of the individual Plan of Study. For a full-time student, the expected maximum length of the program is eight terms or 2 2/3 years (i.e., the time it would take to accumulate 40 course units at the rate of five per term).

Stages of the MES Program:

Work towards the MES degree advances through three levels, identified as MES I, MES II, and MES III.

In MES I, students prepare their initial Plan of Study and undertake course work that supports early exploration and definition of their Area of Concentration. MES I normally involves approximately one term of full-time study.

Work leading to essential substantive command of students' Area of Concentration is undertaken in MES II. Requirements for this level vary, depending on students' prior experience and accomplishments and how these related to their Plan of Study. The normal length of MES II is one to five terms of full-time study.

Students advance to MES III after demonstrating general competence in their Area of Concentration and acquiring approval for their intended MES III activity. Students demonstrate integration and synthesis of their Area of Concentration through the production of a Thesis, Major Paper or Major Project. MES III normally calls for one to two terms of full-time study.

Doctor of Philosophy in Environmental Studies

In general terms, the Faculty's expectations of PhD students are consistent with those traditionally associated with PhD work:

- carrying out original research
- synthesizing and stating the relevance of their research findings in a dissertation
- being able to demonstrate their contribution to the logic and practice of environmental studies.

Student's work at the PhD level will begin with the development of a theoretical conceptualization of the environmental relationships that underlie their areas of interest and study. That is, it will begin with a definition of the nature, methods, and limits of knowledge of the individual student's research focus in environmental studies.

PhD Programme Requirements

To obtain the PhD Degree, students must prepare and satisfactorily defend a PhD Dissertation. The process by which students reach this final stage is guided by the development of a "PhD Programme Plan" which defines the requirements for an individual student's programme. The length and nature of the programme varies depending on the requirements of this individual Plan. There are three stages in each student's programme:

- Interim PhD Programme Plan Stage
- PhD Programme Plan Stage
- PhD Dissertation Stage

All incoming PhD students work with an Interim Advisor on the development of an "Interim PhD Programme Plan" which proposes:

- activities for this stage
- a schedule for the submission of the PhD Programme Plan
- an Advisory Committee, consisting of an Advisor and two other faculty members.

The only common course is the "PhD Research Seminar" which all PhD students must enrol until the approval of their Dissertation Plan. The Interim PhD Programme Plan stage normally lasts one term.

In the PhD Programme Plan Stage, students develop their PhD Programme Plan, undertake study of their proposed area of research, and prepare for their Comprehensive Examination.

The Plan delineates:

The Environmental Studies Program has developed two Minor programs for students whose primary fields are business, economics, cybernetics, geology, geography, biology, natural science, interior design, urban and regional planning, or other environmentally related areas.

The course requirements for the major in Environmental Studies consists of a preparation sequence (or equivalent educational experience) aimed at providing a useful background to the subject; a core sequence designed to provide a comprehensive survey across the scientific and social aspects of the subject; and an emphasis sequence designed to encourage specialization in a particular aspect of the subject, or to stimulate further work in another field of study that is particularly relevant to Environmental Studies. While the core sequence is uniformly specified for both majors and minors, the remainder of the student's program is developed in consultation with a program advisory.

For program design and course descriptions, see Appendix I-2.

SIMON FRASER UNIVERSITY

SCHOOL OF RESOURCE AND ENVIRONMENTAL MANAGEMENT (formally the Natural Resources Management Program)

Faculty:

11 Faculty; 11 Associated Faculty; 22 Adjunct Professors; 2 sessional instructors

The Program:

The REM program offers an interdisciplinary graduate program that leads to a professional masters-level degree in resources management (MRM degree), and a Ph.D which can be completed under special arrangement. Post-doctoral positions are also available.

The MRM degree program is designed for recent graduates in disciplines related to natural resources and individuals with experience in private organizations or public agencies dealing with natural resources and the environmental. Some courses are scheduled in the evening or week-long blocks to allow working professionals to complete the program on a part-time basis. For those studying full time, the program involves four semesters of graduate course work and two summer semesters in which a research paper is completed. An optional co-operative education program permits students to work in a resource management agency to gain first-hand experience.

The School of Resource and Environmental Management provides a focus for interdisciplinary research on natural resource problems of local, national and international interest, and offers a professionally-oriented program of graduate education in resource and environmental management. The degree program is intended for individuals with undergraduate training and experience in fields such as biology, engineering, chemistry, forestry and geology, as well as business administration, economics, geography, planning and other social sciences. Students take an integrated sequence of courses in complementary fields, pursue further courses in their area of specialization, and complete a research project on a topic involving more than one traditional discipline. The aim is to give students increased familiarity and competence in understanding the dynamics of natural resources, the strategies and techniques of natural resource and environmental planning and management, and the biological, physical, social, economic and institutional implications of resource decisions. Students also become familiar with various quantitative methods of analysis and aids to decision making.

Degree Requirements:

Degree requirements (73 credit hours) are completion of the 7 required courses listed below, 5 elective courses, an orientation field workshop (MRM 698), and a research project (MRM

a Dalhousie Honours graduate.

Program Duration and Minimum Degree Requirements:

(a) **The one-year program.** Only students with a well-rounded background may enter a one-year MES program. A "well-rounded background" is BEng or BArch with a concentration in environmental studies. Professional experience following honours graduation may be taken into consideration when evaluating entrance requirements. The requirements for the one-year program are:

1. ES 5000R (Introduction to Environmental Studies) and 5001B (Environmental Assessment)
2. One graduate-level class related to an environmental theme in the student's area of specialization.
3. Thesis

(b) **The Two-year Program.** For all other students the minimum program will occupy two years. Those accepted with an Honours bachelor degree, or a professional degree without environmental content, are required to complete, not later than the end of their first year, three half-credit classes selected from the disciplines of life sciences, earth sciences, chemical and physical sciences, engineering (Group A), and social sciences, law, architecture (Group B). An approved class in statistics as related to the environment may be accepted in either group A or B. Students whose specialization was in Group A should take at least two subjects in Group B, and vice versa. Each credit must be in a different discipline and must be in subjects other than the major subject of the student's first degree. The approved classes from which these three half-credits may be selected will include a meaningful introduction to environmental questions as related to the discipline. In total, 11 half-credit courses and a thesis are required.

Required Courses:

During the first year of a two year program, students will generally complete the following requirements:

1. Three half-classes specified above
2. ES 5000R (Intro to Environmental Studies) and 5001B (Environmental Assessment)
3. An approved graduate class in an area designed to relate the undergraduate major to an environmental theme.
4. ES 5110A (Resource Economics) (or appropriate alternative)
5. ES 5300B (Natural Resources Administration) or appropriate alternative)

The requirements for the second year of a two-year program are:

1. ES 5002A (Environmental Studies Joint Project
2. An approved graduate level class
3. ES 9000 (Thesis)

For a list of courses, see Appendix I-4.

MCGILL UNIVERSITY

DEPARTMENT OF RENEWABLE RESOURCES

Faculty:

13 Faculty; 10 Adjunct Professors

The Program:

The Department of Renewable Resources offers research facilities for studies leading to the degrees of Master of Science and Doctor of Philosophy in Renewable Resources. Areas of specialization include agrometeorology, forest science, soil science, and wildlife biology.

Degree Requirements for the M.Sc. Degree:

Candidates must complete a course and research program of a minimum of 45 credits elaborated in consultation with their advisor. Course work includes at least one graduate course (3 credits, two courses in statistics, 360-310A,B and 360-610A,B (3 credits each) or their equivalent; and one seminar course to be taken in each year of residence (2 credits each). Candidates must register in the three M.Sc. Thesis Research courses (375-679, 698, 699 - 36 credits) and defend their thesis before an examining committee prior to its submission to the Faculty Thesis Office.

Degree Requirements for the Ph.D. Degree:

Candidates are normally required to hold an M.Sc. degree and will be judged primarily on their ability to conduct an original and independent research study.

The work for the degree will include course work as required, one seminar course to be taken in each year of residence, satisfactory performance in the Ph.D. comprehensive examination 372-701D, and satisfactory completion of research work and the thesis.

Prerequisites:

Candidates are required to have a Bachelor's degree with a grade point average of 3.0 out of 4.0 or its equivalent and a sufficient background in the appropriate basic sciences.

For a list of course descriptions, see Appendix I-5.

THE UNIVERSITY OF CALGARY

THE FACULTY OF ENVIRONMENTAL DESIGN

Faculty:

At present there are 242 students, 26 full-time faculty members, some 20 part-time and visiting faculty and 15 support staff.

The Program:

The Faculty of Environmental Design was established in 1971. It offers professional, Master's degrees in Architecture, Environmental Science, Industrial Design, and Planning. It does not offer undergraduate programmes. The Faculty is engaged in research and graduate level, professional education and communications, directed towards management, planning and design in the human and natural environments.

The Faculty's educational mandate is a dual one: to offer a learning environment that prepares individuals for interdisciplinary collaboration and action; and to ensure that its graduates are competent practitioners in the professional specialties they individually elect to develop through studies in one of the four programmes. Students and the members of faculty frequently collaborate in research including outreach projects. Students can obtain credits to their programmes of study through participation in research.

The degree **Master of Environmental Design (Environmental Science)** prepares students for the new and expanding professional and scientific research opportunities in environmental consultant practices and government programmes. It embraces a spectrum of interests, among them impact assessment, landscape rehabilitation, ecological analysis and modelling and research. The programme normally requires three years of study. Although a professional accreditation body does not yet exist in this field, graduates are in high demand in both public and private sectors.

In addition to demonstrating basic knowledge and skills in the general field of Environmental Sciences, students in the Environmental Science Programme are expected to develop specific knowledge, and skills through work in one or a combination of the following areas: behavioural planning; information and policy analysis; ecological management; technological systems.

Prerequisites:

The interdisciplinary programme of the Faculty is dependent upon students with a wide variety of backgrounds. Some enter the Faculty directly from studies at the baccalaureate level, while others come to the programme after a number of years in the work force and other pursuits.

A thesis is required of M.S. degree candidates. The thesis must indicate the student's ability to collect, arrange, interpret, and report pertinent material on a research problem. Although a publishable document is not required, the thesis must be written in an acceptable style and should exhibit the student's competence in scholarly procedures.

The student must present acceptable grades for a minimum of 24 units in graduate courses. Of these, at least 12 units must be in the Department of the Environment. A minimum of 6 units must be in a minor subject or in related fields approved by the department and by the dean of the Graduate School. A maximum of 6 units may be earned by submission of an approved thesis.

General Requirements for the Ph.D. Degree

The Ph.D. is a research degree. Although course work is a necessary part of the student's program, the mere accumulation of course credits will not be sufficient for receiving the doctorate. The granting of the Ph.D. is based primarily upon the student's knowledge of a specialized field of study and upon the production of an acceptable dissertation embodying the results of original research.

The formal requirements of the Ph.D. degree are as follows: (1) major and related courses, (2) foreign language, (3) a supervisory committee for program of study, (4) residence, (5) preliminary examination, (6) dissertation, and (7) final examination. In order to be considered for candidacy for the Ph.D. degree, the student must have passing grades in all courses.

The students's program of study demands substantial concentration on courses in the department. However, a minimum of 6 units in a related field approved by the department must be included.

Ph.D. candidates in the Department of the Environment are not ordinarily expected to have a reading knowledge of a foreign language. However, on recommendation of the student's supervisory committee, knowledge of one or more languages may be required.

As early in a student's course of study as is practicable, and not later than two months before the preliminary examination, the director of the graduate studies will nominate for the approval of the dean a supervising committee consisting of five members, with one member designated as chairman. This committee will include at least three graduate faculty members from the department and at least one from outside the department. This committee, with all members participating, will determine the program of study and administer the preliminary and final examinations. Successful completing of the final examination requires four affirmative votes. The final examination may be administered by four members if the representative of the related field is present.

The minimum registration requirement is 60 units of graduate credit, of which not more than 15 units may be accepted by transfer. The minimum registration per semester is 12 units. The minimum full-time residence requirement is one academic year (two consecutive semesters) at

Duke. All Ph.D. candidates must register for a full course load until they have completed the required 60 units of graduate credit. Those entering with undergraduate deficiencies may be required to take undergraduate courses for which they will not receive degree credit. The student's supervisory committee will determine what requirements above the minimum, if any, the student must meet. More complete information and requirements for the preliminary examination, the dissertation, and the final examination are outlined in the bulletin of the Graduate School.

Master's Degrees for Professionals

Qualified professionals may be admitted to the School of the Environment as part-time students. By taking a three-month leave of absence from their jobs, these professional degree candidates spend a full semester at Duke enrolled in regular, graduate level courses. Up to 15 units of academic credit are taken during this time. The remaining 15 or more units of credit needed for the Master of Environmental Management degree may be earned in absentia or on campus as career responsibilities permit. Part-time candidates have up to five years in which to complete all requirements.

Specific degree requirements for students in the Senior Professional Program, including required courses and the number of academic units necessary to complete the degree, are established by the faculty council upon evaluation of the individual's previous education, working experience, and career goals. A minimum of one semester in residence and 30 units of credit are required. A master's project, which may be completed in absentia, representing 4 to 6 units of credit also is required.

For a list of course descriptions for Environmental Management, see Appendix I-7.

UNIVERSITY OF WATERLOO

FACULTY OF ENVIRONMENTAL STUDIES (1968) (School of Urban and Regional Planning)

Faculty:

29 faculty; 6 Adjunct faculty; 1 lecturer; 5 staff members

The Program:

The School of Urban and Regional Planning (SURP) in the Faculty of Environmental Studies (FES) was formed as an independent professional School in 1969, and has an undergraduate honours planning program, leading to a University degree, in addition to the Masters and Doctoral programs. Part-time and professional in-career studies are also offered.

The Master's and Doctoral programs are aimed at filling the need for persons who can carry out research and design and implement action programs in the field of regional planning, which encompassed the problems of urban growth as well as resource use and regional economic development

Prerequisites:

The Master's program which normally takes two years, is open to graduates with a four-year honours degree or equivalent in Planning, or in a number of fields providing relevant background to planning studies, such as Architecture, Biology, Civil Engineering, Economics, Forestry, Geography, Geology, Landscape Architecture, Law, Political Science, Sociology, other Resource Disciplines and Social Sciences.

Students must have an average of a B+ or better, must provide letters of recommendation, and must have research interests in relation to the faculty resources of the School.

Part-time:

The applicant must hold a four-year honours degree or equivalent from a recognized post-secondary institution in Planning or in a related field which provides relevant background for planning studies; must have maintained at least an honours standing B average during undergraduate work; and must have two years work experience after undergraduate degree.

Master's Program Requirements:

A Master's candidate is required to complete a minimum of five full graduate course credits (with at least a B average) and a thesis in two years. One full course credit may be at the 500 level. All other courses must be at the 600 or higher level. The majority of courses should be

from the School of Planning.

The candidate's set of required courses must include Planning 780, 691 (field trip to be taken in 2nd year), 692, and one full graduate course credit from at least one of the following major special areas:

Major Special Areas

Social-Economic/Human	Physical/Natural	Political/Administrative
Plan 623*	Plan 661	Plan 620*
Plan 624*	Plan 662*	Plan 630*
Plan 625*	Plan 664*	Plan 656
Plan 626*	Plan 665*	Plan 658
	Plan 666*	Plan 660
	Plan 667	Plan 675* (Law Theme)
	Plan 668*	

* Worth .50 credit

The academic objective is to assure that each student will be exposed to a number of core themes, selected from among the following:

- (i) Philosophy and Methodology (Plan 780, 611, 616, 617, 618, 619),
- (ii) The Planning Process in a Regional Context (Plan 656, 658),
- (iii) Politics, Administration and Policy Formulation (Plan 660, 630, 614, 662),
- (iv) Ecology and Resource Management (Plan 664, 665, 661, 662, 663, 666),
- (v) Social Aspects of Planning (Plan 623, 624, 625)

The Master's program normally requires two academic years to complete. The student will be required to be registered as a full-time student for at least five of the six terms.

By the end of the second term, the graduate student must follow up her/his initial declaration of research interest with a statement of the theme, scope and method of approach to her/his topic, which is to be presented to the Supervisor in Writing. When the thesis statement has been accepted by the Supervisor, and received by the Graduate Committee of the School, the Supervisor will form an Advisory Committee, in consultation with the student and the Graduate Officer.

Doctoral Program

Applicants must possess a Master's degree or equivalent in Planning or a related field. Acceptance will depend on his/her academic standing in the Master's program; work experience; letters of recommendation; and research interests.

PhD Programme Requirements

1. Candidates with a non-planning M.A.:

The required courses are PLAN 780, 801, 802. The candidate should demonstrate competence in a second language and must pass a comprehensive examination and successfully defend his/her doctoral thesis (PLAN 899). In addition to the required courses, candidates may be asked to take other courses as stipulated at the time of admission which will be recommended by the Graduate Admission Committee in consultation with the assigned supervisor.

2. Candidates with a planning M.A.:

The required courses are PLAN 801 and 802. The candidate should demonstrate competence in a second language and must pass a Comprehensive Examination and successfully defend his/her doctoral thesis (PLAN 899).

All candidates must maintain an overall average of at least 73%. Candidates' overall achievements are reviewed annually; students whose work does not meet the standards of the program may be required to withdraw.

A comprehensive examination must be taken by the end of February of the second year. The purpose of the Comprehensive Examination in Regional Planning and Resource Development is to evaluate a candidate's ability to correlate and integrate concepts of a general and specific nature and to determine if the candidate demonstrates a solid and broad comprehensive basis of knowledge and shows adequate preparation to undertake thesis research.

For a list of graduate course descriptions, see Appendix I-8.

UNIVERSITY OF MANITOBA

ZOOLOGY DEPARTMENT

The Zoology Department at the University of Manitoba offers a Pre-master's program; a Zoology M.Sc; and Ph.D program.

Pre-Master's Program:

Students with a 4-year undergraduate degree normally apply directly for M.Sc. study. Students entering graduate study with a 3-year general B.A. or B.Sc. are admitted to a qualifying program of study termed "Pre-Masters Study". The pre-master's program is assigned by the Head of the Zoology Department. It is designed to bring the standing of the student approximately to the level of that of Honours or Majors Zoology graduates and to provide any necessary prerequisites for the ancillary subjects.

Pre-requisites:

To be eligible for admission into a pre-master's program the applicant must possess a bachelor's degree and must have attained a composite GPA of 3.0 in the last two years of the undergraduate program.

MSc. and Ph.D. Programs - General:

An application for entrance can only be considered if the potential advisor is in a position to accommodate the student. Applications frequently exceed vacancies, in which case the academically superior students are chosen. Academic superiority is judged on the basis of GPA, reference letters, publications and other supporting documents supplied by the student, and previous research experience.

MSc. Program:

Graduates of honours or equivalent programs from an accredited university are eligible for admission. A GPA average of 3.0 during the last two undergraduate years is required.

MSc. Course Requirements:

A minimum of 12 credit hours must be taken. Six or more of these credit hours must be taken in the Major subject (Zoology) at the graduate (700) level. Three or more of these credit hours must be taken in ancillary subjects at the 700, 600, 500, 400, 300 (or in exceptional circumstances) 200 level, or from Zoology 400 level courses.

Table 3
SUMMARY OF MASTERS/PH.D. PROGRAMS
IN THE RESOURCES MANAGEMENT AREA

Universities	School	Degrees Offered	Credit Hours	Thesis Requirement	Program Length	Program Other
York	Faculty of Environmental Studies	BES ³				
		MES*	40		2 yrs.	* Job experience can be part of credit hours
		PhD		Dissertation		
San Jose State	Environmental Studies Program	Bacc.				
		B.A.	124		4 yrs.	
		B.S.	132		4 yrs.	
		M.S.	30	Thesis*		* 15 core; 15 electives
Simon Fraser	School of Resource and Environmental Management	MRM	73*	Research Project		* 7 required; 5 electives (course credits vary)
		Ph.D.*				* under special arrangement
Dalhousie	School of Environmental Studies	MES				
McGill	Department of Renewable Resources	M.Sc.	45	Thesis	2	
		Ph.D.*		Thesis + Coursework		* under special arrangement
Calgary	Faculty of Environmental Design	M.Ed.*	1 year core courses	Masters project**		* four degree options available ** must take general knowledge exam
Duke	School of the Environment	M.E.M.	48			
		M.S.	30	Thesis		
		Ph.D.	60			
		Professional	15		3 months	
Waterloo	Faculty of Environmental Studies	M.A.	25*	Thesis	2 yrs	* credits vary
		Ph.D.		Thesis*		* plus a comprehensive exam
Manitoba - Zoology	Zoology Department	Pre-M.*				* assigned by Head of Department
		M.Sc.	12	Thesis		
		Ph.D.	12	Thesis*		* plus oral examination
Manitoba - NRI	Natural Resources Institute	M.N.R.M.	42	Thesis		

RESTRUCTURING THE NRI PROGRAM

The recommendations suggested throughout this evaluation are vital to the restructuring of the NRI program. The restructuring of the NRI program should be viewed as a thought-provoking proposal in which further discussion and revision should take place (after external reviews are completed, and questionnaires of employers and students analyzed).

Restructuring of the NRI program is in response to University of Manitoba initiatives such as the Draft Plan 2000; in response to public dissatisfaction of the work of universities (McLean's university ranking article) and public demands in general; in response to a need to keep pace for the 21st Century and be forward looking; and to meet the changing demands of the resources management field.

The restructuring is also based on information presented throughout this paper. A reiteration of several important concepts/information follows:

- Students today are on average older and more likely to be pursuing part-time study than was formerly the case (Draft Plan 2000, p. 3).
- Increasing numbers of students with excellent high school records, who have the financial ability to do so, are leaving the Province to pursue university study elsewhere (Draft Plan 2000, p. 3):
- Use of special program delivery strategies such as co-operative education and distance education has been building relatively slowly at the University of Manitoba (Draft Plan 2000, p. 3).
- Jurisdictional concerns are contributing to a lack of significant progress in reforming the academic schedule and designing new and more flexible arrangements to meet the changing needs of students (Draft Plan 2000, p. 3).

- The University of Manitoba requires that each Unit introduce new kinds of organizational elements, delivery methods (including through the use of advanced technology) to overcome constraints on accessibility and flexibility of university programs (NRI Multi-Year Plan).
- The University of Manitoba requires that each Unit form or strengthen alliances amongst professors, programs, units, institutions and sectors (i.e. universities, industry and government) to enhance the scope of teaching and research opportunities, to optimize use of resources and promote interdisciplinary synergies (NRI Multi-Year Plan).
- The University of Manitoba requires that each Unit link evaluation of unit performance to explicit institution-wide and unit-specific goals and objectives to promote coherent program development and delivery (NRI Multi-Year Plan).
- Universities are urged to change their teaching schedules to accord with the requirements of the part-time learners (University Education Review Commission)
- Universities are urged to form better linkages with public and private industries in order to better prepare students for real-world problems and issues (University Education Review Commission).
- The field of resources management is changing. For example, new legislations and regulations are constantly being created (Clark, 1990).
- Resource managers require strong capabilities in people management (Clark, 1990).
- Resource managers are expected to possess an extremely wide range of skills and knowledge. Resource managers must be managers, planners, problem solvers, politicians, and researchers (Clark, 1990).
- Resource managers require excellent communication skills (written and oral) (Clark, 1990).
- Education in resources management programs will need to be improved and must respond to future trends (Clark, 1990).
- The general subject areas most frequently mentioned included: values and ethics, ecology, environmental effects, environmental indicators, environmental impact assessment, methodology, modelling, monitoring, growth and its implications for the future, economics of the environment, environmental law, administrative processes, and actor/role interactions (Clark, 1990).

- Summary of nine resources management programs illustrates that the University of Calgary and the University of Manitoba's NRI program are the only two programs that do not offer a formal Ph.D. program.
- Summary of nine programs management programs identifies that the average credit-hour requirement for Master's programs is between 30 and 40 credit hours.

Based on the information identified above related to the wants of students, employers, the University and the general public, it is clear that the NRI program must be revised.

The faculty, administrators, and staff at the NRI recognize the need to have an education system that prepares students to participate effectively in a fast changing, diverse and complex world, and understand that they too have to change. As the call for education reform is realized, the NRI must be structured to respond with equal urgency and relevance to become more flexible, responsive and enterprising.

The NRI must take charge of its own future by modifying the existing program before others, who are better organized and more ambitious make changes for them.

In order to plan for the future, it is suggested that the NRI program be restructured according to the following recommendations:

- | | |
|---------------------------|---|
| Recommendation 10: | Develop a formal Ph.D. program; |
| Recommendation 11: | Revise the existing MNRM program to 36 credit hours plus a thesis |
| Recommendation 12: | Develop a one-year Professional Certification program (27 credit hours) with no thesis requirement. |

Recommendation 13: Develop a continuing education/distance education program

Recommendation 14: Change the name of the program from "Natural Resources Institute" to "School of Natural Resources and Environmental Management".

1. Ph.D. program:

The NRI presently has three students doing a Ph.D. program at the NRI under the supervision of the Director and one Faculty member. Previous to this, a Ph.D. program was not offered at the NRI. The demand appears to exist now for students interesting in resources management wanting to go on to higher education once they have completed their undergraduate degree or the MNRM degree. In the past, out of 300 students, approximately 5% went on to work on a doctorate degree (at some other University). It is believed that the Institute's faculty/administrators have the depth in ability and research to guide a Ph.D. student on to higher level thinking and more advanced research than the MNRM degree offers. It is also believed that a Ph.D. program at the NRI would dissolve the notion that the existing MNRM program is a terminal or a career degree for most students. Simply offering a Ph.D. in resources management may encourage some students to pursue a doctorate, when they otherwise would not have thought it possible (for financial reasons, location, advisors, etc.).

It should be noted that out of the nine programs summarized, six offer a formal Ph.D. program. The University of Manitoba (Zoology Dept.), York, Duke, and Waterloo Universities all have an acceptable program structures for their Ph.D. programs (as summarized previously).

It is suggested that the NRI review the four programs in order to determine the best approach in which to develop the new Ph.D. program.

Possibly no more than five students should be targeted as candidates for the Ph.D. program at any time, and it should be anticipated that each student would complete their Ph.D. requirements after three years of study and research.

2. Revision of MNRM program:

It has been recommended that the existing MNRM program be revised to 36 credit hours plus a thesis requirement. The purpose of this revision is to allow students more flexibility in designing their own programs, without losing most of the core course requirements necessary to obtain a well-rounded degree. Student concerns about the core curriculum reveal that the practicum process takes up a great deal of their time and thus, some core courses that could be deleted, should be deleted. Also, student concerns expressed that the core program was inflexible for students that wanted to take electives that would be more suitable for work towards their practicum.

The revised MNRM program would add two courses: Sustainability in Resources Management as a core course and Natural Resources Economics and Environmental Impact Assessment as option courses. In the NRI Mission Statement, Sustainable Development is targeted as one of the areas that the Institute will emphasize in the program. A course in this regard should then appear as a core course requirement. Natural Resources Economics is listed as one of the requirements that students need for a well-rounded resources management education and is listed by other resources management programs as a requirement for students. However, only one course seems to be offered. Therefore, Economics should only be a three

credit hour course, as it is believed that the bulk of what is taught, related to natural resources could be taught in the 3-credit hour time slot. Topics in Environmental Assessment is an important course, however, not all students will need this course in their future employment. Therefore, the course should be located in the options section of the program.

Deletion to the existing program should include Research Planning and Design II and Biological Resources Management I. Research Planning and Design II has been expressed by students as redundant to Research Planning and Design I. Students expressed preference to have the time available to actually work on their practicum requirement. It is believed that practicum preparation, results and discussion sections, and data analysis could all be taught in Research Planning and Design I. If the area of production of published papers for submission to journals is needed to be covered, a seminar series for students interested in pursuing this avenue could be developed. It is believed that the Research Planning Design I and II could be consolidated into a one 3-credit hour course, while still providing students with the methodology that is required. Offering an additional course in its place, such as Sustainable Development, would seem to make more sense.

All other courses that were previously offered should not be deleted as the students require these courses to obtain an understanding of what natural resources management is all about.

The revisions to the existing program would reduce the number of core credits, increase the number of options and electives, thus giving the students more time to do their practicum.

The proposed program would target approximately 70 students, as this is the approximate target that the present program proposes.

The new MNRM Master's Program Course Requirements could be structured as follows:

1. **69.703** Practicum

(This requirement carries no credit-hour value.)

2. A Total of 21 credit-hours consisting of the following:

56.601 Introduction to Natural Resources Management (3)

56.709 Research Planning and Design I (3)

56.714 Topics in Natural Resources Management (3)

XX.XXX Sustainability in Natural Resources Management (3)

22.741 Biological Resources Management (3)

18.447 Natural Resources Economics I (3)*

45.329 Natural Resources Administration and Law (3)

* this course number would have to change because of the reduction in credit hours).

3. A minimum of 6 credit-hours chosen from the following:

56.711 Northern Field Seminar (3)

56.712 Mineral Resources (3)

56.713 Energy Resources (3)

56.715 Environmental Impact Assessment (3)

22.740 Biological Resources Management I (3)

XX.XXX Natural Resources Economics II (3)

4. A total of 9 credit-hours of electives

(a) An area of strength may be developed by a student who normally has undergraduate background in that area. In consultation with the faculty advisor, areas of strength may be developed in any subject area relevant to Natural Resources Management.

(b) Alternatively, students may cover the breadth of the field of natural resources, by taking all of the courses listed under requirement 3 above, and choosing further courses from the list of electives.

(c) Courses at 100 and 200 levels cannot be counted towards the 33 credit-hours required by the NRI program.

3. **One-Year Professional Certification Program:**

In order to meet the needs of older students; to meet the needs of professional students

already in the field; and to meet the accessibility/flexibility requirements that the University has set forth, it is recommended that the Institute develop a one-year Professional Certificate program consisting of 27 credit hours with no thesis requirement. This new program would target professionally employed students who have other commitments, ie. family, employment, etc., to obtain a Master's degree in resources management without having to do a formal research document. Few professional students who are already employed in the resources management field require the research experience for educational purposes that MNRM students require (David Young, interview). The Institute needs to develop a program that will allow for flexibility and accessibility to those students that prefer to do only coursework and learn in other avenues such as workshops, seminars, and extra-curricular activities. Literature suggested that there was a need for 'on-the-job' training and/or research skills for students entering a resources management career. However, students already in the field may already have the necessary skills and abilities requirement, and may require upgrading of those skills and abilities. Most employers would agree to allow a professional to take a leave of absence for one year to receive professional development training², however, if the time period were longer than that, employers may not be flexible enough to accommodate potential students. The programs would target approximately 15 full and/or part time students.

The one-year professional program could also be taken on a part-time basis. Duke University offers a similar program for professionals, and the NRI may want to structure their new program essentially the same way. At Duke University, qualified professionals may be

² The professional degree offered by Duke University is set up in a very similar way, except that the program is offered in 3 month blocks instead of one year. The Duke University calendar states that employers do not object to the leave of absence by the student if it is for upgrading purposes.

admitted to the School of the Environment as part-time students. By taking a three-month leave of absence from their jobs, these professional degree candidates spend a full semester at Duke enrolled in regular, graduate level courses. Up to 15 units of academic credit are taken during this time. The remaining 15 or more units of credit needed for the Master of Environmental Management degree may be earned in absentia or on campus as career responsibilities permit. Part-time candidates have up to five years in which to complete all requirements.

Specific degree requirements for students in the Senior Professional Program, including required courses and the number of academic units necessary to complete the degree, are established by the faculty council upon evaluation of the individual's previous education, working experience, and career goals. A minimum of one semester in residence and 30 units of credit are required. A master's project, which may be completed in absentia, representing 4 to 6 units of credit also is required.

The One-Year Professional Certification Program course requirements could be structured as follows:

A Total of 15 credit-hours consisting of the following:

56.601 Introduction to Natural Resources Management (3)

56.714 Topics in Natural Resources Management I - Policy Development (3)

22.741 Biological Resources Management II (3)

18.447 Natural Resources Economics (3)

45.329 Natural Resources Administration and Law (3)

Plus a minimum of 6 credit-hours chosen from the following:

56.711 Northern Field Seminar (3)

56.712 Mineral Resources (3)

56.713 Energy Resources (3)

56.715 Environmental Assessment (3)

22.740 Biological Resources Management II (3)

Plus a total of 6 credit-hours of electives chosen under NRI Electives

4. Continuing education/distance education program:

It is recommended that the NRI develop a continuing education/distance education program that would target approximately 20 part-time students. The purpose of this program would be to give part-time student access to courses that are currently offered in the program a chance to upgrade their skills/abilities in their present jobs, continue in their personal and professional development, or earn university degree credit. Students could take courses from the existing program or participate in workshops and seminars that the Institute offers on a regular basis. Students could learn from other students who are currently enrolled in existing Master's or Ph.D. programs and vice-versa. Distance education could be another service the Institute should look into developing. An important part of the University of Manitoba's mandate is to make the University's programs more accessible throughout the province. One way that the Institute could respond to this challenge is through the development of a Distance Education Program. Targeted student could be homemakers, professionals, farmers, senior citizens, factory and office workers, and full-time students using Distance Education as an alternative way to study.

Distance Education offers many advantages to students. Regardless of where they live or

work, they can continue their studies without having to travel to campus. They may have young families, work shifts, or simply find studying at home or in their communities a convenient way to continue their education.

5. Name Change

It is recommended that the name of the NRI program be changed from "Natural Resources Institute" to "School of Natural Resources and Environmental Management". By changing the name from an "Institute" to a "School", it appears that more than one program could be offered, ie. MNRM, one-year professional/certificate, Ph.D.. The program presently is based on education of environmental management, not simply, natural resources management, therefore, the longer name would be more suitable for what the new program would be trying to accomplish. The NRI program may also attract more students because the name would be more descriptive.

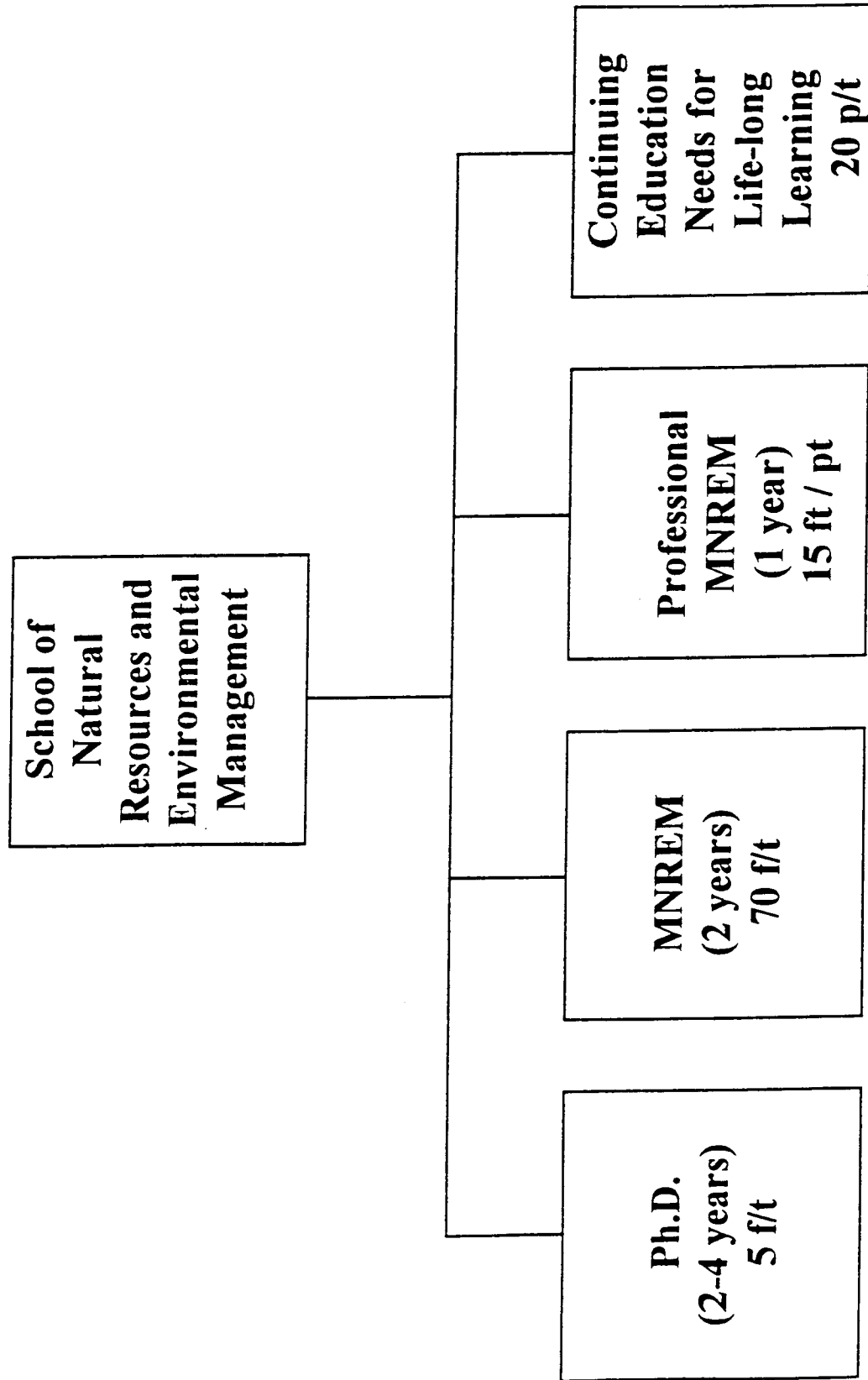
Other programs have change names to accommodate program changes. They include the School of Resource and Environmental Management at Simon Fraser University (formerly the Natural Resources Management Program). The School of Environmental Studies at Dalhousie University was formerly an Institute. Of the nine programs summarized, only the University of Manitoba (NRI) identifies the program by "Institute". Most other programs are either called "Schools" or "Faculties".

It is also recommended that the "MNRM" degree name be changed to "MNREM" to reflect the new name of the program.

Figure 5 provides an illustration of the restructuring of the NRI program.

Figure 5

Restructuring of the NRI Program



DISCUSSION AND CONCLUSIONS

Past and present NRI staff have invested considerable thought in the design of the academic program, however, some revisions and modifications should be made in that regard. The internal and external evaluations performed in the past illustrated that the NRI has been significantly underfunded relative to its role within the University and the needs of society which has limited the Institute's ability to achieve its three major objectives equally: teaching, research, and outreach. The evaluations also illustrated that the University of Manitoba has a valuable academic unit in the NRI. The Institute has achieved a great deal with respect to its mandate since these two evaluations were completed, despite a lack of significant increases in resources by the University. Some new courses, projects and others have been developed; research initiatives have increased by faculty; and the outreach function has increased considerably with a new seminar series, workshops, and conferences underway.

With global concerns, and federal commitments to sustainable development, the Institute has a responsibility to society to respond in this academic field. The NRI seems to be an appropriate vehicle through which the University can make its response to this opportunity.

To be able to make an appropriate response to University initiatives, to the needs and wants of the public, students, and employers of NRI graduates, the NRI should restructure its current program to include a Ph.D. program, a one-year Professional Certification program, and should organize and implement a continuing education/distance education function, and change the current name from the "Natural Resources Institute", to "School of Natural Resources and

Environmental Management", thus capturing what the Institute's purpose is.

Before determining the specific details for the above restructuring, the NRI should collect data from graduates of the Institute and employers of these graduates. The financial implications to collect this data would be minimal since the NRI keeps in touch with graduates on an annual basis by sending them a copy of the NRI Bulletin. To include a questionnaire together with a stamped envelope would not be too costly for the Institute. To survey employers would be more costly, however, it is believed that the data this survey would provide would be invaluable to the Institute, and the cost would be minimal in that regard. The Institute should also arrange to have another external review of the program performed. The Kimmins' Report, although very informative, is now outdated.

With the above data, and a review of other resources management programs, a detailed restructuring strategy could be developed. The general restructuring recommendations in this paper are based on the history of the NRI, the current program, the apparent wants and needs of students, society, and the University. It is suggested that these general recommendations be used as a catalyst to stimulate further discussion.

There may be advantages and disadvantages to restructure the NRI program. The advantages for developing a Ph.D. program would be that the students would not see the present Master's program as a terminal or career degree, and would have the avenue to receive higher education. The advantage to faculty members would be that they would ultimately learn a great deal from students in the Doctoral program, and could translate this knowledge to students in the Master's level programs. Also, if students are working in the same area as faculty members, faculty members may increase their level of research. In addition, other students in other programs at

the NRI may find it informative to have Ph.D. students in their midst whereby they could associate with in extra-curricular activities, workshops, seminars, etc.

Another advantage to having a Ph.D. program is that "the best" students for other programs and from the MNRM program may be kept in the Province instead of going to other resources management programs to study. This would increase tuition for the University, as well as increase the units profile within the University. At the present time, out of the nine programs that were summarized, the NRI and the University of Calgary are the only two programs that do not offer a Ph.D. program.

The disadvantages of a Ph.D. program may be that faculty would have an increased workload to advise Ph.D. students. Possibly their own research would suffer if a considerable amount of time is needed to advise these students. Space in the present NRI faculty may not warrant any additional students, therefore other students may not be provided with office space if Ph.D. students are occupying desks, computers, and other facilities.

The impact that a new Ph.D. program would have on other units in the University is unknown at this time, however, that would have to be investigated by faculty and administrators of the NRI and other programs, and the University in general, before it is implemented.

The advantages of revising the current MNRM degree may be that students would have more time and energy to devote to their practicum than they do at the present time and may have more opportunities to take electives in other areas that would help them in their research process. The practicum process has always been an integral part to the MNRM degree. With modifications to the core curriculum, it is believe that the practicum process would be enhanced.

Reducing MNRM credit hours from 42 to 36 may be an attraction to students coming into the program. If most other resources management programs in Canada and the U.S. require between 30 and 40 credit hours, some students may choose the NRI program over another that requires an additional workload with less emphasis on research. The program in the past required 54 credit hours of coursework and research, and was reduced to 42 credit hours. The impact of that revision seemed to be advantageous to NRI students and to faculty. The program did not seem to suffer because of the revision. However, this statement will not be proven until a survey is analyzed from graduates of the program, and a comparison is made between graduates before the revision was made to graduates after the revision.

The apparent disadvantages of modifying the program is that faculty and administrators would have to spend a considerable amount of time and energy to modify current courses in order to consolidate some, delete others, and develop new courses.

The University may regard program changes positively or negatively. It is unknown at the present time how the University will react.

The advantages of developing a one-year Professional Certificate program may be that professional students can obtain a Master's degree in one year through course work without having the practicum requirement. It should be pointed out that the students in the past that did not have their degree awarded to them was not because of uncompleted coursework, it was due to a failure to complete their practicum. Most of these students were in the process of completing their practicum, but were offered an employment opportunity, and took it. These students, with the above program, could have received credit for the one-year Professional Certification program, instead of receiving no credit at all for two years of course work that was

successfully completed.

Another advantage would be that students in the two-year Master's program would have the opportunity to work in teams with professionals in the field. This may add new insights into current issues of resources management, and could possibly make courses more interesting for students and faculty members.

The new one-year program would target the accessibility trend that the University is highlighting as a requirement for all programs, and would also address some of the accessibility issues set out by the Roblin Commission Report Concerning Universities in Manitoba.

The possible disadvantages of a one-year program could be that students normally wishing to apply to the two-year masters program may choose the one-year program instead. This may have many disadvantages to students and to the NRI. Firstly, students may not get the required research experience that they require (if they do not already have employment), however, if the program is set up in such a way that students could transfer credits to the two-year program, if they desired and do the necessary research requirement, that would rectify that problem. Secondly, admissions administration would be greatly increased by offering the two programs. Presently, faculty are involved to a great extent in the admissions process at the NRI, and increased administration may be seen by many as a negative requirement. Thirdly, if students are able to transfer credits to the two-year program, once they have already been accepted to the one-year program, additional registration administration would be required. This may also be perceived by faculty and administrators as a negative requirement.

There may be many other advantages and disadvantages to the new one-year professional

master's program, however, many may be avoided depending on the requirements for admission to the program, and the rules and regulations that would be set up to transfer to another program at a later date. This program would have the biggest impact on the NRI, and would need the most discussion and information before restructuring begins.

The continuing education/distance education function would also have advantages and disadvantages. There would be many advantages to new and incoming students at the NRI. It has been stated that traditional lecture/seminar courses are not the only way students learn. Students also learn from workshops, off-campus courses/seminars, extra-curricular activities, field trips, etc.. These initiatives would be excellent for students that are just wishing to continue with their life-long learning efforts. It is believed that the Institute faculty and students have a lot to offer students both within the program, and others in and out of other programs at the University and elsewhere in the Province. The continuing education function would be beneficial to all. The Distance education initiative would also have many advantages to students not able to relocate to the University. Students that would not otherwise be able to participate in learning would be given the opportunity.

The Institute faculty may view the continuing education function as negative because it would mean extra work for them, and also require them to teach off-campus, learn new teaching and delivery methods that they may not have the time available to learn.

The continuing education/distance education initiatives will require energy, hard work and dedication on the parts of present faculty. However, if the Institute faculty want to respond to current ideas and respond to new opportunities, they will have to demonstrate an ability to project a level of energy, initiative, creativity and momentum that will persuade any critics that

advances can be made. Besides, with a reduction in core credit hour teaching and preparation, and the recent addition of one new faculty member, the job may not be as difficult as it may now seem.

There may be several advantages and disadvantages to restructure the current NRI program. For instance, it is not known at this time what the financial implications would be to create another 1 year Professional Certificate program, or to develop the continuing education/distance education initiatives.

It is believed that the NRI has the ability to respond to the effect of external and internal conditions as well as improve on the current program. The thrust of change in the next two decades tends to be one of flexibility. It is recommended that if the NRI wants to remain at the leading edge of resources management education, the Institute must be flexible in its design of the program. In order to address the needs of the public, the students, the University, and to keep pace with other resources management programs, the NRI should follow the reiteration of the recommendations imbedded in the evaluation.

- Recommendation 1:** That an external review of the NRI program be done.
- Recommendation 2:** That a questionnaire/survey be sent to all NRI graduates (approximately 300) in order to determine the necessity of altering course requirements and changing the structure of the NRI program.
- Recommendation 3:** That the new faculty member at the Institute be provided with some teaching release time in order to assist in establishing programs of research. Possibly a teaching assistant funding by operating monies, could be one approach.
- Recommendation 4:** That the Institute obtain several entrance fellowships in order to keep new best students in the Province and in the program.

- Recommendation 5:** That the institute ensure that all students are fully informed of scholarship and fellowship opportunities;
- Recommendation 6:** That the Institute inform itself of proposals from other units within the University, as a first step in its attempt to change, to respond and to adapt to a changing world.
- Recommendation 7:** That the NRI survey employers of NRI graduates in order to fully grasp what they expect of NRI graduates and what they expect of the NRI curriculum.
- Recommendation 8:** That the Institute set up an Advisory Committee in which members from government, resources agencies, and others can meet to discuss policy issues and also to keep in touch with employers needs and wants from NRI graduate students.
- Recommendation 9:** That the NRI arrange sabbaticals, not only for research purposes, but for spending time in natural resource agencies. This would provide faculty with the exposure to agency problems and perspectives that they require.
- Recommendation 10:** Develop a formal Ph.D. program;
- Recommendation 11:** Revise the existing MNRM program to 36 credit hours plus a thesis
- Recommendation 12:** Develop a one-year Professional Certification program (27 credit hours) with no thesis requirement.
- Recommendation 13:** Develop a continuing education/distance education program
- Recommendation 14:** Change the name of the program from "Natural Resources Institute" to "School of Natural Resources and Environmental Management".

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- Note: Program summaries were adapted from information provided from calendar material in the NRI and Elizabeth Dafoe Libraries.

Appendix A
Kimmins' Recommendations

The following is a reiteration of the recommendations imbedded in the Kimmin's Report (1989).

Recommendation 1: That the University of Manitoba administration consider the development of a mechanism by which existing resources in the line departments could be better coordinated into an academic framework that would provide a scientific complement to the resource management and policy-based NRI. This could take the form of an Environmental Studies Graduate Program, staffed by existing faculty in the line departments. However, there would be some budgetary implications since the program would require a coordinator or director. Any such program should be closely coordinated with NRI.

Recommendation 2: That one additional FTE academic position be awarded to the NRI in the area of management skills. This position would provide for a comprehensive course offering in business and management skills appropriate to NRI's overall objectives.

Recommendation 3: That supplementary administrative support staff be provided to assist in the area of budgeting and administration of contracts, and in the anticipated increase in NRI research and extension activity. The level of supplementary support required should be evaluated after decisions have been made with respect to other aspects of the NRI program.

Recommendation 4: That every effort is made to maintain the diversity of students taken into the program, and to promote the interaction between students. The apparent educational value of these interaction should be considered a major asset of the NRI, and every effort should be made in curriculum development to capitalize on this asset.

Recommendation 5: That steps be taken to foster the present good relationships between staff and students. Mechanisms could include increased social interactions. Provision of a lounge or common room would be helpful in this regard (see comments under Facilities).

Recommendation 6: That the core curriculum be carefully re-examined for weaknesses relative to the current and anticipated future needs of integrated resource management. Areas currently perceived to be weak are climate soils, landform, ecological site classification, forestry, management "skills," local short-term trips, and computer-based planning tools (see below). Areas that are indeed shown to be weak should be strengthened.

Recommendation 7: That the University of Manitoba administration provide the NRI with sufficient additional budget that can fund contracts with appropriate academic units within the university to provide the specific curriculum modules that are required to achieve the Institute's academic teaching objectives. The content of these modules should be negotiated between NRI and the particular academic unit involved.

Recommendation 8: That modifications be made to the present building to permit unrestricted use of the top floor, and that present "external" space be upgraded to provide a common room/dry lab work area.

Recommendation 9: That an introduction to computer-based planning and evaluation tools be included in the core curriculum, that faculty competence in such microcomputer "decision support tools" be developed, and that a microcomputer lab of at least three up-to-date microcomputers and appropriate peripherals be provided. At least one of these microcomputers should be capable of running a Geographic Information System software package. Basic familiarity with GIS as a planning tool would seem to be fundamental to a program dealing with natural resources.

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Recommendation 10: That the requirements of a student practicum include the preparation of a manuscript for submission to an appropriate professional, technical or scientific journal. This may require some redesign of some research projects. The paper should, when ready, be submitted to the appropriate journal under the joint authorship of the student, the research supervisor, and where appropriate (e.g., where the research funding has been generated by NRI), the NRI faculty member who is administering the project. All papers should be attributed to NRI. With relatively little increase in effort and resources, a considerable research productivity could be achieved where there currently appears to be somewhat of a "famine."

Recommendation 11: That the NRI actively review the possibility of developing an off-campus continuing education program in its area of expertise, and that a more aggressive lecture and seminar program be developed on campus.

Recommendation 12: That steps be taken to promote the work of NRI to visitors to the building by means of visual displays, wall posters etc. The provision of a lounge where the walls could be decorated with such displays would be useful. Steps should be taken to correct the impression, apparently held by some, that the Institute is not the "hub of dynamic activity" it might be.

(Source: Kimmins's External Evaluation of the NRI Report)

Appendix B
Institute Faculty and Staff

Core Faculty

- | | |
|--------------------|---|
| Richard K. Baydack | - Associate Professor, B.Sc.(Hons.)(Manitoba), M.N.R.M. (Manitoba), Ph.D.(Colorado State). Wildlife management, applied ecology, waterfowl habitat conservation, program and policy evaluation. |
| Fikret Berkes | - Director and Professor, B.Sc., Ph.D.(McGill). Living resources; fisheries. Community-based resource management, common property resources, co-management; hydroelectric development. |
| Thomas J. Henley | - Associate Director and Associate Professor, B.A.(Hons.) (Manitoba), M.N.R.M.(Manitoba). Sustainable Development, program and policy evaluation, northern and native affairs. |
| Walter R. Henson | - Professor, B.A.(Hons.)(Queen's), M.S., Ph.D.(Yale). Policy development, research planning, forestry. |
| A. John Sinclair | - Assistant Professor, B.A.(Hons.) (Carleton), M.A.(Carleton), Ph.D. (Waterloo). Environmental assessment, waste management, policy evaluation. |

Adjunct Professors

- | | |
|--------------------|---|
| Richard J. Cooke | - B.A.Sc.(Waterloo), Ph.D.(Birmingham). Hazardous waste management. |
| Wayne L. Everett | - B.Sc., M.B.A.(Lakehead), Ph.D.(Arizona). Impact assessment. |
| George S. Hochbaum | - B.Sc.,(Colorado.) M.F.Sc.(Yale), Ph.D.(U.B.C.). Waterfowl population management. |
| Ludmila N. Ilyina | - Senior Research Geographer, Institute of Geography, Russian Academy of Sciences, Moscow. Northern transportation, geography of the North. |
| Robert E. Jones | - A.A., A.S.(N. Dakota School of Forestry), B.Sc., M.Sc.(Idaho), Ph.D.(Oklahoma). Game bird ecology and management. |
| Diane F. Malley | - B.Sc., M.Sc.(U.B.C.); Ph.D.(Michigan). |
| M. Husain Sadar | - B.Sc.(Middle East Tech U.), M.Sc.(Louisiana State U.), Ph.D. (Sask.). Environmental impact assessment. |
| David A. Young | - B.A.(Manitoba), M.A.(Michigan). Resource economics, energy analysis. |

Support Staff

- | | |
|--------------------|-------------------------------|
| Christina McDonald | - Office Administrator, B.Ed. |
| Judi Zieske | - Office Assistant |

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INSTITUTE FACULTY AND STAFF (Cont.)

Visiting Scholars

Dr. Peter Longo, Political Science Department, University of Nebraska at Kearney (July 1992) Canada-US water policy

Dr. Hellmut Schroeder-Lanz, Department of Geography, Trier University, Germany. (August - September 1992). Comparative physical geography, regional geography and remote sensing of Manitoba.

Dr. Georg Lithman, Department of Anthropology, Stockholm University, Stockholm, Sweden (January 1993 - Spring/Summer 1993). Jointly with the Department of Anthropology. Living resources management and native cultures.

Other Faculty and Professionals

The NRI is appreciative of the time and effort devoted to the program and to graduate student research by members of government, industry, non-governmental organizations, academics, and individuals with specific expertise. Faculty and professionals contributing to practicum research are listed under 1992-93 Graduating Class.

(Source: 1993-94 NRI Bulletin)

Appendix C

NRI Core Courses and Electives

DESCRIPTION OF CORE COURSES

56.601 Introduction to Natural Resources Management

Introduction to the field; concepts of natural resources; history of natural resource use and conservation policies in Canada; agencies and jurisdictions; philosophies, nature and limitations of management; society and resources; institutional mechanisms for resource management – common property resources. A major theme is sustainable development, its multidisciplinary basis, and current issues in resource and environment policies.

56.709 Research Planning and Design I

This lecture/seminar course exposes students to concepts and skills necessary to conduct research related to resource management. Design of investigations; protocols and techniques; professional ethics. Scientific method and interdisciplinary research are discussed in detail, as are various techniques such as survey research, questionnaire design, interview techniques, and participant observation. A portion of the course is also devoted to general principles of research proposal writing and publication standards.

56.710 Research Planning and Design II

A course designed for the formal preparation of a detailed proposal for practicum research. The general objective is to assist in the further development of research, planning and presentation skills, and the application of these skills to the development of a written research proposal on a resource management issue.

56.712 Mineral Resources Management and Policy

This lecture/seminar course provides an interface between managers and mineral resources, focusing on a selection of practical topics related to minerals and mining. The Role of mining activities in the development process; global, national and provincial distribution of resources; policy issues related to environmental, economic and political consequences of non-renewable resource exploitation are discussed.

56.713 Energy Resources Management and Policy

The course covers global energy issues, objectives, strategies and policies, and the environmental impacts of alternative energy sources; Canadian energy issues, objectives, strategies and policies. The course stresses the need for a sound understanding of energy issues of fundamental importance, ability to assess alternatives, appreciation of policy strategies and instruments, and the ability to formulate an energy policy for a region.

56.714 Topics in Natural Resources Management I - Policy Development

A lecture/seminar course in which selected topics of special interest in the planning and use of natural resources are examined. The emphasis of the course is on the policy development and analysis. Different subject areas (e.g. waste management, forest resources) may be used in different years to illustrate principles of general applicability in natural resources policy-making and analysis.

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56.715 Topics in Natural Resources Management II - Environmental Assessment

A lecture/seminar course that provides practical and theoretical bases to environmental assessment processes. During the course, various legislation such as the Manitoba Environment Act and the Canadian Environmental Assessment Act are studied. A variety of assessment cases, largely from the resources sector, are used to exemplify the operation of identified assessment processes.

22.740 Biological Resources Management I

The course provides basic applied ecology for resource managers who have not taken ecology previously; the ecological basis of living resources management. Principles of ecology, the ecosystem concept, nutrient cycles, energy flow, populations and communities are introduced. Principles of conservation and management as applicable to wildlife, fisheries, forestry and natural areas, using selected topics to illustrate these principles.

22.741 Biological Resources Management II

Practical applications of principles for living resources management. Selected topics in applied biological management; practical methods in research and application, such as population simulation and the use of databases. Problem solving; presenting recommendations; dealing with scientific evidence; decision-making. These skills are developed through term-length projects.

18.447 Natural Resources Economics

The course deals with the microeconomic theory of natural resource development, utilization, and pricing, as well as with its application to specific resource issues and problems. Topics studied include: a review of the theory of welfare economics, externalities and market failure; economic rent and surplus; intertemporal optimization, investment criteria and benefit-cost analysis as a micro-planning tool; stock-flow models and characteristics of natural resources; economics of exhaustible (non-renewable) resources; economics of renewable resources; common property resources; resource scarcity and conservation; applications to the study of mineral, fisheries, forestry, land, water and environmental resources; waste disposal and pollution; natural resource policy goals and alternatives.

45.329 Natural Resources Administration and Law

Offered in even-numbered years only.

This lecture course, instructed by the law faculty, provides students with a general introduction to legal systems and to the specific legal aspects of some areas of natural resources administration. A variety of topics such as the Constitution and natural resources, fishing and trapping law, Aboriginal title, etc., are introduced and a variety of cases exemplifying these are discussed.

NRI ELECTIVES

56.707 Readings in Natural Resources Management I. Student planned research in an area of interest. Course syllabus designed by student and approved by N.R.I. faculty.

56.708 Readings in Natural Resources Management II. Student planned research in an area of interest. Course syllabus designed by student and approved by N.R.I. faculty.

56.711 Northern Field Seminar. A ten-day field seminar through rural and northern Manitoba directed at sustainable development and professional practice in the resources management planning field.

(Offered every second year.)

56.716 Projects in Natural Resources Management I. Team research project in an area of interest. Application of problem solving skills to current issues in natural resources management.

56.717 Projects in Natural Resources Management II. Team research project in an area of interest. Application of problem solving skills to current issues in natural resources management.

OTHER ELECTIVES

(This is a representative sample of courses taken by NRI students. Many other U of M courses are available for options).

1.337 Pollution Biology. An introduction to the ecological implications of pollution. Specific examples of pollution will be considered at the abiotic, producer, consumer, and decomposer levels of organization.

1.354 Community Ecology. Lectures and laboratories emphasizing the structure and function of terrestrial biotic communities with emphasis upon selected Manitoba situations.

1.356 Ecological Impact Assessment. Prediction and evaluation of the effects of human activities on ecosystems. Applied aspects of ecological monitoring, impact, prediction, and the preparation of environmental impact statements are addressed.

1.465 Analysis of Biological Communities. Methods and approaches to the analysis of biological communities are reviewed. Emphasis is placed on planning the steps of a biological investigation.

1.724 Wetland Ecology. A study of marsh, bog, and fen communities, with emphasis on their history, soil-plant relationships, and species distribution. Field work at the University Field Station (Delta Marsh) and nearby bog and fen sites will be an integral part of the course.

5.347 Statistical Methods for Research Workers I. Linear regression, multiple regression, correlation analysis, introduction to one way analysis of variance, some related topics.

5.348 Statistical Methods for Research Workers II. Analysis of variance, randomized block design, nested and Latin square experiments, analysis of covariance.

5.452 Sampling Techniques I. A development of sampling theory for use in sample survey problems, regression estimates, in systematic sampling, sources of errors in surveys.

7.463 Geolimnology. The major physical, geochemical, sedimentological, and hydrogeological processes in lakes and their watersheds. A multidisciplinary course.

18.743 Advanced Theory of Resource Economics. Economic theory of the development and management of natural resources. Application of capital theory, investment theory, the theory of externalities and decision-making theory to resource utilization and management. A strong background in microeconomics is required.

18.744 Renewable Resource Economics. A research seminar in applied economic analysis of the development and management of renewable natural resources, agriculture, environmental quality, forestry, fisheries, game, outdoor recreation and other renewable resources.

18.745 Non-Renewable Resource Economics. A research seminar in applied economic analysis of the development and management of non-renewable resources, concentrating on specific topics and policy issues in energy and mineral resources.

19.457 Public Organizational Management (6). A study of the levels and functions of public management in governmental bureaucracy, models of decision-making and organizational development, unionized collective bargaining and equal opportunity employment, with some training in public administration research.

19.486 The Canadian Policy Process (6). This course will examine a number of conceptual frameworks for the analysis of the policy process, will analyze the role of different institutions and actors in the policy process, and will appraise current government responses to problems within Canadian society.

22.343 Behavioral Ecology. Animal behaviour with regard to ecological problems; relationships between animal behaviour, spatial distribution, manipulation of the environment, and exchange of material between the organism and the environment.

22.345 Field Ecology. Problems, techniques, and assumptions involved in measuring parameters of biological populations and environmental variables. A field trip will be held prior to start of classes.

22.348 Population Ecology. Characteristics of populations, effects of resources, other individuals of same species, competitors, predators on distribution and abundance, and regulation of numbers of organisms in a population.

22.350 Limnology. Lectures and laboratories providing an introduction to physical, chemical and biological limnology.

22.448 Animal Behaviour. The causation, development, evolution, and socio-biology of animal behaviour.

22.457 Mammalogy. Structure, classification, evolution, life histories, and distribution of mammals and their relation to human cultures. Techniques of studying mammals. Identification of the mammals of Manitoba. Frequent field trips outside classroom hours.

22.467 Biology of Fishes. A study of organ systems, life histories, evolution of fishes and the interrelation between fishes and man.

22.471 Principles of Wildlife Management. Introduction to the biological and socioeconomic goals of wildlife management and to the basic techniques of wildlife management in terms of these goals. There will be four or five weekend field trips.

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- 22.472 Wildlife and Fisheries Parasitology.** Parasites of major vertebrate groups of economic importance in temperate regions. Emphasis on identification, means of control, and how to evaluate the impact of parasites on animal populations.
- 22.477 Quantitative and Theoretical Ecology I.** Methods of collection and analysis of biological and environmental data for estimation of abundance, life history parameters and spatial pattern in single species populations; population dynamics and life history strategies.
- 22.478 Quantitative and Theoretical Ecology II.** Simple models of growth, structure and movement for single species populations. Multi-species models involving competition, predation, parasitism. Implications for management, community structure and population dynamics are considered.
- 22.479 Boreal Ecology.** A survey of ecological factors in the formation, evolution, and survival of northern biota. Laboratory exercises, weekend field trips, and study week field trip required.
- 22.481 Fishery Biology and Management.** Lectures and laboratories dealing with the principles and practices of fishery science.
- 22.716 Animal Ecology (6).** Detailed examination of special ecological subjects and assignments of special research projects.
- 23.709 Water Resources Systems.** The application of operations research/systems analysis techniques to water resources and urban and environmental systems.
- 23.720 Topics in Environmental Engineering.** Includes topics such as energy and the environment, solid waste management, and environmental problems in transport. Topics are studied through case histories of contemporary issues.
- 23.760 Water Quality Management.** Water quality modelling: management options for water quality planning; treatment options and management schemes.
- 23.770 Water Resources Planning.** Principles and methodologies of planning water resources development projects. An evaluation of a major multi-purpose project from inter-disciplinary viewpoints, incorporating those of designers, planners, critics and political decision makers. Will be offered in alternate years.
- 23.792 Theory of Water Treatment.** Physical and chemical characteristics of water and water treatment including coagulation, sedimentation, filtration, softening and disinfection.
- 23.793 Theory of Waste Treatment.** Physical and chemical characteristics of waste, theory of B.O.D., sedimentation, biological processes, stream pollution, sludge digestion and handling.
- 27.704 Systems Analysis for Management.** The concepts of systems analysis used to provide an analytical framework for study of management as the integrative process which cuts across functional divisions and operational activities.

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- 36.705 Waste Management.** A study of the industrial, rural, and urban sources of important wastes; their control, utilization, and disposal under good environmental management, including by automatic methods.
- 38.413 Principles of Insect Control.** A course for students not majoring in Entomology which discusses the principles of controlling harmful insects and other pests. Methods examined are chemical, cultural, mechanical, physical, biological, legal, and integrated controls.
- 53.346 Urban Geography.** The course studies the processes and trends of urbanization; the classification of cities; central-place theory; cities as systems; land-use patterns; social forces and factorial ecology; and urban transport problems.
- 53.352 Energy and Society (6).** The course reviews in detail the role of energy in modern society. Explanation of basic energy laws and flows in the biosphere precedes discussion of energy resources, technologies, uses, and impacts.
- 53.353 An Introduction to Land-Resource Management (6).** A study of the geographical aspects of problems and conflicts arising from land-resource utilization; methods of classifying land resources; elementary physical planning of resource development.
- 53.359 Geography of Developing Countries (6).** The main theme is modernization; examples from South Asia and Africa of the Sahara. Historical development, population and social problems, land use and conservation, urbanization and industrialization.
- 53.373 Geographic Information Systems.** An introduction to geographic information systems (GIS) input, processing, output and applications. Weekly two-hour lab.
- 53.441 Rural Land Use.** This course focuses on the dynamics of change on the rural-urban fringe. It involves seminars and individual field research.
- 53.454 Remote Sensing and Its Geographical Applications.** The interpretation of conventional aerial photographs and mosaics; problems of rectification and measurement. Remote-sensing techniques and use and interpretation of satellite photography.
- 53.455 Topics in Air Pollution: Climatology, Location, and Planning.** An introduction to air pollution sources; meteorology of air pollution; calculation of ground contractions; effects and controls; environmental planning and policy.
- 53.703 Regional Analysis.** A seminar course reviewing theories of regional development which have planning applications. Further, it assesses government policy aimed at rational intervention and notes procedures of evaluation.
- 53.720 Environment, Resources, and Population.** This course discusses the contemporary imbalance between population and resources. The consequences of resource exploitation upon the natural environment are also examined.
- 53.722 Geography of Tourism and Recreation.** A seminar course with emphasis on research methodology applicable to spatial and environmental aspects of tourism and recreation.

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- 53.728 Geographic Approaches to Land Resource Conflict Resolution.** A survey of the ecologic, environmental and regional approaches to the resolution of land resource conflicts and the planned enhancement of land-related utilities.
- 53.729 Energy Analysis.** A survey of origins, methods and applications of energy analysis, a new technique of system energetics designed to provide information for a more efficient use of scarce natural resources.
- 61.421 Land Economics.** The application of economic theory to analyze the rural real estate market, appraisal procedures, taxation, property rights, and land use planning.
- 61.735 Regional Development.** Review policy, goals, theories, methods and applications relevant to analyzing Canadian and developing country rural development, regional economic growth and project evaluation.
- 61.743 Advanced Theory of Resource Economics.** Economic theory of the development and management of natural resources. Application of capital theory, investment theory, the theory of externalities and decision-making theories to resource utilization and management. A strong background in microeconomics is required.
- 77.720 Seminar in Complex Organizations.** The analysis of complex organizations as social systems: theory relating to the emergence and structure of bureaucracy; authority and control; organizational conflict and change; and the organization and its environment.
- 78.414 Food Problems.** An analysis of the world food and allied resources problems with possible solutions based on sound resource management principles.
- 81.710 Seminar in Environmental Education.** Designed for graduate students wishing to concentrate on environmental education; emerging issues and concepts will be reviewed. Extant and projected programs of and approaches to environmental education will be subjected to critical analysis.

(Source: 1993/94 NRI Bulletin)

Appendix D
Practicum Guidelines

The practicum is one of the requirements for the degree Master of Natural Resources Management. These guidelines are intended to familiarize graduate students and committee members with the practicum research process. The guidelines are supplementary to the regulations of the Faculty of Graduate Studies.

Natural Resources Institute
The University of Manitoba
Winnipeg, Manitoba, Canada
1994/95

15. THE NATURAL RESOURCES INSTITUTE

The Natural Resources Institute at the University of Manitoba was established in 1968 as a degree granting, interdisciplinary unit with a threefold purpose, namely:

- (a) to teach management skills leading to a graduate degree of Master of Natural Resources Management (MNRM);
- (b) to conduct useful research on actual resource problems; and
- (c) to provide a forum for examining problems in resource use.

The Institute exposes graduate students to the realities and practice of natural resource management, and provides access to expertise, within and outside the university, that can be used to deal with vital emerging issues of public concern.

The degree program, of two years duration, is interdisciplinary in nature and provides training in four areas: resources, economics, administration, and analysis. Course work is complemented by the practicum - a written research report prepared to address a practical problem or issue in natural resources management.

Through the practicum and through a number of contract research projects, the Institute is involved in a wide range of natural resource areas. Research is conducted in conjunction with government, business and private groups. The Institute's research process allows for sustained involvement of client groups during the course of the research. In addition, the research process provides a valuable outreach function by bringing together university faculty and practising resource professionals. All research conducted at the Institute is made available to the public.

The Institute's forum function is achieved by circulation of published research and through the organization of conferences, workshops and seminars on diverse resource topics.

16. THE PRACTICUM

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

The practicum is a written research report prepared to address a practical problem or issue in natural resources management. A practicum is usually undertaken in conjunction with a government or private organization, although independent research at the university may be conducted.

The purpose of the practicum is: (1) to develop the student's skills and abilities to conduct applied research in the natural resources management field; and (2) to develop expertise in facilitating clear and concise research reports useful in decision-making.

The student is expected to take a holistic approach to problem definition and resolution that will require the application of knowledge from more than one discipline. In this regard 56.709 introduces students to interdisciplinary research and assists students in the identification of appropriate research methods to interdisciplinary problems. Further, it is expected that students will identify a researchable problem for their practicum studies on their own. An advisor and practicum committee (see below) will assist in developing the final research proposal but the student should have at least some ownership of the topic chosen. As well, 56.710 guides students within the proposal writing task, the outcome of the course being a formal research proposal.

It is also very important to understand that students are also expected to secure their own funding for any practicum research topic chosen. All NRI faculty will assist students in this endeavour, but the primary responsibility is the students.

The practicum research process has four distinct stages:

- development of the initial research proposal;
- field and other empirical research;
- the writing of the first draft report; and
- preparation of the final report.

The research proposal is prepared on a topic approved by the faculty advisor and in consultation with Institute faculty. Acceptance of this proposal by the faculty advisor leads to the formal appointment

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of the practicum advisory committee members by the Director. The committee then meets to review the proposal and to provide constructive criticism.

The research proposal, with minor modifications, becomes Chapter one of the final report and generally has the following format:

- Standard NRI title page
- Table of Contents
- Introduction
- Statement of Problem
- Research Objectives
- Methods
- Assumptions, Delimitations, Definition of Terms
- Outline of Study
- Research Budget
- Critical Path
- Questions to be addressed by the researcher

A review of related literature (Chapter 2) and an expanded statement of methods (Chapter 3) supplement the practicum proposal and are required prior to any empirical research.

Once the empirical research has taken place writing the first draft report requires attention to composition, grammar and to the logical organization of the report. An outline is useful in the writing process and care must be taken in the preparation of maps, figures, and tables. The practicum is usually about 75-100 pages in length. Your faculty advisor should review and comment on this document prior to its distribution to committee members for the first draft meeting. Upon reviewing the documents the practicum committee will suggest required modifications to the document prior to the final oral examination. The student and faculty advisor will decide when the document is suitable for the final oral examination. Students who choose to proceed to the final oral examination without their faculty advisory approval do so at their own peril.

At the final oral examination the practicum is evaluated by standards equivalent to a Master's thesis, and acceptance criteria address the following questions:

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

- Is the research report defensible as a written document, and does it meet Faculty of Graduate Studies standards?
- Has the student demonstrated mastery of the techniques of applied research in the subject area?
- Does the research report meet the client's needs?

A student must pass an oral examination on the subject of the practicum to obtain the MNRM degree. The oral examination, which is open to members of the university community, is conducted by the practicum advisory committee and chaired by the Director or a designate. The Chair may exercise discretion in allowing informal discussion of the subject following completion of the formal examination.

The oral examination, of no more than two hours duration, has the following format:

- the chair calls the meeting to order and asks the student to present a 20-25 minute summary of the research report;
- detailed comments and questions on the report are raised, and when the committee is satisfied that a thorough examination has been completed; the student and all spectators, are required to withdraw while the committee, in camera, considers the acceptability of the practicum. The recommendation must be unanimous.
- the student is informed of the final recommendation by the committee chair. The committee generally requires some corrections and small changes in format or presentation, but no major change in the manuscript.
- when the committee recommendation is to approve the practicum, the chair has the committee sign the practicum approval form, signifying that the document is acceptable in substance.
- when the recommendation is to not approve the practicum, the student is required to correct any deficiencies and to repeat the oral examination. A second attempt is allowed.
- the Director or a designate will ensure that the required time limits for completion of revisions, the necessity of a second oral examination, and other such matters are carried out.
- the student is recommended for graduation after submitting final copies to the appropriate units as follows:
 - 2 copies - Faculty of Graduate Studies (unbound)
 - 3 copies - NRI (unbound)
 - 1 copy - NRI (bound)
 - 3 copies - Committee members (bound)

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

1 copy - Student (bound/unbound)

Costs of duplication and binding for all copies are the student's responsibility. Contact the main office for specific details related to Faculty of Graduate Studies binding requirements.

17. THE PRACTICUM COMMITTEE

The student is guided during the research process by an advisory committee. The committee is formally appointed in writing by the Director and usually has the following composition:

- the Director or a designate, who chairs the oral examination;
- an Institute faculty advisor;
- an academic who should be a member of the Faculty of Graduate Studies but may be from a unit other than the Natural Resources Institute;
- the client for whom the research is conducted; and
- one additional member.

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

The purpose of the committee is to assist the student during the research process and to recommend, on a pass/fail basis, the acceptance of the final written report. The committee reviews the student's proposal and comments upon proposed research activities prior to the initiation of empirical research.

The Institute faculty advisor is appointed by the Director based, whenever practicable, on the students stated research interest at the time of application to the program. The faculty advisor provides on-going guidance to the student, directs the work of the committee, and calls and chairs all meetings of the committee leading to the defense of the practicum. At each stage of the research process, previously noted, the student must submit draft material to their faculty advisor for review and make necessary

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changes prior to submission to the committee as a whole.

The academic member of the committee helps to provide appropriate scope and depth in terms of methodology, and interpretation. The client member assures that the research is focused upon the problem and that the final report is useful in decision making.

Each student, working in close consultation with the faculty advisor, is responsible for coordinating committee meetings and for ensuring that the committee members are informed by the N.R.I., in writing, of meeting date and location. Although the student is expected to consult on a regular basis with individual committee members, the following three meetings of the full committee are required:

- to assess the research proposal;
- to evaluate the first draft document; and
- to evaluate the student at the oral examination.

Once the student has made any changes to the written material, as required by the faculty advisory, it can be submitted to the advisory committee for their review and comment. Submission to the advisory committee must occur **at least two weeks** prior to any meeting of the committee. Students should take into account committee member's schedules in arranging meeting dates.

If at any time during the research process the student feels a committee member is not fulfilling their role the Director should be approached with the concern. If a student wishes to change faculty advisors, written justification for such a change must be provided to the Director or Assistant Director if the Director is the faculty advisor.

18. PRACTICUM FORMAT

Although other formats are acceptable, the following format is often used in the preparation of the final draft.

NRI Title Page
Abstract
Acknowledgements
Table of Contents
List of Tables
List of Figures

Chapter One: Introduction
Chapter Two: Review of Related Literature
Chapter Three: Methods
Chapter Four: Results and Discussion
Chapter Five: Conclusion, Policy, and
Recommendations

References
Appendices

Latitude in format to accommodate the subject matter of the Practicum is possible. The document must, however include all elements listed. Summer fieldwork and other empirical data collection techniques are critical components of the research process. Accurate records of data sources are essential.

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Report writing³ should be conducted during the research process. Presentation of available data will sharpen the researcher's perception of the problem and will direct the search for further data. By beginning to prepare the written report during the summer months, the student will save valuable time during the September - December academic session. The quality of the final report will be improved by review and revision of each draft report.

Students should ensure that duplicate copies of written reports and data are safely kept in alternate locations to prevent loss of irreplaceable material. Care should also be taken to maintain confidentiality of material entrusted to the student by agencies or individuals.

(Source: NRI Supplementary Regulations/Practicum Guidelines)

³An appropriate style manual is essential for report writing. Some widely used ones are:

A Manual of Style, Twelfth revised edition, Chicago: The University of Chicago Press, 1969.

Campbell, William G., Form and Style in Thesis Writing, Boston Houghton Mifflin Company, 1970.

Conference of Biological Editors, CBE Style Manual: a guide for authors, editors, and publishers in the biological sciences. Fifth edition, Bethesda, MD. 1983. Sciences, 1964.

Turabian, Kate W., A Manual for Writers of Term Papers, Theses, Dissertations. Chicago: The University of Chicago Press, Phoenix Books, 1960.

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Appendix E
NRI Practica Titles

**NATURAL RESOURCES INSTITUTE
GRADUATE PRACTICA
1971-1993**

**Natural Resources Institute
The University of Manitoba
430 Dysart Road
Winnipeg, Manitoba, Canada
R3T 2N2**

September 1993

PRACTICA HEADINGS

ENERGY	3
ENVIRONMENTAL MANAGEMENT	4
FISHERIES	6
FORESTRY	9
LAND USE	9
MINING	11
ORGANIZATIONS	12
PARKS AND RECREATION	13
REGIONAL AND COMMUNITY DEVELOPMENT	15
RESOURCE POLICY	17
WASTE MANAGEMENT	18
WATER RESOURCES	19
WILDLIFE	20
MISCELLANEOUS	24

GRADUATE PRACTICA

Publications and reports of The Natural Resources Institute are listed below, under the following headings: Energy, Environmental Management, Fisheries, Forestry, Land Use, Mining, Organizations, Parks and Recreation, Regional and Community Development, Resource Policy, Waste Management, Water Resources and Wildlife.

ENERGY

Ackerman, D.G. *An Assessment of the Economic Effects of the Energy Resources Conservation Board's Waste Management Guidelines on Selected Waste Oil Processing and Disposal Facilities in the Province of Alberta.* 1986. 199 pp.

Budzinski, M. A. *Coal in Yukon: An Overview of Regional Distribution, Development Potential and Environmental Concerns.* 1981. 159 pp.

Carriere, H. *Assessing the Potential for the implication of a High-Performance Window Incentive Program by Manitoba Hydro.* 1993. 178 pp.

Chia, A.C.K. *An Assessment of Supply and Requirements for Oil and Natural Gas in Malaysia.* 1986. 115 pp.

Fast, H. B. *Potential Impacts of an Electric Power Loss in Winnipeg and Integrated Emergency Preparedness.* 1991. 90 pp.

Galarnyk, A. W. *The Role of Wood as a Residential Space Heating Fuel in Manitoba.* 1980. 125 pp.

Graham, J. A. *An Economic Analysis of the Conversion to Natural Gas in the Residential Sector of Halifax, Nova Scotia.* 1980. 94 pp.

Hine, A. M. *An Examination of the Contractual Arrangements Govern the Supply of Hydro-Electricity to the Mining Industry in Northern Manitoba.* 1975. 56 pp.

Kohuska, C. N. *An Evaluation of Extending a Land Line to Manitoba's Remote Communities.* 1990. 107 pp.

Lagerway, R. A. *Methods of Energy Conservation in Winnipeg Elementary Schools.* 1978. 97 pp.

- Lamb, M. L. *Solar Heating of Residential Swimming Pools in Winnipeg: An Analysis of Concepts*. 1982. 116 pp.
- McCall, L. *An Assessment of the Economic and Administrative Feasibility of Substituting Propane for Gasoline in the University of Manitoba Automotive Fleet*. 1982. 78 pp.
- McPherson, J. R. *Long Term Energy Demand Forecasting: Determination of an Energy Baseline for the Manitoba Health Care Sub-Sector*. 1989. 187 pp.
- McVicar, G. D. *Residential Space Heating Policy Alternatives in Manitoba*. 1978. 150 pp.
- Onyebuchi, E. I. *Energy in Nigeria*. 1980. 178 pp.
- Schramm, G. *Analyzing Opportunity Costs: The Nelson River Development*. 1976. 82 pp.
- Selles, H. *Preliminary Assessment of the Feasibility of Straw Biomass as a Renewable Energy Source*. 1982. 177 pp.
- Shekhar, R. *The Potential for Biogas Production and its Utilization from Locally Available Resources in a Typical Indian Village Area: A Preliminary Assessment*. 1980. 108 pp.
- Shillington, T. H. *A Solar Energy Subdivision: An Assessment of Selected Institutional Barriers to Solar Energy in Winnipeg*. 1979. 214 pp.
- Siryj, D. M. *An Analysis of Department of Indian Affairs and Northern Development - Manitoba Hydro Electrical Agreements*. 1978. 183 pp.
- Smith, R. F. *Residential Space Heating Policy Alternatives in Saskatchewan*. 1977. 166 pp.
- Wood, R. R. *Marketing the Link Between Residential Electricity Conservation and the Environment*. 1991. 102 pp.

ENVIRONMENTAL MANAGEMENT

- Albanese, P. J. *Evaluation of Natural Regeneration Along Roadside Rights-of-Way in the Niagara Region of Southern Ontario*. 1989. 103 pp.
- Asgarali, A. S. J. *Proposed Manitoba Hydro D.C. Transmission Line East of Lake Winnipeg: Identification of Alternative Corridors with a View to Minimize Adverse Effects on Outdoor Recreation*. 1973. 214 pp.

- Barto, W. P. *The Agricultural, Forestry, Recreational and Wildlife Opportunity Cost of Pipelines, Hydro Lines and Highways*. 1974. 127 pp.
- Barringer, K. L. *An Assessment of Public Consultation and Participation under the Manitoba Environment Act*. 1990. 150 pp.
- Boyd, D. H. *The Impacts of the Garrison Diversion Unit in Canada*. 1975. 141 pp.
- Brown, G. L. *Environmental Impact Assessment of a Sour Gas Processing Development in the Brazeau Region of Alberta*. 1977. 145 pp.
- Chorney, B. L. *A Comparative Assessment of Alternative and Conventional Agricultural Systems in Manitoba*. 1988. 141 pp.
- Dangerfield, S. *Vegetation Buffer Strip for Stream Rehabilitation*. 1992. 109 pp.
- Dick, C. J. *The Effect of the 'No-Net-Loss of Habitat' Guiding Principles on Manitoba Hydro's Conawapa Development*. 1992. 241 pp.
- Faminow, C. *Native Prairie Restoration Along Transmission Line Corridors in Southern Manitoba: A Planning Framework*. 1993.
- Hendrickson, L. Y. R. *An Analysis of Public Participation in the Alcan Aluminum Smelter Review process*. 1984. 90 pp.
- Henley, T. J. *The Impact of Manitoba Hydro's Churchill River Diversion on the Length of the Navigation Season at the Port of Churchill*. 1975. 52 pp.
- Leitch, D. A. *The Environmental Impact and Regulation of Recreational All-Terrain Vehicles in Manitoba*. 1975. 79 pp.
- Leitch, E. R. *A Framework for Analyzing Pollution Abatement Controls in Manitoba*. 1975. 80 pp.
- Moche, E. *The Identification and Assessment of Potential Oiled Debris Management Sites to Complement British Columbia's Emergency Clean-up Efforts of Marine Oil Spills Along Juan de Fuca Strait*. 1991. 148 pp.
- Ojukwu, B. N. *Socio-Economic and Environmental Effects of Petroleum Development in Nigeria*. 1981. 91 pp.
- Perry, W. T. *An Inquiry into Socio-Economic Aspects of Environmental Impact Assessment with Recommendations for Manitoba's Environmental Assessment and Review Process*. 1982. 85 pp.

- Putt, N. D. *Interpreting Archaeology: An Experiment in Native Awareness and Writing for Children*. 1988. 237 pp.
- Riewe, J. R. *A Survey of Environmental Attitudes and Perceptions of Senior Elected Municipal Officials in Manitoba*. 1989. 217 pp.
- Simmons, N. K. *An Analysis of the Effectiveness of the Manitoba Environmental Assessment and Review Process: A Case Study of Post-Construction Bio-Physical Impacts*. 1982. 154 pp.
- Taylor, M. E. *The Use and Management of Pesticides by Federal Departments and Crown Corporations in Manitoba*. 1983. 245 pp.
- Threadkell, B. *Environmental Assessment and Electric Power Generation Planning in the Prairie Provinces: A Comparison of Manitoba Hydro, Saskatchewan Power Corporation and TransAlta Utilities Corporation*. 1982. 95 pp.
- Vogel, B. E. *The Region Assessment of the Effects of Alternative Transmission Corridors on Outdoor Recreation: Manitoba Hydro's Proposed Third D.C. Line East of Lake Winnipeg*. 1978. 91 pp.
- Winston, N. M. R. *The Slave River Hydro Project: Evaluation of Federal Environmental Impact Interests*. 1986. 106 pp.
- Whalen, C. A. *The Biologic, Economic and Legal Aspects of Pollution and Associated Problems from a Marine Thermal Generating Station*. 1972. 55 pp.
- Zittlau, W. T. *An Environmental Assessment of Agricultural Practices and Policies: Implications for Waterfowl Habitat Management*. 1979. 282 pp.
- Weiszmann, A. J. *An Examination of Risk Assessment Associated with Northern Hydrocarbon Development as Conducted in the Environmental Impact Assessment*. 1989. 99pp.

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- Baker, G. D. *An Economic Study of the South Indian Lake Summer Commercial Fisheries*. 1988. 1990.
- Barlshen, W. J. *The Potential for a Live Bait Fish Industry in Manitoba*. 1972. 46 pp.
- Cable, D., D. Johnston, and W. Plantje. *An Evaluation of the Canada-Manitoba Special*

- ARDA Program of Assistance to Commercial Fishermen and Trappers. 1976. 34 pp.
- Connell, B. E. *Arrangements for Co-Management of Fisheries and Wildlife by Native People and Government in Canada*. 1983. 108 pp.
- Fisher, M. *An Assessment of Methods of Collecting and Valuing Subsistence Fish and Marine Mammal Harvest Data in the Northwest Territories*. 1981. 83 pp.
- Fitzjohn, D. R. *An Analysis of Angler Use in the Intensive Use Zones of Whiteshell Provincial Park*. 1985. 135 pp.
- Heuring, L. *A Historical Assessment of the Commercial and Subsistence Fish Harvests of Lake Winnipeg*. 1993. 103 pp.
- Homenick, P. D. *An Economic Analysis of the 1987 Summer Commercial Fishery at Clear Lake, Manitoba*. 1989. 101 pp.
- Hathaway, B. L. *Biological and Economic Feasibility of Commercial Arctic Charr (Salvelinus alpinus L.) Production Utilizing Waste Heat Aquaculture*. 1987. 103 pp.
- Johnston, D. *An Evaluation of the Canada-Manitoba Special ARDA Grant Program of Assistance to Commercial Fishermen*. 1976. 138 pp.
- Kotak, D. N. *An Assessment of the Molson Lake Commercial-Sport Fishing Controversy*. 1974. 93 pp.
- MacDonald, D. A. *The Channel Catfish Sport Fishery of the Lower Red River*. 1992. 160 pp.
- McGovern, S.P. *Development of a Fisheries Management Plan for Lac Seul, Northwestern Ontario*. 1983. 159 pp.
- McTavish, I. B. *An Assessment of Angler Attitudes Towards Fisheries Management in Northwestern Ontario*. 1990. 91 pp.
- Milligan, S. E. *An Assessment of the Biological and Economic Feasibility of Extensive Aquaculture in Northern Manitoba*. 1987. 136 pp.
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- Remnant, R. A. *An Assessment of the Potential Impact of the Rainbow Smelt on the Fishery Resources of Lake Winnipeg*. 1991. 170 pp.
- Snell, J. W. *An Assessment of the Impacts of the Freshwater Fish Marketing Corporation on the Freshwater Fishing Industry*. 1990. 202 pp.
- Stankevicius, A. *The Policy Implications of Alternative Fisheries Management Objectives in the Manitoba Commercial Fishing Industry*. 1985. 129 pp.
- Stephansson, S. E. *The Fisheries Potential of the Northwest Territories: A Method of Inventory and Assessment and the Organization and Transportation Trends Affecting Future Fisheries Development*. 1973. 193 pp.
- Thornton, M. *An Evaluation of the Southern Indian Lake Commercial Fisherman's Association Subsidy Program*. 1986. 116 pp.
- Tomasson, D. *The Whitefish Fishery - Lake Winnipeg: Problems and Prospects*. 1971. 140 pp.
- Topolniski, D. *The Ilford Fishermen's Co-operative: A Case Study in Commercial Fisheries of Northern Manitoba*. 1972. 68 pp.
- Wagner, M. W. *Economic Performance of the Summer Commercial Fishery of Southern Indian Lake, Manitoba*. 1981. 163 pp.
- Ward, N. J. R. *The Effects of Colour, Twine Size and Twine Structure of Gill Nets on Lake Winnipeg Commercial Fishing Income*. 1975. 31 pp.
- Welby, M. T. *Small-Scale Arctic Charr Production from Man-Made Prairie Ponds*. 1991. 130 pp.
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Brydges, M. *A Study of the Federal and Provincial Tax Receipts from, and Expenditures on, the Forest Sector of Manitoba*. 1975. 56 pp.

Chukwuocha, C. *The Impacts of Industrial Wood Consumption on the Nigerian Forest Resource*. 1984. 77 pp.

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Titi, V. B. *The Rural Afforestation Project in Zimbabwe: Project Effectiveness and the Reality of Women's Participation*. 1991.

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Gill, R. *Manitoba Karst: A Strategy for Action*. 1992. 161 pp.

Hildebrand, W. *Land Use Conflicts in the Plum Lakes Area of Southwestern Manitoba*. 1982. 87 pp.

Hill, S. *Fox Lake Band Land Use and Occupancy*. 1993.

- Jones, C. W. *An Assessment of the Economic Effects of Land Use Conflicts on the Crushed Stone Industry in the Rural Municipality of Rockwood, Manitoba.* 1982. 83 pp.
- Kabaluk, R. M. *The Implications of Leasing Versus Selling Crown Lands for Summer Homes.* 1971. 53 pp.
- Kimanga, R. S. *Rural Land Resources Cover Inventorying and Monitoring: An Evaluation of a Low Level Aerial Photographic Sampling Method.* 1986. 114 pp.
- Knock, R.D. *A Land Classification to Integrate Remote Sensing with a Provincial Geographic Information System.* 1985. 174 pp.
- Leskiw, C. M. *Guidelines for Preservation, Propagation and Utilization of Native Grass Prairies in Manitoba.* 1978. 197 pp.
- Mackling, H. N. *The Identification and Assessment of Soil and Water Conservation Demonstration Sites in the Turtle River and Whitemud Watershed Conservation Districts.* 1988. 140 pp.
- Martin, H. V. P. *Impact of Fire in the Taiga of Southeastern Manitoba on Wildlife, Vegetation, and Value to Resource Users.* 1982. 99 pp.
- Medd, K. D. *The Anticipated Effects of Land Use Policies on Rural Residential Development: A Case Study of the Rural Municipality of Springfield, Manitoba.* 1978. 140 pp.
- Nilsson, W. *An Analysis of Gross Vegetation Changes on CFB Shilo Military Reserve Between 1954 and 1974.* 1983. 63 pp.
- O'Grady, L. C. *Integrated Resource Management Planning on the Pembina Escarpment: The Deerwood Experience.* 1990. 131 pp.
- Pearson, J. C. *An Opportunity Analysis: Potential Industrial Parks for Growth Industries in the Winnipeg Area.* 1982. 77 pp.
- Poor, P. J. *An Assessment of Farmer Attitudes Towards Winter Wheat Production in Southwestern Manitoba.* 1987. 98 pp.
- Radwanski, M. J. *An Appraisal of the Management of Sand and Gravel Pits in the South Riding Mountain District, Manitoba.* 1981. 119 pp.
- Robinson, P. *Effects of a Transition to Ecological-Organic Agriculture on Livestock Production in Manitoba.* 1983. 101 pp.

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Simonton, J. *Remote Sensing for Resources Management: To Assess Post-Harvest Ground Cover Conditions in the South Interlake Region of Manitoba.* 1988. 85 pp.

Sutton, V. *An Evaluation of Landowner's Attitudes Toward Field Shelterbelts in Agro-Manitoba: A Case Study of the Lyleton Area.* 1983. 83 pp.

Wamugi, I. K. *The Effect of Pastoral Settlement on the Use of Rangeland Resources In Olturot Area of Marsabit District, Northern Kenya.* 1993. 113 pp.

Weiss, P. J. *Waterfowl Habitat Preservation: The Potential Role of Federal and Manitoba Legislation.* 1982. 93 pp.

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Wonneck, M. *Attitudes and Perceptions of Local Landowners Toward Military Activity and its Effects from Canadian Forces Base Shilo Military Reserve.* 1985. 217 pp.

MINING

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Barchyn, D. P. *An Assessment of Capital Investment in Mineral Exploration in Manitoba, 1976-2000.* 1978. 133 pp.

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- Goodwin, G. M. *Wildlife of Manitoba's Souris River Basin: Resource Base, Present Use, and Impact Analysis*. 1977. 165 pp.
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- MacMillan, S. *The Effect of Harvesting on Denning Populations of the Red-Sided Garter Snake (Thamnophis sirtalis parietalis) in the Interlake Region of Manitoba*. 1987. 88 pp.
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- MacWilliam, L. R. *An Analysis of Components of Waterfowl Hunting and Violations of Hunting Regulations in Prairie Canada*. 1990. 79 pp.
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- Morgan, S. B. *The Effects of Tabanidae (Diptera) on the Behaviour of Wood Bison at Waterhen, Manitoba*. 1987. 84 pp.
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- Pattimore, J. H. *The Feasibility of Reintroducing the Swift Fox to Southwestern Manitoba.* 1985. 102 pp.
- Pelesh, R. E. *A Wildlife-Based Tourism Development Strategy for Churchill, Manitoba.* 1988. 113 pp.
- Pirt, G. *Attitudes Towards Wildlife: Developing and Testing of Measurement Scales.* 1975. 98 pp.
- Purdy, R. J. *Landowner Perceptions Towards Elk Damage Management and Elk Ranching in the Swan River Area, Manitoba.* 1987. 114 pp.
- Ramsay, D. B. *The Economic and Social-Cultural Situation of Native Trappers in Northern Manitoba.* 1975. 147 pp.
- Rosenberg, G. B. *Levels in the Effects of Organochlorine Insecticides, PCB's and Mercury on Manitoba's Great-Horned Owl Populations.* 1990. 111 pp.
- Rounds, R. C. *Beaver Depredation on Private Lands Surrounding Riding Mountain National Park.* 1980. 105 pp.
- Scaife, B. E. *The Impact of Forestry Practices on Moose (Alces alces) in North-Central Manitoba.* 1980. 70 pp.
- Semchuk, B. *An Assessment of the Environmental Impact of Drought on Waterfowl in Agro-Manitoba and Recommendations for Mitigation Measures.* 1982. 133 pp.
- Servos, M. C. *Summer Habitat Use by the Great Gray Owl (Strix nebulosa) in Southeastern Manitoba.* 1986. 96 pp.
- Shaar, M. *Attitudes and Behaviours of Residents in the Quebec City Region Towards Urban Wildlife.* 1979. 159 pp.
- Strong, T. *Distribution, Range Use, and Movements of Elk on the Shilo Military Reserve.* 1981. 121 pp.
- Tarleton, P. M. *An Analysis of the Status of Elk and Moose Population in Prince Albert National Park, Saskatchewan, with Monitoring Options.* 1988. 136 pp.

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An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

Appendix F
Example of Faculty Annual Reports

ANNUAL REPORT
by members of Natural
Resources Institute Faculty

Name: Richard Kenith Baydack
Academic Year: 1993-94
(1 April 1993 to 30 June 1994)

PART I. ACTIVITY REPORT

(a) ADMINISTRATION

i) Natural Resources Institute

- Associate Professor, NRI
- Coordinator, NRI Admissions Committee
- Chair, NRI Research and Publications Committee
- NRI Program Review Committee
- Various additional NRI committees and activities

ii) Other, University of Manitoba

- Faculty Council of Graduate Studies
- St. Paul's College Assembly
- University Animal Care Committee
- NSERC Research Liaison Officer
- External Thesis Examiner, Department of Zoology

iii) Special Projects and Initiatives

- On leave to June 30, 1993 to serve as Chair, Scientific Evaluation Program, North America Waterfowl Management Plan, Prairie Habitat Joint Venture
 - Evaluation Coordinating Committee meetings
 - Advisory Board representative
 - Assessment design subcommittee
 - Canadian representative, Continental Evaluation Team
- NRI representative to Conference organizing committees
 - The Wildlife Society, First Annual Conference, Albuquerque, New Mexico (September 1994)
- NRI-based workshops, consultations, networking, research
 - NRI Admissions Committee Process and Procedures
 - Manitoba Hydro Fellowship Procedures
 - Development of a new field course, Waterfowl Ecology & Management, to be offered at the University Field Station, Delta Marsh

- NRI Mission Statement; Research Profile
- Manitoba Hydro Research Board
- Manitoba Department of Natural Resources Research Projects

(b) TEACHING

i) Courses Taught

<u>Course Number & Title</u>	<u>Term</u>	<u>Lecture, Seminar, Other</u>	<u>Contact Hrs.</u>	<u>Enrolment</u>
56.709	Fall	Seminar	3/week	22
22.471	Fall	Lecture, Seminar	6/week	18
22.741	Spring	Lecture, Seminar	3/week	21
56.707	Fall /Spring	Tutorial	varied	5
56.708	Fall/Spring	Tutorial	varied	5
69.703	Annual	Practicum	varied	15-20

ii) Students Supervised (Graduate)

<u>Name</u>	<u>Date Started</u>	<u>Date Completed</u>	<u>Status F.T. or P.T.</u>
MacLeod, C.	1988	1993	PT
Schuster, M.	1988	1993	PT
Bergeson, D.	1989	1993	PT
Deniset, Y.	1990	1994	FT
Fisher, J.	1990	1993	FT
Gylywoychuk, D.	1990	1993	FT
Johnstone, P.	1990	1993	FT
Faminow, C.	1991	1993	FT
Hellman, S.	1991	1994	FT
Seunarine, I.	1991	1994	FT
Basso, A.	1992	1994	FT
Dhol, S.	1992	1994	FT
Etches, M.	1992	1993	FT
Black, J.	1990		PT
Molinski, D.	1990		PT
Benoit, D.	1992		FT
Hrubeniuk, J.	1992		FT
Olson, R.	1992		FT
Arsenault, R.	1993		FT
Benoit, A.	1993		FT
Hood, J.	1993		FT
Kowalchuk, T.	1993		FT

Zoology Students

Gifford, M.	1990	1993	FT
Shnier, G.	1990		FT
McDonald, D. (Ph.D.)	1993		FT
Yerkes, T.	1993		FT

iii) Activities engaged in designed to improve teaching competence:

- Evaluation of all courses and subsequent analysis and appraisal
- Attendance at professional conferences/workshops
- Research and administrative activity while on leave

(c) SCHOLARSHIP AND RESEARCH

I. Publications (Please list all publications which have appeared in print since last Annual Report and follow the style of citation in the NRI Bulletin)

Baydack, R.K. (Ed.). 1993. Prairie Habitat Joint Venture, Evaluation Coordinating Committee Annual Report for Fiscal Year 1993. Report prepared for the PHJV Advisory Board, Edmonton. 19pp.

Baydack, R.K. (Contributor). 1994. A review of the evaluation activities of the Canadian Joint Ventures of the North American Waterfowl Management Plan. Report prepared for the North American Wetlands Conservation Council, Ottawa. 12pp.

Baydack, R.K., D.A. Sexton, and P.J. Caldwell. 1994. Recommendations on management plans for the Private Lands Program of the Sharptails Plus Foundation. Reports (3) to the Executive Board, Sharptails Plus Foundation, Winnipeg. 9 pp.

Berger, R.P., and R.K. Baydack. 1993. Effects of aspen succession on sharp-tailed grouse, *Tympanuchus phasianellus*, in the Interlake region of Manitoba. Canadian Field-Naturalist 106: 185-191.

II. Conference Papers (Title, conference, place, date)

Baydack, R.K. "Sustainable ecosystem management - a case study of the North American Waterfowl Management Plan in action." First National Wildlife Habitat Workshop, Winnipeg, April 1993.

Baydack, R.K. "Biodiversity Monitoring Workshop." The Wildlife Society, Biological Diversity Working Group Meeting, Anchorage, March 1994.

III. Other conferences attended and workshop participation

59th North American Wildlife and Natural Resources Conference, Anchorage, Alaska, March 1994

North American Waterfowl Management Plan Continental Evaluation Team Workshop, Jackson, Mississippi, January 1994

38th Summer Meeting of the Central Mountains and Plains Section of the Wildlife Society, Manhattan, Kansas, August 1993

Several Liaison Meetings/Workshops with Agriculture and Natural Resources Agencies in Prairie Canada

III. Research Grants:

<u>Granting Agency</u>	<u>Subject of Research</u>	<u>Amount</u>	<u>Date</u>
Wildlife Habitat Canada	NAWMP	\$45,000	1991-93
Wildlife Habitat Canada	Personal Contract While on Leave	\$200,000	1991-93
Canadian Wildlife Service	Personal Contract for NAWMP CET duties	\$20,000	1991-95
Manitoba Gov't - Env't. Innov. Fund	In association with Sharptails Plus Foundation	\$40,000	1993-95
Canada/Manitoba Agric. Agreement	In association with Manitoba Forage Council	\$75,000	1994-96

Student Research Grants:

Manitoba Natural Resources	Forestry/Wildlife	\$ 3,000	1990-93
Canadian Parks Service	Prince Albert National Park Bison	\$10,000	1990-93
University Northern Studies Committee	Northern Wildlife Management	\$ 5,000	1992-93
Manitoba Hydro	Environmental Assessment	\$10,000	1992-93

Canadian Forestry Service	In association with I.D. Systems Ltd.	\$14,000	1993-94
Manitoba Gov't - Spec. Cons. Fund	In association with Rural Development Institute	\$ 9,000	1993-94
TransCanada Pipelines	In associatioion with Delta Waterfowl Foundation	\$51,000	1993-94
Manitoba Hydro	Contaminated Sites	\$18,500	1994-95
Manitoba Hydro	Expert Systems	\$16,500	1994-95
Delta Waterfowl & Ducks Unlimited	Nesting Structures	\$31,000	1994-95
Manitoba Natural Resources & REPAP	Caribou management	\$12,000	1994-95

(d) PROFESSIONAL ACTIVITIES

i) Professional activities engaged in during the period 1 April to 30 June

Chair, North American Waterfowl Management Plan, Prairie Habitat Joint Venture, Evaluation Coordinating Committee, 1991-1993

Co-Chair, Workshop on Maintaining Regional Biodiversity, First Annual Conference of The Wildlife Society, 1993-1994

Chair, Sharp-tails Plus Foundation, Technical Advisory Committee, 1992-date

Chair, Manitoba Chapter Bylaws Committee of The Wildlife Society, 1991-date

ii) Participation in Other Community Affairs:

Presenter, University of Manitoba Public Seminar Series in Zoolgy and Animal Science, 1993-1994

Presenter, Career Day Symposia at various schools in Manitoba

Co-organizer of NRI 25th Anniversary Celebration

Co-organizer of NRI displays for various public exhibitions and meetings

Member, Environment Action Committee, St. Vital School Division, 1992-date

Chair, Building Committee, Roman Catholic Parish of St. Timothy, 1989-date

iii) Special awards or honours (including election or appointment by learned societies):

Canadian Representative, North American Waterfowl Management Plan, Continental Evaluation Team, 1991-date

Vice-President, Central Mountains and Plains Section of the Wildlife Society, 1992-date

PART II. ASSESSMENT

Self-Assessment of activities in the past year (attach).

The 1993-94 year allowed me to complete my assignment with the North American Waterfowl Management Plan, and return to my faculty position on a full-time basis. The time spent working on the NAWMP was advantageous to my career development generally, as well as to my teaching, research, and outreach responsibilities at the Institute.

In terms of teaching, I have achieved a better understanding of the operation of government bureaucracies and agencies, which can be passed on to students and colleagues. I was able to establish a large number of contacts, particularly in Ottawa and Washington. This resulted in an immediate benefit to students in the Biological Resources Management course who were able to take part in a real-world, team assignment. The exercise involved formulating a strategy for evaluating effects of government policy on biodiversity conservation in Prairie Canada. The report from their initiative has been filed with several organizations across North America, and we are awaiting feedback and comment. In terms of Research Planning and Design, I find that I am better able to advise students of appropriate contacts for their various projects, and mechanisms to secure research funding. I find that I am more cognizant of what agency needs are likely to be in examining research proposals. The experience of the NAWMP also enabled me to design a new course in Waterfowl Ecology & Management, as a future offering at the University Field Station at Delta Marsh.

I have also expanded my research capabilities through the above. I have become more familiar with techniques and areas of waterfowl research. I have been able to establish a large number of international contacts in the areas of waterfowl management and administration, as well as in wildlife management generally. My recent efforts at developing a strong presence in the field of biological diversity conservation should begin to pay dividends as more research focus is directed to this initiative. Similarly, the increased attention being paid to the importance of wildlife management in the fields of agriculture and forestry bodes well for my future research plans. In terms of graduate student endeavours, my students are fully funded on projects of their choice. In fact, I have begun to work with incoming first year students on a number of research initiatives.

In terms of outreach or extension, I have broadened my abilities to interact with a number of diverse organizations and individuals. This will benefit my own career, but also makes the general public and community more aware of the capability of the University to meet the needs of society. My recent work has increased the presence of the Institute to a large number of areas across North America.

The administrative experience gained in this endeavour has also assisted in my duties at the NRI. Specifically, upon returning to the Institute, I have become more active in defining and developing administrative functions in a number of diverse areas. This was particularly useful in upgrading the Admissions Process for the NRI in the past year. The process is now virtually fully computerized, allowing for future time savings and efficiencies. I have also been active in formulating strategies for Research & Publications, which will enhance opportunities for faculty and students to publish, particularly practicum research results.

PART III. PLANNING

Plans for the coming year (attach).

During the coming academic year, I expect to be involved in the following new initiatives:

a) Teaching

- refinement of content in existing courses
- developing assignments for students in collaboration with practicing resource professionals in government or industry which assist in their decision-making
- investigating the feasibility of a new course offering in agro/wildlife ecology and management
- improving opportunities for NRI students to complete field-oriented and project courses
- considering ways of offering courses through distance education or correspondence

b) Research

- increasing effort at submitting joint publications with graduate students
- expanding research initiatives in the areas of biological diversity conservation, agriculture/wildlife interactions, and forest/wildlife management
- developing expertise to conduct research in areas involving native environmentalism, and ensuring its place in environmental assessment
- investigating research partnerships with other University departments in the area of international resource projects

c) Outreach

- increasing involvement in University Career Days and the Graduate Recruitment Fair
- expanding efforts at presenting seminars to students in rural Manitoba
- enhancing the image of the NRI at conferences and workshops across North America

d) Administration

- monitoring, and enhancing as required, the NRI Admissions Process
- improving the process for administration of the NRI conditional grant from DNR

- establishing a set of guidelines for advertising research opportunities to NRI students
- enhancing the computer capability of the Institute and its associated administrative tasks

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

Appendix G
Academic Committee Membership

Academic Committee (1993/94)

Ms. A. Basso	NRI 2nd Year Student Representative
Dr. R. Baydack	Natural Resources Institute
Dr. F. Berkes	Natural Resources Institute
Dr. M. Campbell	Foods and Nutrition, University of Manitoba
Mr. D. DePape	Manitoba Hydro
Mr. W. Everett	Manitoba Hydro
Dr. K. Fox	Physical Education and Recreation Studies, U of M
Dr. J. Gray	Economics, University of Manitoba
Ms. L. Ham	NRI 1st Year Student Representative
Prof. T. Henley	Natural Resources Institute
Dr. W. Henson	Natural Resources Institute
Dr. G. Johnson	Agricultural Economics, University of Manitoba
Dr. P. Laznicka	Geological Sciences, University of Manitoba
Dr. R. Riewe	Zoology Department, University of Manitoba
Dr. J. Romanowski	Geography, University of Manitoba
Dr. J. Sinclair	Natural Resources Institute
Prof. D. Young	Symbion Consultants

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

Appendix H
Curriculum Review Sub-Committee Membership

Dr. F. Berkes	Director, Natural Resources Institute
Mr. D. DePape	Manitoba Hydro
Mr. G. Farthing	Former Graduate, Natural Resources Institute
Ms. L. Ham	2nd Year Student Representative
Dr. G. Johnson	Agricultural Economics, University of Manitoba
Dr. J. Sinclair	Chair, Natural Resources Institute
Prof. D. Young	Symbion Consultants

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

Appendix I
Resources Management Course Descriptions

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An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

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YORK UNIVERSITY
Faculty of Environmental Studies

COURSE DESCRIPTIONS

Formal courses offered in the Faculty reflect the curriculum as it develops over time. There is no core curriculum in the Faculty. Incoming MES students are required, however, to attend ES 5101 (Approaches to Environmental Studies) which is offered each Fall as an orientation for incoming students and for preparation of the initial Plan of Study. PhD students are required to enrol in the PhD Research Seminar until their Dissertation Proposal has been approved.

The courses described here comprise only a partial list of FES course offerings and are intended to suggest the range of subject matter dealt with in the Faculty. Not all of the courses listed are offered every year. The Faculty's course offerings are reviewed on a regular basis and adjusted to take into account student's programme needs and faculty members' interests and availability.

ENVS 5101 APPROACHES TO ENVIRONMENTAL STUDIES

Examination of the substantive range and interdisciplinary perspectives of environmental studies, as a basis for orientation of incoming students within the philosophy of the Faculty, for exploration of the complex nature of environmental studies, and for the preparation of the initial Plan of Study.

ENVS 5111 ENVIRONMENTAL THOUGHT AND ADVOCACY

Introduction to the cultural and historical aspects of environmental issues. The development of environmental thought is examined through various environmental movements and the expressions of environmental advocates.

ENVS 5112 ECOLOGY IN ENVIRONMENTAL STUDIES

Introduction to concepts and principles in ecology as they relate to both natural and managed environments and to resources, planning, management and conservation. Topics are analyzed within the context of ecological change and its implications for both the non-human world and human habitats.

ENVS 5119 INTRODUCTION TO RESOURCE MANAGEMENT

Examination of the principles of resource management and conservation, with emphasis on integrating ecological/physical, economic, and social/philosophical/ethical considerations in contemporary problems in resource management.

ENVS 5121 INTRODUCTION TO PLANNING PROCESSES

Overview of the basic activity of planning, approached generically. Emphasis is on the components of planning, conceptual frameworks and factors affecting the design of planning processes for various activities in a range of contexts.

ENVS 5122 INTRODUCTION TO URBAN-REGIONAL PLANNING

Introduction to planning for urban centres and regions. Emphasis is on the history of urban-regional planning thought and practice, key planning models and concepts, the planning process, and plan implementation.

ENVS 5123 PERSPECTIVES ON ENVIRONMENT AND BEHAVIOUR

Introduction to the study of human responses to the environment, focusing on responses to attempts to shape the environment through planning and design. Emphasis is on built and social aspects, with some attention given to natural aspects. Examples are drawn from environmental psychology, environmental sociology, behavioral geography, and environmental health.

ENVS 5124 INTRODUCTION TO DEVELOPMENT STUDIES

Survey of the evolution of development theory over the past three decades. Economic, social, political, and environmental ideas are discussed in relation to the process of development in both northern Canada and the Third World.

ENVS 5141 MANAGEMENT IN TURBULENT ENVIRONMENTS

Introductory examination of the redeployment of social organizational systems within environments experiencing continuing, large-scale, and unpredictable change. Emphasis is on the critical evaluation of adaptive planning, design, and management models intended to extend the capacity of organizations operating within social, economic, and political turbulence.

ENVS 5164 INTRODUCTION TO ENVIRONMENTAL ECONOMICS

Examination of pollution, resource depletion, urban land use and social deprivation from a critical economic viewpoint. Emphasis is on basic theory, analytical methods and policy prescriptions. No background in economics is required.

ENVS 5181 COMPUTERS IN ENVIRONMENTAL STUDIES

Development of the theory and practical skills for utilizing both larger (mainframe and mini-) and smaller (micro-) computers, as well as the basis for understanding the multitude of social and personal effects generated by the widespread use of computers, given that the management of information resources is central to environmental questions.

ENVS 5183 QUANTITATIVE METHODS IN ENVIRONMENTAL STUDIES

Introduction to basic concepts for the treatment of environmental problems in quantitative terms: measurement and statistics, models, model selection, interpretation and communication. Adversarial themes, risk, and prediction are considered.

ENVS 5321 INTRODUCTORY WORKSHOP IN DESIGN AND PLANNING

Applied problem-solving in the context of environmental thinking. The identification and resolution of problems in design and planning of physical environments.

ENVS 5599 READINGS IN ENVIRONMENTAL STUDIES

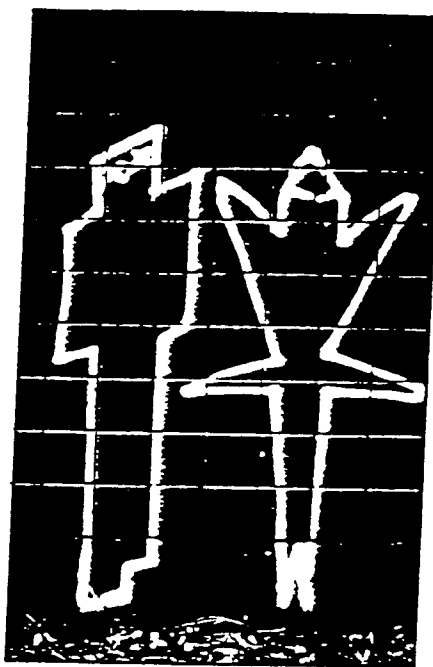
Directed reading programmes individually arranged, and supervised by faculty members, in subject areas not available in current Environmental Studies course offerings. An appropriate course at the undergraduate level may be used as the basis for the work, supplemented by additional requirements as determined by the instructor.

ENVS 5699 FIELD EXPERIENCE

Relevant applied research or other work experience outside the university, integrated as a learning experience in the individual Plan of Study, arranged and carried out under the direction of a faculty member. Intended for students at the MES I level, but only after the initial Plan of Study has been approved.

ENVS 6101 SPECIAL TOPICS IN ENVIRONMENTAL STUDIES

Exploration of selected issues in environmental studies, arranged for small groups of students at the MES II level who are at similar stages in their programmes and who share common substantive and methodological interests.

**ENVS 6102 TRANSITIONS IN ENVIRONMENTAL STUDIES**

Exploration of the implications of various conceptual and methodological approaches to the study of environmental phenomena. Assists students in the transition from MES II to MES III, with emphasis on the design of the substantive and integrative experiences to be undertaken in MES III (including expectations of the Major Project, Major Paper, Thesis, or other form of synthesis) and the ways that students may demonstrate the essential command of the subject matter of their Areas of Concentration for advancement to MES III.

ENVS 6111 CULTURAL AND HISTORICAL PERSPECTIVES OF NATURE

Examination of the influence of western culture on man/environment relations as an aid to identifying 'root' problems underlying contemporary environmental issues.

ENVS 6112 BIOLOGICAL CONSERVATION

Examination of the ways in which biological conservation is perceived, understood and acted upon; identification of the causes of biological depletions and of the multidisciplinary nature of the issues. Major attention is given to the nature of vulnerability of species, populations and habitats. Some issues in theoretical ecology are examined.

ENVS 6113 RESOURCE MANAGEMENT IN THIRD WORLD DEVELOPMENT

Study of the theory and practice of natural resource management in the Third World, including a general assessment of the nature and distribution of the renewable and non-renewable resource base for development. Particular emphasis is placed on ecologically sustainable and socially viable approaches to development, primarily in rural areas. Major themes include the role of ecology in development planning and the importance of energy utilization and its impacts on development and natural environments.

ENVS 6114 HEALTH AND ENVIRONMENTS

Presentation of a health and environment perspective that serves as the main basis for the prevention of illness - physical, mental and social - and the promotion of health and fitness. Relevance is for the study of any of the aspects of the quality of life.

ENVS 6115 ECONOMICS OF POLLUTION AND RESOURCE DEPLETION

Examination of the economic causes of pollution and resource depletion, and critical review of current and prospective environmental protection policies. The theory and application of mainstream economics to environmental issues is supplemented by a consideration of steady-state economics.

continued...

COURSE DESCRIPTIONS

ENVS 6116 ENERGY: POLICY, TECHNOLOGY, AND RESOURCES

Examination of the nature and role of energy, both in modern society and as an important determinant of the shape of future society. Characteristics of energy, energy resources, energy conversion and technology are examined and Canadian and Ontario energy policies are considered. Future energy policy options are critically examined.

ENVS 6117 ECOLOGY IN THIRD WORLD DEVELOPMENT

Examination of the nature of tropical and subtropical environments, particularly as they relate to conservation, resource management and development. Emphasis is directed toward alternative approaches to issues in conservation and development, particularly ecodevelopment strategies, and toward the integration of ecology into development planning in third world countries.

ENVS 6118 APPLIED ECOLOGY

Application of ecological knowledge and principles to problems of resource management, planning, pollution and conservation.

ENVS 6120 PUBLIC INVOLVEMENT AND PLANNING

Emphasis is on theories of public participation, with some consideration given to methods and techniques relevant to planning issues and problems of citizen involvement in planning practice.

ENVS 6121 URBAN DEVELOPMENT PROCESSES

Critical investigation of processes of urban growth, development and redevelopment. Changes in the structure and organization of urban activities are studied from the perspective of conventional and alternative theories of urbanization. Emphasis is on urban change since World War II, as shaped by politicians, citizen movements, civil servants and market forces.

ENVS 6122 THEORY AND PLANNING OF RURAL LAND USE

Survey of the theory and research methods used in the analysis of rural areas. The spatial arrangement of land uses, human settlement, urbanization of the countryside, and rural planning are emphasized. Same as Geography 5340.03/4140.03.

ENVS 6123 CITY FORM AND NATURAL PROCESS: A BASIS FOR ENVIRONMENTAL DESIGN

This course is intended to be both pragmatic and philosophical in content and has several purposes: first, to explore how urbanism shapes perceptions of nature and how environmental and social values are linked; second, to examine how a broadly based ecological view of cities is necessary to their environmental and social health; third, how the application of ecological processes to urban design can influence the shaping of urban form.

ENVS 6124 BEHAVIOURAL BASES FOR PLANNING AND DESIGN

Study of the relationships among people, their behaviour, and the built environment, as well as methods for applying knowledge of these relationships to policy-making for, and the planning and design of, the built environment.

ENVS 6125 RECREATION PLANNING AND MANAGEMENT

Explorations in leisure and recreation - theory, research, planning and practice, with emphasis on the social and environmental contexts in which people 'recreate' and on the roles that leisure and recreation play in the quality of people's lives.

ENVS 6126 HOUSING

A multi-faceted approach to shelter, in which housing is examined as a cultural/symbolic phenomenon, as the focus of urban services, as a commodity in a market, and as the object of government legislation and regulation.

ENVS 6127 WOMEN AND ENVIRONMENTS

Examination of theories and research relevant to the analysis of women's dual roles as creators and users of environments in a wide range of built and natural contexts. A framework is developed for integrating concerns from women's studies and environmental studies.

ENVS 6128 WOMEN AND URBAN CHANGE

Examination of the inter-relationship between women's changing roles in society and the form and structure of urban areas. The focus is on those problem areas where urban studies/urban planning, women studies and the study of the family intersect. This interdisciplinary perspective highlights the issues and emphasizes alternatives for social change.

ENVS 6129 SOCIAL PLANNING

The course addresses three aspects of social planning: first, major theoretical and action frameworks; second, social planning practice in various institutional contexts including the place of research, evaluation, and implementation; third, selected case studies of social planning problems, special needs groups, or the implementation process in social planning.

ENVS 6130 URBAN-REGIONAL PLANNING THEORY

Critical examination of current and emerging theories underpinning urban regional planning, with emphasis on the procedural and normative, and assessment of the role of theory in practice.

ENVS 6131 ENVIRONMENTAL PLANNING

Focus is on planned approaches to identifying and resolving environmental problems encountered in human settlements. Consideration is given to the location, form, pattern and functioning of human communities in relation to the natural environment, as well as to the livability and quality of built environments.

ENVS 6133 CONTEMPORARY URBAN PLANNING PRACTICE

Examination of present-day planning practice and the planning system in its institutional context, emphasizing the scope and content of planning activity, its purpose and objectives, the interests served, and the results obtained. Concern is mainly with what 'planning' does as an institution, and to a lesser extent with what planning practitioners ('planners') do, to help understand planning practice in practice.

ENVS 6134 STRATEGIC PLANNING AND MANAGEMENT

Seminar that examines concepts, approaches and practices in strategic planning and management with particular reference to public sector and not-for-profit organizations.

ENVS 6135 TRANSPORTATION PLANNING

Emphasis is on transportation planning at the regional and urban scales, including land use/transportation relationships. Some exposure is given to methods and procedures for determining needs and for the analysis and evaluation to alternatives in serving those needs.

ENVS 6137 WOMEN AND DEVELOPMENT

Overview of current issues in gender and development analysis as a framework for the integration of women in Third World development. Emphasis will be placed on theoretical and conceptual issues as the necessary background to project-oriented approaches to Women and Development.

ENVS 6140 ENVIRONMENTAL EDUCATION

Development of a comprehensive understanding of 'Environmental Education' in the widest sense, by looking at definitions of environmental education, its practices, perspectives on it and constraints in its implementation.

ENVS 6141 THE STUDY OF THE FUTURE

Appraisal of main scenarios for alternative futures and of problems and tasks of planning, organizing and development under conditions of high interdependence and high uncertainty.

ENVS 6142 ORGANIZATIONAL ECOLOGY

Emphasis is on the processes of organizational change and development and methods of intervention, across the range from organizational to broad socioecological settings (such as communities).

ENVS 6143 RESEARCH AND INTERVENTION IN ORGANIZATIONS

Exploration of the use of research in organizational settings. Emphasis is on method, the basic logic of inquiry and change, and on action research as a mode of organizational inquiry. Topics include the concept of design in action research, idealization, modelling, the research-planning linkage, organizational and action learning, dynamics and management of a research intervention.

ENVS 6144 ACTION LEARNING

Examination of the 'action learning' approach to research, planning, management, and social change. Included are examination of theoretical, methodological and pedagogical aspects of the concept, and evaluation of its potential impact on planning strategies.

ENVS 6145 THE QUALITY OF WORKING LIFE

Exploration of principles and techniques of work analysis and job and organizational design. Consideration is given to strategies and methods for initiating and sustaining change.

ENVS 6146 PHYSICAL FACTORS IN THE QUALITY OF WORKING LIFE

Focus is on the interactions, in the workplace, of environmental factors and institutional, social, and individual goals and objectives. Consideration is given to the implications of the limited nature of the control most people have over the indoor man-made environments in which they spend their working lives.

ENVS 6147 WORKPLACE DESIGN AND SOCIETY

A historical survey of the changing pattern of the nature and organization of work from pre-industrial times to the present with special emphasis on the relationship of work to leisure, political participation, family and education.

ENVS 6148 ENVIRONMENTAL NEGOTIATION AND MEDIATION

Introduction to the concepts and principles of negotiation and mediation, key process requirements, basic techniques and strategies, and constraints and limitations on the application of alternative dispute resolution methods as applied to environmental problems.

ENVS 6149 MEDIA, CULTURE & NATURE

This introductory course provides an overview of different contemporary thinking about media in order to heighten awareness and knowledge of its problematic. Students will be expected to actively analyze different genres of media and to understand the social context of media production. They will additionally be expected to explore these concepts through production and analytical exercises which comprise a central learning experience on the course.

COURSE DESCRIPTIONS

ENVS 6150 CRITICAL EDUCATION FOR SOCIAL CHANGE

The course will look at learning from a critical perspective. This will include studying learning theories; context and learning; and four streams of critical education theory—critical pedagogy, popular education, feminist/gendered pedagogy, and development education contributions towards understanding the learning process. Applied work will focus on critical issues involved in doing critical environmental and social education.

ENVS 6151 HUMAN SERVICES ORGANIZATIONS

Exploration of the dynamics of change in human service systems through the study of related organizations and their environments in the voluntary sector (including community-based and self-help), in the private sector (profit and non-profit), and in the public sector. Human services are broadly defined — education, health, recreation, and social services — but the emphasis is on organizations providing services to individuals with special needs.

ENVS 6152 CO-OPERATIVE MANAGEMENT

Provision of a conceptual and empirical appreciation of the Canadian co-operative movement/system, with emphasis on historical and regional patterns of development.

ENVS 6153 NATIVE/CANADIAN RELATIONS

The purpose of the course is to investigate the relationships between First Nations, their communities, and their organizations, and the broader Canadian society and its institutions. Within this broad framework, selected issues of relevance to First Nations and other stakeholders will be examined.

ENVS 6154 NORTHERN STUDIES

Examination of the Canadian north, focusing on regions of special interest and on the circumpolar context as appropriate. Frameworks for discussion are provided by both environmental sciences and the social, political, economic and legal disciplines. A background for the study of the Canadian north is provided and an understanding of the fundamental factors underlying current and future issues in the north is developed.

ENVS 6155 PROGRAMME IMPLEMENTATION

The course will focus on the transition from programme/policy/plan to field action. The central questions are why some policies are carried out in the manner intended, some are not carried out at all, and many go in directions that are shaped more by field realities than the original intentions of their proponents.

ENVS 6156 THEORY OF INTERNATIONAL DEVELOPMENT

Study of theories of development, underdevelopment and maldevelopment in Third World countries, with stress on the social, economic, political, ideological and ecological bases for development approaches. Historical and current approaches to the theory of development are presented, and the extent to which they respond to environmental concerns is investigated.

ENVS 6159 THE ENVIRONMENTS OF HUMAN RELATIONS

Examination of one dimension of human behaviour - relationships - that ranges across all types and scales of environments.

ENVS 6161 LOCAL GOVERNMENT ORGANIZATION AND OPERATION

Examination of the political, governmental and administrative contexts for public policy, planning and implementation. Emphasis is on local government in Canada, relationships of municipalities to other governmental levels, and the role of various actors (citizens, voluntary groups, planners, developers, government agencies) in municipal governance.

ENVS 6162 POLITICS AND PLANNING IN THEORY

Examination of theoretical aspects of urban planning and politics. The relationship between the two is considered along a number of dimensions: the ideologies of planning; the role of planning as a selective filter of values and interests in society; planning as a mediator of conflicts between concepts of urban places as 'economic space' and 'community space'; planning as the agency of change/stasis/redistribution. Cross-listed as Political Science 5140.03F.

ENVS 6163 POLITICS AND PLANNING IN PRACTICE

Examination of the role of politics in the definition and resolution of major planning-related issues, using the Toronto region as the case. The aim is to identify the assumptions, the methods, the organizational forms, the behaviours of the parties involved, and the processes that determined the public outcome of these issues. Cross-listed as Political Science 5140.03W.

ENVS 6164 ENVIRONMENTAL LAW

Examination of the institutions and processes of the law as they relate to environmental degradation and environmental protection, including consideration of regulatory aspects in the management of renewable and non-renewable resources. Emphasis is on the Canadian context with comparisons of approaches taken by other jurisdictions.

ENVS 6165 LAW OF LAND USE PLANNING AND DEVELOPMENT

Examination of law relating to planning and development, with emphasis on the Canadian context. Topics include land use, real estate, urban and regional planning.

ENVS 6166 INTERVENTIONIST ROLES AND RESPONSIBILITIES

Focus is on various roles adopted by intervenors as they undertake to bring about change, the responsibilities these roles imply, and alternative strategies for performing them effectively.

ENVS 6168 BASIC NEEDS: PHILOSOPHY, ECONOMICS, AND POLITICS

Determination of basic needs; normative arguments concerning their policy priority; causes of deprivation; state, popular and international action to advance the fulfilment of basic needs. Relevant theoretical perspectives in political philosophy and the social sciences; case studies.

ENVS 6171 POLITICS, POLICY MAKING, AND ORGANIZATIONS

Examination of the basic principles and institutions of politics, policy-making and organizations in the Canadian environment, including the public, private and voluntary sectors.

ENVS 6172 SOCIAL POLICY

Exploration of the context and content of social policy in Canada including a review of the development and status of the liberal welfare state. Within the course, students examine specific policy areas in detail including social housing, immigration policy, income security programmes, health care and a range of social services.

ENVS 6173 VALUE PRINCIPLES FOR SOCIAL ACTION

Examination of ethical argument, applied to issues relevant to environmental, social, and economic planning and politics. The first part deals with central concepts, schools of thought and issues in moral and political philosophy. The second part focuses on analysis of particular normative issues in politics, policy-making and social values.

ENVS 6174 ENVIRONMENTAL POLITICS

Exploration in politics of the environment, with the objective of assisting participants to clarify the basis of their own practice. Examination of theories of 'being' and theories of state (functionalism, structuralism and instrumentalism), and an examination of the implications of these for methods and practice.

ENVS 6175 ECOLOGY, IDEOLOGY AND SOCIAL POWER

Examination of the concept of political ecology and assessment of the state of this emerging discipline. The course will explore the theoretical issues that the current ecological crisis raises for social and political movements.

ENVS 6181 COMPUTER APPLICATIONS IN ENVIRONMENTAL STUDIES

Exploration of the application of computers to dealing with a variety of problems that occur in environmental studies. Coverage includes statistical analysis, modelling and simulation, and graphics. Intended for students who have a background in computers.

ENVS 6182 APPLIED RESEARCH METHODS: QUANTITATIVE TECHNIQUES

Development of a paradigm of inquiry, hypothesis development, data sources and the theory of measurement, sampling alternatives, cost estimation, audience-appropriate reports, and the commissioning and management of research.

ENVS 6183 APPLIED RESEARCH METHODS: FIELD RESEARCH

Examination of the various phases of carrying out research in the field: planning the research project; choosing appropriate methods for data collection; analyzing data and communicating results of research. Emphasis is on analysis and reporting of qualitative data.

ENVS 6184 PROGRAMME AND POLICY EVALUATION

Development of formal approaches to the evaluation of plans, policies and programmes in their post-implementation phase, for determining whether the desired objectives actually were achieved.

ENVS 6185 PLAN, PROGRAMME, AND PROJECT EVALUATION

Examination of the valuation aspect of evaluation in environmental, social, and economic planning - the selection and presentation of objectives and the measurement of their achievement; ethical, political, economic, and measurement issues in evaluation. Focus is on social cost-benefit analysis, collective-objective approaches and non-aggregative approaches.

ENVS 6186 ENVIRONMENTAL IMPACT ASSESSMENT

Examination of the theory and methods of environmental impact assessment, focused on Canadian legislative and administrative contexts.

ENVS 6187 SOCIAL IMPACT ASSESSMENT

Examination of Canadian and U.S. legislative/administrative contexts of social impact assessment, its role in environmental impact assessment, procedures (profiling, projecting, assessing and evaluating), citizen participation, and the adequacy of social impact assessment and its alternatives.

COURSE DESCRIPTIONS

ENVS 6188 URBAN AND REGIONAL PLANNING TECHNIQUES

Examination of the most used planning techniques for urban and regional areas. Emphasis is on techniques used to prepare key inputs to plans, such as population projection, housing needs studies, employment and labour force analyses, retail market and space analyses.

ENVS 6189 ENVIRONMENTAL RISK MANAGEMENT

Examination of the nature of risk, its distribution and its consequences; objective versus perceived risk; risk analysis methods and their application in Canadian and other industrialized countries.

ENVS 6190 SYSTEMS THEORY

Exploration of the systems approach or systems perspective in environmental studies. Emphasis is placed on the basic principles and assumptions of systems theory, and its use as a technique for analysis and management in different contexts.

ENVS 6191 APPROACHES AND METHODS IN PROCESS CONSULTATION

Focus is on interactive approaches to and methods of intervention in organizational and community settings. Topics addressed include: process design, diagnosis, team building, inter-group problem solving, conflict management, decision-making, personal intervention styles and strategies, and evaluation. Issues of power will be explored in each of these areas.

ENVS 6314 WORKSHOP ON SUSTAINABLE DEVELOPMENT

Development and testing of approaches to identifying, assessing and implementing programmes or projects which are consistent with the emerging principles of "sustainable development". The focus will be primarily on the Faculty of Environmental Studies and York University as case studies in how sustainable development characteristics can be developed within institutions.

ENVS 6321 PLANNING WORKSHOP

Application in planning problem-solving or plan making. Provides direct experience in the main elements of planning practice, with emphasis on implementation implications of the recommended solutions.

ENVS 6322 URBAN DESIGN WORKSHOP

Production of a three-dimensional design proposal and a set of guidelines for private developments, for selected urban locations.

ENVS 6381 ENVIRONMENTAL PLANNING AND ASSESSMENT WORKSHOP

Development and testing of approaches to identifying, assessing, and preventing mitigating potential environmental problems associated with the siting or routing of a proposed development project. Emphasis is on the integration of environmental capacity and quality considerations in the processes of project planning and decision making.

ENVS 6399 FIELD WORKSHOP IN ENVIRONMENTAL STUDIES

Exploration of selected issues in environmental studies in field settings, arranged for groups of students at the MES II level who are at similar stages in their programmes and who share common substantive and methodological interests.

ENVS 6599 INDIVIDUAL DIRECTED STUDY

Individual study programmes in subject areas not addressed in current Environmental Studies course offerings, devised and carried out under the supervision of a faculty member and arranged to suit the requirements of the student's individual Plan of Study. Normally intended for students at the MES II level.

ENVS 6699 FIELD EXPERIENCE

Relevant applied research or other work experience outside the university integrated as a learning experience in the individual Plan of Study, arranged and carried out under the direction of a faculty member. Intended for students at the MES II level.

ENVS 7101 SPECIAL TOPICS IN ENVIRONMENTAL STUDIES

Exploration of selected issues in environmental studies, arranged for small groups of students at the MES III level who are at similar stages in their programmes and who share common substantive and methodological interests.

ENVS 7102 SYNTHESIS IN ENVIRONMENTAL STUDIES

Exploration of concepts and applications of 'synthesis' and 'integration' in the study of environmental phenomena. Assists students in the final phase of their MES programmes to synthesize the components of their Areas of Concentration and to prepare themselves for the Final Examination.

ENVS 7103 MAJOR PAPER/THESIS SEMINAR (METHODOLOGY IN ENVIRONMENTAL STUDIES)

Provides a structured peer-group setting for students undertaking Theses, Major Papers or Major Projects to examine and discuss their work in the perspectives of scientific method and professionalism and in the contexts of knowledge development and knowledge application.

ENVS 7599 INDIVIDUAL DIRECTED STUDY

Individual study programmes in subject areas not addressed in current Environmental Studies course offerings, devised and carried out under the supervision of a faculty member and arranged to suit the requirements of the student's individual Plan of Study. Normally intended for students at the MES III level.

ENVS 7699 FIELD EXPERIENCE

Relevant applied research or other work experience outside the university, integrated as a learning experience in the individual Plan of Study. Arranged and carried out under the direction of a faculty member. Intended for students at the MES III level, but not normally permitted in the final term of study.

ENVS 7799 MAJOR PROJECT INDEPENDENT WORK

Approved work on a Major Project individually arranged as an integral and culminating experience of the individual Plan of Study, organized and carried out under the supervision of a faculty member.

ENVS 7899 MAJOR PAPER INDEPENDENT WORK

Approved work in the preparation of a Major Paper, as arranged with the Faculty Advisor and the Major Paper Supervisor.

ENVS 7999 MES THESIS RESEARCH

Approved research toward the submission of an MES Thesis, arranged and conducted under the supervision of the Thesis Supervisory Committee.

ENVS 8101 SPECIAL TOPICS IN ENVIRONMENTAL STUDIES

Exploration of selected issues in environmental studies, arranged for small groups of PhD students who share common substantive and methodological interests.

ENVS 8102 PHD RESEARCH SEMINAR

This ongoing seminar is designed to assist PhD students in the formulation of their PhD Programme Plan, through a comparative examination of research methods and research designs.

ENVS 8599 INDIVIDUAL PHD RESEARCH

Individual research programmes in subject areas not addressed in current Environmental Studies course offerings, devised and carried out under the supervision of a faculty member and arranged to suit the requirements of the student's individual PhD Programme Plan.

ENVS 8699 FIELD EXPERIENCE

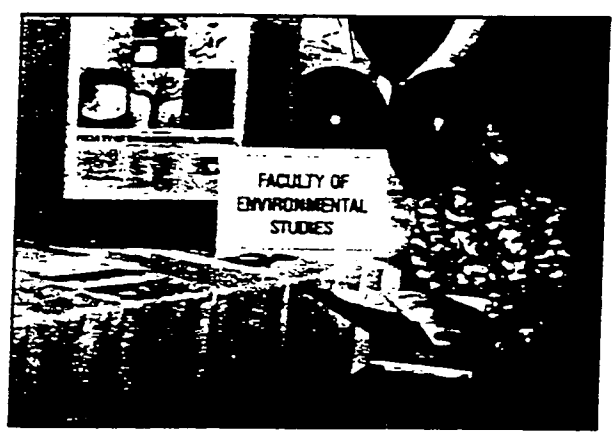
Relevant applied research or other work experience outside the university, integrated as a learning experience in the individual Plan of Study. Arranged and carried out under the direction of a faculty member. Intended for PhD students.

ENVS 8999 PHD DISSERTATION RESEARCH

Approved research toward the submission of a PhD Dissertation, arranged and conducted under the supervision of the Dissertation Supervisory Committee.

In addition to the formal courses described in the previous pages, in recent years the following courses have been offered one or more times on a developmental basis:

- ENVS 5213 Nature and Society
- ENVS 5225 Feminist Perspectives in Environmental Studies
- ENVS 5260 Perspectives on Social Analysis
- ENVS 5285 Evaluation and Utilization of Existing Research
- ENVS 6213 Nature:Art:Nature
- ENVS 6214 Sustainable Development for Canada
- ENVS 6221 Waste Management
- ENVS 6223 Siting Major Facilities
- ENVS 6225 Women and Natural Environments
- ENVS 6226 Planning for Safer Cities
- ENVS 6233 The Planning and Design of Housing
- ENVS 6234 Planning Theory
- ENVS 6235 Approaches to Environmental Design
- ENVS 6236 Urban Waterfront Environments
- ENVS 6237 Case Studies in Environmental Management
- ENVS 6251 Natural Communities
- ENVS 6262 Women and Public Policy
- ENVS 6264 Communication Law
- ENVS 6265 Science, Policy, and the Legal Process
- ENVS 6267 Health Promoting Cities
- ENVS 6269 Health Futurism
- ENVS 6272 Political Linguistics
- ENVS 6273 Communication and Environmental Issues
- ENVS 6276 Healthy Public Policy
- ENVS 6277 Health Promotion: The New Public Health
- ENVS 6278 Social Conscience and Marketing
- ENVS 6280 Applied Research Methods: Policy and Regulatory Studies
- ENVS 6281 Consulting Skills
- ENVS 6289 Preparing and Presenting Evidence
- ENVS 6423 Physical Planning and Design Workshop
- ENVS 6483 Computer Simulation Workshop
- ENVS 7222 Seminar in Planning



An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

I-2
SAN JOSE STATE UNIVERSITY
Environmental Studies Program

B.A.— Environmental Studies

Concentration in the Social Sciences or Humanities

This program provides an emphasis in such areas as the following: analytic techniques; communication and the media; transportation planning; cybernetics; photojournalism; public relations; environmental values, ethics, and perception; population; and urban design.

	Semester Units
General Education (total University requirement 48 units) Of the 48 units required by the University, up to 9 units are satisfied by completion of supporting courses for the major, and 39 units are met by other General Education courses.	39
Physical Education	2
Preparation for the Major	23
Biol 20 (3); Chem 1A (5); Cyb S 15(3); Geog 1 (3); Nat S 100W Geol 100W or Social Science 100W (3); Econ 1B (3); Math 70 (3).	
Requirements for the Major	57
Core courses: Env S 101, 107, 110, 117, 124, 198, 199	20
Major electives (of which at least one course must be from the Env S 180-190 series)	17
* Emphasis (minimum)	20
Electives (major and non-major)	3
Total Units Required for the Degree	124

B.A.— Environmental Studies

Concentration in the Natural Sciences

This program provides a concentration in areas such as environmental health; nutrition/management; nutrition/natural science; wilderness and open space planning; or natural history.

	Semester Units
General Education (total University requirement 48 units) Of the 48 units required by the University, up to 12 units may be satisfied by completion of supporting courses for the major, and 36 units by other General Education courses.	36
Physical Education	2
Preparation for the Major	28
Chem 1A, 1B (10); Math 70 (3); Biol 20 (3); Cyb S 15(3); Geog 1 or Geog 1A or Env S 111 (3); Nat S 100W or Geol 100W or Social Science 100W (3); Econ 1B (3).	
Requirements for the Major	52
Core courses: Env S 101, 107, 110, 117, 198, 199	20
Major electives (of which at least one course must be from the Env S 180-190 series)	12
* Emphasis (minimum)	20
Electives (major and non-major)	6
Total Units Required for the Degree	124

B.S.— Environmental Studies

Concentration in Environmental Technology or Management

This program provides a concentration in a technical specialty aimed at careers in environmental agencies or industry, dealing with monitoring, protection, control, or management, or as the basis for further undergraduate or graduate work in that specialty. As this is the most intensive and diverse degree program, students have a wide range of areas in which to emphasize, such as solid and hazardous waste management and recycling; energy resources; solar energy design and policy; soil, wildlife, water or air resource management; and environmental chemistry.

	Semester Units
General Education (total University requirement 48 units) Of the 48 units required by the University, 15 units may be satisfied by completion of supporting courses for the major, and 33 units are met by other General Education courses.	36
Physical Education	2
Preparation for the Major	38
Chem 1A, 1B (10); Phys 2A, 2B (8); Math 70 (3); Biol 20 (3); Cyb S 15(3); Geog 1 or Geol 1A or Env S 111 (3); Nat S 100W or Geol 100W or Social Science 100W (3); Econ 1B (3).	
Requirements for the Major	52
Reduced core courses: Env S 101, 107, 110, 117, 124, 198	18
* Emphasis (minimum)	34
Electives (major and non-major)	9
Total Units Required for the Degree	132

Self-designed with faculty advisor approval.

The emphasis is waived when the student elects to take a double major, provided that the second major supplements— or is in some way directly in support of— the Environmental Studies major.

B.A.— Environmental Studies

Preliminary Multiple Subject Instruction Credential

This degree program qualifies as an approved diversified major for the Multiple Subject Instruction Credential. At the completion of this program a student qualifies for the preliminary Multiple Subject Instruction Elementary Teaching Credential. A second option is to complete the B.A. in Environmental Studies with an approved minor and then earn the Clear Credential. Students choosing this major should note that the core sequence is different from the common core of the other Environmental majors. Elementary or Secondary Education advisors must be consulted by the student for information about the professional education program qualifying for the teaching credential.

Specific course requirements for the diversified preparation may be obtained from the Environmental Studies office.

Diversified Preparation Including General Education

	Semester Units
Total Diversified Preparation (48 units in General Education are included. See departmental or General Education Advisement Center for details)	84
Category 1: English, Speech-Communication and Linguistics	15
Category 2: Mathematics and Natural Science (Physical and Life) (3 units in the Major included)	27
Category 3: Social Science (18 units in the Major included)	27
Category 4: Humanities, Fine Arts, and Foreign Language	15
Major units included in the Diversified Preparation	21
Major units to be assigned by the advisor	4-6
Total units in the Major	25-27

Minor— Energy Resource Management

	Semester Units
Requirements for the Minor	15
Core requirements:	15
Env S 116, 133	
Select three courses from the following:	9
Env S 116, 118, 130, 132, 186	

Minor— Environmental Studies

	Semester Units
Requirements for the Minor	15
Env S 101, 107, 110, 117, 124	

Master of Science Degree in Environmental Studies

(Adviser: Dr. G. A. Klee— Dr. Aitken or Dr. Anthop when Dr. Klee is not in residence)

Purpose The goal of the Master of Science degree in environmental Studies is to offer advanced studies that will help our country (and world) move towards a sustainable society— one that balances social needs with ecological realities. One specific objective of the M.S. in Environmental Studies is to help provide students with the needed edge in the competition for entry and middle-level management positions in resource and environmental quality fields, whether they be in business, industry, or government. The graduate degree also aims at preparing candidates for careers in teaching or the pursuance of a doctoral program.

Plan A (with thesis)

A. Course Work (Minimum of eighteen units in Environmental Studies)	Units
Env S 200 Seminar: Environmental Methods	3
Env S 230 Seminar: Environmental Theory	3
Env S 250 Seminar: American Environmental History	3
Env S 299 Thesis	6
Electives— 100 or 200 level courses in Environmental Studies or related fields selected with adviser's approval	15
Total	30
B. Thesis	
The thesis, based on original research and usually involving field study, is to be conducted under the direction of a thesis adviser and must be acceptable to and approved by the thesis committee which consists of the thesis adviser (committee chairperson), an additional member from the department, and one member from outside the department. In addition, the thesis must conform to the University standards of style and form.	

Environmental Studies

Upper Division Courses

Note: Upper division standing or instructor consent is prerequisite to all upper division courses.

- *101. **Environment and Humans in Transition.** Historical perspectives on America's conservation movement, global implications and consequences of non-renewable resource exploitation, including forests, soil, water, wilderness. Emergence of renewable energy systems, sustainable agriculture, economics, and environmental policies for the 21st Century. (Prereq: Engl 1A or 1B or instructor consent. 3 units)
107. **Introduction to Environmental Economics and Policy.** Analysis of basic economic and political factors related to the environmental crisis. Surveys policy approaches to the problem: regulation, taxes, subsidies, cost benefit analysis. (Prereq: Econ 1B or instructor consent. 3 units)
110. **Resources for the Future.** Present status and projections of America's natural resources including soil, water, grassland, forest, wildlife, and wilderness. Emphasis: Social, political, economic, and ecological implications of resource conservation and management aiming toward the 21st Century. (Prereq: Chem 1A and Math 70. 3 units)
- *111. **Geology and Environment.** See Geol 111. (3 units)
112. **Solid and Hazardous Waste.** Familiarization with major environmental problems through study of federal, state, and regional regulation of solid and hazardous waste management. Methods of treatment, disposal, and destruction. Reduction of waste generation by resource recovery and reuse. Health effects. (Prereq: Junior standing, two semesters chemistry and biological science or instructor consent. 3 units)
113. **Introduction to Air Pollution.** Sources, effects, and fates of pollutants in the atmosphere. Interaction of pollutants and weather systems, including acid precipitation and nuclear winter. Air pollution policy and regulations. (Prereq: One college-level science course. 3 units)
116. **Solar Energy Design and Applications.** The practical use of solar energy by means of "passive" architectural design. Integration of energy-efficient lighting technologies with daylighting in commercial buildings. Relevant implications of the California Energy Code. (Prereq: Upper division standing or instructor consent. 3 units)
117. **Human Ecology.** Diversity and similarity of human adaptation, cultural evolution, cultural change, and environmental modification in African, Asiatic, Oceanic, and Latin American cultural groups. Emphasis: Traditional non-western conservation practices and their lessons for the modern-day resource manager. (Prereq: Env S 101. 3 units)
118. **Advanced Solar Energy Theory.** Theoretical and practical concepts of "active" solar thermal technologies and systems: solar electric technologies and applications; California Energy Code compliance documentation; introduction to computer performance calculation methodologies approved for code compliance. (3 units)
119. **Energy and the Environment.** The various sources of energy available to humans and the major forms of energy consumption by industrialized civilizations; the environmental implications of both trade-offs between energy consumption and environmental protection. (Prereq: Chem 1A. 3 units)
123. **Historic Preservation and Neighborhood Revival.** See Urb P 123. (3 units)
124. **Introduction to Environmental Law.** Public law and the agencies providing for environmental protection; analysis of the effectiveness of both: political and legal routes to bringing about changes in both; projected future needs and directions. (Prereq: Env S 101 or instructor consent. 3 units)
126. **Solar Architectural Design.** Step-by-step procedures of solar architectural design. Design "rules of thumb" developed and justified. Simple analysis methods. Visits to regional solar homes. (Prereq: Env S 116. 3 units)
128. **Water Resource Management.** Water uses and supplies; water resource measurement methods; hydrology; erosional processes; sediment production and transport particularly on Northern California Coastal Watershed; flood hazards and methods of control; groundwater and groundwater aquifers; water quality. (Prereq: Chem 1A and Math 70. 3 units)
129. **Water Policy in the Western U.S.** Water resource development; federal reclamation policy; water law and water rights; interbasin transfers; Colorado River, Central Valley Project and State Water Project; groundwater overdrafting; agricultural water and water pricing. (Prereq: Env S 128. 3 units)
130. **Energy Policy Analysis.** Energy Policy questions and examination of choices including energy pricing, options for controlling oil imports, incentives for reducing consumption, allocation and end use of synthetic fuel production, offshore oil development. (Prereq: Env S 119. 3 units)
131. **Air Pollution Meteorology.** See Metr 131. 3 units)
132. **Integral Urban Home Designs.** Advanced techniques for integrating design elements for occupant health and environmental responsibility in urban homes. Full-Spectrum lighting, identification of hazardous materials/stressful interiors, conservation, ventilation, solarization for owners, renters, professional designers! Theme: "Living Better (with less) Not Without." (Prereq: Env S 101 or instructor consent. 3 units)
133. **Alternative Energy Strategies.** Problems and prospects facing non-conventional or alternative energy systems including solar, wind, geothermal, and biomass conversion, and use of agricultural and urban waste. (Prereq: Env S 116 or 119 or 130 or consent of instructor. 3 units)

135. **Urban Design and Environmental Quality.** Urban and architectural design affecting environmental quality; how physical and natural features and processes influence and are affected by the growth and function of cities; insights into the complexity of urban ecosystems. (Prereq: Env S 101. 3 units)
138. **National Parks.** See Geog 138. (3 units)
142. **Land Use and Energy.** See Urb P 142. (3 units)
158. **Environmental Paradigms for the 21st Century.** Education of individuals can make a difference in protecting the environment. Comprehensive overview from the perspectives of schools: American culture and law. Interdisciplinary approaches for correcting conditions created by modern living, energy and environmental demands. (Prereq: English 1A, 1B, upper division standing, or instructor consent. 3 units)
159. **Nature and American Culture.** See Am S 159. (3 units)
166. **Nature and Conservation Photography.** Still photography of nature and illustrative conservation subjects in both color and black-and-white. Theory critique sessions supplemented with field experience. (Prereq: Photo 40 or instructor consent. Lecture 2 hrs/activity 2 hrs. 3 units)
171. **Cartography: Interpretation and Expression.** See Geog 171. (3 units)
172. **Cartography: Compilation and Presentation.** See Geog 172. (3 units)
181. **Environmental Resource Center.** A supervised operation of a center for environmental information resources and dissemination and consultation, staffed by those taking the course as a service to campus and community. Students adopt one particular subject area as their specialty. (Prereq: Env S 101. Repeatable by majors for 3-unit maximum; by non-majors for 6 units. Activity 2-6 hrs. 1-3 units)
182. **Remote Sensing: Basic Theory and Image.** See Geog 182. (3 units)
183. **Remote Sensing. Non-Photographic Sensing: Digital Analysis.** See Geog 183. (3 units)
184. **Directed Reading.** Directed reading in an environmental subject to gain broader knowledge. (Prereq: Specific proposal to or need defined by department, with consent of faculty. CR/NC grading. Repeatable for credit. 1-4 units)
185. **Environmental Impact Analysis.** Current environmental impact reports subjected to critical review; determination of alternative procedures and mitigating opportunities; extensive field analysis and practice. (Prereq: Env S 101, 117, 110, 124, and completion of University 100W writing requirement. Repeatable once for credit. 4 units)
186. **Solar Architecture Design Studio.** Supervised design learning opportunity in the development of actual solar home and building designs. Performance expectations tailored to individual experience and skills level. (Prereq: Env S 116, 126. 3 units)
188. **Solar Architecture Performance Analysis Methodology.** Theory and techniques of solar building performance estimation and analysis: California's Energy Conservation Standards (Title 24); techniques of building performance estimation approved for compliance with these standards, including microcomputer software. (Prereq: Env S 116, 118. 3 units)
189. **Bay Area Field Studies.** Field trips every other Saturday to illustrate principles of resource management. One hour guest lecture per week with resource manager. (Prereq: Env S 101 and 110. CR/NC grading. Repeatable for a maximum of twelve units. 3 units)
193. **Supervised Projects and Research.** Projects and/or research to build practical environmental skills. Work primarily off-campus and with direct social value. (CR/NC grading. 1-15 units)
194. **Public Service Internship.** Service in a local, city, county, state, or federal environmental agency, or in environmental industry; or with a worthwhile environmental education or protection organization or center. (Prereq: Senior standing in Env S. CR/NC grading. 1-15 units)
195. **Instructor Assistant in Environmental Studies.** Experience as a tutor assistant in classroom demonstrations, field techniques, and discussion. (Prereq: Senior standing, Engl 1A, instructor consent, and appropriate academic background. Repeatable for a 4-unit maximum, but not for same course or instructor. CR/NC grading. 1-3 units)
198. **Senior Seminar—Achieving A Desirable Future.** Modeling possible future societies and environments; defining how to get there; identifying the environmental, social, political, and economic compromises involved in each model. (Prereq: Senior standing in Env S, completion of all Env S core requirements and University 100W writing requirement. 3 units)
199. **Senior Thesis.** Thesis demonstrating grasp of environmental subjects and principles, ability to research in depth particular environmental problems, and facility at recommending practical solutions. (Prereq: Senior standing in Env S, completion of all Env S core requirements and University 100W writing requirement. CR/NC grading. 2 units)

Graduate Courses

(See Graduate Catalog for description of courses.)

*Fulfills General Education.

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

I-3
SIMON FRASER UNIVERSITY
School of Resource and
Environmental Management

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

I-5
MCGILL UNIVERSITY
Department of Renewable Resources

Courses for Higher Degrees

Denotes not offered in 1991-92

338-510B AGRICULTURAL MICROMETEOROLOGY. (3 credits; 3 lectures). Interaction between plant communities and the atmosphere. The physical processes governing the transfer of heat, mass and momentum as they relate to research and production in agricultural systems. Experimental techniques for measuring fluxes of heat, water-vapour, CO₂ and natural and man-made pollutants. Professor Schuepp

338-602B ISOTOPIC TRACER TECHNIQUES. (3 credits) (2 lectures and 1 four-hour laboratory; Prerequisite: 338-303A or equivalent). An advanced practical course to introduce students to laboratory equipment and techniques required for tracer experiments. Theory and use of end-window and windowless G.M. counter, proportional counters, scintillation counters both solid and liquid types. Professor Bartha

360-612B MATHEMATICAL METHODS. (3 credits) (3 lectures; prerequisite: 360-205B, Differential Equations, or equivalent). Partial differential equations and boundary-value problems; Fourier and Bessel series expansions; applications; special topics; numerical methods; Laplace transformation. Professors Schuepp and Kok

72-602D CHEMISTRY AND FERTILITY OF SOILS I. (3 credits) (2 lectures per week, one term). Discussion of significant research in soil chemistry; movement and uptake of plant nutrients; composition and properties of soil organic matter; analytical techniques. Professor MacKenzie

72-603D CHEMISTRY AND FERTILITY OF SOILS II. (3 credits) (2 lectures per week, one term). Discussion of significant research in soil chemistry and soil fertility; nutrient reactions, soil organic matter, analytical techniques, etc. Professor MacKenzie

72-610D PEDOLOGY. (3 credits) (2 lectures per week, one term). Processes of profile development, principles of classification, comparative taxonomy, U.S. and Canadian systems. Professor Henderson

72-621B ADVANCED SOIL BIOCHEMISTRY. (3 credits) (2 lectures, 1 seminar per week). Discussion of the dynamics of organic matter cycling in soils with emphasis on the carbon, nitrogen, phosphorus and sulphur components; the role of biological and chemical processes in the economy of the organic fraction in soils and the relationship of organic matter processes to soil properties and fertility. Professor O'Halloran

72-630D SOIL MINERALOGY. (3 credits) (2 lectures per week, one term).

72-631D ADVANCED SOIL PHYSICS. (3 credits) (2 lectures per week, one term). State and fluxes of matter and energy in the soil. Applications to movement of water, salts, nutrients; diffusion of gases; heat transfer. Discussion of significant research in soil physics. Professor Mehry

72-640D (2 credits); -641D (2 credits); -642D (2 credits); -643D (2 credits) GRADUATE SEMINAR IN SOIL SCIENCE. (One-hour, weekly meetings). Discussion of selected topics in soil science and renewable resources. Seminars presented by invited speakers, staff, and graduate students. Students are expected to register for one of the graduate seminars in each year of their residence. Professor Côté and Staff

72-701D PH.D. COMPREHENSIVE EXAMINATION. Staff and Others

-650A,B RECENT ADVANCES IN TREE ECOPHYSIOLOGY. (3 credits) (3 lectures per week). Discussion of the effects of environmental factors on the physiology of trees. Both anthropogenic and natural factors will be discussed. Professor Côté

ronmental factors on the physiology of trees. Both anthropogenic and natural factors will be discussed. Professor Côté

375-500B AVIAN PHYSIOLOGY. (4 credits) (3 lectures, 1 lab.; Suggested prerequisite 342-323A or equivalent).

375-605B WILDLIFE ECOLOGY. (3 credits) (2 class hours per week). Discussion of problems in wildlife ecology with special reference to the research interests of staff and students involved. Professor Tibman and Staff

375-640D (2 credits); -641D (2 credits); -642D (2 credits); -643D (2 credits) GRADUATE SEMINAR IN WILDLIFE RESOURCES. (One-hour, weekly meetings). Discussion of selected topics in wildlife and renewable resources. Seminars presented by invited speakers, staff, and graduate students. Students are expected to register for one of the graduate seminars in each year of their residence. Professor Bird and Staff

375-610A ADVANCED FISH ECOLOGY. (3 credits) (3 class hours per week). A critical examination of current topics in fish ecology; discussion of migration, reproductive strategies, sex determination mechanisms, competition, communication and predator-prey relationships. Professor Whonskey

375-615B COMMUNITY ECOLOGY. (3 credits) (3 class hours per week). Critical analysis of current theories of community structure. Discussions of different types of ecological communities and the roles of biotic and abiotic factors in influencing their structure. Professor Whonskey

375-680A,B,C SPECIAL TOPICS IN RENEWABLE RESOURCES. (1 credit). Students pursue topics not otherwise available in formal courses, under staff supervision.

375-681A,B,C SPECIAL TOPICS IN RENEWABLE RESOURCES. (1 credit). Students pursue topics not otherwise available in formal courses, under staff supervision.

375-682A,B,C SPECIAL TOPICS IN RENEWABLE RESOURCES. (2 credits). Students pursue topics not otherwise available in formal courses, under staff supervision.

375-683A,B,C SPECIAL TOPICS IN RENEWABLE RESOURCES. (2 credits). Students pursue topics not otherwise available in formal courses, under staff supervision.

375-697A/B M.Sc. THESIS RESEARCH I (12 credits)

375-698A/B M.Sc. THESIS RESEARCH II (12 credits)

375-699A/B M.Sc. THESIS RESEARCH III (12 credits)

1-3

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

I-6
CALGARY UNIVERSITY
Faculty of Environmental Design

COURSES OF INSTRUCTION

Legend:

F - Full course

H - Half course

(3-3) - 1st digit = number of lecture hours per week; 2nd digit = number of laboratory or studio hours per week.

An asterisk indicates a course will not be offered in 1992-93.

The following list of courses, offered by members of the Faculty of Environmental Design and members of other departments in the University, are specific to the 1992-93 academic year.

Students are advised that some of the courses listed below may not be offered in 1992-93 if special circumstances require that they be dropped. Students should consult with their Faculty advisor or Programme Director before registering for any course.

Core Courses in Environmental Design are:

Environmental Design 604. Conceptual Bases of Environmental Design

Environmental Design 605. Research Methods for Environmental Design

Environmental Design 609. Environmental Design Practice

Environmental Design 702. Advanced Environmental Design Practice

CANADIAN STUDIES (CNST)

SENIOR COURSES

Canadian Studies 427 H(3-0)

Canadian Architecture in its Social and Historical Context

An outline of Canadian architecture, its institutional and economic setting; the nature and objectives of architecture education and practice in relation to their historical development.

Canadian Studies 429 H(3-1)

The Design and Construction of Canadian Architecture

An interdisciplinary study of the field of architecture as it pertains to the Canadian design and building professions. Among the actors of the Canadian economy to be studied are the design, development and construction sectors, the financing and mortgaging sectors, and the architectural and engineering professions.

ENVIRONMENTAL DESIGN (EVDS)

SENIOR COURSE

Environmental Design 531 H(3-0)
(Law 531)

Environmental Law

Interdisciplinary studies under instructors from the Faculties of Law and Environmental Design. Lectures and readings on ecological principles, economics, economic analysis in environmental policy, public and private law concepts. Selected issues (e.g. information access, environmental assessment). Independent directed research by multi-disciplinary student teams; presentation of results.

Prerequisite for Faculty of Environmental Design students: Environmental Design 637.

Offered in odd-even dated academic years.

GRADUATE COURSES

Environmental Design 601 H(3-0)

Seminar in Environmental Science

Environmental Science as a profession, focusing on current issues, interdisciplinary research and communications, successes and failures of scientists as consultants, and on the development of professional practice skills.

Note: This course normally is taken after Environmental Design 603.

Environmental Design 603 H(4-2)

Introduction to the Professional Practice of Environmental Science

Study of the nature of environmental science and its professional practice. Examples will be drawn from a broad range of professional activities. The course will examine problems of project definition, design, scoping and budgeting.

Environmental Design 604 F(4¹/2-0)

Conceptual Bases of Environmental Design

Conceptual frameworks for design intervention in the environment based on perspectives from the humanities, natural and social sciences of human relation to natural, social and built environments; theories and models of investigation and intervention; discussion of professional responsibilities and environmental design issues. **Required course for all first-year MEdes degree programme students.**

Environmental Design 605 Q(1¹/2-0)

Research Methods for Environmental Design

Overview of methods for developing information required for design intervention in the natural and built environment with emphasis on research techniques from the social sciences. Interdisciplinary perspectives on techniques and their appropriateness for the designer. Roles of research methods in design processes. Practical issues in conducting research.

Environmental Design 609 H(0-8)

Environmental Design Practice

Introduction to environmental design encompassing perspectives of architecture, industrial design, urban and regional planning and environmental science; communication and interdisciplinary approaches; environmental design as technique and creative process. Lectures, field and studio work.

Note: Open only to students in the MEdes degree programme and required of all first year degree programme students.

Environmental Design 611 H(3-1)

Building Science and Technology I

Functioning of the building enclosure: demonstration of the behaviour of building elements and their sub-assemblies under differential temperature and pressure stresses; fundamentals of acoustics; nature and use of building materials; response of building materials to climatic cycles radiation, precipitation, heating and cooling.

Environmental Design 613 H(3-1)

Building Science and Technology II

Theory and principles of structural, foundation and building service systems. Application of building science principles to building structure and enclosure, examination of the types and manufacture of building elements and the application of building components to specific problems in architecture.

Environmental Design 614 F(3-0)

Introduction to Industrial Design

Historic and conceptual frameworks of industrial design; principles of ergonomics, materials and industrial production technologies; industrial design as technique and creative process; professional perspectives. Lectures and field work.

Environmental Design 615 H(3-0)

Introduction to Design Theories

The contemporary cultural, social, and philosophical arenas in which architecture exists are examined

of rocks, physical features of U.S. groundwater regions, problems related to development and protection of the groundwater resource. 1 unit, intensive. Spring. *R. Heath*

334. Applied Groundwater Flow Modeling. Basic physical and mathematical concepts needed for effective modeling of groundwater systems. Application of the U.S. Geological Survey modular finite-difference groundwater flow model, MODFLOW. 1 unit, intensive. Fall. *Eimers*

336. Nonpoint Pollution Control for Forestry and Agriculture. Strategies and methods for control of nonpoint pollution, building upon a basic understanding of soil and water resources. 1 unit, intensive. Fall. *McIntyre*

366. Mathematical Modeling of Lake and Reservoir Water Quality. Practical application of mathematical models of lake and reservoir water quality. The major objective is to expose the participant to a wide variety of techniques that are useful in predicting the responses of lakes and impoundments to pollutants. Statistical and mass balance models are included. Knowledge of elementary calculus and statistics is recommended. 1 unit, intensive. On demand. *Reckhow and Chapra*

375. Timberland Investments. Investment characteristics of timberlands, particularly with reference to institutional investors. Consideration of investment objectives (preservation of capital, return on investment, liquidity) and constraints (taxes, accounting conventions, legal requirements). 1 unit, intensive. Spring. *Mason and Howard*

384. Special Tax and Accounting Aspects of Financial Statements of Industrial Timberland Owners. Examination of the many recent changes in tax and accounting rules which have significantly affected the financial statements of major timber companies. Open to professionals and Senior Professional Program candidates only. 1 unit, intensive. On demand. *Condrell*

386. Implementation of the National Environmental Policy Act on Federal Lands and Facilities. Overview of NEPA content, case law, and current issues. Discussion of methods of implementing regulations, conducting and processing an environmental impact analysis, determining the proper level of documentation to fully record and disclose results. 1 unit, intensive. Fall. *Clark*

Courses at the Marine Laboratory

203. Physical Oceanography. Physical processes in the oceans: the physical properties of seawater, the dynamics of currents, waves and tides, and the transmission of light and sound in the sea. Prerequisite: Physics 41 or 51. C-L: Geology 203. 2 units. Fall. *Johnson*

203L. Marine Ecology. Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. Prerequisites: none; suggested introductory ecology, invertebrate zoology, or marine botany. C-L: Zoology 203L. 6 units. Summer. *Gerhart*

209. Climatic Change. Record of changing climate on Earth, as determined from the analysis of deep sea sediments, ice-cores, lake sediments, and tree rings. C-L: Geology 209. 4 units. Fall. *Johnson*

210. Tutorial in Advanced Cell Biology/Physiology. Directed reading and study in cell biology/physiology. [Descriptions of specific areas may be obtained from the

Director of Graduate Studies.) Consent of Director of Graduate Studies required. C-L: Cell Biology 210. 3-9 units each. Fall, spring, summer. *Staff*

213L. Behavioral Ecology. How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Prerequisite: introductory biology. C-L: Zoology 213L. 4 units. Summer. *Rubenstein (visiting summer faculty)*

217L. Biology of Marine Macrophytes. Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. Prerequisite: introductory biology and chemistry. C-L: Botany 217L. 4 units. Summer. *Ramus*

218. Barrier Island Ecology. Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis will be placed on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Prerequisite: course in general ecology. C-L: Botany 218 and Environment 218. 6 units. Summer. *Evans, Peterson and Wells (visiting summer faculty)*

19L. Benthic Marine Algae. Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and field work in ocean and estuaries. Prerequisite: introductory biology; plant diversity recommended. C-L: Botany 219L. 4 units. Summer. *Searles*

223. Analysis of Ocean Ecosystems. Examination of the ecosystem concept considering its history, utility, and heuristic value. Examination of ocean systems in the context of Odum's ecosystem concept. Structure and function of the earth's major ecosystems. Prerequisite: one year of biology and chemistry, or permission of instructor. C-L: Zoology 223. 3 units. Fall. *Barber*

224T, 225T. Special Problems. Students with adequate preparation may do special work in the appropriate field. C-L: Botany 224T, 225T. Credit to be arranged. Fall, spring, summer. *Staff*

235, 235L. Advanced Research Training in Marine Molecular Biology and Biotechnology. Modern molecular biology is taught in lectures and laboratory exercises using fish, molluscs, algae, and other marine forms. Topics and techniques include DNA, RNA, and protein assays; isolation, genomic library screening and bacteriological and cell culture techniques. C-L: Cell Biology 235, 235L. 4 units; 6 units with laboratory. Summer. *Van Beneden and staff*

250L. Physiology of Marine Animals. Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Prerequisites: introductory biology and chemistry. C-L: Zoology 250L. 4 units. Spring, summer. *Forward*

255L. Biochemistry of Marine Animals. Functional, structural, and evolutionary relationships of biochemical processes of an importance to marine organisms. Prerequisite: introductory biology and inorganic chemistry. C-L: Zoology 255L. 4 units. Fall, summer. *Rittschof*

274L. Marine Invertebrate Zoology. Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips included. Prerequisite: introductory biology. Not open to students who have taken Zoology 76L or 176L. C-L: Zoology 274L. 6 units. Summer. *Dimock (visiting summer faculty)*

- 316. Case Studies in Environmental and Forest Management
- 319. Environmental Toxicology and Risk Assessment (intensive)
- 322.L. Microbiology of Forest Soils
- 323. Coastal Zone Management (intensive)
- 330.L. Environmental Monitoring and Instrumentation
- 333. Basic Groundwater Hydrology (intensive)
- 334. Applied Groundwater Flow Modeling (intensive)
- 335. Water Quality Modeling
- 336. Nonpoint Pollution Control for Forestry and Agriculture (intensive)
- 350. Applied Regression Analysis
- 351. Computer Based Map Analysis with Geographic Information Systems
- 355. Optimization Methods for Resource Management
- 366. Mathematical Modeling of Lake and Reservoir Quality (intensive)
- 367. Laird, Norton Distinguished Visitor Series
- 372. Advanced Natural Resource Economics
- 373. Advanced Environmental Economics
- 375. Timberland Investments (intensive)
- 384. Special Tax and Accounting Aspects of Financial Statements of Industrial Timberland Owners (intensive)
- 385. Decision Theory and Risk Analysis
- 386. Implementation of NEPA on Federal Lands and Facilities (intensive)
- 388. Seminar in Resource and Environmental Policy
- 389. Seminar in Conservation and Environmental History
- 397. Environmental Speaker Series
- 398. Program Area Seminar
- 399. Master's Project

353, 354. **Research.** To be carried on under the direction of the appropriate staff members. Hours and credits to be arranged. C-L: Zoology 353, 354. Fall, spring, summer. *Staff*

360T, 361T. **Tutorials.** An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. C-L: Zoology 360T, 361T. Hours and credits to be arranged. Fall, spring, summer. *Staff*

Seminar. Special topics in the marine sciences. Exploration at the advanced level of current research in the marine sciences. Subject dependent on faculty and student interests. C-L: Botany 295S, 296S; Cell Biology 270S; and Zoology 295S, 296S. 2 units. Fall, spring, summer. *Staff*

Numerical Listing of ENV Courses

- 191, 192. Independent Study in Forestry and the Environment
- 200. Integrated Case Studies
- 201. Forest Resources Field Skills
- 204. Forest Inventory, Growth and Yield
- 205, 205L. Ecological Management of Forest Systems (Silviculture)
- 207, 207L. Forest Pest Management
- 210, 210L. Forest Pathology
- 211L. Applied Ecology and Ecosystem Management
- 212. Ecological Toxicology
- 213. Forest Ecosystems
- 215. Environmental Physiology
- 216. Applied Population Ecology
- 217. Tropical Ecology
- 218. Barner Island Ecology
- 220. Vegetation Management in Urban Ecosystems
- 221. Soil Resources
- 230L. Weather and Climate
- 232. Microclimatology
- 234L. Watershed Hydrology
- 236. Water Quality Management
- 237. Water Resources Modeling
- 238. Hydrologic Transport Processes
- 240. Fate of Organic Chemicals in the Environment
- 242. Environmental Chemistry
- 251. Natural Resource Data Analysis
- 257. Applied Forest Inventory (intensive)
- 258. Forest Appraisal (intensive)
- 260. Western Field Trip
- 261. Remote Sensing for Resource Management
- 262. Forest Utilization Field Trip
- 265. Financial Management: The Key to Sound Resource Management (intensive)
- 266. Ecology of Southern Appalachian Forests
- 270L. Resource and Environmental Economics
- 271. Economic Analysis of Resource and Environmental Policies
- 274. Resource and Environmental Policy
- 277. Conservation and Sustainable Development I—Concepts and Methods
- 278. Conservation and Sustainable Development II—Integrated Problem Solving
- 281. Environmental Law (intensive)
- 285. Land Use Principles and Policy
- 286. Conservation Land Acquisition (intensive)
- 288. Forest Taxation (intensive)
- 299. Independent Studies and Projects
- 302. Models in Forest and Environmental Management
- 305. Harvesting Effects on Productivity
- 306. Dynamic Modeling of Forestry and Natural Resource Management Strategies (intensive)
- 307. Ecophysiology of Productivity and Stress
- 312. Wetlands Ecology and Management
- 313. Advanced Topics in Ecotoxicology
- 314. Integrated Case Studies in Toxicology

Courses Outside of the School

The School of the Environment encourages students to take courses offered by other schools and departments at Duke, as well as the University of North Carolina at Chapel Hill and North Carolina State University. The following are representative of courses that are available and have been taken by students in the past few years to broaden their programs of study. For additional offerings and course descriptions, students should consult the graduate school bulletins of the three universities.

Business, Economics

Econometrics
Microeconomic Theory
Macroeconomic Analysis
Federal and Public Finance
Economic Growth Problems
International Monetary Theory
Industrial Governmental Relations
Financial Management
Industrial Organization
Financial Accounting

Botany, Zoology

Phycology
Biological Oceanography
Comparative Physiology
Physiological Plant Ecology
Plant Physiology
Community Ecology
Evolutionary Mechanisms
Tropical Biology

Environmental Science, Engineering

Limnology and Water Pollution
Administration of Environmental Protection
Wastewater Treatment
Environmental Microbiology
Pollutant Transportation
Hazardous Wastes
Solid Waste Engineering

Forestry and Related Disciplines

Forest Genetics
Computer Cartography
Soil Morphology, Chemistry, and Microbiology
Forest Tree Improvement

Law

Land Use Planning
Judicial Administration Policy
International Business Transactions
Resource Law and Policy
Environmental Law
Wildlife Law

Mathematics, Statistics

Linear Models
Multivariate Statistics
Computer Numerical Analysis
Artificial Intelligence
Linear Algebra and Digital Computation
Bayesian Inference and Decision
Stochastic Methods

Planning

Planning Law
Planning Problems
Environmental Systems Analysis
Regional Land Planning
Water Resource Planning

Political Science, Public Policy

Microeconomics and Policy Making
Analytical Methods
Comparative International Development
Politics and Policy Processes

Toxicology

Mammalian Toxicology
Pharmacology and Toxicology
Biochemical Toxicology
Biochemistry
Neurotoxicology

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

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UNIVERSITY OF WATERLOO
Faculty of environmental Studies

GRADUATE COURSES, 1987-88*

- 611 *Industrial Location Theory and the Planning of Industrial Development* (also GEOG 611): An examination of industrial location theory and related empirical studies. The application of theoretical concepts to the planning of industrial development at the urban and regional scales. Examples will be drawn not only from Canada but from other world regions.
Fall (1.0): David Walker.
- 614 *Issues in Housing* Canadian housing policies and programs, particularly with regard to the housing of low and moderate income families. Economic, political, physical and social consideration underlying these policies. Study of the housing problems and programs of the United States and developing countries.
Fall (0.5): Harry Coblentz.
- 616 *Multivariate Statistics* (also GEOG 616): Theory and application of multivariate statistics, regression and correlation analysis, factor analysis, discriminant analysis and grouping analysis, with emphasis on the use of the computer. Pre-requisite: An undergraduate statistics course or consent of instructor.
Not offered 1987-88.
- 617 *Nonparametric Statistics* (also GEOG 617): The theory and application of nonparametric statistics with emphasis upon social science problems. Pre-requisite: An undergraduate statistics course or consent of instructor.
Not offered 1987-88.
- 618 *Spatial Analysis* (also GEOG 618): Advanced quantitative analysis applied to spatial patterns and interactions. Emphasis on a selection from gravity models, linear programming, nearest neighbour analysis, Markov chain analysis, graph theory, simulation and trend surface analysis. Pre-requisite: An undergraduate statistics course or consent of instructor.
Not offered 1987-88.
- 619 *Regional Planning Techniques* (also GEOG 619): Discussion, appraisal and application, at the regional level, of selected economic techniques — specifically, cost-benefit analysis, Planning — programming — budgeting systems, and input-output analysis.
Pre-requisite: An undergraduate statistics course or consent of instructor.
Fall (0.5): Brent Hall.
- 620 *Small Groups in Planning*: Various small group concepts, such as leadership, goal-setting, decision-making, communication and interpersonal relationships, will be examined and related to typical planning groups, such as committees, councils, staff groups, boards and teams. The course will look at how groups function and how their effectiveness can be improved and will stress the important role of the planner in this process.
Fall (0.5): William Shalinsky.

* Credit weighting for each course is in parentheses after the term in which it is offered. 1.0 credit courses span two terms. 0.5 credit courses are for one term.

- 645 *Design in Planning*: An evaluative approach to design concepts in planning at urban and regional scales developed through seminars and projects; primarily intended for those with little or no design background.
An attempt will be made to develop a critical awareness, sensitivity and evaluation of the physical and social components inherent in structuring the man-made environment. (Limit: 10 students).
Fall (0.5): Saul Herzog.
- 656 *The Process of Urban and Regional Planning*: Advanced seminar on theory and practice in urban and urban-centered regional planning. Case studies and readings demonstrating the techniques used in various aspects of plan preparation within the framework of the planning process.
Year Course (1.0): Larry Martin (Fall), Ross Newkirk (Winter).
- 658 *Regional Development* (also GEOG 658): Theories of regional growth and development and concepts of development planning. Types of region, regional policy objectives, strategies, and plans. Detailed case studies of Canada and at least two other countries.
Year Course (1.0): David Walker (Fall), Pierre Filion (Winter).
- 659 *Special Problems and Projects*: Special planning or resource management problems and projects chosen in consultation with the instructor.
Year Course (1.0): Arrange with individual Faculty Member.
- 660 *Politics and Administration of Planning*: Focus on the understanding of the processes involved in planning, policy-making and implementation; study of the planning function and planning in the context of political-economic systems, treated conceptually, in Canada and in a comparative international framework.
Year Course (1.0): Len Gertler.
- 661 *Planning and Conservation of Water Resources* (also GEOG 661): Study of a number of water resource topics such as water quality criteria; water quality management; regional water resources planning; agricultural pollution; management of urban storm water runoff; urban lakes; lake planning; wetlands. A few case studies are presented.
Year Course (1.0): George Mulamoottil.
- 662 *Natural Resource Planning: Policies and Programs* (also GEOG 662): Natural resources and the planning process. Social, economic, political and legislative settings for natural resource planning; major areas of public controversy and conflict in natural resource use and development; international relations and the formulation of criteria for future resource planning policies.
Winter (0.5): Gordon Nelson.
- 663 *Social Concepts in Recreation Planning*: Examination and development of sociological and demographic concepts in recreation behaviour. Translation and application of these concepts to recreation planning. Planning 663 is a complementary course to Geography 663 (Fall).
Not offered 1987-88.

- 623 *Social Concepts in Planning*: Examination of planners in their environment using systems, organization, changes and planning theories. What planners do, where they do it and why they should be concerned with social concepts. Social concepts will be examined within a framework of social structures, looking at case studies and coming to some practical conclusions on how planners can and should use social concepts to enhance their efforts and accomplishments.
Winter (0.5): Mike Lazarowich.
- 624 *Sociological Problems in the Implementation of Regional Development* Examination of social consequences of planned change programs in Canada's regions: Maritimes, Arctic and Sub-arctic emphasized.
Fall (0.5): Sally Weaver.
- 625 *Field Methods for Community Studies*: A course in research methods and planning process; interviews and self-administered surveys; questionnaire design; non-survey data collection techniques; practical applications.
Not offered 1987-88.
- 626 *Planning, Citizen Involvement and Social Change*: Centered on the theory and practice of citizen involvement and social change in relation to planning and policy formulation, it includes the ideology of involvement, social change and intervention strategies, economics and social development, and new models of change based on degrees of centralization. There is an emphasis on Canadian case materials. Pre-requisite: consent of instructor.
Winter (0.5): Pierre Filion.
- 630 *Environmental Law - Planning Law*: A seminar in Planning Law using the case study approach. Although the emphasis is primarily on the law in Ontario, comparative reference is made to planning law in other Provinces for purposes of comparison. Planning issues dealt with by the Ontario Municipal board are used to illustrate the power to regulate the use of land, the law relating to citizen participation, problems of non-conforming uses, and the maintenance of environmental quality in neighbourhoods, and communities. Some general familiarity with law is desirable, but not essential.
Winter (0.5): Steve Garrod.
- 640 *Project-based Planning Workshop*: A project-based workshop concerned with the following aims: (1) to involve graduate students in a co-operative team investigation, concerned with integrating several essential perspectives: environmental, social, political and design; (2) to involve graduates and faculty as particular observers in government/planning processes; (3) to provide experience in the formulation of policies, programs and projects to overcome identified problems; and (4) to create a forum within which basic ingredients of the graduate program — philosophy, theory, technique — meet the test of action. Projects will vary from year-to-year. Some workshop exercises have resulted in publications. Recent projects were:
1984-85: Planning Process for a Complex Project: Railway Lands, Toronto (Part I).
1985-86: Same (Part II).
1986-87: A Community Sensitive Approach To Municipal Futures.
Pre-requisite: consent of instructor.
Year Course (1.5): Mark Dorfman and Murray Haight.

675A *Seminar on Planning with Native Peoples*: This seminar is designed for persons interested in planning problems specific to native communities in Canada and North America. It will include critical evaluation of problems facing native peoples in larger urban settings where native peoples are a minority group as well as in complex situations encountered in traditional settlements and new resource communities.
Winter (0.5): Harry Coblentz.

675K *Issues and Resource Law*: This course will give an opportunity for a limited number of senior undergraduate and graduate students to examine in depth the legal and institutional constraints affecting current and potential resource issues. Students will be expected to undertake in depth research related to one of the topic areas and to present and defend their analysis of the issues, particularly taking into account legal and institutional parameters.
Pre-requisite: by permission of the instructor. Only students who have completed Environmental Law or an equivalent course may apply. Enrollment limited to ten (10) undergraduates and ten graduate students.
Winter (0.5): David Estrin.

676A-Z *Special Readings and Seminars on Selected Planning Topics*: Same procedure as Planning 675.
Year Course (1.0): Various faculty.

691 *Field Research Projects*: Field seminar on analysis and solutions of problems in a specific area.
Fall (0.5): George Rich and

692 *Graduate Thesis Seminar*: Each first-year Master's student presents to fellow students and faculty an outline of his or her thesis research in the form of a formal thesis proposal. A few preparatory meetings will be held in the Fall Term.
Note: Restricted to Master's planning graduate students.
Winter (0.5): William Shalinsky and Ross Newkirk.

699 *Master's Thesis*
(2.0).

780 *Seminar on Philosophy and Methodology of Regional Planning Resource Development*: Major philosophical and theory-based issues in regional planning, both in urban-centered and resource-based regions. Planning as a field of thought; action, forms and styles of planning; research/investigative methodologies; and process in the institutional, political and legal context will be discussed. This is a core course for the graduate program.
Year Course (1.5): Beth Moore Milroy (Fall), Pierre Filion (Winter).

- 664 *Ecological Foundations of Resource Use* (also GEOG 664): Principles of biogeography and field ecology. Ecological principles in resource use and development. Case studies, projects and field trips. Pre-requisite: Env S 200 or equivalent. Not offered 1987-88.
- 665 *Resource Conservation and Development* (also GEOG 665): Appraisal of renewable resources with reference to policy, demand, and changing technology. Problems related to management and development of resources. Resource-oriented regional case studies and projects. Pre-requisite: Planning 664, or the equivalent. Fall (0.5): Doug Hoffman.
- 666 *Ecosystem Approach to Park Planning* (also GEOG 666): An ecological approach to planning national and provincial parks, focusing on system planning, master planning and park administration. Examination of the theory and practice of parks planning, utilizing ecological concepts. Pre-requisite: Planning 664 or an undergraduate ecology course, or consent of instructor. Fall (0.5): John Theberge and Gordon Nelson.
- 667 *Problems in Resource Management* (also GEOG 667): Analysis of existing management concepts and practices. Study of proposed theories, concepts, methods and techniques relevant to the management of resources. Year Course (1.0): Bruce Mitchell.
- 668 *Environmental Impact Assessment*: Techniques and technicalities covered in the first part of the course include legal aspects, teamwork, data collection and manipulation, public participation, and cost benefit analysis. These topics are followed by case histories considered from the perspective of proponent, public, consultant and government. Finally, the ethics and politics of environmental impact assessment are reviewed. Students are required to participate in a simulated environmental impact assessment. Winter (0.5): Roger Suffling.
- 675A-Z⁺ *Special Readings and Seminars on Selected Planning Topics*: Student should discuss proposed topic of study with the Graduate Officer, who will then suggest appropriate Faculty member(s). Some topic studies are already included. Fall, Winter and Spring Terms (0.5): Various faculty.

* (a) Student must submit a full description of the course to the SURP Graduate Office along with the signed agreement of the instructor. It should provide a brief title, a one paragraph description, note the method of evaluation and work to be done to obtain credit. Beginning date and end date of course and credit weight should also be noted. A Course Letter must be assigned (e.g. 675W) by the Graduate Secretary and is designated when the signed agreement is handed in to her.

(b) Reading courses cannot be added after the first month of term.

(c) Student's regular term registration or add forms listing reading-type courses will not be signed (i.e. approved) until receipt of course plan (a) above.

- 801 *Doctoral Research Forum: Examination of the theory, methods and process of regional planning and Resource Development through intensive examination of selected aspects of planning issues.*
Pre-requisite: Restricted to first year Doctoral candidates.
Year Course (1.5): Len Gertler, and Ross Newkirk.
- 802 *Advanced Doctoral Research Forum: Advanced examination of paradigms in Planning and Resource Development, and seminars on doctoral research development, through student, guest and faculty presentations.*
Pre-requisite: Restricted to second year Doctoral candidates.
Year Course (1.5): Len Gertler, and Ross Newkirk.
- 875A-Z *Special Readings and Seminars on Selected Planning Topics: Same procedure as Planning 675.*
Fall, Winter and Spring (0.5): Varied faculty.
- 899 *Doctoral Thesis*
(2.0).

INTER-UNIVERSITY CO-OPERATION

Arrangements have been made to enable students registered in one Ontario university to take graduate courses at another Ontario university. Normally, a student registered at the University of Waterloo will be allowed to take one two-term course or two one-term courses at another Ontario university under this arrangement. The home department chairman must request admission for the student from the department chairman of the host university. Unless the host chairman agrees, the transfer will not take place. If the host university agrees to accept the transfer student, there will be no further admission requirements.

A transfer student must enrol and pay regular fees to the home university and register in a course but pay no fees to the host university. The home university will accept the grade reported by the host university and will grant appropriate course credit on the student's program. Student awards will not be affected by this procedure.

Forms for this procedure may be obtained from the University Graduate Office in Needles Hall or the School Graduate Office.

An Evaluation and Restructuring of the Master's Program at the Natural Resources Institute

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UNIVERSITY OF MANITOBA
Zoology Department

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Appendix II - Zoology Graduate Courses.

(a) Course Offerings

Ancillary Courses

The following (half or full) Honours courses may be taken for ancillary credit: 437, 440, 447, 448, 457, 458, 460, 466, 467, 468, 471, 472, 473, 474, 476, 477, 478, 479, 480, 481, 482, 483.

22.707 Advanced Parasitology (6) The methods of descriptive and experimental parasitology are considered in lectures, seminars, and laboratories and related to contemporary parasitological problems. Prerequisite: 346 or consent of instructor.

22.714 Advanced Physiology (6) A study in depth of topics selected from the physiological research interests of the Department.

22.716 Animal Ecology (6) Detailed examination of special ecological subjects and assignments of special research projects.

22.723 Advanced Topics in Zoology (6) A seminar on current research topics in Zoology.

22.726 Ichthyology (3) This course deals with the biology of fishes, their identification and classification. Second term. Prerequisite: 250 (or former 227).

22.727 Problems in Evolution (3) Lectures, seminars, and research in selected topics of biological evolution with emphasis on selected mechanisms. First term.

22.730 Advanced Embryology (6) A detailed course in primary and secondary inductive processes during organogenesis, growth regulatory mechanisms, and experimental techniques. Prerequisites: 230 and 466 or consent of instructor.

22.731 Selected Topics of Animal Behavior (6) Assigned projects, seminars, and discussions designed to familiarize advanced students with topics of current interest in animal behavior. Prerequisite: 448 or consent of instructor.

22.732 Nematology (6) Lectures cover the morphology, taxonomy, physiology, and ecology of the nematodes. Laboratories concentrate on techniques of identification and culture. Prerequisite: 260 (or former 341).

22.734 Problems in Developmental Zoology I (3) A seminar and lecture course dealing with current advances in the field of zoology. No laboratory. First term. Prerequisite: By consent of instructor.

22.735 Problems in Developmental Zoology II (3) A seminar and lecture course dealing with current advances in the field of zoology. No laboratory. Second term. Prerequisite: By consent of instructor.

22.736 Problems in Biological Statistics (3) The course discusses statistical problems and techniques which specially apply to biological research. Laboratory exercises will be based primarily on examples from field research. First term. Prerequisite: 5.221 and 5.333 (or equivalent) and consent of instructor.

22.738 Advanced Limnology (6) The biological productivity of lakes. A seminar and tutorial course given with the help and co-operation of scientists in the Freshwater Institute and the Department of Botany. Prerequisite: 350 or equivalent (or former 470).

22.739 Advanced Mammalogy (6) Lectures and seminars on mammals, their evolution, physiology, and ecology.

22.740 Biological Resource Management I (3) A survey of the principles of ecology in relation to renewable resources, with emphasis on ecosystem concept ecological homeostasis, and energy flow. Open to students of the Natural Resources Institute or by consent of instructor.

22.741 Biological Resource Management II (3) Examination of natural resource management practices, in discussions with resource managers. Open to students in the Natural Resources Institute or by consent of instructor. Prerequisite: 740.

22.742 Advanced Ornithology (6) Detailed examination of special ornithological subjects and assignments of research projects and seminars. Prerequisite: 468 or consent of instructor.

Not all courses may be offered each year. Check with the Zoology Office and Current Calendar.