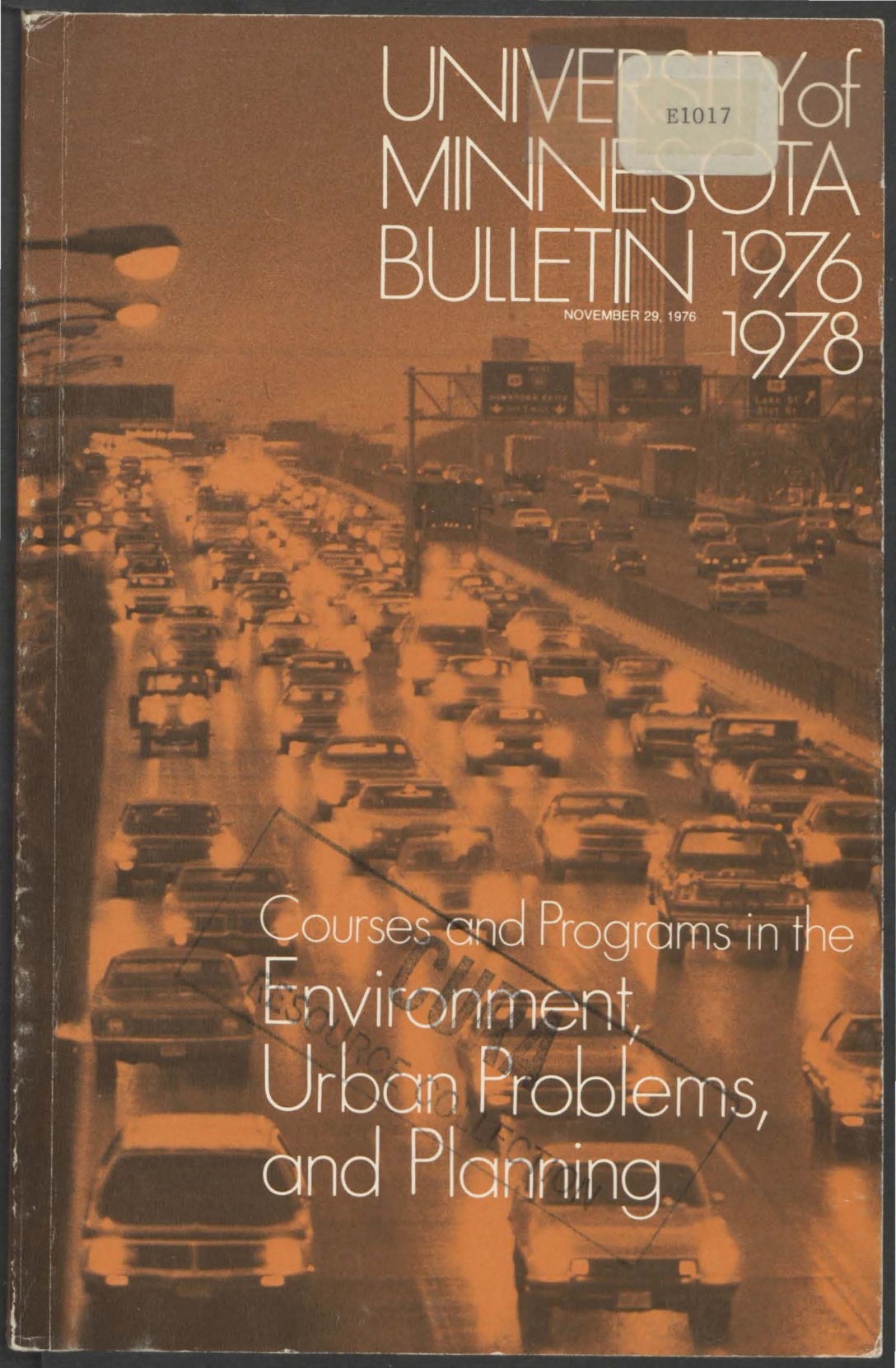
UNIVERSITY of MINNESOTA BULLETIN 1976 1978

NOVEMBER 29, 1976



Courses and Programs in the Environment, Urban Problems, and Planning

UNIVERSITY OF MINNESOTA

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Volume LXXIX, Number 18 November 29, 1976

UNIVERSITY OF MINNESOTA BULLETIN

Published by the University of Minnesota, Office of Admissions and Records, 105 Morrill Hall, 100 Church Street S.E., Minneapolis, Minnesota 55455, monthly April, May, June, October, four times in November, semimonthly January, March, August, and five times in July. Second-class postage paid at Minneapolis, Minnesota. Send change of address notices and other communications to Office of Admissions and Records.

Courses and Programs in the Environment, Urban Problems, and Planning

UNIVERSITY OF MINNESOTA

How To Use This Bulletin

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SECTION II describes offerings at the Minneapolis and St. Paul Campuses in the following sections: Programs; Subject Index; Course Descriptions; Special Centers and Services; and Libraries.

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SECTION IV describes offerings at the Morris Campus.

SECTION V describes offerings at the Crookston Campus.

SECTION VI describes offerings at the Waseca Campus.

SECTION VII lists contributing faculty.

Course Numbering

1000 to 1998—open to freshmen and sophomores

3000 to 3998—open to juniors and seniors

5000 to 5998—open to juniors, seniors, and graduate students

8000 to 8998—open to graduate students only

A final digit "0" identifies courses which may be repeated.
The number "970" indicates "directed study."

Course Abbreviations and Symbols

Departmental prefix—abbreviation indicating name of department (e.g., Geog for Geography)

Course number—four digit figure denoting the course (e.g., 5002)

*—courses in which graduate students may prepare Plan B projects

†—all courses preceding dagger must be completed before credit will be granted for any quarter of the sequence

§—credit will not be granted if equivalent course listed after section mark has been taken for credit

¶—concurrent registration allowed with course listed after paragraph mark

♯—consent of instructor is required for registration

△—consent of department or school offering the course is required for registration

f,w,s,su—following a course number indicate fall, winter, spring, or summer quarters

Students should consult the *Class Schedule* each quarter to learn the hour and place specific courses are offered.

Courses and Programs in the Environment, Urban Problems, and Planning

I. GENERAL INFORMATION

This bulletin differs from other University bulletins in that it does not describe the courses and programs in a single college or school. Rather, it includes courses and programs relating to environmental studies, urban problems, and planning—insofar as they can be identified—in all colleges of the University of Minnesota.

In the broadest sense, a very large portion of the courses and programs at the University have implications for planning, environmental quality, or urban problems. It was, of course, necessary to set some limits on what would be included in this bulletin. Many arbitrary decisions were made. Some courses have probably been included that should not have been, and, likewise, some courses and programs have certainly been missed.

There is no "Department of Environmental Quality" or "Planning School" at the University of Minnesota. There is a Planning Program, which offers a Master's degree in planning, and an Urban Studies Program, which offers a Bachelor's degree. The details of these programs are described in Section II of this bulletin. There is also a degree program in urban studies at the University of Minnesota, Duluth. This program is described in Section III of this bulletin. Although there is no special degree program in environmental studies or environmental quality, several departments and colleges offer programs which include a primary concentration on the environment. These programs are also described in Section II.

Statement on Human Rights

The Board of Regents has committed itself and the University of Minnesota to the policy that there shall be no discrimination on the basis of race, creed, color, sex, age, or national origin. In adhering to this policy, the University abides by the requirements of Titles VI and VII of the Civil Rights Act of 1964, Revised Order No. 4, Executive Orders 11246 and 11375, Sections 799A and 845 of the Public Health Service Act, and other federal regulations and pertinent acts of Congress.

It is also the policy of the University of Minnesota not to discriminate on the basis of sex in its educational programs, admissions, activities, or employment policies as required by Title IX of the Education Amendments of 1972.

Inquiries regarding compliance may be directed to Lillian H. Williams, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, 100 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 55455, (612) 373-7969, or to the Director of the Office of Civil Rights, Department of Health, Education, and Welfare, Washington, D.C. 20201.

II. MINNEAPOLIS AND ST. PAUL CAMPUSES

PROGRAMS

This section of the bulletin lists the degree programs and other departmental or college programs offered on the Minneapolis and St. Paul Campuses. Degree and other programs offered at the Duluth, Morris, Crookston, and Waseca Campuses are included in their respective sections of the bulletin.

Planning Program

The School of Public Affairs (SPA) offers a master of planning degree and a planning concentration as part of the master of arts in public affairs (M.A.P.A.) degree. The following information pertains to the master of planning degree; the planning concentration within the M.A.P.A. degree program is similar. For further information, contact the Director, Planning Program, 909 Social Sciences Building, 267 19th Avenue S., University of Minnesota, Minneapolis, Minnesota 55455; (612) 373-2653.

OBJECTIVES

Planning is a field of study, not a discipline. It is a generic function which does not vary significantly whether it occurs in the public or private sector, at the federal or local level, or in the executive or legislative branch of government. While the product and the set of constraints which affect planning decisions are different in these varied areas, the process of planning is largely the same. The Planning Program attempts to teach this generic

process, and its variations, as it operates at the governmental level and in the public or private sector.

The major premise of the Planning Program is that planning must be viewed as an integral part of decision making. The planner is expected to advise on decisions in a variety of contexts, and to possess a basic understanding of the planning process—how decisions are made and where to intervene most effectively.

The Planning Program emphasizes the role of the generalist. Options for specialization are arranged within the School of Public Affairs and carried out through work in other units of the University.

Five major components comprise the Planning Program; the core, planning proseminars, planning concentration, summer internship, and workshop. These are designed, respectively, to give students an understanding of some of the basic concepts and tools of planning, to introduce them to the major subareas of planning, to allow them to investigate one type of planning in depth, to expose them to actual practice, and to integrate the classroom and practical experience.

MAJOR REQUIREMENTS

Students pursuing the master of planning degree or a concentration in planning as part of the master of arts in public affairs degree must fulfill the general requirements for graduate study as specified in the School of Public Affairs information booklet. This brochure is available from the School of Public Affairs, 909 Social Sciences, 267 19th Avenue S., University of Minnesota, Minneapolis, Minnesota 55455. In essence, the requirements for the degrees are the same as those described in the *Graduate School Bulletin,* with the following important exceptions:

1. A single integrated course of study is substituted for the traditional major and minor fields of work.
2. A minimum of 54 quarter credits of graduate work plus an arranged internship are required. The internship can be waived for individuals with relevant experience.
3. Students complete the Master's degree under the Graduate School's Plan B option. Plan B project requirements may be satisfied by:
   a. Preparing one policy analysis or research project which may be in conjunction with, or independent of, the courses in the student's program, and developing a portfolio of written or other communicative efforts that meet the objectives of the Plan B project concept.

      or by

   b. Preparing two policy analyses or research projects which may be in conjunction with, or independent of, the courses in the student's program.

   Project possibilities include:

   (1) Papers completed in conjunction with specific courses.
   (2) Projects prepared independently of specific courses. In this case students must provide a brief description or title of each proposed project on the Plan B program form when submitted for approval.
   (3) A portfolio of written or other communicative efforts.

Students fulfill all other requirements of the Planning Program as outlined below.

Planning Proseminars—In addition to the SPA core (described in the SPA information booklet) which is required of all SPA students, planning students must take four proseminars. These are 2-credit reading courses, meeting for about 2 hours a week, which are designed to introduce students to the basic ideas in key planning areas. The following proseminars will be offered in 1976-77: planning theory, comprehensive planning—fall quarter; regional planning—winter quarter; comparative planning, social planning—spring quarter. Additional proseminars are planned.

Students may take the required proseminars in the first or second year, although it is desirable to take most of them during the first year to aid in choosing concentrations and to allow more time for concentrations in the second year.

Concentration—The following planning options are now available or are in process of development: comprehensive planning or generalist; human services and social planning; environment and resource management; transportation (to be expanded to include all physical infrastructure); land development and land use; housing; urban design including the built and landscape environment.

Comprehensive Planning or Generalist Option—This is the most commonly elected option. It focuses on techniques of planning and programming to handle spillovers or make trade-offs among jurisdictions, among functions, or among individual firms or interests. This option is designed as preparation for planning positions involving general development strategy, resource allocation, and budgeting.

Human Services and Social Planning Option—These two areas are combined because they are closely related and allow the development of a broad and generic specialization. Comprehensive health planning and criminal justice planning courses will be incorporated within this option in the future. Study in social planning and human services is oriented toward planning for people and for the delivery of social services.

Environment and Resource Management Option—This specialization embraces the more traditional field of resource management (managing water resources, forest and agricultural lands) and also the more recent field of residuals management (managing environmental pollutants). Energy and energy policy will also be incorporated because these issues are inextricably related to this area of specialization.

Transportation, Communication, and Utilities Option—This specialization involves planning, programming, financing, and integrating networks of facilities that support land development. As funds will continue to be in short supply for these facilities in the foreseeable future and as all levels of government begin to use more rigorous management techniques to hold down capital costs in the face of decreasing capital availability, this field should have growing interest.

Land Development and Land Use Option—This specialization incorporates work dealing with land use (geography, agricultural economics, and planning) with work dealing with the land development process. It treats the full geographic scale of land development control and includes state as well as local strategies. This option is intended for people who may work either for private developers or for governments dealing with development management.

Housing Option—This option addresses housing from a variety of standpoints—federal and state programs, regulation, finance, and design.

Urban Design Option—This option is being developed with the School of Architecture and Landscape Architecture. Training in architecture or landscape architecture is required for many of the courses offered.

Internship, Workshop, Fieldwork—Planning students must complete a 3-month internship between the first and second years of study (this requirement may be waived for persons with relevant experience). They are also required to take the Planning Workshop in the second year of study. In addition, students may earn credit for various types of fieldwork.

SPECIFIC PROGRAMS

The course listings in this bulletin include many areas appropriate for planning students. Candidates for a planning degree must work out a specific program with a Planning Program adviser.

Environmental Programs

INSTITUTE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

The institute is composed of the Colleges of Agriculture, Forestry, and Home Economics, the Minnesota Agricultural Experiment Station, the Minnesota Agricultural Extension Service, and the Office of International Agricultural Programs. The institute supports the teaching, research, and extension programs of these units but does not offer a degree program itself.

COLLEGE OF AGRICULTURE

Agricultural science deals with the interrelationships of people and their environment in the areas of conservation, food production, environmental design, and environmental management. Students examine the relationships between air, water, plants, animals, soils, and humans in natural and modified environments. Graduates have been employed in educational, management, or planning positions with governmental agencies and private businesses involved in resource and environmental management.

The College of Agriculture is comprised of six curricular areas in which 22 majors are offered. The college's degree programs are administered through its 12 departments. Programs with an environmental focus are described briefly below, by department or curricular area.

Department of Agricultural Engineering—The Department of Agricultural Engineering offers two degree programs directly concerned with environmental problems. One program, offered jointly with the Institute of Technology, leads to the degree bachelor of agricultural engineering and provides opportunity for specialization in the areas of soil and water management and/or agricultural waste management (see *Institute of Technology Bulletin*).

The second program leads to the bachelor of science degree with a major in soil and water resource management. While administered by this department, study for this major is outlined in the resource and community development curriculum (see *College of Agriculture Bulletin*).

For more information about these programs contact C. L. Larson, 207 Agricultural Engineering, 373-1331.

Department of Entomology, Fisheries, and Wildlife—The degree programs in entomology, fisheries, and wildlife are designed to provide students with the basic training in the biological and physical sciences and related disciplines necessary for work in these professional fields. For further information see the college bulletin or contact L. D. Frenzel, 143 Hodson Hall, 373-1715; or T. F. Waters, 120 Hodson Hall, 373-1706. Students interested in insect ecology should contact H. C. Chiang, 212 Hodson Hall, 373-1713.

Department of Horticultural Science—The Department of Horticultural Science and the School of Architecture and Landscape Architecture jointly sponsor programs in landscape architecture. These programs are briefly described in this bulletin under Architecture and Landscape Architecture and are outlined completely in the *College of Agriculture Bulletin*. More information can be obtained from Peter Olin, 422 Alderman Hall, 373-1663.

Department of Soil Science—Students majoring in soil science may pursue an environmental emphasis in their program by choosing courses offered within the department that are of direct environmental interest. These courses

are listed in this bulletin and also in the *College of Agriculture Bulletin.* For more information, contact Russell S. Adams, Jr., 125 Soil Science, 373-1361.

Resource and Community Development—This curricular area offers programs of study leading to a Bachelor's degree in either the College of Agriculture or the College of Forestry. Majors are presently available in landscape architecture, recreation resource management, resource economics, and soil and water resource management. For more information consult the *College of Forestry* and *College of Agriculture Bulletins* or contact D. B. White, 456 Horticulture, 373-1609.

COLLEGE OF BIOLOGICAL SCIENCES

The departments and program units in the College of Biological Sciences include: Biochemistry, Biology, Botany, Ecology and Behavioral Biology, Genetics and Cell Biology, and Zoology. The college is also administratively responsible for the Lake Itasca Forestry and Biological Station, the Cedar Creek Natural History Area, the James Ford Bell Museum of Natural History, the Freshwater Biological Institute, and the Dight Institute of Human Genetics. Detailed program information can be found in the *College of Biological Sciences Bulletin.* Each department of the college offers an independent study course option. For additional information contact the coordinator of student services, P190 Kolthoff Hall, 373-3648.

COLLEGE OF EDUCATION

The College of Education offers some opportunity for students to prepare to teach environmentally related courses and programs. Portions of methods courses and workshops in biological education, social studies education, and elementary education are devoted to certain aspects of environmental studies. Further details can be obtained from the appropriate contact people: Roger Johnson (elementary education), 242 Burton Hall, 373-5793; Eugene Gennaro (science education/secondary), 370 Peik Hall, 373-3305; and James Mackey (social studies education/secondary), 166 Peik Hall, 373-9721.

COLLEGE OF FORESTRY

A forest science major is designed to provide students with the broad foundation in the biological and physical sciences and related disciplines necessary for work in this professional field. Options for specializations are available in the Departments of Forest Resources and Forest Products. For further information consult the college bulletin or contact K. W. Winsness, 12 Green Hall, 373-0842.

Forestry Technician Course—This program, a joint venture of the college and the University's North Central School and Experiment Station at Grand Rapids, Minnesota, was begun in 1958. The intensive course work, offered at Grand Rapids, consists of 960 hours of instruction in both classroom and field laboratory, and is divided into 2 terms of 3 months each. The first term is held from October through December, the second from January through March. For further information contact William Matalamaki, Superintendent, North Central School and Experiment Station, Grand Rapids, Minnesota 55744.

GENERAL COLLEGE

The General College offers a course package which is a problem-centered, team-taught, interdisciplinary study of environmental problems. This "package" is 1 academic quarter in length and is taught via field studies, seminars, field trips, and formal contact between students and staff. Course work emphasizes individual and small group off-campus investigation and reporting. Approximately 40 students may register for 16 credits in the four courses which comprise the package: GC 1921, 1922, 1923, and 1924. The credits are split between the natural sciences, social sciences, communications, and humanities.

More information can be obtained from A. B. Johnson, 116 Folwell Hall, 373-3723 or 373-3719.

HEALTH SCIENCES

Division of Environmental Health—The programs in environmental health have been offered in the School of Public Health since 1935. They are designed to cover the many health aspects of environmental control and to develop broad-based knowledge to prepare graduate students for responsible planning and direction of environmental programs. Programs of graduate study leading to the M.P.H. (master of public health), M.S., and Ph.D. degrees are available. The course of instruction leading to a Master's degree requires a minimum of 11 months of study, beginning with the second term of summer session (about July 15) preceding the regular academic year. Course work is available in such areas as air pollution, institutional environmental health, radiological health, occupational health, water hygiene, liquid and solid wastes, food hygiene, environmental biology and microbiology, injury control, administration, or general sanitation. Students may either specialize in a particular topic area or make a broad selection from all the courses available.

For more information consult the *Graduate School Bulletin*, the *School of Public Health Bulletin*, or Rexford D. Singer, 1160 Mayo, 373-8080.

Family Planning Administration—Family planning and population studies require skills and expertise from many disciplines. A broad range of University resources—clinical, laboratory, and didactic—is available for teaching these skills. This graduate program, which leads to a Master's degree in family planning and population studies, brings together such resources from the Department of Obstetrics and Gynecology, the Medical School, the School of Public Health, the Department of Sociology, and other units of the University. The program is designed to train personnel to establish, administer, and operate family planning programs as well as to prepare individuals to administer individual programs such as those that are part of OEO-funded community action agencies, HEW-funded agencies, Planned Parenthood affiliates, etc. In addition, the program is designed to meet the needs of students who wish to pursue careers in family planning research. The courses developed to meet the needs of this program are open to other interested students who find the course content useful for their disciplines.

More information on this program can be obtained from Dr. Harry Foreman, 4208 Powell Hall, 373-9656.

Department of Pharmacology—The graduate program of the Department of Pharmacology enables students to investigate certain aspects of toxicology. In many instances this investigation of research problems may be directly

concerned with environmental problems. For information about the pharmacology graduate program contact Dr. Frederick E. Shideman, 105 Millard Hall, 373-3085.

COLLEGE OF HOME ECONOMICS

Much of the subject matter in the broad field of home economics deals with aspects of the near environment of individuals and families: shelter and furnishings, food and nutrition, clothing and textiles, as well as the social environment created through human relationships.

Undergraduate programs in the college are interdepartmental in nature and provide opportunities for students with special interests in environmental problems. Students may develop a concentration with an emphasis on environmental issues, concerns, and/or policy as part of the usual B.S. degree requirements for some of the college programs (i.e., consumer food science, general home economics, family relationships, housing, or textiles and clothing).

Specific courses dealing with aspects of the environment are offered in the College of Home Economics by the Departments of Design, Family Social Science, Food Science and Nutrition, and Textiles and Clothing. More detailed information may be obtained from Natalie Gallagher, coordinator of undergraduate programs, or other staff in the college office, 212 McNeal Hall, 373-0933.

Housing—The housing program provides a multidisciplinary sequence of educational experiences in the study of family and individual needs and problems. Building upon courses offered within the College of Home Economics and pertinent courses offered by other units of the University, the curriculum provides a choice of three options: business and commerce, social service, and design. Within each option students may direct their choices toward specific career requirements. In addition, by careful planning of the collateral sequence, field experiences, and free electives, students may acquire further depth in a particular area of interest.

Students graduating from this program may work with public agencies concerned with housing at the local, state, or federal level; with private companies; with utility companies; or with design firms or contractors. The social service option is designed to prepare students for community service in housing relocation. Specific requirements for this program are outlined in the college bulletin, and further inquiry can be made of Lura M. Morse, 231 McNeal Hall, 373-1542.

COLLEGE OF LIBERAL ARTS

Department of Geography—This department provides a program for geography majors who wish to orient their program toward studies of the physical environment. For further information consult Professors Barrett, Brown, Gersmehl, Skaggs, Squires, or Tuan through the departmental office, 414 Social Sciences Building, 373-2661.

Interdepartmental Majors—Students who wish to design a major program in an environmental area may do so by consulting an adviser in the interdepartmental majors office. Course work for such majors, leading to the B.A. degree, is interdisciplinary in nature. These majors resemble formalized major sequences in balance, unity, and areas of concentration, but cut

across departmental lines and usually require more credits. The degree requirements are substantially the same as those for other B.A. programs in CLA.

Illustrative of the kind of program that might be devised, for example, is one that would combine courses in such life sciences as biology, ecology, and zoology with courses in other disciplines such as anthropology, chemistry, and geography. A major program focusing on the environment and society might include work in the life sciences, anthropology, geography, and the social sciences.

Additional information may be obtained from the Office for Interdepartmental Majors and Programs, 114 Johnston Hall, 376-3030.

Interdepartmental Courses—The interdepartmental directed studies course, ID 3970 (3 to 15 credits), may be used by any University student to design an individual project in an environmentally related area. Students register in the Office for Special Learning Opportunities (OSLO), 201A Wesbrook Hall, and plan their project with an OSLO adviser and two or more instructors. Staff members in the OSLO office (373-7550) can provide more information.

School of Public Affairs—A program in technology planning exists within the School of Public Affairs. Students pursuing a master of arts degree with a major in public affairs may choose a concentration in technology planning with emphasis on environmental policy. The master of arts curriculum in public affairs consists of an internship and 54 credits of graduate work, the latter being comprised of required courses (18 credits), two areas of concentration (at least 12 credits each), and electives. Students work under the Plan B option.

The technology planning program is based on the realization that technological innovation is one of the major forces in the restructuring of society, that new technologies frequently carry with them the risk of profound social and environmental change, and that effective accommodation to such risk is a vital part of the policy process. Accepting this and assuming that a traditional function of the University is to serve as a societal monitor, the program is structured to include: research on the societal and environmental impacts of technologies, the application of research to the policy process, and a series of descriptive courses and seminars which examines the relationships between policy, technology, and institutions.

Students wishing to take their internship in an area related to technology planning are encouraged to work with public interest law firms, environmental or consumer groups, or one of the several governmental agencies having substantial involvement in technology.

Inquiry about this degree program should be directed to D. E. Abrahamson, 967 Social Sciences Building, 373-7796.

INSTITUTE OF TECHNOLOGY

Department of Aerospace Engineering and Mechanics—As one of several program options in aerospace engineering and mechanics, students may select a concentration in environmental and biological systems. More information can be obtained from A. S. Berman, 119B Aeronautical Engineering, 373-2164; or Professor G. S. Beavers, 101 Aeronautical Engineering, 373-5010.

Department of Agricultural Engineering—See description under College of Agriculture.

School of Architecture and Landscape Architecture—The architecture and landscape architecture programs are of direct environmental interest. The four degree programs offered by the School of Architecture and Landscape Architecture are the bachelor of environmental design, bachelor of landscape architecture, bachelor of architecture, and master of architecture. Further information can be obtained from the *Institute of Technology Bulletin* or from L. LaVine, 110 Architecture, 376-4525.

Department of Chemical Engineering and Materials Science—The department offers an environmentally oriented program in ecochemical engineering. For information about this program contact H. Tsuchiya, 251 Chemical Engineering, 373-2306; or A. Frederickson, 431 Chemical Engineering, 373-2312.

Department of Civil and Mineral Engineering—The Department of Civil and Mineral Engineering offers specializations in several areas of environmental concern: environmental engineering, mineral engineering, surveying and land use planning, transportation, and water resources. During the junior and senior years, four or more courses are taken in the area of specialization and one or two in several of the other areas. Graduate study and research in environmental engineering focus on the water environment; course offerings and research in aquatic chemistry and pollution abatement technology emphasize measurement dispersion, transformations, and modeling of trace contaminants.

Environmental Intern Program—The Center for Studies of the Physical Environment sponsors an environmental intern program to give interested undergraduate students direct experience in working with state and local agencies on ongoing or new programs in environmental protection and conservation. Participating agencies include, but are not limited to, the Minnesota Pollution Control Agency, the Department of Natural Resources, the Department of Agriculture, the Highway Department, the Metropolitan Council, the State Planning Agency, and the Department of Economic Development. This program involves employment of a student, without salary, for a minimum of 1 academic quarter; the student can register for a full quarter's academic credit (15 credits). Each student works closely with a faculty adviser. For more information contact Walter Maier, 296 Experimental Engineering, 373-2517 or 373-2968.

Department of Mechanical Engineering—This department offers work in environmental engineering with emphasis on air pollution, energy utilization, and emission studies. The environmental engineering staff offers courses in particle technology, air quality and conditioning, contaminant control, and thermal environmental engineering. Course work is designed to provide a basic preparation for entry into such areas as the heating, ventilation, and air conditioning industry; air pollution measurement and control activities at the local, state, and federal levels; and the manufacturing of pollution control equipment.

Interdisciplinary Programs—A number of interdisciplinary programs which emphasize environmental areas are described in a booklet entitled *Some Examples of Undergraduate Interdisciplinary Programs Available in the Institute of Technology.* Programs described in this booklet include the following areas: acoustics, agricultural wastes and ecosystems, architecture and environmental design, energy systems, environmental engineering, and transportation. Copies of the booklet are available for inspection only in 105 Lind Hall.

UNIVERSITY COLLEGE

The name University College means many things to many people because under this single rubric are several degree-granting units, each of which has its own particular set of goals and procedures. This unusual situation of "colleges within a college" is the result of University College's unique mission within the larger University of Minnesota system: to house undergraduate experimental programs of collegiate scope. By their nature, therefore, University College's specific programs are experimental and not permanent features in the college (with the exception of the Inter-College Program). From year to year new programs may be added, and programs which have completed their experimental phase may transfer to some other auspices. Presently University College has four degree-granting programs: the Inter-College Program, University Without Walls, University Scholars, and the Foreign Studies Degree Program.

When no other address is given in the following descriptions, more information about the program can be obtained from the University College office, 105 Walter Library, 373-4638.

The **Inter-College Program (ICP)** is a traditional program which has no fixed curriculum and allows students to draw from the entire University for their courses. Its purpose is to provide flexibility in the educational program of the undergraduate who finds none of the standard curricula of the other schools and colleges suited to his or her particular interests or objectives. Each candidate arranges a program of study which includes suitable amounts of work in two or more colleges of the University. Upon completing this approved program the student is granted either a B.A. or B.S. degree. An applicant for admission should be at least a third-quarter sophomore who has completed a minimum of 1 full quarter, or its equivalent, at the University of Minnesota. Additional information is available at 321 Walter Library, 376-1253.

University Without Walls (UWW) is oriented toward the self-directed student who has clear educational objectives but who has met barriers in the attempt to participate in traditional undergraduate programs. UWW serves students who are geographically isolated, physically handicapped, restricted by responsibilities or financial obligations, or who face other insurmountable problems. Students are encouraged to pursue their educational goals through nonconventional formats and activities.

UWW does not offer classes of its own; students typically develop a project proposal for each learning activity which is designed to answer questions relevant to their area of interest. UWW students may register for regular courses offered by the University.

UWW, like Experimental College, evaluates student work in narrative form, rather than through grades or credits. The B.A. or B.S. degree granted by this program is based, therefore, not upon the traditional 180 credits and standard GPA, but rather upon a demonstrated competency in the area the student has chosen to pursue.

Additional information is available at 201 Wesbrook Hall, 373-3919.

The **University Scholars Program** allows a student and faculty adviser the freedom to construct a baccalaureate degree program based on individually tailored educational goals and learning experiences, which may include travel, internships, independent reading and research, as well as traditional classroom instruction. The program is directed toward students whose needs are not met by the University's current degree offerings. It is open to any Uni-

versity of Minnesota student who has completed 2 years of college. A student must be nominated for the program by a faculty member who agrees to serve as the student's adviser in the program, supervising and assessing the academic work.

The **Foreign Studies Degree Program** is a pilot program which encourages students to include overseas study in their undergraduate curriculum. Major components of the program include: language study, cultural-geographic area studies, overseas study (at least 1 quarter in duration), orientation and re-orientation seminars related to the overseas study, and a major concentration. Students may choose courses from any units of the University in order to meet these requirements. The major concentration can be an individually designed major in University College or an existing major in another college of the University. Students may also participate in the Foreign Studies Degree Program while maintaining enrollment in any other college of the University.

Other Options—University College makes available to students regularly enrolled in any undergraduate college of the University of Minnesota an opportunity for independent study when intercollegiate in nature. A student may earn from 3 to 15 degree credits registering for independent study projects under UC 3075. The student designs his or her own project and works with an appropriate faculty member who supervises and evaluates the project.

UC also sponsors a variety of pilot experimental programs and cross-college course work. A Degree by Examination Only pilot program is currently in the planning stages. Further information about any of these programs may be obtained from the University College.

Urban Studies Program

Students who wish to explore the city as a field of study may find the breadth of a cross-disciplinary major in urban studies particularly well-suited to their needs. This major offers fieldwork experiences, special interdisciplinary urban studies courses, and an opportunity to sample courses in several urban-oriented disciplines. Three degree programs are available: a general B.A. program that provides students with a broad survey of urban-oriented disciplines; a B.S. program that emphasizes quantitative skills, fieldwork, and/or internship experience; and a B.A. degree preparatory for graduate work in one of the contributing disciplines of urban studies.

Since urban studies course offerings vary significantly from quarter to quarter, interested students must contact the Urban Studies advising office, 952 Social Sciences Building, for information about them prior to the start of each quarter. Most urban studies courses have limited enrollments, and all require the permission of the instructor to register.

MAJOR REQUIREMENTS

Although each student develops an individual plan of study, the three degree programs share certain requirements as described below.

Urban Studies Colloquia (S-N only) of 2 credits each are usually offered each quarter. They are designed to introduce students, in a small discussion setting, to the multiplicity of perspectives involved in the analysis of a complex urban problem. The colloquia, stressing an interdisciplinary viewpoint, enable students to integrate the theory and practice of such issues as urban and regional planning, public decision making, and housing policy development. Students register for the colloquia under UrbS 3101, 3102, and 3103, during fall, winter, and spring quarters respectively. Students may register for more than one colloquium in a quarter, but this is not recommended. The colloquia are typically completed before the end of the junior year.

Urban Studies Seminars of 2-4 credits each are intended to provide in-depth examination of topics bearing on the urban environment. These might include an examination of a particular period of urban history, the anthropological process in neighborhood analysis, the impact of alternative futures. Typically the seminars are offered by collegiate units outside of the Urban Studies Program, and their departmental prerequisites must be met before registering. Seminars are usually taken during the junior or senior year.

Urban Studies Workshops of 4 credits each give students a chance to participate in project-focused fieldwork and regularly scheduled group discussions, linking theory to practice in both settings. Topics have included such areas as urban economics, immigration, local history, planning, and arts in the city. Students register for workshops under UrbS 3500. Students may register for more than one workshop in a quarter, but as with colloquia, this is not recommended. Occasionally courses offered in other departments or programs also satisfy the workshop component, but program advisers must approve any substitution before registration.

Fieldwork takes students outside the classroom as an essential part of their educational experience. Credit for fieldwork is arranged and may be earned in several ways. Those pursuing the B.S. degree are required to fulfill this program component via an internship which is described below. Those in the B.A. programs may complete an internship for their fieldwork experience,

or may select other options including: registration in an approved fieldwork course; directed study registration endorsed by the Urban Studies Program Committee; or registration for extra credit in a course in which a field project serves as an approved extension of the classwork.

Urban Studies Internships, credit arranged, are required only of students in the B.S. degree program, although those in the B.A. programs may also register for them. The internship is a job-related experience designed to be of value to students from both an academic and a professional perspective. Typically students arrange their own internships in consultation with and with approval of the internship coordinator. An urban studies internship seminar is taken concurrently with the internship to provide an academic foundation for the overall experience. Students may earn a maximum of 6 credits per quarter for an internship, and no more than 12 credits total may be earned through internships.

To register for an internship students must be a junior or senior in the Urban Studies Program and must secure approval from the internship coordinator for the proposed experience, or must have completed at least one previous field experience. Interested students should consult with an urban studies adviser at least 1 quarter before the proposed internship is to begin.

Because many students find it convenient to fulfill the internship requirement during the summer, the internship seminar is offered during both terms of summer session.

Urban Studies Electives are offered annually by the various disciplines which contribute to the Urban Studies Program. Students choose courses to expand their perspectives and skills in areas fundamental to the field of urban studies. Because these courses are offered by many different departments they are subject to prerequisites and other regulations that are beyond the control of the Urban Studies Program. Students should thoroughly investigate all such requirements before completing their schedules.

Quantitative Skills Courses are offered each year by some of the contributing disciplines. Students in both B.A. programs must fulfill this requirement by selecting courses which complement their major interest. Courses should be chosen in sequence from a particular discipline; for example, a student in the B.A. general program interested in sociology might take Soc 3801, Descriptive Statistics, and then Soc 3802, Statistical Inference.

Students in the B.S. program should choose two courses related to their disciplinary concentration and one additional course that complements it.

As with urban studies electives, students taking skills courses must meet the prerequisites of the various departments offering the courses.

A Disciplinary Concentration is required in the B.A. degree program preparatory for graduate work and in the B.S. degree program. While the degree of specialization does not equal that of a disciplinary major, it is sufficient to approach the breadth of study which is a hallmark of the urban studies major. Students should make sure they meet the departmental requirements for these courses before registering.

The following areas have been approved by the Urban Studies Program for use as disciplinary concentrations:

- anthropology
- architecture
- business administration
- economics
- geography
- history
- journalism and mass communication
- landscape architecture
- political science
- psychology
- social work
- sociology
- speech-communication

The Urban Studies Program has selected these disciplines because most graduate and professional schools require that prospective students demonstrate knowledge of a concentrated and methodologically structured field of study. In choosing a disciplinary concentration, students are assigned a faculty adviser from that discipline, who will also be a member of the Urban Studies faculty; this person will then serve as the student's major adviser for urban studies.

These components, combined in various proportions, comprise the three urban studies degree programs. The number of credits required in the component areas for each degree program is listed below:

B.A. General Program	*Credits*
Colloquia	4
Advanced seminars or workshops	8
Fieldwork	4
Urban studies electives	24
Quantitative skills courses	8
Total credits specified	48

B.A. Program Preparatory for Graduate Work	
Colloquia	4
Advanced seminars or workshops	8
Urban studies electives	8
Quantitative skills courses	8
Disciplinary concentration	24
Total credits specified	52

B.S. Program	
Colloquia	4
Advanced seminars or workshops	8
Internships (S-N only)	12
Urban studies electives	8
Quantitative skills courses	12
Disciplinary concentration	20
Total credits specified	64

Students should note that in all degree programs no course may be used to fulfill more than one degree requirement and that 75 percent of the credits applied toward the requirements must be taken under the A-N grading system. Also, all CLA degree requirements, as specified in the *CLA Bulletin*, govern these major programs.

URBAN STUDIES HONORS PROGRAM

Students with an outstanding academic record may become a candidate for graduation with honors. Students must have completed 90 credits and must have earned grades of A in at least half of these credits for admission to the Urban Studies Honors Program. Other requirements are listed below. Students who feel they are eligible should see the faculty adviser for urban studies honors.

Urban studies honors students must:

1. complete at least 2 quarters in a single upper division seminar or proseminar in a related discipline; this is in addition to the normal 8-credit workshop requirement.
2. complete UrbS 3950, Honors Seminar, or an appropriate alternative approved by the program coordinator.
3. submit a thesis on an interdisciplinary topic for evaluation by three faculty members from at least two approved disciplines.

CONTINUING EDUCATION AND EXTENSION

The Urban Studies Program also offers courses through Continuing Education and Extension. For information about these courses consult the *Extension Classes Bulletin.*

For further information on courses and program requirements, contact:

Urban Studies Program
959 Social Sciences
267 19th Avenue S.,
University of Minnesota
Minneapolis, Minnesota 55455
(612) 373-2612

Richard Nigro
Dana Noonan
Urban Studies Program Advisers
952 Social Sciences
267 19th Avenue S.,
University of Minnesota
Minneapolis, Minnesota 55455
(612) 373-4613

Prof. John S. Adams
Coordinator, Urban Studies Program
956 Social Sciences
267 19th Avenue S.,
University of Minnesota
Minneapolis, Minnesota
(612) 373-2612

SUBJECT INDEX

This section contains a subject index of environmental, planning, and urban affairs courses. While some courses are obviously found in certain collegiate units—law courses which relate to environmental matters in the Law School, for instance—there are general subject areas for which there is no corresponding department. For example, courses dealing with various aspects of air pollution or meteorology/climatology are found in several departments. This subject index identifies such topical areas and steers interested students to the appropriate courses in various colleges or departments.

All courses listed below are described in at least one other University bulletin. Students interested in exploring the full extent of degree programs and course offerings in a specific area should consult the appropriate college bulletin. Graduate-level (8xxx) courses are described only in the *Graduate School Bulletin.*

AIR

ChEn 5801. Air Pollution Control Engineering
FR 1101. Introduction to Air and Water Quality
GC 1111. Science in Context: Weather and Climate
PIPa 5110. Air Pollution and Its Effects on Vegetation
See also Departments of Environmental Health and Mechanical Engineering course listings

AMERICAN GOVERNMENT

BGS 3005. Government and Business
See Department of Political Science and School of Public Affairs course listings

CITIZEN PARTICIPATION/COMMUNITY, *see Minority Groups*

Afro 1036. Black Participation in American Politics
Afro 3091-3092. Development of a Black Political Strategy
Afro 3098. Community Power Structure and American Blacks
Pol 8323. Seminar: Community Power Systems
PubH 5057. Community Organization and Development
RCD 5110. Special Problems in Resource and Community Development
SSci 3103. The Meaning of Community
SW 3984. Introduction to Community Development
SW 8305. Community Development

CLIMATOLOGY, *see Meteorology/Climatology*

COMMUNICATION

See School of Journalism and Mass Communication and Department of Speech-Communication course listings

CONFLICT/CHANGE, *see Development Planning/Comparative Planning*

Anth 5151. Cultural Change and Development
Anth 5152. Anthropology of Social Movements
Soc 5301. Social Movements in a Changing Society
Soc 5311. Sociology of Conflict
Soc 5605. Urbanization and Social Policy

CONSUMER PROTECTION
- FScN 1010. Man's Food
- FScN 5120. Food Microbiology
- PubH 5213. Public Health Aspects of Toxic Products
- TexC 5622. Issues and Trends in Textile Consumer Protection

DESIGN, *see Housing*
- *See School of Architecture and Landscape Architecture course listings*

DEVELOPMENT PLANNING/COMPARATIVE PLANNING, *see Land Use*
- AgEc 3610. Community Resource Development
- AgEc 5630. Regional Development Systems
- AgEc 5790. World Food Supply Problems
- Anth 5153. Urban Anthropology
- Anth 5155. Anthropology and Social Issues
- BGS 3002. Business and Society
- BGS 3003. Business and the Physical Environment
- BGS 3019. Business and Society Topics
- Econ 8311-8312. Economic Growth and National Planning
- Geog 3377. The Development of Indigenous Markets in the Third World
- Geog 3378. Modernization and the Third World
- IntR 5804. Modernization, Equality, and Social Justice
- IntR 5901. Approaches to International Relations
- IntR 5902. Decision Making in International Relations
- IntR 5903. Analysis of International Policy Problems
- Pol 5771. Comparative Public Policy
- PubH 8752. Seminar: Comparative Health Care Systems
- RCD 5200. Community Development Simulation
- Soc 5415. Comparative Social Organizations
- Soc 5551. World Population Problems
- Soc 8308. Modernization and Social Conflict: A Cross-National Approach

ECOLOGY
- Anth 5116. Cultural Ecology
- CE 8550. Analysis and Modeling of Aquatic Environments
- Ent 5400. Experimental Ecology
- Ent 8300. Experimental Ecology Laboratory
- Ent 8305. Insect Ecology
- FR 1203. Introduction to Minnesota's Natural Resources
- FW 5451. Ecology of Fishery Populations
- FW 5561-5562. Wildlife Ecology, Management I and II
- GC 1112. Science in Context: Humanity and the Environment
- Geo 1013. Origin and Evolution of Life
- MicB 5611. Microbial Ecology
- Zool 5814. Natural History of Invertebrates
- Zool 5834. Field Ornithology
- Zool 5869. Physiological Ecology
- *See also Department of Ecology and Behavioral Biology course listings*

ECONOMICS, *see Development Planning/Comparative Planning, Land Use, Planning Methods*
- Anth 5115. Economic Anthropology
- PA 8204. The Public Economy
- *See also Departments of Economics, and Agriculture and Applied Economics course listings*

HISTORY-PLANNING/URBAN

Arch 1023. History of Environmental Development: Planning
Hist 3901-3902. American Urban History
Soc 5601. Urban Sociology

HOUSING, *see Planning Methods*

Arch 5139. Planning: Housing and Urban Services
ArtS 3136. Interior Design: Housing and the Urban Environment
Dsgn 5567. Housing Alternatives for the Family
Dsgn 5568. Housing Problems of the Family
PA 5505. Housing Policy

INSECTS AND INSECT CONTROL

See Department of Entomology, Fisheries, and Wildlife course listings

LAND USE, *see Development Planning/Comparative Planning*

GC 3292. Social Science: Special Topics; Geographic Perspectives of Urban Problems
Law 5201. Land Use Planning
PA 8521. Urban Development
Soil 5540. Soil Resources and Land Use
See also Departments of Agricultural and Applied Economics, and Geography course listings

LAW/PLANNING

Afro 5001. Law and Society: A Minority Point of View
Afro 5002. Law and Society: A Minority Point of View—Research
CJS 5106. Law and Social Issues
CJS 5113. Community-Based Corrections
CJS 5116-5117. Law, Justice, and the Individual in Society
EdAd 8225. Educational Policy and the Law
GC 1235. The Law and Society
Hist 5031-5032. A Social History of Anglo-American Law
Law 5113. State and Local Tax
Law 5208. State and Local Government
Law 5606. Administrative Law
PA 8511. Law and Urban Affairs
SSci 3601. Law and Society

METEOROLOGY/CLIMATOLOGY

GC 1111. Science in Context: Weather and Climate
Soil 1262. Introduction to Meteorology
Soil 5240. Microclimatology
See also Departments of Geography; Ecology and Behavioral Biology; and Physics course listings

MINORITY GROUPS

Afro 1036. Black Participation in American Politics
Afro 3091-3092. Development of a Black Political Strategy
Afro 5001. Law and Society: A Minority Point of View
Afro 5002. Law and Society: A Minority Point of View—Research
AmIn 3061. American Indian in the Modern World
AmIn 5121. Urban Indians in the United States

AmIn 5131. Industrialization, Employment, and the American Indian
Chic 1107. Introduction to Chicano Studies: The Chicano and Contemporary Society
Pol 5739. The Politics of Ethnic Communities
Soc 5951. Minority Group Relations
SSci 3503. Urban Crisis

NOISE

AEM 5687. Fundamentals of Acoustics
AEM 5688. Intermediate Acoustics
AEM 5689. Special Topics in Acoustics
Arch 3064-3065. Environmental Management and Control
CDis 5704. Noise and Hearing

ORGANIZATION THEORY AND BEHAVIOR

IR 3010. Human Relations and Applied Organizational Theory
IR 8004. Organizational Theory and Analysis
PsyF 8571. Psychology of Conflict Resolution
PsyF 8572. Organizational Development and Change
Rhet 5165. Studies in Organizational Communication, Conflict and Change

PLANNING METHODS

Arch 5137. Planning Urban Function and Structure
Arch 5138. Planning Theory and Methodology
Econ 5831. Cost-Benefit Analysis
Geog 5372-5373. Metropolitan Analysis I, II
Phil 5611. Philosophy of the Social Sciences I
Phil 5612. Philosophy of the Social Sciences II
Phil 8650. Seminar: Philosophy of the Social Sciences
Pol 8337. Seminar: Policy Evaluation
Soc 5611. Planning
Soc 8601-8602. Seminar: Research in Urban Sociology
Soc 8751-8752-8753. Seminar: Methods for the Evaluation of Social Action Programs
SW 3005. Social Work Processes: Methods of Intervention

PLANNING THEORY/URBAN THEORY

Arch 5137. Planning Urban Function and Structure
Arch 5138. Planning Theory and Methodology
Geog 5381. Services and Location Theory
Geog 5383. Transportation Geography
PA 5516-5517. Seminar: Social Theory and Social Planning I, II
PA 5550. Planning Proseminar
PA 5601-5602. Planning Theory Seminar
Phil 3302. Moral Problems of Contemporary Society
Phil 5321. Theories of Justice
Phil 5414. Political Philosophy
Pol 1041. Contemporary Political Ideologies
Pol 5663. Political Theory and Utopia
SW 8307. Theories of Social Planning and Social Welfare
See also Departments of Economics, Geography, and Social Work course listings

POLLUTION CONTROL
- AgEn 5810. Agricultural Waste Management
- AgEn 5910. Agricultural Waste Management Engineering I
- AgEn 5920. Agricultural Waste Management Engineering II
- CE 3500. Introduction to Environmental Engineering
- CE 5501. Analysis and Design of Waste Water Systems
- CE 5510. Solid Waste Management
- ChEn 5801. Air Pollution Control Engineering
- ChEn 5904. Special Topics in Pollution Control
- Law 5215. Environmental Regulation
- *See also Departments of Environmental Health and Soil Science course listings*

POPULATION
- AgEc 5790. World Food Supply Problems
- Soc 5551. World Population Problems
- Soc 5555. Population Theory
- Soc 5675. World Food Supply Problems

POVERTY/WELFARE
- SSci 3203. Structure and Dynamics of Poverty
- SSci 3205. Poverty, Insecurity, and Inequality of Opportunity
- SW 1001. Introduction to Social Welfare and Community Services
- SW 3101. Social Welfare: A Framework for Analysis
- SW 5101. Introduction to Social Policy: Social Welfare Perspectives
- SW 8307. Theories of Social Planning and Social Welfare

PUBLIC HEALTH, *see Environmental Health*

RADIATION
- *See Department of Environmental Health course listings*

RECREATION
- FR 5232. Management of Recreational Lands
- FR 5267. Recreation Land Policy
- GC 1178. Geology of the National Parks
- LA 5010. Principles of Outdoor Recreation Design and Planning
- LA 5105. Recreational Planning and Design I
- *See also Department of Education, Recreation and Park Administration course listings*

RESOURCES
- AgEc 3610. Community Resource Development
- AgEc 5130. Land Resource Use
- AgEc 5600. Land Economics
- AgEc 5620. Regional Economic Analysis
- AgEc 5630. Regional Development Systems
- AgEc 5650. Economics of Natural Resource Policy
- AgEc 5720. Economics of World Agriculture
- AgEc 8264. Resource Economics
- CE 5405. Hydrology
- CE 8415. Hydro and Thermal Power Development
- CE 8420. Water Resource Systems Planning
- FR 1201. Conservation of Natural Resources
- FR 5222. Forest Policy and Economics

GC 1113. Science in Context: Natural Resources, Their Utilization and Management
Geo 1007. Environmental Geology
Geo 1008. Geology and Man
Geo 1012. Earth as a Planet
Geo 1601. Marine Sciences
Law 5807. Seminar: Natural Resources—Conservation and Management
MinE 5630. Surface Mining Engineering
Rec 5160. Conservation of Natural Resources
Soil 5540. Soil Resources: Environmental Relationships
Soil 5550. Organic Soils

SOILS

EBB 5819. Soils and the Ecosystem
Geo 3101. Surficial Geologic Processes
See also Department of Soil Science course listings

SOLID WASTE

AgEn 5810. Agricultural Waste Management
Arch 3064-3065. Environmental Management and Control
CE 5510. Solid Waste Management
See also Department of Environmental Health course listings

SURFACE MINING

MinE 5630. Surface Mining Engineering
MinE 5660. Mine Environment and Ergonomics
MinE 5710. Environmental Aspects of Mineral Engineering

TECHNOLOGY, IMPLICATIONS OF

I of T 3101. Introduction to Environmental Technology
I of T 3301. Energy, Power, and Society
I of T 5931. Engineering for New Priorities
NSci 3101. Introduction to Environmental Technology
NSci 3301. Energy, Power, and Society
PA 5151. Energy and Energy Policy
PA 5152. Topics in Energy Policy
PA 5161-5162. Technology Planning
PA 5181. Policy Topics in Communication and Informational Technologies

TRANSPORTATION

CE 5210. Introduction to Transportation Planning
CE 8210. Seminar: Advanced Transportation Planning
Geog 5383. Transportation Geography
Tran 3054. Fundamentals of Transportation
Tran 5194. Government Promotion of Transportation
Tran 5195. Government Economic Regulation of Transportation

URBAN DESIGN/SITE PLANNING

Arch 8271-8272-8273-8274-8275-8276. Problems in City and Community Design
LA 1024. Landscape Theory
LA 5010. Principles of Outdoor Recreation Design and Planning
ME 5254. Design Morphology with Applications
ME 5255. Engineering Design Project
See also School of Architecture and Landscape Architecture course listings

WATER

AgEn 3410. Hydrology, Water Control
AgEn 3411. Current Topics in Water Resources
AgEn 3800. Rural Sanitation and Water Supply
AgEn 5540. Erosion Control, Watershed Engineering
AgEn 5550. Drainage and Irrigation Engineering
EBB 5601. Limnology
EBB 5602. Case Studies in Limnology
EBB 5812. Aquatic Ecology
EBB 5813. Topics in Limnology
Ent 5130. Aquatic Entomology
Ent 5131. Aquatic Entomology
FR 1101. Introduction to Air and Water Quality
FW 5454. Fishery Ecology in Polluted Water
Geo 1601. Marine Sciences
Geo 5611. Groundwater Geology
Geo 5642. Marine Geology
Soil 3218. Seminar: Soil Drainage and Irrigation
See *also Departments of Environmental Health, Civil and Mineral Engineering, and Geology course listings*

WILDLIFE

See Department of Entomology, Fisheries, and Wildlife course listings

COURSE DESCRIPTIONS

This section includes course descriptions and, in most instances, the name of an individual who is prepared to advise students desiring more information about the environmental, planning, or urban courses in a variety of departments. New courses are always being developed and old courses revised or dropped; hence this listing may not be totally complete or accurate.

Aerospace Engineering and Mechanics (AEM)

Institute of Technology

107 Aeronautical Engineering

CONTACT: *Environment*—

T. A. Wilson, 120 Aeronautical Engineering, 373-2169

5687. INTRODUCTION TO ACOUSTICS AND ENVIRONMENTAL NOISE. (4 cr; prereq Phys 1291, Math 3221 or equiv; 3 lect and 1 lab hrs per wk)
Derivation of the wave equation, plane wave solution, transmission and reflection at boundaries, resonators and mufflers, 3-dimensional wave propagation, properties of environmental noise sources, hearing and perception of sound, acoustic properties of rooms, sound and noise measurements and noise control techniques.

5688. INTERMEDIATE ACOUSTICS. (4 cr; prereq 5687; 4 lect-rec hrs per wk)
Intended for juniors, seniors, and graduate students, primarily those in aerospace, electrical, and mechanical engineering. Topics include: wave propagation in inhomogeneous media with application to atmospheric and underwater acoustics, propagation in ducts, Kirchoff solution to the inhomogeneous wave equation, radiation from moving sources including rotating machinery.

5689. SPECIAL TOPICS IN ACOUSTICS. (4 cr; prereq 5688)
Intended for juniors, seniors, and graduate students, primarily those in aerospace, electrical, and mechanical engineering. Selected topics of current interest to students and staff.

Afro-American Studies (Afro)

College of Liberal Arts

214 Social Sciences

CONTACT: *Planning*—

Geneva H. Southall, 214 Social Sciences, 373-7217

1036f,w,s. BLACK PARTICIPATION IN AMERICAN POLITICS. (4 cr)
Participation of the American Black in administrative, judicial, electoral, and confrontation politics in the United States.

3075f-3076w†. THE HELPING PROCESS: BLACK/NONBLACK. (4 cr per qtr; prereq ‡)
Tucker
Interpersonal relations and the impact of race within the educational and welfare systems. Interviews, role playing, situational exercises. Fieldwork optional.

3091w-3092s†. DEVELOPMENT OF A BLACK POLITICAL STRATEGY. (5 cr per qtr; prereq 1036 or Pol 1001 or Pol 1027 or # for 3091)
Political strategies developed by Black philosophers and activists, American and non-American.

3098s. COMMUNITY POWER STRUCTURE AND AMERICAN BLACKS. (4 cr)
Research seminar. Sources of power and influence in the community; relationships of power and its possessors in the Black community.

5001f,w. LAW AND SOCIETY: A MINORITY POINT OF VIEW. (5 cr; prereq Pol 1001 or #)
Ward
Afro-American history; American constitutional development as it relates to the American Black community.

5002s. LAW AND SOCIETY: A MINORITY POINT OF VIEW—RESEARCH. (5 cr; prereq 5001) Ward
(Continuation of 5001) Research seminar. Emphasis on a major scholarly investigation.

Agricultural and Applied Economics (AgEc)

College of Agriculture
231 Classroom-Office Building
CONTACTS: *Environment*—
J. Waelti, 231D Classroom-Office Building, 373-1604
Planning—
Wilbur R. Maki, 248 Classroom-Office Building, 376-3433

3610w. COMMUNITY RESOURCE DEVELOPMENT. (4 cr; prereq 1020-1030 or Econ 1001-1002 or #) Easter, Jensen
Basic concepts of resource use including physical and economic classifications; physical and economic feasibility; benefits and costs; external effects; cost sharing; selected resource use problems. Economic areas and units for planning and development; generating alternative program elements and developing consequences; problems in choosing elements for an optimum resource development program.

3710. AGRICULTURAL AND MARKET POLICIES. (4 cr; prereq 1400 or 3101, 3102 or Econ 3101, 3102 or #)
Analysis of public problems and issues concerning U.S. agriculture and the welfare of rural residents; economic problems of the food and fiber industry and of rural residents and communities; appraisal of past and present public programs; economic and social implications of alternative policies and programs; political decision making in policy formulation.

5130. LAND RESOURCE USE. (3 cr; not open to agricultural economics majors; prereq 1020, 1030) Waelti
Land as a factor in production; rural and urban utilization; rents and land values; land classification; taxation; exchange; public land management.

5600. LAND ECONOMICS. (4 cr for undergrad, 3 cr for grad; prereq 3101, 3102 or Econ 3101, 3102 or #) Raup
Land as a factor in production; land use, classification, and value; sale and rental markets for land; domestic and foreign land policies.

5610. INSTITUTIONAL FACTORS IN LAND USE. (4 cr for undergrad, 3 cr for grad; prereq 1020, 1030) Snyder
Public laws and administrative rules, public and private contractual arrangements, monetary and tax policies, public spending and legal procedures that affect land use and development.

5620. REGIONAL ECONOMIC ANALYSIS. (4 cr for undergrad, 3 cr for grad; prereq 1030 or Econ 1002) Hoyt
Basic concepts and theories used and problems encountered in economic study of subregions, including those applicable to space and planning, population and employment change, income estimation and social accounting, industrial location, identification of the planning region, intraregional and interregional analyses, planning goals, and national and regional planning programs.

5630. REGIONAL DEVELOPMENT SYSTEMS. (4 cr for undergrad, 3 cr for grad; prereq 1020-1030 or Econ 1001-1002) Maki
Regional subsystems in resource productivity cycle. Public service delivery subsystems. Public intervention strategics in environmental management. Settlement planning and resource development.

5650. ECONOMICS OF NATURAL RESOURCE POLICY. (4 cr for undergrad, 3 cr for grad; prereq 3101 or Econ 3101 or Econ 5151) Easter, Waelti
The application of economic analysis, including project evaluation, to current natural resource issues. Emphasis on conservation and resource scarcity, environmental quality, population growth and resource use issues and their implications for public policy.

5720. ECONOMICS OF WORLD AGRICULTURE. (4 cr for undergrad, 3 cr for grad; prereq 1020, 1030 or #) Raup
Distribution, quality, and utilization of agricultural resources, agricultural organization and structure; location of agricultural activity; national and international agricultural policies.

5790. WORLD FOOD SUPPLY PROBLEMS. (4 cr, §PIPa 5220, §Soc 5675, §LACS 5280, §FScN 5643; prereq agriculture, veterinary medicine, home economics, or social science major or ♯...agricultural economics grads by ♯) Martin
A multidisciplinary approach will examine the social, economic, and technical problems of feeding the world's growing population. Principles from the social and economic sciences, the plant sciences, and the animal sciences and their application to food problems.

8264. RESOURCE ECONOMICS. (3 cr; prereq Econ 5162 or ¶Econ 5162 or #) Martin

8266. APPLIED REGIONAL ECONOMICS. (3 cr; prereq Econ 5151, 5152 or equiv or ♯) Maki, Hoyt

8360. SEMINAR: LAND ECONOMICS AND TENURE. (3 cr; offered when demand warrants) Raup

8364. SEMINAR: RESOURCE ECONOMICS AND POLICY. (3 cr; offered when demand warrants) Martin, Easter

8366. SEMINAR: APPLIED REGIONAL ECONOMICS. (3 cr; offered when demand warrants)

Agricultural Engineering (AgEn)

College of Agriculture and
Institute of Technology
213 Agricultural Engineering
CONTACT: *Environment*—
C. L. Larson, 207 Agricultural Engineering, 373-1331

3410. HYDROLOGY, WATER CONTROL. (4 cr; prereq Math 1111, Phys 1032, Soil 1122; 3 lect and 1 rec hrs per wk) Larson
The hydrologic cycle—precipitation, infiltration, evaporation, surface runoff. Water table variations, subsurface runoff. Flow in open channels, flow measurements. Watershed runoff, floods. Sediment sources, erosion and sediment control. Water control on a watershed basis.

3411. SEMINAR: CURRENT TOPICS IN WATER RESOURCES. (1 cr; 1 rec hr per wk) Larson
Small-group discussion of water resources problems, primarily socioeconomic, legal, and environmental aspects. Reading on discussion topics.

3800. RURAL SANITATION AND WATER SUPPLY. (4 cr; prereq Phys 1031, Chem 1005; 3 lect hrs per wk) Goodrich
Wells, pumps, water supply and treatment. Water supply and waste disposal systems for homes, farmsteads, resorts, and recreational use.

5540. EROSION CONTROL, WATERSHED ENGINEERING. (4 cr; prereq 3050 or CE 3300, CE 5401 or ♯; 3 lect and 3 lab hrs per wk) Larson
Measurement and mechanics of watershed runoff and soil erosion. Estimating peak runoff, soil losses, and sediment yields. Environmental effects. Principles of small watershed planning for flood control, water storage, and sediment control. Hydraulic design of graded and storage type terraces, grass waterways, diversions, and erosion control structures.

5550. DRAINAGE AND IRRIGATION ENGINEERING. (4 cr; prereq 3050 or CE 3300, CE 5401 or ♯; 3 lect and 3 lab hrs per wk) Allred
Flow of water through agricultural soils. Irrigation and drainage requirements, salinity control. Evapotranspiration, water supply development and control. Conveyance of drainage systems. Design, layout, and construction of irrigation and drainage systems. Instructional, environmental, and economic aspects of soil moisture control.

5740. ENVIRONMENTAL CONTROL FOR AGRICULTURAL PRODUCTION. (4 cr; prereq ME 5603; 3 lect and 3 lab hrs per wk) Jordan
Ventilation, insulation, and condensation control in enclosed plant and animal production structures. Biological constraints upon the system. Temperature, humidity, light, and contaminants; e.g., dust, noxious gases, and pathogens. Simulation of weather phenomena for prediction of environmental conditions.

5810. AGRICULTURAL WASTE MANAGEMENT. (4 cr; prereq Phys 1031, Chem 1005, Biol 1001; 3 lect and 3 lab hrs per wk) Moore
Characteristics of various animal manures, plant materials, and processing wastes. Sanitary collection, storage, treatment, and utilization or disposal of liquid and solid agricultural waste.

5910. AGRICULTURAL WASTE MANAGEMENT ENGINEERING I. (4 cr; prereq 3050 or ♯, Chem 1005 or 1014; 3 lect and 3 lab hrs per wk) Moore
Sources and characteristics of agricultural wastes including animal manures, crop residues, sediments, processing wastes, and domestic wastes. Effects on the environment. Sanitary collection, storage, treatment, and disposal. Utilization of liquid and solid wastes. Nonurban water supply and quality.

5920 AGRICULTURAL WASTE MANAGEMENT ENGINEERING II. (4 cr; prereq 5910; 3 lect and 3 lab hrs per wk) Goodrich
Design of systems for the collection, storage, treatment, utilization, and disposal of animal wastes.

American Indian Studies (AmIn)

College of Liberal Arts
812 Social Sciences
CONTACT: *Planning*—
W. Roger Buffalohead, 810 Social Sciences, 373-0146

3112. AMERICAN INDIAN HISTORY: 1887 TO THE PRESENT. (4 cr; prereq 3111 or Anth 1002 or #)
Indian-white relations and the impact of federal Indian policy on American Indians. Persistence and adaptation of Indian cultures in modern times.

5411. URBAN INDIANS IN THE UNITED STATES. (4 cr; prereq 3112 or Anth 1002 or Anth 3211 or #) Buffalohead
Social science and historical analysis of the rapid cityward Indian migration since World War II.

5422. INDUSTRIALIZATION, EMPLOYMENT, AND THE AMERICAN INDIAN. (4 cr; prereq 3112 or ♯)
Sources of unemployment on Indian reservations; efforts to promote industrialization and economic development; employment and economic problems of urban Indians.

Anthropology (Anth)

College of Liberal Arts
215 Ford Hall
CONTACT: *Environment and Planning*—
Janet Spector, 215 Ford Hall, 376-7148

5115. ECONOMIC ANTHROPOLOGY. (5 cr; prereq 1102, 3201 or #)
Analysis and comparison of systems of production and distribution, especially in nonindustrial societies. Relationship among economic and social, political, religious, psychological, and environmental factors.

5116. CULTURAL ECOLOGY. (5 cr; prereq 1101, 1102, one ethnographic area course or ♯)
Survey of the literature on cultural ecology; emphasis on biological approach to ecosystems and population studies.

5117. ENERGY, RESOURCE USE, AND SYSTEM CHANGE. (5 cr; prereq 3201 or #)
Social-cultural system factors in the development, production, control, distribution, and use of energy, water, key resources, and food in the United States and other societies. Social-cultural evolution, interaction among different societies; growth and no-growth issues; emerging global interdependence.

5151. CULTURAL CHANGE AND DEVELOPMENT. (5 cr; prereq 1102 or #)
Processes of cultural change; invention, diffusion, and acculturation. Effects of colonialism, urbanization, and modernization. Analysis of developing societies. Applied anthropology.

5152. ANTHROPOLOGY OF SOCIAL MOVEMENTS. (5 cr; prereq 3201 or #)
Cross-cultural study of nature, process, and function of social, political, and religious movements of change. Theories and case studies, including Christianity, Islam, Asia, Africa, United States.

5153. URBAN ANTHROPOLOGY. (5 cr; prereq 1102 or #)
Structure and process in non-Western urban centers; the role of rural migrants, relationship of urbanism to political and economic development, role of voluntary associations, adjustment of kinship groups to urban life.

5154. ANTHROPOLOGY OF COLONIALISM. (5 cr; prereq 1102 or #)
Social, structural, symbolic, and psychological aspects of the societies of colonizers and the colonized; emphasis on South Asia, Oceania, and Puerto Rico.

5155. ANTHROPOLOGY AND SOCIAL ISSUES. (5 cr; prereq 1102 or #)
Anthropological views about poverty, racism, the myth of the melting pot, the Third World, and the social responsibilities of anthropology.

5185. MEDICAL ANTHROPOLOGY. (5 cr; prereq 1102, 3001, #..or introductory biology and introductory social science courses, #)
Humans in health and disease, from biological and cultural points of view. The origins of human disease, relationship of disease to subsistence technique (hunter-gatherer to industrial), notions of disease causation; medical care in Western and non-Western societies; effects of the introduction of Western medicine on non-Western societies.

Architecture and Landscape Architecture

Institute of Technology
110 Architecture

CONTACTS: *Environment*—
Dennis Holloway, 110 Architecture, 373-2198
Planning—
Walter K. Vivrett, 110G Architecture, 373-5336

ARCHITECTURE (Arch) or LANDSCAPE ARCHITECTURE (LA)

1001. ENVIRONMENTAL DESIGN: MAN AND ENVIRONMENT. (4 cr, §LA 1001) Holloway
Exploration of interaction of man and man's environment using the disciplines of natural and social sciences and the arts as resource background for readings, lectures, discussions, and workshop sessions.

1002. ENVIRONMENTAL DESIGN: TOOLS AND PROCESSES. (4 cr, §LA 1002; prereq 1001) Holloway
Nature and effects of various tools and processes of environmental change, ranging from buildings and landscapes to economic policies, climate, and myths. Readings, lectures, discussions, and workshop sessions.

1003. ENVIRONMENTAL DESIGN: IMPLEMENTATION AND EVALUATION. (4 cr, §LA 1003; prereq 1002) Holloway
Design projects, discussions, and readings exploring personal abilities to implement and evaluate environmental change.

1021. HISTORY OF ENVIRONMENTAL DEVELOPMENT: ARCHITECTURE. (4 cr, §LA 1021; 4 lect hrs per wk)
Introduction to architecture, philosophy and principles of architecture as an art; survey of architectural history, with emphasis upon development of contemporary architecture from its roots in the 19th century until the present time.

1022. HISTORY OF ENVIRONMENTAL DEVELOPMENT: LANDSCAPE ARCHITECTURE. (4 cr, §LA 1022; prereq 1021; 4 lect hrs per wk) Martin
Forces and individuals that shaped the form of landscape architecture in 19th- and 20th-century America.

1023. HISTORY OF ENVIRONMENTAL DEVELOPMENT: PLANNING. (4 cr, §LA 1023; prereq 1022; 4 lect hrs per wk) Odegard
Survey of rise and history of cities as centers of civilization. Collaboration among various disciplines for creating better urban environment and improving the quality of human life in cities.

ARCHITECTURE (Arch)

3064-3065. ENVIRONMENTAL MANAGEMENT AND CONTROL. (5 cr per qtr; prereq 3062; 4 lect hrs per wk) Diedrich
Environmental-mechanical considerations including comfort technology, space habitability, climate, psychometrics, control and management systems; waste management including plumbing systems and waste disposal techniques. Electrical systems, energy, power distribution and machinery; lighting systems, physiology of seeing, light sources and control, spatial acoustics, noise barriers, absorption.

5137. PLANNING: URBAN FUNCTION AND STRUCTURE. (4 cr, § 5132; prereq ♯) Odegard
Economic, technological, and social factors which underlie the location,. distribution, and internal structure of urban settlements. Quantitative and qualitative analysis of social, economic, and physical problems or consequences of contemporary problems.

5138. PLANNING: THEORY AND METHODOLOGY. (4 cr; prereq 5137 or ♯) Odegard
Logic of a planning process as a method of decision making. Formulation and goals and evaluation of alternative course of action, standards and requirements for specific planning objectives (housing, transportation, and community facilities). Legal, administrative, and fiscal devices for plan implementation. The place of planning function in government and the role of citizens and private groups.

LANDSCAPE ARCHITECTURE (LA)

1024. LANDSCAPE THEORY. (4 cr; 3 lect and 3 lab hrs per wk)
Analysis of design elements and forms involving direction, shape, proportion, and color, with emphasis on their function in design; perception and man's relationship to the environment, and the social effects and psychological basis for design.

1031. INTRODUCTION TO LANDSCAPE ARCHITECTURE. (4 cr; 4 lect hrs per wk)
Design potential of materials of the landscape; exercises in assessment of land developments and detail landscapes; the role of the landscape architect in shaping the natural and cultural environment; brief historical review of site developments.

3073. LANDSCAPE TECHNOLOGY: LAND ANALYSIS TECHNIQUES. (4 cr; prereq 3072; 2 lect and 6 lab hrs per wk)
Lectures, exercises, and projects in land analysis techniques for use in assessment of land development potential.

5010. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING. (4 cr; 4 lect hrs per wk)
(Same as LA 5233) For advanced students associated with design, management, and planning of recreational facilities. Planning and design principles related to recreational land use and development; parks, campsites, water areas, highways, summer and winter recreational facilities.

5262. HISTORY AND LITERATURE OF LANDSCAPE ARCHITECTURE. (4 cr; prereq 1022; 4 lect hrs per wk) Martin
A search for design principles as expressed in landscapes created by man from ancient times to the present. Analysis of the visual form of environments as an outgrowth of geographical, cultural, and technological determinants.

Biology (Biol)

College of Biological Sciences

P190 Kolthoff

CONTACT: *Environment*—
Eville Gorham, 750 Biological Sciences Center, 373-5619

1011f,w,s,su. GENERAL BIOLOGY. (5 cr)
Introduction to the principles of biology. The cell, metabolism, heredity, reproduction, ecology, and evolution.

1101f,w,s. HEREDITY AND HUMAN SOCIETY. (4 cr, §GCB 3003; no cr if taken after 3032 or GCB 3022; for students in programs not directly related to biological sciences) Fan, Woodward
Principles of heredity and their social and cultural implications.

1102w,s. MICROBES AND MAN. (4 cr)
Microorganisms in relationship to man and man's environment in the processing and preservation of food, waste disposal, and environmental factors; bacterial products of industrial and pharmaceutical importance; role of microorganisms in recycling elements of the biosphere; microorganisms and disease.

1103w,s. GENERAL BOTANY. (5 cr, §3012; prereq 1011) Wetmore, Charvat
Levels of organization of plants, plant function, plant growth and development, plant reproduction.

1105f,w. ECOLOGY AND EVOLUTION. (4 cr; prereq 1011 or 1101) Birney, Pace
Evolutionary processes, interactions of organisms with their environments, predictions about living systems including that of man.

1106f,w,s. GENERAL ZOOLOGY. (5 cr; prereq 1011) Olson, Schmid, Underhill
Survey of animal phyla; structure, function, behavior, adaptation, and evolutionary relationships.

1951f-1952w-1953s. BIOLOGY COLLOQUIUM. (2 cr; for prospective majors; S-N only; prereq 1011 or ¶1011, ⇄)
Encourages and allows active participation in education. Provides an orientation to the biological sciences as well as the opportunity for interaction with other biology students and faculty.

3051f. BIOLOGY AND THE FUTURE OF MAN. (4 cr; S-N only) Pratt, Gorham
Nontechnical discussion of biological factors affecting the quality of life; e.g., pollution, chemical and biological warfare, population growth, food supply, resource sufficiency, value of wilderness, genetics and eugenics, public health, aging, behavior control, and biological aspects of ethics, morals and societal organization.

5501s. BIOCHEMICAL EVOLUTION. (4 cr; prereq 5 cr in biochemistry) Kirkwood, Jenness, Seal
Molecular evolution covering prebiotic evolution and the phylogeny of important functional molecules and biochemical systems in living organisms.

5951w. THE BIOLOGIST AS SCIENTIST, EDUCATOR, AND CITIZEN. (3 cr; prereq 15 cr in biological sciences) Hooper, Cunningham
The role of the scientist in decision making and persuasion; teaching methods in biology; the organizational structure of the academic and governmental worlds.

Botany (Bot)

College of Biological Sciences

220 Biological Sciences

CONTACT: *Environment*—
D. C. Pratt, 220 Biological Sciences Center, 373-2211

1009s. MINNESOTA PLANT LIFE. (4 cr; suitable for nonmajors) Morley
Identification of the more common and conspicuous Minnesota plants with some discussion of their basic distinctions, life cycles, habitat requirements, distribution, and ecological relations. Lectures, demonstrations, six or seven field trips.

1012f,w. PLANTS USEFUL TO MAN. (4 cr; for majors or nonmajors) Jonas
Roles which plants have played in man's biological and cultural development. Lectures and demonstration of material.

3071f. PLANTS AND HUMAN AFFAIRS. (4 cr; prereq #) Jonas
Reciprocal and deterministic interaction between plants and man as illustrated by events and developments in agriculture, industry, trade, domestic and foreign affairs, medicine, religious customs, and the arts.

5205s. FLORA OF MINNESOTA. (4 cr; prereq 3201 or #) Ownbey
Vascular plants of Minnesota; taxonomic and floristic relationships; geographical distribution and variation; collecting and identifying. Field trips.

Business, Government and Society

College of Business Administration
225 Business Administration
CONTACT: *Environment*—
R. J. Holloway, 1235 Business Administration, 373-4407

3002. BUSINESS AND SOCIETY. (4 cr; prereq jr or sr) Holloway
Basic economic and social goals and attempts to meet them in American society. Business as an institution; its relationships to other institutions and to society. Ethical and practical conflicts in the firm and the manager in public policy. Current social issues and their impact on business.

3003. BUSINESS AND THE NATURAL ENVIRONMENT. (4 cr; prereq jr or sr) Holloway
Business and its relationship to the natural environment. The use by industry of renewable and nonrenewable resources. Environmental deterioration caused by business to air, land, and water. Business solutions to environmental problems.

3005. GOVERNMENT AND BUSINESS. (4 cr, §Econ 3651; prereq Econ 1001 and 1002 or equiv)
The role of the free enterprise system; structure of American industry; economic and social consequences of big business; public policies toward private enterprise; public regulation, public ownership; antitrust laws and their applications.

3019. TOPICS IN BUSINESS, GOVERNMENT AND SOCIETY. (4 cr; prereq 3002) Holloway
Selected topics and problems of current interest. Subjects vary quarterly.

Chemical Engineering (ChEn)

Institute of Technology
151 Chemical Engineering
CONTACTS: *Environment*—
H. Tsuchiya, 251 Chemical Engineering, 373-2306
A. Fredrickson, 431 Chemical Engineering, 373-2312

5751f-5752w-5753s. BIOLOGICAL ENGINEERING ANALYSIS. (3 cr per qtr; prereq ♯; 3 lect hrs per wk) Keller, Swanson, Fredrickson
Modeling and analysis of biosystems. Thermodynamics, transport and transfer, biochemical reactions, growth and death processes discussed from both deterministic and probabilistic viewpoints.

5754. BIOCHEMICAL ENGINEERING. (4 cr per qtr; prereq 5103 or ♯; 3 lect hrs per wk) Tsuchiya, Valentas
Biochemical engineering of industrially important biological materials. Microbiological, biochemical, and chemical considerations of these systems and their industrial processing.

5755. BIOCHEMICAL ENGINEERING. (4 cr; prereq 5103, 5754 or ♯)
Application of chemical engineering principles to the solution of processing problems of industrially important biological materials. Statistical experimental design of industrial systems.

5801. AIR POLLUTION CONTROL ENGINEERING. (4 cr; 4 lect hrs per wk)
Analysis and design of equipment used to reduce emission of gases and particulates. Methods for controlling air pollution.

5904. SPECIAL TOPICS IN POLLUTION CONTROL. (Cr ar)
Special topics to be taught winter and/or spring quarters. For further information, contact W. Ranz, 151 Chemical Engineering, 373-2296.

Chicano Studies (Chic)

College of Liberal Arts
489 Ford Hall
CONTACT: *Planning*—
Manuel P. Guerrero, 489 Ford Hall, 373-9707

1107s. INTRODUCTION TO CHICANO STUDIES: THE CHICANO IN CONTEMPORARY SOCIETY. (4 cr)
Conditions which led to Chicano social, political, economic, and cultural consciousness; forms in which that consciousness was expressed: farmworker struggle, land grant litigation, urban strife, education.

Child Psychology (CPsy)

College of Education
CONTACT: *Planning*—
Willard W. Hartup, 190 Child Development, 373-9853

5334. CHILDREN AND YOUTH IN SOCIETY. (4 cr; prereq #) Tapp
Rule-acquisition process in children and youth and its relation to concepts of rights, roles, and responsibilities; an interdisciplinary theoretical and research perspective is employed to examine the development of moral, political, and legal ideologies in sub- and cross-cultural contexts.

Civil Engineering (CE)

Institute of Technology
122 Mines and Metallurgy
CONTACT: *Environment*—
W. Maier, 296 Experimental Engineering, 373-2517

The department welcomes participation in its courses by non-IT students with adequate preparation. CE 5420, Introduction to Water Resources Management, is especially designed to combine nonengineering and engineering students in its program and may be used by students in the College of Liberal Arts for credit toward the B.A. degree.

3500. INTRODUCTION TO ENVIRONMENTAL ENGINEERING PROBLEMS AND ANALYSIS. (4 cr; prereq 1005 or ♯)
Interdisciplinary approach to problem solving: water and air pollution and pollution control technology, noise, alternative energy resources, solid waste disposal, nuclear energy, radioactive wastes; impact of technology on environmental quality.

5104. PHOTOGRAMMETRY. (4 cr; prereq Math 1211; 3 lect and 3 lab hrs per wk)
Stereoscopy and parallax; geometry of single and overlapping photographs; stereoscopic plotting instruments; flight planning; aerial cameras and calibration; mosaics; terrestrial photogrammetry; principles of photo interpretation; elements of remote sensing; and applications to resource evaluation.

5210. INTRODUCTION TO TRANSPORTATION PLANNING. (4 cr; prereq #)
Outline of the transportation planning process as applied to urban areas; data requirements and travel characteristics; trip generation analysis; models of travel distribution; transit characteristics and usage; selection and evaluation of alternate transportation proposals; transportation and land use linkages.

5405. HYDROLOGY AND HYDROLOGIC DESIGN. (4 cr; prereq 5401 or ♯; 3 lect and 3 lab hrs per wk))
Hydrologic cycle, precipitation, evaporation, infiltration, runoff analysis, flood routing, statistical procedures in hydrology, urban hydrology, introduction to mathematical models of medium and large watersheds, application of hydrology to design of outlet works and flow control structures.

5410. OPEN CHANNEL HYDRAULICS. (4 cr; prereq 5401 or ♯; 3 lect and 4 lab hrs per wk)
Mechanics of flow in open channels including gradually varied, spatially varied, and rapidly varied flow; unsteady flow (waves and surgers); and flow in alluvial channels.

5420. INTRODUCTION TO WATER RESOURCES MANAGEMENT. (4 cr; 4 lect hrs per wk)
Water problems of the United States and of the earth as a whole as affected by the natural occurrence of water; man's use of water; and economic, social, and political conditions and goals of society.

5500. ANALYSIS AND DESIGN OF WATER SUPPLY SYSTEMS. (4 cr; prereq 3500 or #; 3 lect and 2 lab hrs per wk)
Planning and engineering design considerations in developing water supply systems for urban centers. Supply, quality, storage, treatment, distribution, and cost analysis.

5501. ANALYSIS AND DESIGN OF WASTE WATER SYSTEMS. (4 cr; prereq 3500 or #; 3 lect and 2 lab hrs per wk)
Planning and engineering design considerations in developing waste disposal systems for urban communities. Volume and quality of the waste streams, treatment, and ultimate disposal of domestic and industrial waste waters and storm water runoff. Environmental effects, cost, and political aspects of ultimate disposal.

5505. WATER QUALITY AND TREATMENT. (4 cr; prereq 3400 and 3500; 3 lect and 2 lab hrs per wk)
Introduction to water and wastewater treatment processes. Chemical and physical properties and composition of natural waters, introduction to aquatic biology, biogeochemical cycles.

5510. SOLID WASTE MANAGEMENT. (4 cr; prereq 3500 or ♯; 3 lect and 2 lab hrs per wk)
Solid waste disposal for urban areas in terms of volume, composition, and chemical characteristics. Methods and equipment for collection and treatment. Effects on the environment and unit cost of various disposal methods.

8210. SEMINAR: ADVANCED TRANSPORTATION PLANNING. (3 cr; prereq 5210 or #)

8413. MECHANICS OF SEDIMENT TRANSPORT. (3 cr; prereq 5410 or #)

8415. HYDRO AND THERMAL POWER DEVELOPMENT. (3 cr; prereq 5405; 2 lect and 3 lab hrs per wk)

8420. WATER RESOURCES SYSTEMS PLANNING. (4 cr; prereq 5420 and experience in computer use; 3 lect and 2 lab hrs per wk)

8430. LAKE, RESERVOIR, AND OCEAN HYDRODYNAMICS. (3 cr; prereq 3400)

8550. ANALYSIS AND MODELING OF AQUATIC ENVIRONMENTS. (4 cr; prereq #; 3 lect and 2 lab hrs per wk)

8551. SEMINAR: MODELS OF AQUATIC ENVIRONMENTS. (1-5 cr; prereq 8550)

Communication Disorders (CDis)

College of Liberal Arts
110 Shevlin Hall
CONTACT: *Environment*—
W. D. Ward, 2630 University Avenue S.E., 373-4565

5704s. NOISE AND MAN. (4 cr; prereq 5301 or ♯) Ward
Temporary and permanent effects of steady, intermittent, and impulse noises on hearing. Annoyance and community noise. Noise measurement, reduction, and control; ear defenders and their limitations. Hearing conservation programs; preemployment testing and monitoring audiometry.

Criminal Justice Studies (CJS)

College of Liberal Arts

314 Social Sciences

CONTACT: *Planning*—

Jim DeConcini, 314 Social Sciences, 373-2613 or 373-9918

5106. LAW AND SOCIAL ISSUES. (4 cr; prereq Soc 3101) Samaha
How far the law can go in solving pressing social issues which impinge upon individual liberties such as sexual relations, drug use, abortion, family relationships.

5113. COMMUNITY-BASED CORRECTIONS. (4 cr; prereq Soc 5105 or #) Murton
Theory, structure, and description of programs that exist as alternatives to imprisonment.

5116-5117†. LAW, JUSTICE, AND THE INDIVIDUAL IN SOCIETY. (4 cr per qtr; prereq sr, grad student, law student or #) Tapp
Experiential, interdisciplinary approach to theory and research about individual and institutional processes in developing expressions of law and justice. *5116:* Psychology-law interface, cross-cultural examples, law and justice theories, the legal socialization process. *5117:* Compliance styles, deviance dynamics, functioning justice systems, psychological reforms.

Design (Dsgn)

College of Home Economics

200 McNeal Hall

CONTACT: *Planning*—

Gertrude Esteros, 240E McNeal Hall, 373-1015

5567. HOUSING ALTERNATIVES FOR THE FAMILY. (4 cr; prereq 1551 or 1552, 3563 or #)
Alternative housing choices for the family in today's market; emphasis on design for special needs of the elderly, the handicapped, and differing life-styles.

5568.* HOUSING PROBLEMS OF THE FAMILY. (1-5 cr; prereq 1551 or 1553 or 3563 or equiv)
Housing problems of low-income, elderly, and minority individuals and families. Rehabilitation of older housing: process, programs, and projects. Fieldwork with a low-income, inner city client family on a home improvement project.

Ecology and Behavioral Biology (EBB)

College of Biological Sciences

310 Biological Sciences Center

CONTACT: *Environment*—

Margaret B. Davis, 310 Biological Sciences Center, 373-5177

3001w. INTRODUCTION TO ECOLOGY. (4 cr, §Biol 1104; open to jrs and above, but not to biology majors) Corbin
Basic concepts in ecology; the organization, development, and functioning of ecosystems; population growth and regulation. Man's impact on such systems.

3004w. FUNDAMENTALS OF ECOLOGY. (4 cr; not open to biology majors; prereq Biol 1011, college algebra) Tester
Relationships between organisms and their environment; ecosystem structure and function emphasizing energy flow, biogeochemical cycling and succession; population dynamics; regional biotic communities.

3101f,w. ECOLOGY FOR ENGINEERS AND PHYSICAL SCIENTISTS. (4 cr, §3001, §Biol 1104; not open to biology majors; prereq Math 1231) Megard, Bright
Spatial and temporal interactions between populations in ecosystems: processes affecting populations, transformations of energy and materials in the biosphere. Lectures and recitations.

5014f. ECOLOGY OF PLANT COMMUNITIES. (5 cr; prereq 3004 or Biol 3041, 1 qtr statistics or #) Cushing
Methods of describing, sampling, and classifying plant communities; theory of their structure, development, and stability; theory of the interactions among their constituent populations. Field trips to local vegetation types; analysis of quantitative data.

5015w. NUTRIENTS AND ENERGY IN TERRESTRIAL ECOSYSTEMS. (6 cr; prereq Biol 3041, 4 cr statistics, and #)
Principles of hydrologic and biogeochemical cycling processes, flow of energy in natural ecosystems and effects of certain perturbations. Concepts of ecosystem modeling. Nutrient cycling in terrestrial plant communities. Laboratory includes greenhouse experiments, a Saturday field trip, and student discussions of current literature.

5016s. ECOLOGICAL PLANT GEOGRAPHY. (3 or 5 cr; prereq 3004 or Biol 3041, Bot 3201 or ¶Bot 3201 or ‡) Cushing
Vegetation regions of the world in general and North America in detail; ecological principles of plant distribution; interpretation of regional and temporal patterns in distribution of vegetation and taxonomic groups. Field trips to floristic regions of Minnesota.

5017f. PREDATORS. (3 cr; prereq Biol 3041 or #) Taylor
Energetics, ecology, and evolution of vertebrate and invertebrate predators and insect parasitoids.

5021f. PREDATION LABORATORY. (2 cr; prereq 5017 or ¶5017 and #) Taylor
Individual projects in the behavior and population ecology of predators.

5029w. POPULATION ECOLOGY. (4 cr; prereq 3004 or Biol 3041, one course in statistics) Siniff
Factors involved in the regulation, growth, and general dynamics of populations. Major topics include data needed to describe populations, population growth, population models, and regulatory mechanisms.

5031s. EVOLUTIONARY ECOLOGY. (3 cr; prereq Biol 3041 or equiv, ‡; offered 1977 and alt yrs) Corbin
Evolutionary concepts and theory applied to populations, communities, and ecosystems, emphasizing current research and literature.

5601f. LIMNOLOGY. (4 cr, §Geo 5601; prereq Chem 1005 or #) Shapiro
Description and analysis of events occurring in lakes, reservoirs, and ponds, beginning with their origins and progressing through a study of their physics, chemistry, and biology. Interrelationships of these parameters and effects of civilization on lakes. Laboratory, field trips.

5602f. CASE STUDIES IN LIMNOLOGY. (3 cr; prereq 5601 or Geo 5601 and #; offered 1976 and alt yrs) Shapiro
Interactions between physical, chemical, and biological phenomena in lakes; relationships between lakes, watersheds, and human activities.

5811su. WEATHER IN THE BIOSPHERE. (5 cr, §5024, §5025, §5026; limited to 15 students; prereq 1 yr physics and course in ecology; offered at Itasca)
Distribution and variability of weather parameters, such as solar and longwave radiation, temperature, water vapor, and wind speed, studied in microhabitats found in the Itasca region. Field measurement and effect of parameters on energy budget of an organism.

5812su. AQUATIC ECOLOGY. (5 cr; limited to 20 students; prereq 15 cr in biology and 5 cr in chemistry; offered at Itasca) Staff
Nature, origin, development, and productivity of lakes, and conditions for plant and animal life in water. Individual or team projects in field and laboratory research.

5814su. COMMUNITY STRUCTURE AND FUNCTIONING. (5 cr; limited to 20 students; prereq course in ecology; offered at Itasca) Staff
Communities represented in Itasca Park and vicinity and their dynamic relationships. Relationships of local communities to the flora and fauna of Minnesota as a whole. Use of modern methods of community analysis and measurement.

5815su. FIELD ETHOLOGY. (5 cr; limited to 15 students; prereq course in ornithology or ecology; offered at Itasca) Oring
Behavioral function, evolution, causation, and development, stressing relationship between environment and behavior. Sound recording, motion picture photography, tape and film analysis, and marking techniques emphasized. Individual research project and term paper on the social behavior of one species of bird, mammal, frog, or dragonfly.

5817su. VERTEBRATE ECOLOGY. (5 cr; limited to 15 students; prereq course in ecology; offered at Itasca) Tester
Field studies on populations and their relationships to local environments; habitat analysis and ecological research methods. Individual and team research projects, field trips, and lectures.

5818su. QUANTITATIVE ECOLOGY. (5 cr; limited to 15 students; prereq 9 cr in ecology, 1 qtr statistics or ♯; offered at Itasca) Staff
Design of field studies of populations, communities, and ecosystems. Emphasis on formulation and testing of hypotheses in the field, design of field sampling, and analysis and interpretation of data.

5819su. SOILS AND THE ECOSYSTEM. (5 cr; limited to 20 students; prereq course in ecology; offered at Itasca) Grigal
Functional and structural aspects of soils as a component of the ecosystem. Interrelationships of soil and vegetation on the landscape.

5821su. QUATERNARY PALEOECOLOGY. (5 cr; limited to 15 students; prereq 1 qtr in ecology or ♯; offered 1977 and alt yrs at Itasca) Staff
Problems and techniques in the reconstruction of past communities and ecosystems from fossil evidence in deposits of Quaternary age. Field and laboratory methods in collection and description of stratigraphic sequences and identification and quantitative analysis of fossil assemblages.

5822su. REGIONAL LIMNOLOGY. (5 cr; limited to 20 students; prereq 15 cr biology, 10 cr chemistry; offered at Itasca)
Basic limnology involving field and laboratory research on diverse lakes and ponds of Itasca region. Morphometric, physical, and chemical characteristics of aquatic ecosystems.

8003w. ANALYSIS AND MODELING OF ECOLOGICAL SYSTEMS. (3 cr; prereq Ecol 5014 or 5015 or 5029 and Math 5427, or ♯; offered 1977 and alt yrs) Taylor

Economics (Econ)

College of Liberal Arts
1035 Business Administration

CONTACTS: *Environment and Planning*—
Edward Coen, 1935 Business Administration, 373-3690
Harlan Smith, 1149 Business Administration, 373-3572

3131f,w,s. WELFARE ECONOMICS. (4 cr; prereq 3101)
Economic efficiency and the conditions necessary to sustain it. Conflicts between efficiency and income distribution goals. How market structure and public policies increase or decrease efficiency.

5021. ECONOMICS, ETHICS, AND ECONOMIC PHILOSOPHY. (3-5 cr; prereq 1001, 1002 or equiv; offered when feasible)
Literature and issues it raises; relation of ethics to economic organization, practice, and policy. Different economic philosophies; elements involved in formulation of economic philosophy.

5307. COMPARATIVE ECONOMIC SYSTEMS. (4 cr, §5337; not open to economics majors; prereq 1001, 1002)
Functions of economic systems; market economy, liberal socialism, centrally planned economy. American and Soviet economies.

5421. THE PROSPECTIVE WORLD ECONOMY. (4 cr, §IntR 5802; prereq 5401 or 5431 or ♯) Smith
Alternative patterns for a future world economy and their implications for the economic welfare of nations. World institutions and their relation to growth and survival problems in a world economy.

5611. ECONOMICS OF ENVIRONMENTAL CONTROL. (4 cr; prereq 1001, 1002 or equiv)
Pollution as an external diseconomy; use of taxes and subsidies to reduce pollution. Replenishable resources; maximum sustainable yield; role of the discount rate; taxation to protect yields and minimize harvesting costs. Nonreplenishable resources; controlling rates of depletion.

5621. ECONOMICS OF URBAN PROBLEMS. (4 cr; prereq 1001, 1002 or equiv)
Unemployment and central city decay. Minimum guaranteed income proposals. Low income housing policies. Public policies toward health care. Financing public education. Fiscal problems of cities. Mass transit issues.

5623. HOUSING MARKETS AND PUBLIC POLICY. (4 cr; prereq 1001, 1002 or equiv)
Analysis of housing markets: failures, external factors, government intervention. Relative efficiency of particular forms of intervention.

5661. ECONOMICS OF LOCATION. (5 cr for undergrads, 3 cr for grads; prereq 3131, 1 qtr calculus and ♯ for undergrads...5161 for grads)
Location of economic activity in relation to resources and markets. Effects of changes in transport costs. Problems of urban growth.

5811. STATE AND LOCAL FINANCE. (4 cr; prereq 3801 or 3851 or equiv)
Problems of state and local finance and proposed solutions; interstate comparisons and coordination of practices and policies.

5831. COST-BENEFIT ANALYSIS. (4 cr; prereq 3101 or equiv)
Principles for evaluation of benefits and costs of public projects or programs. Issues connected with definition and measurement of benefits and costs. Rate of return and rate of discount. Treatment of market imperfections, risk and uncertainty.

5861f-5862w-5863s. PUBLIC FINANCE. (5 cr per qtr [no grad cr]; prereq 3102, 3131, ♯)
Theory of economic policy. Economic effects of taxes, public debt, and public expenditure on resource allocation, employment and income distribution; including techniques of cost-benefit analysis. Current problems of fiscal policy and taxation.

8121. APPLIED WELFARE ECONOMICS. (3 cr; prereq 8103 or ♯; offered when feasible)
Hurwicz, Richter

8311-8312. ECONOMIC GROWTH AND NATIONAL PLANNING. (3 cr per qtr; prereq 8103, 8106, plus a course in economic development)

8801-8802-8803. PUBLIC FINANCE. (3 cr per qtr; prereq 8102, 8105)

Education, Elementary (Elem)

College of Education

CONTACT: *Environment*—
Roger T. Johnson, 242 Burton Hall, 373-5793

5120. PLANNING AND EVALUATION OF EDUCATIONAL ALTERNATIVES. (3 cr)
Survey of alternative school concepts and designs; curricular programs and materials; procedures for systematic study of options within a classroom, school, or school system.

Education, Recreation and Park Administration (Rec)

College of Education

CONTACTS: *Environment and Urban Problems*—
John H. Schultz, 203 Cooke Hall, 373-4269
Frederick M. Chapman, 207 Cooke Hall, 373-4287
Planning—
Leo H. McAvoy, 209 Cooke Hall, 373-4232

5160. CONSERVATION OF NATURAL RESOURCES. (3 cr; prereq 1520 or 5100 or △)
Environmental considerations in relation to recreation and leisure services. (Open to nonmajors)

5200. RECREATION IN COMMUNITY EDUCATION. (3 cr; prereq 1520 or 5100 or △)
Recreation and leisure services in the community education process. (Open to nonmajors on a space available basis.)

5250. FINANCING PUBLIC RECREATION. (3 cr; prereq 3500 or △)
Methods and techniques of financing operations and capital improvements in public parks and recreational agencies; legal basis, fiscal policy, federal and state aids, revenue sharing and budgeting procedures.

5300. FOUNDATIONS OF OUTDOOR EDUCATION. (3 cr; prereq sr, 1520 or 5100 or ♯)
The philosophical, historical and educational foundations of outdoor education. (Open to nonmajors on a space available basis; offered through extension, also.)

5900. WORKSHOP: CONTEMPORARY ISSUES IN LEISURE SERVICES. (1-12 cr [max 12 cr]; prereq △)
Contemporary issues emphasizing administrative and supervisory functions for recreation and allied professionals; individual offerings focus on special issues and/or professional groups. (Offered in 1 credit or 3 credit blocks. Open to nonmajors.)

Education, Secondary (SeEd)

College of Education
242 Burton Hall
CONTACT: *Environment*—
Eugene Gennaro, 370 Peik Hall, 373-3305

5394su. WORKSHOP: SCIENCE EDUCATION. (1-12 cr [max 12 cr]; each section limited to 35 students)
Analysis of issues, materials, and instructional techniques on current topics of relevance to secondary school and college science teachers.

Education, Social and Philosophical Foundations of (HEd)

College of Education
203 Burton Hall

5211. SOCIAL DESIGN AND EDUCATIONAL FUTURES. (3 cr)
Medium-range interdisciplinary approach to community design and analysis emphasizing formal education systems in community context; focus upon new neighborhoods, towns, experimental cities and subcultural enclaves in rural and urban settings emphasizing time period from several years to 3 decades hence.

Entomology, Fisheries, and Wildlife

College of Agriculture
219 Hodson Hall
CONTACTS: *Environment*—
H. C. Chiang, 212 Hodson Hall, 373-1713 (insects)
L. D. Frenzel, 143 Hodson Hall, 373-1715 (wildlife)
T. F. Waters, 120 Hodson Hall, 373-1706 (fisheries)

ENTOMOLOGY (Ent)

1005. ECONOMIC ENTOMOLOGY. (4 cr; prereq Biol 1011 or ♯)
Brief introduction to structure and classification of insects; management of insect populations; life histories, habits, and recognition of insect pests of livestock, orchards, field crops, vegetables, and ornaments.

3175. INTRODUCTORY ENTOMOLOGY. (5 cr; limited to 15 students; prereq Biol 1011; offered summer session term I at Itasca)
The insect found in various natural habitats of the park and surrounding areas. Includes field trips, collection and identification of insects, as well as studies of general morphology, life histories, and habitats of local species.

5050. FOREST ENTOMOLOGY. (4 cr; prereq forestry major or ♯)
Lectures and laboratory concerning ecology and population management of forest insects with emphasis on tree factors and biological control.

5130. AQUATIC ENTOMOLOGY. (5 cr; prereq 3175 or 5020 or ♯; offered at Itasca)
Identification and biology of aquatic and littoral insects in all stages.

5131. AQUATIC ENTOMOLOGY. (2 cr; prereq 3175 or ♯; offered at Itasca)
Identification and biology of aquatic and littoral insects in all stages.

5210. INTEGRATED CONTROL. (4 cr; prereq 3175, ♯)
Suppression of insect, mite, and weed populations by integration of biotic agents; host plant resistance, artificial pest control measures and cultural practices. Principles of ecological approach to pest control. Laboratory work or independent study required. Laboratory work is concerned with identification of entomophagous insects, both those used in control programs and those naturally occurring.

5250. PRINCIPLES OF ECONOMIC ENTOMOLOGY. (4 cr; prereq 15 cr zoology and entomology incl 1005 or ♯; offered 1976-77 and alt yrs)
Methods and principles of insect control. Individual projects.

5400. EXPERIMENTAL ECOLOGY. (3 cr; prereq 9 cr biology, 3 cr animal or plant ecology or ♯)
Experimental approach to study of environmental factors affecting animal populations

8300. EXPERIMENTAL ECOLOGY LABORATORY. (2 cr; prereq 5400 or ¶5400)

8305. INSECT ECOLOGY. (3 cr; prereq 5400 or ♯)

FISHERIES AND WILDLIFE (FW)

0001. ORIENTATION IN FISHERIES AND WILDLIFE. (No cr)
Survey of technical requirements and training of fishery and wildlife technicians and scientists; introduction to fields of work, problems, and career outlets.

3052. INTRODUCTION TO FISHERIES AND WILDLIFE BIOLOGY AND MANAGEMENT. (4 cr, §5451, §5561; prereq EBB 3004, non-FW major and Pre-FW student)
Introduction to fishery and wildlife population ecology; relationships of fish and wildlife to their environments; management of fish and game populations and habitats; management and research methods; administration of fish and wildlife agencies.

3167. TECHNIQUES OF FOREST WILDLIFE MANAGEMENT. (2 cr; prereq 3052; offered at Cloquet)
Biology and management of important forest wildlife species; methods of evaluating forest wildlife populations and habitats.

5450. TECHNIQUES OF FISHERY BIOLOGY. (4 cr; prereq 3052, EBB 5813 or Geo 5601, Zool 5121 or ♯)
Basic methods used in fishery research and management; lake and stream survey methods, mapping, chemical and biological sampling; methods of fish collection, use of nets and traps, fish toxicants, electrofishing; tagging and marking; methods of creel census.

5451. ECOLOGY OF FISHERY POPULATIONS. (3 cr; prereq 5450 or ♯)
Relationship of fishery populations to limnological conditions; factors influencing strength of year classes; influence of climatological factors on fish growth; species interactions as related to population structure; influence of natural and fishing mortality rates on structure and yield of exploiting populations; fishery yield models.

5452. FISHERY MANAGEMENT. (3 cr; prereq 5451 or ♯)
Fundamentals of population control; use of fishing regulations; habitat development; water quality control; use of artificial stocks for population maintenance; relationship between sport and commercial fisheries, including economic aspects; fundamentals of hatchery practice; pond management.

5454. FISHERY ECOLOGY OF POLLUTED WATERS. (3 cr; prereq 5452, Chem 1006, ♯)
Description of degrading water quality factors and influence on fish production. Fishery bioassay, setting of standards, and determination of criteria for aquatic organisms; administrative problems of pollution abatement. Biological effect of various pollutants on fish.

5561. WILDLIFE ECOLOGY, MANAGEMENT I. (4 cr; prereq 3052, 5129, EBB 3004, Zool 5077 or 5834 or ♯...courses in soils, plant and animal physiology, experimental or field vertebrate ecology recommended)
Review of ecological background for wildlife management, development of programs in the field, and organizations working with fisheries and wildlife programs.

5562. WILDLIFE ECOLOGY, MANAGEMENT II. (3 cr; prereq 5561 or ♯)
Characteristics of wildlife population relevant to management including natality, recruitment, and mortality rates, density and behavior.

5563. WILDLIFE ECOLOGY, MANAGEMENT III. (3 cr; prereq 5562 or ♯)
Principles and concepts pertaining to management of wildlife populations and their habitats, to land use and land management practices; field exercises involving collections and analyses of data for wildlife management; ethical and biopolitical aspects of wildlife management.

Environmental Health (PubH)

School of Public Health
Health Sciences
1158 Mayo

CONTACT: *Environment*—
R. D. Singer, 1160 Mayo, 373-8080

3151s. INTRODUCTION TO ENVIRONMENTAL HEALTH. (3 cr; prereq 3 cr in public health) Vesley
Principles of environmental health relating to water, food, wastes, housing, accidents, radiation, air, industrial hygiene.

5150f,w,s,su. TOPICS IN ENVIRONMENTAL HEALTH. (Cr ar; prereq ♯)
Selected readings and discussions on problems in environmental health.

5151f. ENVIRONMENTAL HEALTH. (3 cr; prereq ♯) Straub
Methods for promoting man's health and comfort by controlling the environment.

5170f,w,s. TOPICS IN ENVIRONMENTAL BIOLOGY. (Cr ar; prereq ♯)
Selected readings in environmental biology with discussion of control techniques.

5171w. ENVIRONMENTAL MICROBIOLOGY. (3 cr; prereq 5151, 5155, MicB 3103 or ♯) Greene
Survival, dissemination, transportation, and significance of microorganisms in the environment; application of principles to environmental health problems.

5172w. ENVIRONMENTAL MICROBIOLOGY LABORATORY. (2 cr; prereq 5171, ♯) Greene, Vesley
Laboratory and field exercises in microbiological sampling, detection, enumeration, and control.

5177f. PUBLIC HEALTH BIOLOGY. (3 cr; prereq ♯) Ruschmeyer
Introduction to plant and animal forms important in environmental health; biological aspects of water supply, waste treatment, stream pollution, and special phenomena related to human disease transmission.

5180f,w,s. TOPICS IN AIR POLLUTION. (Cr ar; prereq ♯)
Selected readings in air pollution with discussion based on these readings.

5181f,w. INTRODUCTION TO THE AIR POLLUTION PROBLEM. (3 cr; prereq ♯) Paulus
History, sources, controls, effects, surveys, legal aspects; administration of programs.

5182s. AIR POLLUTION CONTROLS AND SURVEYS. (3 cr; prereq 5181, ♯) Paulus, Caplan
Public health engineering approach to air pollution controls and surveys.

5183f,w,s,sul. PROBLEMS OF AIR POLLUTION CONTROL. (C ar; prereq 5181, ♯) Paulus
Special supervised studies involving laboratory and field investigation procedures; review of pertinent literature.

5184w. AIR ANALYSIS I. (3 cr; prereq 5181, 5183, or 5211, ♯) Paulus, Caplan
Laboratory and field exercises involving air flow calibration, dynamic calibration of field equipment for analysis of air contaminants, respirable mass sampling, dust counting and sizing, and instrumentation for measuring physical environmental stresses.

5185s. AIR ANALYSIS II. (3 cr; prereq 5184, ♯) Paulus, Caplan
Laboratory and field exercises involving sampling and analysis techniques for stack sampling and for ambient air monitoring. Group surveys of air pollution problems and special projects.

5194s. OCCUPATIONAL SAFETY. (2 cr; prereq ♯) Scheffler
Occupational safety procedures, environmental controls to reduce injuries on and off the job, safety program development and administration.

5200f,w,s. TOPICS IN RADIOLOGICAL HEALTH. (Cr ar; prereq ♯)
Selected readings in radiological health with discussion based on these readings.

5201f. MEASUREMENT AND APPLICATION OF IONIZING RADIATION. (3 cr lect and lab, 2 cr lect only; prereq ♯) Barber
Introduction to principles of measurement and use of radiative sources; emphasis on health hazards.

5202w. ENVIRONMENTAL RADIOACTIVITY. (3 cr; prereq ♯) Straub, Barber
Sources, measurement, evaluation, and control of environmental radioactivity; hazards to general population.

5203s. LOW-LEVEL RADIOACTIVITY MEASUREMENTS. (3 cr; prereq ♯) Barber
Lectures and laboratory assay of low levels of radioactivity in environmental samples.

5210f,w,s. TOPICS IN OCCUPATIONAL HEALTH. (Cr ar; prereq ♯)
Selected readings in occupational health with discussions based on these readings.

5211f. INDUSTRIAL HYGIENE ENGINEERING. (4 cr; prereq ♯) Caplan
Concepts and techniques used in occupational health; emphasis on fieldwork, evaluation of potential hazards, and preventive techniques.

5212w. VENTILATION CONTROL OF ENVIRONMENTAL HAZARDS. (3 cr; prereq 5211, ♯) Caplan
Theory and application of exhaust ventilation in control of airborne environmental hazards; principles of exhaust hoods, air moving devices, gas cleaning devices; demonstration of measurement techniques; relationship of hazard and process to ventilation design criteria.

5213s. PUBLIC HEALTH ASPECTS OF TOXIC PRODUCTS. (2 cr; prereq 5215) Caplan
Problems of protecting industrial workers and private consumers from useful but potentially harmful products; product testing programs and administration; labeling problems.

5215w. APPLIED OCCUPATIONAL TOXICOLOGY. (3 cr; prereq 5181 or 5211, ♯) Caplan, Long
Basic toxicology and physiology with emphasis on environmental contaminants. Inhalation toxicology of the work environment and air pollution.

5220f,w,s. TOPICS IN FOOD SANITATION. (Cr ar; prereq ♯)
Review of literature and practice to identify association of food sanitation problems with public health.

5222s. FOOD SANITATION. (3 cr; prereq ♯) Jopke
Review of current literature on sanitary problems in production, processing, and distribution of meat, milk, shellfish, and other foods; methods of supervision.

5230f,w,s. TOPICS IN INSTITUTIONAL ENVIRONMENTAL HEALTH. (Cr ar; prereq ♯)
Review of literature and practice to identify institutional environmental health problems.

5231f. ENVIRONMENTAL HEALTH AND SAFETY IN HEALTH CARE FACILITIES I. (4 cr; prereq ♯) Vesley
Environmental health concepts and problems related to isolation techniques; cleaning, disinfection, and sterilization; laundry processes; food service; physical plants; interdepartmental relationships.

5232w. ENVIRONMENTAL HEALTH AND SAFETY IN HEALTH CARE FACILITIES II. (4 cr, §5126; prereq ♯) Michaelsen, DeRoos
Ventilation; water supply; plumbing; solid and liquid waste systems; and other environmental engineering problems.

5233s. ENVIRONMENTAL HEALTH AND SAFETY IN HEALTH CARE FACILITIES III. (Cr ar; prereq 5231, 5171, ♯) Vesley, Greene
Field practice in solving institutional environmental health problems.

5240f,w,s. TOPICS IN WATER HYGIENE. (Cr ar; prereq ♯)
Selected readings on and discussions of problems relating to the health aspects of water supply and waste water systems.

5241w. ENVIRONMENTAL HEALTH ASPECTS OF WATER SUPPLY. (3 cr; prereq ♯) Straub, Singer
Role of water in human health; physical, chemical, and biological characteristics; evaluation of source, treatment and distribution systems.

5242f. ENVIRONMENTAL HEALTH ASPECTS OF GROUNDWATER SYSTEMS. (2 cr; prereq ♯) Singer
Introduction to groundwater geology, quality, and treatment; well design, construction, and maintenance; public and environmental health problems.

5244s. ENVIRONMENTAL HEALTH ASPECTS OF WASTE WATER SYSTEMS. (3 cr; prereq ♯) Straub
Role of liquid wastes in health of man; physical, chemical, and biological characteristics; evaluation of source, treatment and disposal facilities.

8201s. RADIATION DOSIMETRY. (3 cr; prereq ♯) Barber

8202s. RADIATION DOSIMETRY LABORATORY. (1 cr; prereq ¶8201) Barber

8248sul. WATER QUALITY INVESTIGATION AND RESEARCH TECHNIQUES. (6 cr; prereq ♯) Staff

8249sul. WATER QUALITY RESEARCH. (6 cr; prereq ♯) Staff

Extension Classes

Continuing Education and Extension

170 Wesbrook Hall

CONTACT: *Environment*—
Beverly R. Sinniger, 180 Wesbrook Hall, 373-0115

Extension classes are scheduled in the evening on campus and in Twin Cities suburban area locations. Course listings, times, and locations are described in the *Extension Classes Bulletin.* Copies available in 101 Wesbrook Hall or will be sent if you call 376-3000.

When no course descriptions are given, refer to the appropriate departmental listing in this bulletin.

Arch 1021. HISTORY OF ENVIRONMENTAL DEVELOPMENT: ARCHITECTURE. (4 cr; fall qtr 1976, winter qtr 1977)
May be used as a refresher course for the State Board Examination.

Arch 1022. HISTORY OF ENVIRONMENTAL DEVELOPMENT: LANDSCAPE ARCHITECTURE. (4 cr; tentatively scheduled for 1977-78)

Arch 1023. HISTORY OF ENVIRONMENTAL DEVELOPMENT: PLANNING. (4 cr; tentatively scheduled for 1977-78)

BGS 3002. BUSINESS AND SOCIETY. (4 cr; A-N only; limited to 60 students; fall qtr 1976, winter qtr 1977, spring qtr 1977, spring semester 1977)

BGS 3003. BUSINESS AND THE NATURAL ENVIRONMENT. (4 cr; limited to 60 students; fall semester 1976)

Biol 1105. INTRODUCTION TO EVOLUTIONARY BIOLOGY. (4 cr; prereq 1011 or 1101 or ♯; winter qtr 1977)

Biol 3051. BIOLOGY AND THE FUTURE OF MAN. (4 cr; spring semester 1977)

Bot 1012. PLANTS USEFUL TO MAN. (4 cr; winter qtr 1977)

CE 3500. INTRODUCTION TO ENVIRONMENTAL ENGINEERING. (4 cr; prereq 3400 or ¶3400 or ♯; fall qtr 1976)

CE 5501. ANALYSIS AND DESIGN OF WASTEWATER SYSTEMS. (4 cr; a joint day/Extension class; prereq 3500 or ♯; spring qtr 1977) Christensen

Dsgn 3463. INTERIOR DESIGN: HOUSING AND THE URBAN ENVIRONMENT. (4 cr; spring semester 1977) Hozza
Housing and its relationship to human interaction, both individual and group. Topics in perception of the environment, interior and exterior planning and design, socioeconomic patterns (income, poverty, racial distribution, etc.) community organization and community values, and how each relates to housing.

EBB 3001. INTRODUCTION TO ECOLOGY. (4 cr, §Biol 1104; spring semester 1977) Gorham

FR 1201. CONSERVATION OF NATURAL RESOURCES. (3 cr) Scholten

FR 5402. INTERPRETATION AND MANAGEMENT OF FOREST ENVIRONMENTS. (3 cr; limited to 50 students; winter qtr 1977)

FR 5403. FUNDAMENTALS OF NATURAL RESOURCE EDUCATION. (3 cr; limited to 36 students; special terms: Oct 8-Nov 15, 1976, Apr 8-May 16, 1977) Johnson, Miles
Intended for elementary teachers. Soil, water, forest and wildlife resources of Minnesota; biological principles and ecological implications of management. Environmental issues related to natural resource manipulation; practice of outdoor environmental education teaching skills in metropolitan nature centers.

FScN 1010. MAN'S FOOD. (4 cr, §1012; offered by correspondence only) Morris
Topics such as man's nutritional needs, food composition, world food supply, consumption patterns, food acceptance, food fads, quality programs and regulations, food preservation, commercial processes, packaging, marketing, national and international food programs.

FScN 1012. FOOD FOR THOUGHT. (4 cr, §1010; audio cassette course) Labuza
Sound nutritional guidelines; why food is processed, how it is processed, and how to analyze nutritional claims for special food and diets. Nutritional requirements of man and the physiology of digestion, food fads, and the world malnutrition problem.

GC 1111. SCIENCE IN CONTEXT: WEATHER AND CLIMATE. (4 cr; spring qtr 1977) A Johnson

GC 1112. SCIENCE IN CONTEXT: MAN AND ENVIRONMENT. (4 cr; fall qtr 1976, winter qtr 1977) Jefferson

GC 1113. UTILIZATION OF NATURAL RESOURCES. (4 cr; winter qtr 1977) Steinhauser

GC 1178. GEOLOGY IN MINNESOTA'S STATE PARKS. (4 cr; spring qtr 1977) Harris
Minnesota's state parks as representative examples of the geology of the state; their geologic features and the geologic principles required to explain them. May include field trips to parks near the Twin Cities.

GC 1212. MAN IN SOCIETY: URBAN PROBLEMS. (4 cr, winter qtr 1977) F Johnson

GC 3114. PERSONAL ENVIRONMENTAL HEALTH. (4 cr; winter qtr 1977) Dearden

GC 3285. ANTHROPOLOGY OF THE CITY. (18 cr; spring qtr 1977) F Johnson

GC 3292. URBAN GEOGRAPHY. (5 cr; spring qtr 1977) Steinhauser

GC 3314. NATURE AND ITS IMPACT ON THE MIND. (4 cr; spring qtr 1977) Jefferson

GC 3841. MINNESOTA RESOURCES. (4 cr; fall qtr 1976) Steinhauser
Quality of life in Minnesota—future possibilities as well as present problems—analyzed in relation to major elements of current scene: resources and their use, population trends. Such industries as transportation, mining, forestry, flour milling, and agriculture. Topics include urban development and environmental controversies involving pollution controls, new sources of energy, conservation, and utilization of undeveloped regions. Class supplemented by field trips; independent investigations encouraged.

Geo 1008. GEOLOGY AND MAN. (4 cr, §1001, 1007; fall semester 1976) Shaw

Hort 3076. ARBORICULTURE. (3 cr; limited to 30 students; prereq 1021, Soil 1122, or FBio 1100; winter qtr 1977) Simons
Environmental and design functions of shade trees. Application of specific cultural principles and techniques pertaining to the installation, maintenance, and preservation of shade and ornamental trees. Equipment selection and adaptability. Fundamental concepts used in the organization and administration of community shade tree programs. Lectures, demonstrations, and field trips.

NSci 1005. PHYSICAL WORLD: CHEMISTRY. (4 cr; prereq 1 yr high school algebra...high school chemistry and NSci 1004 recommended; spring semester 1977) Conroy
Fundamental concepts of chemistry, structure of matter, and important reactions and products of the physical world. Scientific methods and principles developed in lectures, and experiments, not only to help students understand the environment but also to provide solutions to problems faced in improving it.

NSci 3101. INTRODUCTION TO ENVIRONMENTAL TECHNOLOGY. (4 cr; prereq high school physics or chemistry; winter qtr 1977) Lambert, Whitby

NSci 3301. ENERGY, POWER AND SOCIETY. (4 cr; prereq high school physics or chemistry; fall qtr 1976) Goldstein

PA 3121. INTRODUCTION TO PUBLIC INTEREST RESEARCH. (4 cr; fall qtr 1976) Abrahamson

PA 3151. INTRODUCTION TO ENERGY POLICY. (4 cr, §5151; winter qtr 1977) Abrahamson

PA 5151. ENERGY AND ENERGY POLICY. (4 cr; winter qtr 1977) Abrahamson

Phcg 1800. NATURE'S REMEDIES. (3 cr; limited to 50 students; spring qtr 1977) Staba
Evaluation of those substances obtained from nature that are medicinally used. Chemical and physiological terminology; vitamins and enzymes; drugs from animals (hormones); drugs from the sea and microorganisms (antibiotics and vaccines); spices and herbs; tranquilizing plants; stimulating and hallucinogenic plants; poisonous plants and mushrooms. History and literature.

Pol 1027. URBAN POLITICS. (4 cr; winter qtr 1977) Nimitz

PubH 5151. ENVIRONMENTAL HEALTH. (3 cr; prereq ♯; fall qtr 1976) Straub
Methods for promoting man's health and comfort by controlling the environment.

PubH 5159. SEMINAR: ENVIRONMENTAL HEALTH. (1 cr; prereq ♯; spring qtr 1978 and alt yrs)

PubH 5171. ENVIRONMENTAL MICROBIOLOGY. (3 cr; prereq 5151, 5155, MicB 3101 or ♯; spring qtr 1977)

PubH 5181. INTRODUCTION TO AIR POLLUTION PROBLEMS. (3 cr; prereq ♯; fall semester 1976) Paulus

PubH 5182. AIR POLLUTION CONTROLS AND SURVEYS. (3 cr; prereq 5181 or ♯; spring semester 1977) Paulus

PubH 5202. ENVIRONMENTAL RADIOACTIVITY. (3 cr; prereq ♯; winter qtr 1978 and alt yrs)

PubH 5244. ENVIRONMENTAL HEALTH ASPECTS OF LIQUID WASTE DISPOSAL. (3 cr; spring qtr 1978 and alt yrs)

RCD 5120. ENVIRONMENTAL PROBLEMS. (3 cr, §1010)

Soc 3601. URBAN COMMUNITY. (4 cr; limited to 50 students; prereq 1001 or 1002; winter qtr 1977)
Urban community patterns. Comparison of social interaction in neighborhood, city, and metropolis—across societies. Review of community studies. Urban power structures. Settlement patterns, organization of social life, and urban problems.

Soc 5601. URBAN SOCIOLOGY. (4 cr; prereq 1001 or 3505, 3506 or ♯; fall qtr 1976)

Soil 0100C. GARDEN SOIL MANAGEMENT. (3 cr; winter qtr 1977) Adams, Arneman, Hanson
Designed for the home gardener or hobby farmer. Soils and the factors that make them suitable or unsuitable for productive gardens. Topics include effects of different methods of fertilizer tillage, mulching, water use, and their influence on plant growth. Deficiency symptoms.

Soil 1122. INTRODUCTORY SOIL SCIENCE. (4 cr; limited to 14 students; prereq Chem 1001 or 1004; fall qtr 1976) Arneman

UrbS 3101. URBAN STUDIES COLLOQUIUM. (2 cr; S-N only; limited to 20 students; fall qtr 1976)
Our perceptions of urban space. Design elements of the American city; the problem of spatial imagery. Design implications of certain kinds of neighborhoods; role of factors such as architecture and open space in determining spatial perceptions.

UrbS 3500. WORKSHOP IN AMERICAN URBAN ETHNICITY. (4 cr; winter qtr 1977) Murphy
Traditional models of urban ethnic assimilation and their weaknesses; the rise of the "new ethnic politics" as a factor in urban political and social behavior. The history and makeup of particular ethnic groups locally (e.g., the Italians in Minneapolis, the Spanish-speaking community in St. Paul, etc.). Fieldwork will include optional oral or informal histories of local ethnic neighborhoods.

Family Social Science (FSoS)

College of Home Economics
206 McNeal
CONTACT: *Planning*—
Sheila Henry, 205 North Hall, 373-1549

5210. THE FAMILY IN WORLD PERSPECTIVE. (5 cr, §Anth 5312, §Soc 5511; prereq 5200 and Anth 1002 or ♯)
Comparison of kinship, marriage, family organization, the family life cycle, and modes of family functioning across cultures; relationship to economic, political, religious, and other institutions, with emphasis on adaptations of the family to urbanization and industrialization.

5255. PUBLIC SOCIAL POLICY AND THE AMERICAN FAMILY. (4-5 cr; prereq ♯)
How social legislation in areas of welfare, housing, child development, health care, etc., affects and, in some cases, determines the nature, structure, and quality of the family as a social institution.

Finance (BFin)

College of Business Administration

3500. REAL ESTATE INVESTMENT ANALYSIS. (4 cr; prereq Econ 1002 or equiv)
Economic aspects of investments in real property including: cash flows; accounting depreciation vs. market value depreciation or appreciation; financing methods and cost; sources of funds; measures of return on investment. Ellwood techniques. Computer models for investment analysis. Impact of property taxes on urban land use.

Fisheries and Wildlife

See ENTOMOLOGY, FISHERIES, AND WILDLIFE

Food Science and Nutrition (FScN)

College of Agriculture and
College of Home Economics
225 Food Science and Nutrition
CONTACT: *Environment*—
Elwood F. Caldwell, 228 Food Science and Nutrition, 373-1073

1010. MAN'S FOOD. (4 cr, §1012; offered by correspondence only) Morris
Man's nutritional needs; food composition, world food supply, consumption patterns, acceptance, quality programs and regulations, food preservation, commercial processes, packaging, marketing, national and international food programs.

1012w,s. FOOD FOR THOUGHT—FOR FOOD. (4 cr, §1010) Addis, Labuza
Nutritional requirements of man, basis of a balanced diet, effect of processing and storage on food quality and nutritional value, chemical additives and food safety, FDA, food fads, dieting, future world food production problems and answers. Individual 2-week dietary survey to be conducted.

5120. FOOD MICROBIOLOGY. (3 cr [for lect taken separately with ♯] or 5 cr [for lect and lab]; prereq MicB 3103) Busta
Relationship of environment to occurrence, growth, and survival of microorganisms in foods; evaluation of microbiological quality of dairy and food products; characteristics and activities of bacteria, yeasts, and molds related to food spoilage; utilization of microorganisms in manufacture of dairy and food products; recognition and control of food-borne pathogens and food poisoning.

5643. SEMINAR: WORLD FOOD SUPPLY PROBLEMS. (4 cr, §AgEc 5790, §PIPa 5220, §Soc 5675, §LACS 5280; limited enrollment; prereq sr or grad student with ♯) Doyle, Busta
A multidisciplinary approach will examine social, economic, and technical problems of feeding the world's growing population.

Forest Resources (FR)

College of Forestry
110 Green Hall
CONTACT: *Environment*—
K. E. Winsness, 12 Green Hall, 373-0842

1100. DENDROLOGY. (4 cr; prereq Biol 1011)
Identification, nomenclature, classification, and distribution of about 200 important forest trees. Preparation and use of keys, systems of natural classification, and field and laboratory methods of identification.

1101. INTRODUCTION TO AIR AND WATER QUALITY. (4 cr)
Air and water quality problems. Basic processes which govern the accretion, depletion, and cycles of specific types and sources of pollution. Methods of pollution abatement and influence of political, social, and economic pressures on the maintenance of a "quality environment."

1201. CONSERVATION OF NATURAL RESOURCES. (3 cr)
Renewable natural resources of the U.S. and the world; their utilization, interrelationship, and management treated from an economic standpoint; their importance to society and our responsibility for their conservation. Lectures and reports.

1203. INTRODUCTION TO MINNESOTA'S NATURAL RESOURCES. (3 cr, §1200, §1201; for non-forestry students)
Ecological, social, and economic implications of Minnesota's soil, water, forest, wildlife, and other resources are studied in field exercise and group discussions at nature centers and natural areas. Environmental teaching techniques for the elementary indoor classroom.

3114. FOREST TREE BIOLOGY. (4 cr; prereq Chem 1004, 10 cr of biology)
The growth, function, and genetics of forest trees. Lecture and laboratory.

5100. SILVICULTURE. (3 cr; prereq Itasca Session, 1100, 3101)
Introduction to silvics, silvicultural systems, intermediate cuttings, and related practices. Forest regeneration problems and techniques.

5102. REGIONAL SILVICULTURE. (3 cr; prereq 5100 or ♯)
Forest regions of North America emphasizing silvical, historical, geographic, economic, and other determinants of forest management. Topics on special problems of current concern. Field trips.

5114. FOREST HYDROLOGY AND SOILS. (5 cr; prereq Itasca Session, Geo 1001, or ♯)
Water and its relation to forests and forest management. Effects of managing the forest system on components of the hydrologic cycle with emphasis on soil water content, evapotranspiration and quantity and quality of runoff. Basic soil science including chemical and physical properties, soil genesis, and classification. Role of soils in determining tree species distribution and productivity.

5150. FOREST ECOLOGY SEMINAR. (3 cr; prereq sr, 3101, 5100, or ♯)
Survey of classical concepts and contemporary developments in ecology as related to forestry. Discussion group format.

5151. MULTIPLE-USE SILVICULTURE. (3 cr; prereq sr, 5100, or ♯)
Wildlife production, aesthetics, wilderness area management, minor forest products, noise and air pollution, and other non-timber production forest uses. Classical and recent contributions.

5222. FOREST POLICY AND ECONOMICS. (5 cr; prereq AgEc 1030)
Forest resource supply and consumption relationships, U.S. and world; legal and political factors; basic economic and financial analysis of forestry activities: production, consumption, and investments.

5232. MANAGEMENT OF RECREATIONAL LANDS. (3 cr; prereq jr in forestry or ♯)
Recreational use of the forest and associated land and water. Policy problems arising from recreational demands.

5233. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING. (4 cr; prereq 5232 or ♯)
(Same as LA 5010) For advanced students associated with design, management, and planning of recreational facilities. Planning and design principles related to recreational land use and development; parks, campsites, water areas, highways, summer and winter recreational facilities.

5240. METEOROLOGY AND FOREST FIRE MANAGEMENT. (4 cr; prereq ¶1100, Itasca Session, wildlife management major or ♯)
Fundamentals of meteorology and climatology and applications to forestry. Forest fire behavior, administration of forest fire control, and applications of prescribed burning.

5257. RECREATIONAL LAND POLICY. (3 cr; prereq 5232 or ♯)
Policy issues affecting the use and management of lands devoted entirely or in part to recreational objectives.

General College (GC)

106 Nicholson Hall

CONTACT: *Environment*—
A. Johnson, 113 Folwell Hall, 373-3723

1111. SCIENCE IN CONTEXT: WEATHER AND CLIMATE. (5 cr; 5 lect, 1 lab hrs per wk) Johnson
Day-to-day and long-range weather patterns studied in terms of interactions among atmosphere, oceans, land surfaces, and earth motions. Fair weather, storms, seasonal change, climatic change, air pollution, and water resource problems. Basic principles of science applied to analyzing and forecasting weather, interpreting climates and climatic change, and understanding how man is changing the atmospheric environment. Individual laboratory investigations and problem solving using weather instruments and maps.

1112f,w,s. SCIENCE IN CONTEXT: HUMAN USES OF THE ENVIRONMENT. (5 cr) Liston
Biological principles of the interrelationships between man and the environment. Ecology as applied to the problems of man's past, present, and future existence; such topics as structure and function of the ecosystem; pollution of air, water and soil; population explosion; evolution of man, man's migrations, and development of human settlements or biosocial environments; marine, radiation, and space biology; and creation of livable environments for man, present and future.

1113f,w,s. SCIENCE IN CONTEXT: NATURAL RESOURCES, THEIR UTILIZATION AND MANAGEMENT. (5 cr) Jefferson
Intelligent use of natural resources such as land, soil, water, plants, animals, forest, minerals, and wildlife. Their location, characteristics, and use by man.

1131f,w,s. BIOLOGICAL SCIENCE: PRINCIPLES. (5 cr) Jefferson
The variety and relationships of living organisms, illustrating general principles of biology as they apply to man, animals, and plants.

1133. NATURE STUDY. (4 cr) Dearden
Appreciation of wild plants and animals in their natural environment. Techniques and objectives of giving field instruction to groups of children and adults interested in nature. Identification, behavior, and relationships of living things. Individual projects may be assigned, such as writing nature poetry; drawing, sketching, or painting plants and animals; studying life histories of plants and animals; recording sounds and calls; studying effects of specific chemicals on plants and animals; cultivating house plants; or collecting insects or leaves. Lectures, laboratories, and field trips.

1171. PHYSICAL SCIENCE: GEOLOGY. (5 cr; 5 lect, 1 lab hrs per wk) Johnson
Description of common land features—valleys, mountains, hills, and lakes—and the processes responsible for their origin and change. Types of surface materials such as rocks and glacial deposits. Individual laboratory work with rocks, minerals, maps, and models to take direct data and apply them to problems.

1172. PHYSICAL SCIENCE: HISTORICAL GEOLOGY. (5 cr; prereq 1171; 5 lect, 1 lab hrs per wk) Johnson
Principles of physical geology are used as tools to unravel the earth's past as recorded by rocks and fossils. Development of earth's physical features and changing patterns of life through time, with implications for problems that chal-

lenge man's existence. Emphasis on problem solving and logical deductions from facts rather than on memorization. Individual laboratory work with rock samples, fossils, and structural maps and models taking data to apply problems.

1212. MAN IN SOCIETY: URBAN PROBLEMS. (5 cr)
Using problem-solving, interdisciplinary approach, students examine some major urban problems, such as social class and poverty, social change, crime, and education. Emphasizes practical involvement through fieldwork and/or community activities.

1217. MAN IN SOCIETY: COMMUNITY SERVICE: INTERNSHIP. (15 cr or cr ar; prereq ♯)
Combining tutorial, fieldwork, and seminar experiences, interns study, analyze, and evaluate a particular agency in Twin Cities community. Designed primarily for students who intend to major in urban affairs.

1921. ENVIRONMENTAL PROBLEMS: NATURAL SCIENCE. (5 cr; prereq ¶1922, 1923, 1924)

1922. ENVIRONMENTAL PROBLEMS: SOCIAL SCIENCE. (5 cr)

1923. ENVIRONMENTAL PROBLEMS: INDIVIDUAL WRITING. (3 cr)

1924. ENVIRONMENTAL PROBLEMS: HUMANITIES. (3 cr) Johnson
Package study in environmental control.

3114. PERSONAL ENVIRONMENTAL HEALTH. (5 cr; prereq 1132) Dearden
Health as a product of harmony between man and environment: biological, physical, social, and ideological. Possible topics: personal health—interaction of mind and body, progress in medicine; environmental health—impact of new types of pollution, environment and personality, occupational health and industrial medicine, community health organizations and consumer costs, health in college community.

3181. MODERN PHYSICAL SCIENCES: ENERGY SOURCES AND CONVERSIONS. (4 cr; prereq one college course in physics and in chemistry) Schwabacher
Principles of chemistry and physics applied to energy conversion, types of engines, heaters and other devices, and to chemical and nuclear fuels and their different sources.

3217. URBAN AFFAIRS: INTERNSHIP. (Cr ar; prereq ♯)
Students examine programmatic aspects of community agencies, with emphasis on evaluating effectiveness with which agencies meet stated goals and objectives. Consent of instructor or urban affairs coordinator required because students should have adequate background through traditional course work to understand agencies' roles in society, sufficient skills in communication and human relations to function as interns in agencies, and specialized course work to prepare for independent research activity.

3285. ANTHROPOLOGY OF THE CITY. (5 cr)
Anthropologist's way of looking at urbanization as a process and at the city as a community made up of a variety of cultures. Ecological perspective as it relates to the whole of interaction between various cultures. Field study allows students to apply theories introduced to one of the many cultures which make up the city in the 1970's.

3292. URBAN GEOGRAPHY. (5 cr) Steinhauser
Focus on Twin Cities metropolitan area, particularly the two central cities and selected suburban communities. Urbanization, cultural pluralism, environmental control, and shifting values. Several other large American and foreign cities also studied.

Genetics and Cell Biology (GCB)

College of Biological Sciences

227 Snyder Hall

3002s. HUMAN GENETICS, SOCIAL AFFAIRS. (3/4 cr, §3022, §Biol 1101, Biol 3032; for students in programs not directly related to biological sciences) Anderson
Human genetics; study of individuals, families, populations, and races with respect to differences in intelligence, behavior, disease, and other matters of social concern. For students in programs not directly related to the biological sciences.

Geography (Geog)

College of Liberal Arts

414 Social Sciences

CONTACTS: *Environment*—
R. Skaggs, 414B Social Sciences, 373-2662
Planning—
J. Adams, 368 Social Sciences, 376-7106

1401. PHYSICAL GEOGRAPHY. (5 cr)
Distribution patterns of climate, relief, vegetation, and soils; regional differences in problems of physical development.

1425. INTRODUCTION OF METEOROLOGY. (4 cr, §Soil 1262) Baker, Skaggs
(Same as Soil 1262) Precalculus introduction to nature of the atmosphere and its behavior. Topics include atmospheric composition, structure, stability, and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns; meteorological instruments and observation; plotting and analysis of maps; forecasting.

3101. GEOGRAPHY OF THE UNITED STATES AND CANADA. (4 cr) Borchert, Hart
The manner in which abilities of different peoples have interacted with the natural environment in producing regional differentiation in United States and Canada.

3111. GEOGRAPHY OF MINNESOTA. (4 cr)
Physical resources, population, and commercial production. Field trips in eastern Minnesota.

3343w. LAND USE ECOLOGY. (4 cr) Squires
Man as an animal; the ecological principles of man's existence and present use of the earth.

3355. ENVIRONMENTAL PROBLEMS. (4 cr) Gersmehl, Squires
Environmental problems associated with human activities.

3361. ENVIRONMENTAL EVALUATION AND ADAPTATION. (4 cr) Tuan
The making of "worlds" out of " environments;" how different peoples evaluate and adapt to their natural surroundings, past and non-literate cultures.

3371w,s. URBAN GEOGRAPHY. (4 cr) Adams
Character, distribution, and development of cities in present-day world. Internal and external locational relationships.

3377f. THE DEVELOPMENT OF INDIGENOUS MARKETS IN THE THIRD WORLD. (4 cr) Scott
Comparative analysis of markets and marketing in the Third World; organizational structure, function, commodity exchange, economic efficiency, and contributions to rural economic growth and national integration.

3378. MODERNIZATION AND THE THIRD WORLD. (4 cr) de Souza
Major concepts and ideas of modernization in the Third World; historical trends and impact of changes on spatial organization.

3421. CLIMATOLOGY. (4 cr; prereq 1401 or ♯) Skaggs, Barrett
World distribution of climatic elements; methods of arranging climatic data; climatic classifications and world distributions of climatic types; general circulation; climatic change and climatic fluctuations.

3431. PLANT AND ANIMAL GEOGRAPHY. (4 cr) Squires
Distribution of plants and animals on the earth. Emphasis on geographical factors (climate, land and sea distribution, soil) and biological factors (dispersal, evolution, competition) responsible for this distribution.

3973. GEOGRAPHY OF THE TWIN CITIES. (4 cr, §1973) Staff
Major social and physical characteristics of the Twin Cities and their place in the urban network of the United States.

5372-5373. METROPOLITAN ANALYSIS I, II. (4 cr per qtr) J Adams
5372: Urban systems and metropolitan areas, structure and growth; daily urban systems; simulated urban systems; metropolitan population dynamics; social area analysis; transportation systems; travel behavior; land use; retail structure, change. *5373:* Neighborhood transition; conflicts in housing, location of facilities, and urban renewal.

5375-5376. AMERICAN CITIES—LOCATION AND GEOGRAPHIC DESIGN. (4 or 6 cr per qtr; prereq ♯) Borchert
5375: The spread of urbanization across the U.S.; differentiation of city sizes and functions within the nation's resource regions and circulation network; the evolution of today's system of cities and its regional and national management problems. *5376:* The internal development of the major metropolitan areas of the U.S.; evolution of today's land-use patterns, activity systems, and metropolitan management problems.

5381. SERVICES AND LOCATION THEORY. (4 cr; prereq 3331 or ♯) Adams
Localization of economic activity; case studies of industries and services; location factors, models, and theory.

5383s. TRANSPORTATION GEOGRAPHY. (4 cr; prereq 3331 or ♯) R Adams
Principles and theory of spatial development of transport systems; interaction of resource use and network growth; commodity and passenger flows; case studies at national, regional, and local (urban) levels.

5385. GEOGRAPHY OF COMMUNICATIONS SYSTEMS. (4 cr; prereq 12 cr social or behavioral sciences)
Evolution, diffusion, and spatial structure of communication systems. Impact of communications media on settlement patterns and spatial behavior in advanced and developing nations. Interpersonal media.

5391s. RURAL GEOGRAPHY. (4 cr) Mather
Geographic components and assemblages of rural settlement. World patterns and geographic problems of rural settlement in the United States.

5424. QUATERNARY CLIMATES. (4 cr; prereq ♯) Skaggs, Squires
Climatic variability during the Quaternary period; the evidence for, and significance of, such variability.

5445. QUATERNARY PALEOGEOGRAPHY. (4 cr) Squires
Evidence of past environments with special reference to the Quaternary period.

5811. ENVIRONMENTALISM, ENVIRONMENT, AND THE QUALITY OF LIFE. (4 cr; prereq ♯) Tuan
Ideas of environmentalism; organization of the physical environment into rural and urban settings that reflect human ideals.

5849. SPACE AND PLACE: A GEOGRAPHY OF EXPERIENCE. (4 cr) Tuan
How experience creates structure and meaning in space and environment.

8340. SEMINAR: LAND USE PLANNING. (3 cr; prereq ♯) J Adams, Borchert

8410 PHYSICAL ENVIRONMENT PROBLEMS IN METROPOLITAN AREAS. (3 cr; prereq ♯)

8440. PLEISTOCENE BIOGEOGRAPHY. (1-3 cr) Squires

8850. SEMINAR: ATTITUDES TOWARD ENVIRONMENT. (3 cr; prereq ♯) Tuan

Geology and Geophysics (Geo)

School of Earth Sciences
Institute of Technology
108 Pillsbury Hall
CONTACT: *Environment*—
H. O. Pfannkuch, 2d Pillsbury Hall, 373-5678

1001f,w,s. PHYSICAL GEOLOGY. (5 cr; high school physics and chemistry recommended; 3 lect hrs, one 2-hr lab, 1 rec hr per wk)
A first course in geology for science majors, and an introduction to scientific method and nature of the earth for others. Survey; main features of physical world and processes that have formed them.

1002f,w,s. HISTORICAL GEOLOGY. (4 cr; prereq 1001; 3 lect hrs and one 2-hr lab per wk) Sloan
Evolution of earth from its origin to present; the succession of physical and biological events of past 600 million years.

1007. ENVIRONMENTAL GEOLOGY. (4 cr, §1008; prereq 1001) Wright
Geological applications in resource management, land use planning, technology, and conservation. Geological evolution of the biosphere and the impact of man's activities on land, sea, and air resources. Geological hazards. The Twin Cities metropolitan area as a geological environment. Lectures, labs, and field trips.

1008. GEOLOGY AND MAN. (4 cr, §1001, 1007) Shaw
Man in the physical environment: geological hazards (e.g., earthquakes); the nature and use of natural resources; geological aspects of pollution, recreation, and land use; the effect of the composition of rocks and soils on nutrition and disease. An introduction to the broad nature of earth science. Lecture, labs, and field trips.

1012. EARTH AS A PLANET. (4 cr) Murthy
The origin and evolution of the earth, its structure and composition in relation to other planets, and the cosmic abundances and mode of formation of elements in the solar system.

1013. ORIGIN AND EVOLUTION OF LIFE. (4 cr) Sloan
Geological evidence of the origin and increasing complexity of living systems, including biogenesis, single-celled organisms, plants, animals, and ecosystems. Problems of extraterrestrial life.

1601. MARINE SCIENCES. (4 cr; high school physics, chemistry, and biology recommended; §1014; 3 lect and 1 rec hrs per wk) Johnson, Shapiro, Barnwell
Survey of marine sciences including marine geology, marine biology, physical and chemical oceanography, resources of the sea, and man's interaction with the sea.

3101f. SURFICIAL GEOLOGIC PROCESSES. (5 cr; prereq 3102, 3401 or ♯) Hooke, Pfannkuch, Johnson
Geological processes acting at the surface of the earth. Geomorphology, limnology, groundwater geology, and sedimentology. Field trips.

5108. ADVANCED ENVIRONMENTAL GEOLOGY. (4 cr; prereq geology core curriculum 1111 through 3103 or equiv) Parham
Man's impact on the geological environment and the effect of geology/geologic processes on man. Land use planning; geologic hazards; geologic aspects of health and disease; mineral conservation; waste disposal; and geologic controls and limitations in developed versus underdeveloped countries.

5261. GLACIAL GEOLOGY. (4 cr [5 cr with term paper]; prereq 1002 or 3112) Wright
Formation and characteristics of modern glaciers; erosional and depositional features of Pleistocene glaciers; history of Quaternary environmental changes in glaciated and nonglaciated areas. Field trips.

5601. LIMNOLOGY. (4 cr, §EBB 5601; prereq Chem 1005 or equiv and ♯) Shapiro
Description and analysis of events occurring in lakes, reservoirs, and ponds, beginning with their origins and progressing through study of their physics, chemistry, and biology. Interrelationships of these parameters and effects of civilization on lakes. Field trips.

5602. CASE STUDIES IN LIMNOLOGY. (3 cr; prereq 5601 or EBB 5601 and ♯)
Detailed analyses of specific studies on lakes and their problems throughout the world.

5611. GROUNDWATER GEOLOGY. (4 cr; prereq 1001 or 1111, Math 1231, 1 qtr physics and chemistry, or ♯) Pfannkuch
Origin, occurrence, and movements of groundwater. Characteristics of major aquifers and aquitards. Exploratory investigations. Hydrogeologic units and boundaries. Principles and theoretical aspects of recharge. Quality of groundwater supplies.

5642. MARINE GEOLOGY. (4 cr; prereq geology core courses or ♯) Johnson, Chase
Physiography and structure of ocean basins and continental margins; their development as suggested by concepts of global tectonics. Geologic processes within the marine environment. Review of marine geological and geophysical techniques.

8608. SEMINAR: LIMNOLOGY. (1 cr; prereq ♯) Wright, Shapiro, Megard, Cushing, Gorham

8612. ANALYTICAL GEOHYDROLOGY. (3 or 4 cr; prereq Math 3211, CE 3400 or ♯) Pfannkuch

8618. SEMINAR: GROUNDWATER GEOLOGY. (Cr ar; prereq ♯) Pfannkuch

History (Hist)

College of Liberal Arts
614 Social Sciences

CONTACT: *Planning*—
Stuart Schwartz, 614 Social Sciences, 373-2705

3901, 3902. AMERICAN URBAN HISTORY. (4 cr per qtr)
3901: Preindustrial America. 3902: Industrial America.

5031-5032. A SOCIAL HISTORY OF ANGLO-AMERICAN LAW. (4 cr per qtr) Samaha
Law as a social institution. Development of the Anglo-American legal system from its inception as an unsophisticated attempt to settle disputes by self-help to a complex structure relying on formal, professionalized judicial machinery supported by political power to enforce decisions.

Horticultural Science

College of Agriculture
305 Horticultural Science

See LANDSCAPE ARCHITECTURE listings.

Humanities Program (Hum)

College of Liberal Arts
286 Ford Hall

CONTACTS: *Environment*—
Paul D'Andrea, 314 Ford Hall, 373-3516
Planning—
M. Roshwald, 384 Ford Hall, 373-4883

1009f,s. INTRODUCTION TO SCIENCE AND HUMANITIES. (5 cr)
Examines the relationships between science and the humanities.

3049. SCIENCE AND HUMANITIES. (5 cr; prereq jr, sr, or ♯)
"Warfare" between the scientific and humanistic cultures; documents from Ficino and Vives to Polanyi, Koestler, Bronowski, and A. Huxley. Humanistic scholarship and methodological character of sciences, creativity in arts and sciences, science and human values.

3101f, 3102w, 3103s. THE MEANING OF HUMANITY, SOCIETY AND TECHNOLOGY, COMMUNITY. (4 cr per qtr) Roshwald
3101: The essence of man and the factors determining man's course, explored through theories such as those of Marx, Freud, Plato. *3102:* Impact of technology on human conditions; the attitude of man toward technology, examined philosophically and sociologically. *3103:* Meaning of man as a social being in groups in which human beings participate.

Industrial Relations (IR)

College of Business Administration
537 Business Administration

CONTACTS: *Environment*—
G. W. England, 547 Business Administration, 373-3853
Planning—
M. Bognanno, 537 Business Administration, 373-3826
G. E. O'Connell, M.D., Labor Education Service,
4th floor Business Administration, 373-5380

3010f,w,s. HUMAN RELATIONS AND APPLIED ORGANIZATION THEORY. (4 cr)
The problems of human relations arising in modern organizations and approaches to their solution. Philosophies and theories of human relations and their translation into policy. Discussions, cases, role playing, and skill building sessions.

8004. ORGANIZATION THEORY AND ANALYSIS. (4 cr; prereq 8002 or ♯) Mahoney, Pinto, Weitzel

International Relations (IntR)

College of Liberal Arts

CONTACT: *Planning*—
Robert T. Kudrle, 1246A Social Sciences

5804. MODERNIZATION, EQUALITY, AND SOCIAL JUSTICE. (4 cr; prereq 12 cr in social sciences) Ellenbogen, Henry
Effects of modernization on distribution of scarce resources and on civil rights. Forms of intervention to modify the opportunity structure; consideration of policy alternatives; comparative approach between and within nations.

5901. APPROACHES TO INTERNATIONAL RELATIONS. (4 cr; prereq major in international relations)
Proseminar designed to synthesize the approaches of different academic disciplines to the study of major problems of international relations. Topics vary quarterly.

5902. DECISION MAKING IN INTERNATIONAL RELATIONS. (4 cr; prereq major in international relations)
Proseminar designed to synthesize different approaches to international relations through student participation in decision-making roles in experimental, simulated situations.

5903. ANALYSIS OF INTERNATIONAL POLICY PROBLEMS. (4 cr; prereq major in international relations)
Proseminar designed to synthesize different approaches to international policy problems. Topics vary yearly.

Journalism and Mass Communication (Jour)

College of Liberal Arts

111 Murphy Hall

CONTACTS: *Environment*—
P. Tichenor, 35 Murphy Hall, 376-7104
Planning—
Robert L. Jones, 112 Murphy Hall

3021. MASS COMMUNICATION AND THE NEWS. (4 cr; not open to journalism majors) Fang
Mass communication media in contemporary society: structure, organization, professional norms, audience composition. Press and broadcasting; role of media in news dissemination.

5133. SPECIALIZED REPORTING: SOCIAL AND PHYSICAL SCIENCES. (4 cr; prereq 3121 or 3176 for majors...♯ for nonmajors) Tichenor
Role of journalistic communication in science; scientist-journalist relationships; communicating results of scientific investigations to public, specialized audiences, industry.

5143. INTERPRETATION OF SCIENCE AND TECHNOLOGY. (4 cr; prereq 5133, 5501 or ♯) Tichenor
Analysis of scientific research and technological development for mass and specialized media; science content in media; audience impact.

5144. URBAN JOURNALISM. (4 cr; prereq 3121, 5131, or grad student, professional experience, ♯, or △)
Urban problems and mass media role and performance; specialized reporting and commentary on urban functions; urban media policy and news gathering techniques; analysis of media content; reporting projects on urban subjects and appropriate readings.

5501f,s. COMMUNICATION AND PUBLIC OPINION I. (4 cr, §Soc 5355; prereq 15 cr in social science depts) Carter, Tichenor, Wackman
Theories of the communication process and of persuasion and attitude change. Interpersonal and mediated communication in diffusion of information and in opinion formation.

5531w. COMMUNICATION AND PUBLIC OPINION II. (5 cr; prereq 5501 or Soc 5355) Carter, Tichenor, Wackman
Theories and research findings on opinion formation, persuasion, diffusion of information. Social science contributions to studies of the process and effects of mass communication.

5721w,s. MASS MEDIA IN A DYNAMIC SOCIETY. (4 cr; prereq 1201 or 3121 for journalism majors...♯ for others) Dennis, Gillmor, Ismach, Ward
Economic, political and social determinants of character and content of mass communications, Patterns of operations, effect on content, and relative social utility. Theory of mass society.

8721f, 8722w, 8723s.* COMMUNICATION AGENCIES AS SOCIAL INSTITUTIONS. (4 cr per qtr; prereq 5721 or equiv, ♯) Dennis

Landscape Architecture

See ARCHITECTURE AND LANDSCAPE ARCHITECTURE

Law School (Law)

125 Fraser Hall

CONTACT: *Environment*—
Marcia Gelpe, 245 Fraser Hall, 376-7234

5113. STATE AND LOCAL TAX. (4 cr; prereq ♯) Schoettle
Legal and most of the economic issues presented by the various forms of taxation and finance used by state and local governments. Sales tax, property tax, corporate and personal income tax, bonds and government indebtedness as well as the fiscal crises of state and local governments.

5201. LAND USE PLANNING. (3 cr; prereq ♯) Freeman, Bryden
Public control of land use and development, primarily in metropolitan areas. For lawyers whose practice will involve them in the affairs of local governments or in real estate transactions.

5208. LOCAL GOVERNMENT LAW. (4 cr; prereq ♯) Morrisen
The distribution of decision-making power between the state and other units of government. The proper role of the courts in reviewing decisions of other units of government.

5215. ENVIRONMENTAL REGULATION. (3 cr; prereq ♯) Gelpe
Legal aspects of major environmental problems with emphasis on issues that reappear in various regulatory contexts: e.g., who should bear the cost of enhancing environmental quality; allocation of responsibilities among courts, legislatures, and administrative agencies; role of citizens groups and environmental litigation; environmental policy acts; etc.

5220. SOCIAL WELFARE LAW. (3 cr; prereq ♯) Cooper
State and federal laws governing income maintenance programs, including constitutional law, statutes, regulations and court decisions. Emphasis on the program of Aid to Families with Dependent Children.

5606. LEGAL AID. (3 cr; prereq ♯) Weissbrodt
Function of administrative agencies in our society; interrelations of legislative, judicial, executive, and administrative agencies in development of public policy.

5621. CIVIL RIGHTS. (4 cr; prereq ♯) Freeman
Federal and state remedies for discrimination on the basis of race, religion, ethnic background, sex, or age in the areas of voting rights, education, the administration of justice, employment, housing, public accommodations, and health and welfare services, where such discrimination is applicable.

5807. SEMINAR: NATURAL RESOURCES. (1-4 cr; prereq ♯) Bryden
Problems concerning resource preservation and open space zoning such as: management of public lands, lakeshore zoning, scenic easements, highway beautification, wild and scenic rivers programs, cluster development, taxation policies to conserve open space, etc.

5834. SEMINAR: STATE AND LOCAL TAX. (3 cr; prereq ♯) Schoettle
Legal problems presented by various statutory schemes for financing state and local governments. Basics of public finance including theories of taxation, function of the public budget, and PPBS.

5885. SEMINAR: ENVIRONMENTAL REGULATIONS. (1-3 cr; prereq ♯) Gelpe
Review of proposed state and federal environmental regulations and preparation of written comments thereon. Roles of law and other disciplines in regulation development; identification of political, legal, administrative, and technical problems and comparison of these problems under different regulatory schemes.

Marketing (Mktg)

College of Business Administration

1235 Business Administration

CONTACT: *Environment*—
R. J. Holloway, 1235A Business Administration, 373-4407

8820w. SEMINAR: SOCIAL AND ECONOMIC ASPECTS OF MARKETING. (4 cr; prereq 3000 or 8000 or equiv, ♯) Holloway

Mechanical Engineering (ME)

Institute of Technology

125 Mechanical Engineering

CONTACTS: *Environment*—
K. T. Whitby, 130 Mechanical Engineering, 373-3049, or instructor listed

5603. THERMAL ENVIRONMENTAL ENGINEERING. (4 cr; prereq 3303, 5342; 4 lect hrs per wk) Threlkeld
Thermodynamic properties of moist air; h-w diagram for moist air; solar radiation; heat and water vapor transmission in structures; effects of thermal environments upon people, processes, and materials; thermal loads, thermal environmental control systems.

5607. INDUSTRIAL VENTILATION AND CONTAMINANT CONTROL. (4 cr; prereq 3303, CE 3400; 4 lect hrs per wk) Whitby
Contaminants, dispersion mechanisms, transport, fans, hoods, gas cleaners, behavior of jets and sinks, closed and open systems, applications to industrial processing and emission control.

5612. ENVIRONMENTAL ENGINEERING. (4 cr; prereq jr or sr in IT or ♯; 4 lect hrs per wk) Whitby
Basic principles of engineering assessment and control of emissions to air and water, noise measurement and control, and control, handling, and disposal of solid wastes.

5613. PRINCIPLES OF PARTICLE TECHNOLOGY. (4 cr; 3303 recommended; 4 lect hrs per wk) Liu
Definition, theory, and measurement of particle properties, particle statistics, fluid dynamics, optical, electrical and thermal behavior of particles.

5614. PRINCIPLES OF PARTICLE TECHNOLOGY. (4 cr; prereq 5613; 4 lect hrs per wk) Liu
Gas cleaning, particle transport, comminution, classification, surface properties, packed beds, powder behavior, and miscellaneous topics.

5615. AIR CONTAMINANT MEASUREMENT. (4 cr; prereq 5613 or ♯) Whitby
Principles of operation, application and interpretation of data from instruments and instrument systems used for in-plant contaminants, emissions and air quality measurement. Part lecture and part laboratory.

5712. SOLAR ENERGY UTILIZATION. (4 cr; prereq 5342 or ♯) Liu
History and potential of solar energy utilization; availability of solar radiation on clear and cloudy days; incident radiation on horizontal, vertical and inclined surfaces; flat-plate and concentrating solar collectors; heating and cooling with solar energy; power generation; review of current research.

Microbiology (MicB)

College of Biological Sciences and
Medical School
1060 Mayo

5105f,w,s. BIOLOGY OF MICROORGANISMS. (4 cr, §3103, §Biol 3013; prereq 5 cr in biological sciences, Chem 3302 or Biol 3021 or ♯) Dworkin
Taxonomy, anatomy, physiology, biochemistry, and ecology of microbes. Molecular structure in relation to bacterial function. Lectures, demonstrations, and laboratory exercises.

5611f. MICROBIAL ECOLOGY. (4 cr; prereq general microbiology course, Biol 3021 or ♯) Crawford
Microbial adaptation and diversity; role of microorganisms in natural processes; methods in microbial ecology; other topics.

Mineral Engineering (MinE)

Institute of Technology

CONTACT: *Environment*—
Dr. N. F. Schulz, Mineral Resources Research Center, 373-3341

5630. SURFACE MINING ENGINEERING. (4 cr; prereq Geo 1111, MinE 5611 or ♯)
Unit operations of drilling, blasting, loading, hauling, and transporting of surface rocks and soils. Equipment productivity, selection, and cost estimating. Design of open pits and quarries. Economics, environment, and organization.

5660. SPECIAL MINERAL ENGINEERING PROBLEMS. (Cr ar; prereq 5612)
Literature survey, research, design, feasibility studies on mining and metallurgical problems.

5710. ENVIRONMENTAL ASPECTS OF MINERAL ENGINEERING. (4 cr; prereq 5613 and 5820 or ♯; 3 lect hrs and one 2-hr lab per wk)
Recognizing and minimizing the environmental problems posed by mining and metallurgical operations in both the immediate working environment and the larger ecological environment. Only a limited number of students from outside the department can be accommodated.

Natural Science (NSci)

Cross-Disciplinary Studies
College of Liberal Arts
106 Johnston

CONTACT: *Planning*—
Director, Cross-Disciplinary Studies, 106 Johnston, 373-3507

3101. INTRODUCTION TO ENVIRONMENTAL TECHNOLOGY. (4 cr; prereq high school physics or chemistry)
Technological aspects of protecting man and the environment from man's activities. Sources and magnitude of pollution problems in air, water, noise, solid waste. Environmental quality standards, pollution abatement options, technological limitations.

3301. ENERGY, POWER, AND SOCIETY. (4 cr; prereq high school algebra, physics, or chemistry)
The need for energy and its use in society. Concepts of energy and power; problems of pollution and waste disposal.

Pharmacology (Phcl)

Medical School
105 Millard Hall

CONTACT: *Environment*—
M. W. Anders, 105 Millard Hall, 373-5112

5106w. TOXICOLOGY. (2 cr; prereq ♯)
The chemistry, mechanism of action, and physiological disposition of substances toxic to man and animals including environmental chemicals. Intended primarily for pharmacy students but open to other students with instructor's approval. Students should have some background in the biological sciences and chemistry.

8214s. TOXICOLOGY. (3 cr; prereq MdBc 5101 or equiv or ♯; offered 1977-78 and alt yrs)

Philosophy (Phil)

College of Liberal Arts
395 Ford Hall

CONTACT: *Planning*—
H. E. Mason, 399 Ford Hall, 373-3613

3302. MORAL PROBLEMS OF CONTEMPORARY SOCIETY. (5 cr) Mason, Dahl, Sartorius
Selected moral problems of current interest.

5321. THEORIES OF JUSTICE. (5 cr; prereq 1003 or 1004 or 5311 or ♯) Mason
Philosophical accounts of the concept and principles of justice.

5414. POLITICAL PHILOSOPHY. (5 cr; prereq 1004 or ♯) Dolan, Sartorius
Central concepts and principal theories of political philosophy.

5611. PHILOSOPHY OF THE SOCIAL SCIENCES I. (5 cr; prereq 15 cr in philosophy or social sciences or ♯)
Criteria for describing and explaining human actions; problems of objectivity, reduction, freedom.

Physics (Phys)

School of Physics and Astronomy
Institute of Technology
148 Physics

CONTACTS: *Environment*—
George Freier, 238 Physics, 373-3347
William Zimmerman, 48 Physics, 373-9787

5451. CLOUD PHYSICS. (3 cr; prereq Math 3211 or equiv, 1 yr general physics; 3 lect hrs per wk)
Composition of the atmosphere, past, present, and future. Thermodynamics of atmosphere with condensable water. Properties and growth of drops and ice crystals. Particles in the atmosphere.

5452. CLOUD SYSTEMS. (3 cr; prereq Math 3211 or equiv, 1 yr general physics; 3 lect hrs per wk)
Circulation and energy balance of atmosphere. Radar techniques for analyzing cloud systems. Cloud structure and motion.

5453. ELECTRICAL PROPERTIES OF CLOUDS. (3 cr; prereq Math 3211 or equiv, 1 yr general physics; 3 lect hrs per wk)
Structure, thermodynamic and electrical properties of water and ice. Ions in the atmosphere. Generation of charge and its effects on cloud processes. Generation of lightning and properties of lightning discharges.

Plant Pathology (PlPa)

College of Agriculture

304 Plant Pathology

5108w. ABIOTIC DISEASES OF PLANTS. (4 cr; prereq 1001 or 5002, PlPh 5184 and Soil 1122, or ♯; offered 1977 and alt yrs)
(Same as Soil 5108) Diagnosis, etiology, and control of plant diseases caused by adverse physicochemical factors. Effects on plants of temperature, moisture, light, agrochemicals, nutritional disorders, and air pollutants.

5110w. AIR POLLUTION AND ITS EFFECTS ON VEGETATION. (4 cr; prereq 10 cr biology or ♯)
Types of air pollutants, sources and dispersal, meteorology, pollutants in rain and aerosols, field investigation techniques, effects on vegetation including communities, control of injury to plants, air quality criteria, case histories.

Political Science (Pol)

College of Liberal Arts

1414 Social Sciences

CONTACTS: *Planning—*
Samuel Krislov, 1414 Social Sciences, 373-2651
C. Backstrom, 1380 Social Sciences, 373-2686

1027. URBAN POLITICS. (4 cr) Nimtz, Scott, staff
Urban politics and issues facing American cities. Political conflicts over economic and social problems.

1041. CONTEMPORARY POLITICAL IDEOLOGIES. (4 cr) Arnaud, Fogelman, staff
Major modern and contemporary ideologies such as liberalism, democracy, conservatism, socialism, communism, facism, nationalism, imperialism, racism. Adequacy of alternative ideologies for analysis and solution of current political and social issues.

5315.* STATE GOVERNMENT. (4 cr; prereq 1001 or ♯) Backstrom, Gray
Political institutions, political behavior, and public policies in American states; comparisons between states and between state and national political systems.

5322. AMERICAN SOCIAL POLICY. (4 cr; prereq 1001 or ♯) Eyestone
American government actions affecting the distribution of social benefits such as health care, education, and housing; social burdens such as taxation and regulation of social conduct. Relationships between government action and social problems; possibilities for change.

5327. LOCAL GOVERNMENT. (4 cr; prereq 1001 or ♯) Backstrom, Scott
Development and role of American local government; forms and structures; relationships with states and the federal government; local politics and patterns of power and influence.

5328. METROPOLITAN GOVERNMENT AND POLITICS. (4 cr; prereq 1001 or ♯) Nimtz, Scott
Development of the modern American metropolis; central cities and suburbs; intergovernmental relationships in the metropolis; state and federal responses to metropolitan problems; politics of reforming metropolitan government.

5663. POLITICAL THEORY AND UTOPIA. (4 cr; prereq 1051 or 9 cr in social science or ♯) Sibley
Great utopias from viewpoint of the political theorist; idea of planning an ideal state; achievement of utopia; stability and change in great utopias; problems of authority and law; anarchist, socialist, and conservative utopias.

5739. THE POLITICS OF ETHNIC COMMUNITIES. (4 cr; prereq 6 cr in social science) Koeppen, Nimtz
Cross-cultural study of politics of ethnic communities; emphasis on the politics of Black communities in the United States. Internal community politics and their local and national political systems.

5771. COMPARATIVE PUBLIC POLICY. (4 cr; prereq 1051 or ♯; offered alt yrs) Wynia
Policy making and administrative implementation in high and low income countries; content and impact of economic development and social welfare policies.

8321.* SEMINAR: LOCAL GOVERNMENT AND POLITICS. (3 cr; prereq ♯) Backstrom, Scott

8323.* SEMINAR: COMMUNITY POWER SYSTEMS. (3 cr; prereq ♯) Backstrom, Scott

8325.* SEMINAR: COMPARATIVE STATE POLITICS. (3 cr; prereq ♯) Gray

8327.* SEMINAR: INTERGOVERNMENTAL RELATIONS: (3 cr; prereq ♯) Staff

8335.* SEMINAR: PUBLIC POLICY. (3 cr; prereq ♯) Eyestone, Gray

8337.* SEMINAR: POLICY EVALUATION. (3 cr; prereq ♯) Staff

Public Affairs (PA)

College of Liberal Arts
909 Social Sciences

CONTACTS: *Environment*—
D. E. Abrahamson, 967 Social Sciences, 373-7796
Planning—
J. S. Adams, 909 Social Sciences, 373-2653

3101, 3102. INTRODUCTION TO PUBLIC AFFAIRS. (4 cr per qtr) Chase, Naftalin
Problems and issues confronting government and society; how public policies are developed and implemented; career opportunities in public service.

3121. INTRODUCTION TO PUBLIC INTEREST RESEARCH. (4 cr, §5121) Abrahamson
Public interest activities, particularly as they relate to environmental, consumer, and public health issues. Public interest law; case studies of local and national public issues.

3151. INTRODUCTION TO ENERGY POLICY. (4 cr, §5151) Abrahamson
The "energy crisis." Energy supply and demand, alternative energy sources, energy conservation possibilities, environmental and social implications of alternative policies. Current energy policy issues.

5114, 5115. WORKSHOP ON MINNESOTA GOVERNMENT. (3 cr per qtr) Warp
Current Minnesota public policy issues. Lectures, panel discussions, and seminars.

5121. PUBLIC INTEREST RESEARCH AND PRACTICE. (4 cr, §3121; prereq ♯) Abrahamson
Public interest groups—their origins, methods of operation, and activities. Consumer and environmental topics, public interest legal activities, policy analysis using environmental impact statements, regulatory agencies. Student research and review papers.

5151. ENERGY AND ENERGY POLICY. (4 cr; §3151; prereq ♯) Abrahamson
Fuel and energy supply and demand; environmental, social, and economic implications of alternative energy policies; means to effect changes in use patterns; political and institutional factors; relation of energy policy to economic, foreign, and environmental policies.

5152. TOPICS IN ENERGY POLICY. (4 cr; prereq 5151 or ♯) Abrahamson, Geesaman
Topic selected each year on the basis of current activities in state, federal, or international energy policy.

5161. 5162. TECHNOLOGY PLANNING I, II. (4 cr per qtr; prereq ♯ for 5161...5161 for 5162) Abrahamson, Geesaman
Relationship of science and technology to the ideological bases of society; technology's significance in the policy process; society's institutions for governing its technologies.

5181. POLICY TOPICS IN COMMUNICATIONAL AND INFORMATIONAL TECHNOLOGIES. (3 cr; prereq ♯) Geesaman, Dewar
Contemporary topics selected for their political and social significance. Related technologies and their economic and political importance; related policies and institutional controls.

5301. THE MULTINATIONAL CORPORATION. (4 cr; prereq Econ 1001, 1002 or equiv) Kudrle
Economic, political, social, and legal significance of the multinational corporation. Major policy options open to individual governments and international bodies.

5319. INTERGOVERNMENTAL RELATIONS. (4 cr, §Pol 5319; prereq 6 cr in social science or ⇄) Jernberg
Evolution of intergovernmental relations in the United States; administrative and fiscal problems and issues; human resources and services.

5502. LOCAL ADMINISTRATION. (4 cr) Gleeson
Local public agencies in the political system, the individual in such agencies. Administrative tools to control or change local public agencies; constraints under which the administrator works. Lecture-discussion and laboratory.

5505. HOUSING POLICY. (4 cr; prereq 12 cr in social sciences or ⇄) Gleeson
The role of American national, state, and local governments in financing, control, taxation, and construction of housing.

5516. 5517. SEMINAR: SOCIAL THEORY AND SOCIAL PLANNING I, II. (4 cr per qtr; prereq 5516 for 5517)
Major issues in social theory; urban planners' responses, implicit and explicit, to these issues. Social change, alienation and anomie, power, images of society, values and objectivity; examples from urban planning. What the planner can do and has done in regard to social problems.

5550. PLANNING PROSEMINAR. (2 cr; prereq ⇄)
Major subareas of planning (social planning, planning theory). Topics vary quarterly.

5601-5602. PLANNING THEORY SEMINAR. (4 cr per qtr; prereq 5601 for 5602, ⇄)
Philosophical and theoretical aspects of the relationship of systematic knowledge to public action and planning. Design methodology.

5691. COMPARATIVE SERVICE ORGANIZATIONS. (3 cr) Dewar
Goals, operation, and impacts of service organizations compared and contrasted; general patterns and critical issues; incentives and negative influences in organizational or bureaucratic settings. Fieldwork.

Public Health (PubH)

See also ENVIRONMENTAL HEALTH

School of Public Health

Health Sciences

1325 Mayo

CONTACT: *Planning*—
Bright M. Dornblaser, Hospital and Health Care Administration, 1260 Mayo (Box 97), 373-8052

5006. INTRODUCTION TO COMMUNITY HEALTH. (5 cr; prereq nursing student, nurse, public health student, other health professional or ⇄) Greene
(Same as Nurs 5625) Lectures, discussions, seminars, personalized readings on critical and current issues in community health, emphasizing public health programs and controversies.

5009. HONORS COURSE: ISSUES AND CONTROVERSIES IN CONTEMPORARY COMMUNITY HEALTH. (3 cr; prereq advanced application and ⇄ and 3001, 3004, 5006, or equiv; limited to 30) Greene and others
Exploration of selected current issues and controversies in health through readings, discussion, and limited field assignment. Emphasis on the balance between personal and community needs, interests, rights, and responsibilities.

5057. SEMINAR: COMMUNITY ORGANIZATION. (Cr ar; prereq SW 8305 and ⇄) Craig, Mills
Basic philosophy, principles, methods, and procedures in community organization and development; alternative approaches to community organization for health action; case studies in community organization.

5769. COMPREHENSIVE HEALTH PLANNING SEMINAR. (3 cr; prereq ⇄) Staff
Alternative health systems and their planning requirements; planning strategies and technologies; application to planning agency work programs; lectures, case studies, seminars.

5790. SOCIAL, ECONOMIC, AND POLITICAL ASPECTS OF MEDICAL CARE. (3 cr; prereq ≠) Dickler and Litman
Social, economic, and political forces shaping health care systems; possible future impact of these forces.

5795. THE SOCIOLOGY OF MEDICINE AND HEALTH CARE: AN INTRODUCTION TO THE FIELD OF MEDICAL SOCIOLOGY. (4 cr) Litman
(Same as Soc 5855) Social and psychological components of health and medical care. Organization and delivery of health care services; problems and perspectives with focus on the patient, the provider of care, and the environment within which health care services are dispensed.

8750f-8751w†. SEMINAR: ALTERNATIVE PATTERNS OF HEALTH CARE. (3 cr per qtr; prereq ≠; offered 1976-77 and alt yrs) Litman

8752f. SEMINAR: COMPARATIVE HEALTH CARE SYSTEMS. (3 cr; prereq ≠; offered 1977 and alt yrs) Litman

8770s. SEMINAR: HEALTH AND HUMAN BEHAVIOR. (3 cr; prereq Soc 5855; offered 1977-78 and alt yrs) Litman

8790w. POLITICAL ASPECTS OF HEALTH SERVICES. (3 cr; prereq ≠; offered 1977 and alt yrs) Litman

8795. ECONOMIC ASPECTS OF HEALTH CARE. (3 cr; prereq ≠) Bognanno

Resource and Community Development (RCD)

College of Agriculture

CONTACT: *Environment*—
D. White, 280 Coffey Hall, 373-0921

1010. ISSUES IN THE ENVIRONMENT. (3 cr) R Adams, Jr
Interdisciplinary offerings designed to explore five areas of environmental concern: aspects of environmental design which provide maximum compatibility of man with the environment, sources of water pollution and their control, disposal and control of solid wastes from agriculture, minimization of pesticide pollution of the environment, and managed use of forest resources to maintain environmental quality. This is a televised course involving 20 taped lectures and 10 discussion periods. Cooperative offering available at several Minnesota institutions.

3010. THE MINNESOTA COMMUNITY: ANALYSIS OF ITS ORGANIZATION, CHANGE, AND DEVELOPMENT. (4 cr; prereq one social science course and ≠)
Community problem solving and decision making. How local problems are defined, what communities can do in dealing with their problems, and how information (primarily scientific knowledge) may be applied to local problems. Conceptual analysis of communities and their problems. Secondary data analysis as a research technique for use in analysis of community problems in Minnesota.

5120. ENVIRONMENTAL PROBLEMS. (3 cr, §1010)
Interdisciplinary offering which examines the same five areas as RCD 1010. This is a televised course involving 22 taped lectures and 10 discussion periods. In addition, students prepare a report on a specific environmental problem. This course offered in Continuing Education and Extension only.

5200. COMMUNITY DEVELOPMENT SIMULATION. (4 cr; prereq 9 cr in social science and ≠)
Simulation of regional activity systems and their environmental impacts. Playing community development game for decision makers in economic, social, and political sectors of model urban community.

Rhetoric (Rhet)

College of Agriculture
202 Haecker Hall

CONTACT: *Planning*—
L. D. Schuelke, 202 Haecker Hall, 373-0917

5165. STUDIES IN ORGANIZATIONAL COMMUNICATION, CONFLICT, AND CHANGE. (4 cr; prereq freshman communication or equiv)
The roles of internal and external organizational communication, conflict-problem identification, and change processes. Contemporary theory and research in organizational development and methods of problem identification and diagnosis. Change processes and applications to actual organizational settings.

5600. TRANSFER OF TECHNOLOGY. (4 cr; prereq one of the following: 5257, Jour 5133, Engl 3085, PubH 5070, or ≥)
(Same as AgJo 5600) Methods of transferring scientific and technical knowledge and practice from those individuals and organizations who possess it to those who need it. Review of research in diffusion and transfer methods at different technical levels. Tools, methodologies, and assessment procedures for an actual program of technical or scientific subject matter. Planning state-of-the-art or frontier technology seminars and impact analyses for scientists, engineers, and/or segments of the public required.

Social Science (SSci)

Cross-Disciplinary Studies

College of Liberal Arts
106 Johnson

CONTACT: Director, Cross-Disciplinary Studies, 106 Johnston

3101. AN INTRODUCTION TO MARXISM. (4 cr)
Marxist philosophy of science, knowledge, and social development; evolutionary and revolutionary processes of change; formation of class societies; capitalism, imperialism; paths of socialism; transition from socialism to communism.

3203. STRUCTURE AND DYNAMICS OF POVERTY. (4 cr; prereq 9 cr in related social science)
Structural characteristics of poverty, described by social, legal, and economic criteria. Specific problems of poverty; unemployment, immobility, illiteracy, crime, others. Private and public programs designed to alleviate poverty.

3205. POVERTY, INSECURITY, AND INEQUALITY OF OPPORTUNITY. (4 cr; prereq Econ 1001, 1002 or ≥) Zaidi
Concepts of income distribution; dimensions of poverty; measures adopted or proposed to ameliorate poverty, assure security, and provide equality of opportunity.

3402. ECOLOGY, TECHNOLOGY, AND SOCIETY. (5 cr)
The impact of technology on society as seen by engineers, scientists, and social scientists. The social problems associated with economic growth such as environmental consequences, the arms race, food and fertilization, and population growth. Alternative strategies for meeting the problems.

3601. LAW AND SOCIETY. (5 cr; prereq soph) Samaha
The nature and functions of legal institutions.

Social Work (SW)

College of Liberal Arts
400 Ford Hall

CONTACT: *Planning*—
James Goodman, 400 Ford Hall, 373-2837

1001. INTRODUCTION TO SOCIAL WELFARE AND COMMUNITY SERVICES. (5 cr)
Fields of community-based social services representative of societal responses to needs. Characteristics of such services reviewed historically, dynamically, and comparatively.

3005f,w,s. SOCIAL WORK PROCESSES: METHODS OF INTERVENTION. (4 cr, §5401; prereq jr or sr, 1001)
The function of values and knowledge in social work practice; the meaning of giving and receiving help; the process of intervention; some social work principles.

3101f,w,s. SOCIAL WELFARE: A FRAMEWORK FOR ANALYSIS. (4 cr, §5401; prereq jr or sr)
Historical development, legislative enactments, administrative policy, and program structure under which federal, state, and local governmental programs of income maintenance, medical care, and public housing operate.

3984f,w,s. INTRODUCTION TO COMMUNITY DEVELOPMENT. (4 cr; prereq 1001 or ≠)
Trends, pace, and dynamics that dominate urban communities; strategies used to achieve neighborhood goals; factors that control and influence change in planning; action on the community level.

5101. INTRODUCTION TO SOCIAL POLICY: SOCIAL WELFARE PERSPECTIVES. (3 cr, §3101; prereq ≠ for undergrad)
Basic concepts and perspectives necessary for understanding and analyzing social welfare programs.

8180. SOCIAL POLICY FORMULATION AND ANALYSIS. (3 cr; for doctoral students only) Hoshino

8181. SOCIAL POLICY FORMULATION AND ANALYSIS. (3 cr; for doctoral students only)

8305. COMMUNITY DEVELOPMENT. (3 cr)

8307. THEORIES OF SOCIAL PLANNING AND SOCIAL CHANGE. (3 cr)

Sociology (Soc)

College of Liberal Arts
1114 Social Sciences

CONTACTS: *Environment*—
Robert Kennedy, 1114A Social Sciences, 373-3643
Planning—
David Cooperman, 1114 Social Sciences, 376-3930

5301. SOCIAL MOVEMENTS IN A CHANGING SOCIETY. (4 cr; prereq 3505 or 5401 or equiv or ≠)
Factors underlying social change in modern mass society. Recent research on social movements, reform and revolution, culture contact, impact of rapid technological change. The individual and social structures under rapid social change.

5311. SOCIOLOGY OF CONFLICT. (4 cr; prereq 3505 or 5401 or equiv or ≠) Cooperman
Theoretical, empirical study of group conflict. Methods and models. Animal conflict. Aggression and conflict. Types of conflict: feuds, community, racial, ecologies of urban conflict, internal war, revolution. Conflict and social organization: relation of stratification and of industrial and social change to conflict.

5415. COMPARATIVE SOCIAL ORGANIZATIONS. (4 cr; prereq 20 cr in sociology, economics, or political science, or ≠)
Demographic and ecological characteristics, stratification systems, institutional organization, and forms of association in several modern nations other than the United States.

5551f,w. WORLD POPULATION PROBLEMS. (4 cr; prereq 3505 or 5401 or equiv or ≠) Kennedy
Population policy, historical and present, in Europe, Asia, and other selected areas; emphasis on the United States. Population and power politics.

5555s. POPULATION THEORY. (4 cr; prereq 5551 or ≠) Kennedy
Cultural and social phases of population change; birth rates, death rates, migration. Implications of population change.

5601. URBAN SOCIOLOGY. (4 cr; prereq 3405 or 3505 or 5401 or equiv or ≠) Stone, T Anderson, Skura
Cities, urban ecology; urban institutions and urban way of life.

5605. URBANIZATION AND SOCIAL POLICY. (4 cr; prereq 5601 or ≠) Cooperman
"Problematic" contemporary changes in urban processes; responses and policies of public groups. Interrelationships of social, cultural, economic, political factors in development of urban problems. Models of urban systems and social policy formation. Social cost analysis and formation of policy alternatives.

5611. PLANNING. (4 cr; prereq sr) Stone
Social, economic, political, geographic, and technical phases of modern city planning.

5675. WORLD FOOD SUPPLY PROBLEMS. (4 cr, §AgEc 5790, §FScN 5643, §PIPa 5220, §LACS 5280; prereq major in agriculture, veterinary medicine, nutritional sciences, social science or ⇄...grad students △) Ellenbogen
A multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles from the social and economic sciences, plant sciences, and animal sciences and their application to food problems.

5951. MINORITY GROUP RELATIONS. (4 cr; prereq 3505, 3506 or 5201, 5401 or equiv or ⇄) Finestone, Rose, Sykes
Systems of ethnic stratification; race relations in American society.

8308. MODERNIZATION AND SOCIAL CONFLICT: A CROSS-NATIONAL APPROACH. (5 cr; prereq ⇄) Ellenbogen

8601, 8602. SEMINAR: RESEARCH IN URBAN SOCIOLOGY. (3 cr per qtr) Stone

8751, 8752, 8753. SEMINAR: METHODS FOR THE EVALUATION OF SOCIAL ACTION PROGRAMS. (3 cr per qtr) Finestone

Soil Science (Soil)

College of Agriculture
125 Soil Science

CONTACT: *Environment*—
Russell S. Adams, Jr., Soil Science, 373-1361

The Department of Soil Science has divided its environmentally related courses into two categories: those of primary environmental interest which are indicated below with a double asterisk (**) and those of secondary environmental interest which should be taken only by students with a major or minor in soil science.

1122f,w,s. ** **INTRODUCTORY SOIL SCIENCE.** (4 cr; prereq Chem 1001 or 1004) Arneman
Basic physical, chemical, and microbiological properties of soil. Soil genesis, classification, and principles of soil fertility.

1262f. INTRODUCTION TO METEOROLOGY. (4 cr) Baker, Skaggs
(Same as Geog 1425) Precalculus introduction to nature of the atmosphere and its behavior. Atmospheric composition, structure, stability and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns; meteorological instruments and observations; plotting and analysis of maps; forecasting.

3528f. ** **SEMINAR: USE AND INTERPRETATION OF SOIL SURVEYS.** (1 cr; S-N only; offered alt yrs) Arneman
Round table discussions on assigned readings in the subject area.

5114f,w,s,sul,sull. ** **SPECIAL PROBLEMS IN SOILS.** (1-5 cr [may be repeated for max 10 cr]; prereq 1122 or ⇄)
Research, readings, instruction.

5240. MICROCLIMATOLOGY. (5 cr; prereq Math 1111, 10 cr in physics or ⇄) Baker
Meteorology and climatology in relation to soil-atmosphere interface; soil microclimate, physical processes taking place within the microclimate, modification of microclimate by agricultural practices. Weather instruments and use of climatic data.

5340f. ** **ORGANIC AND PESTICIDAL RESIDUES.** (5 cr; prereq 1122, sr or ⇄) R S Adams
The fate of natural and synthetic organic materials in soil, with emphasis on the chemical, physical, and biological factors of the soil which influence decomposition or persistence. Soil pollution from crop residues, animal wastes, sewage, petroleum hydrocarbons, detergents, and pesticides.

5512s. SOIL GEOGRAPHY. (4 cr; prereq 1122) Farnham
Introduction to soil morphology and classification essential to understanding distribution patterns of soils. Emphasis on soil geography of the state, region, United States, and world. Interpretation of this geography with the use of soil maps and aerial photographs of various types of resource development. Lectures, laboratories, field trips.

5532s,sul. SOILS AND THE ECOSYSTEM.** (5 cr, §EBB 5819; limited to 20 students; prereq course in ecology; Itasca offered 1977 and alt yrs) Grigal
Functional and structural aspects of soils as a component of the ecosystem. Interrelationships of soil and vegetation on the landscape.

5540. SOIL RESOURCES AND ENVIRONMENTAL RELATIONSHIPS.** (4 cr; prereq 1122 or ≠) Hanson
Nutrient and contamination transfers through soil, water, and the atmosphere; specific soil-environmental quality relationships relating to residential and agricultural land use. A half-day field trip and seminar. Reports.

5550w. ORGANIC SOILS. (3 cr; prereq 1122) Farnham
Formation, classification and properties of organic soils; their use and management. Lectures and laboratories.

5632. SOIL MICROBIOLOGY AND PLANT GROWTH. (4 cr, §5612; prereq 1122 and course in microbiology, or ≠) Hamm
The soil environment. Microbiological population of the soil. Role of microorganisms in the soil-plant environment and cyclic transformations of agronomic interest (C, N, and mineral substances). Effect of soil microflora on soil fertility and plant nutrition. Lectures and laboratory.

Speech-Communication (Spch)

College of Liberal Arts
317 Folwell

CONTACT: *Planning*—
George Shapiro, 401A Folwell, 373-2568

5231. COMPARATIVE BROADCAST SYSTEMS. (4 cr; prereq 3211 or ≠) Browne
Historical, sociological, and political aspects of various systems of broadcasting throughout the world. American, Canadian, British, French, German, Soviet, and other broadcast institutions: why and how they are regulated and what impact they have had on their country's political, social, and economic development.

5441. COMMUNICATION IN HUMAN ORGANIZATIONS. (4 cr; prereq 1102 or 3401, 3641 or 5411, or grad student) Shapiro
Communication in organizational settings. Organizational structure and dynamics and their effect upon communication process. Collateral readings and individual projects.

8421. SEMINAR: COMMUNICATION AND NEGOTIATION. (3 cr; prereq 5403, 5411, 5441 or ≠)

Technology, Institute of (I of T)

107 Lind Hall

CONTACT: *Environment*—
Richard Goldstein, 240 Mechanical Engineering, 373-3042

3101. INTRODUCTION TO ENVIRONMENTAL TECHNOLOGY. (4 cr [no cr for IT students]; prereq high school physics or chemistry)
Technological aspects of protecting man and the environment from man's activities. Sources and magnitude of major pollution problems in air-water-noise-solid waste. Environmental quality standards, pollution abatement options and technological limitations.

3233. ENERGY: TODAY AND TOMORROW. (3 cr)
Energy as a physical concept. Sources of energy and ways in which it is converted for use. Political, social, economic, and ecological consequences of energy use.

3301. ENERGY, POWER, AND SOCIETY. (4 cr [no cr for IT students]; prereq high school physics or chemistry)
The need for energy and its use in society. Concepts of energy and power; problems of pollution and waste disposal.

Textiles and Clothing (TexC)

College of Home Economics
200 McNeal Hall

CONTACT: *Environment*—
Robert F. Johnson, 354 McNeal Hall, 373-1696

5622. ISSUES AND TRENDS IN TEXTILE CONSUMER PROTECTION. (3 cr)
The needs of the textile consumer for protection from deception and hazard; federal, state, and local legislation as well as voluntary industrial systems; case histories; change mechanisms.

Transportation (Tran)

College of Business Administration
868 Business Administration

CONTACT: A. K. Wickesberg, 804 Business Administration, 373-3486

3054. FUNDAMENTALS OF TRANSPORTATION. (4 cr, §8154; prereq Econ 1002 or equiv)
Organization and economic aspects of transportation systems of the United States, including rail, highway, air, pipeline, and water. Administration of transportation by its users, carriers, and government.

5194. GOVERNMENT PROMOTION OF TRANSPORTATION. (4 cr; prereq 3054 or 8154 or ♯)
The need for, form of, administration of, and impact of government promotion and subsidy of rail, highway, air, water, and urban transportation in the United States.

5195. GOVERNMENT ECONOMIC REGULATION OF TRANSPORTATION. (4 cr; prereq 3054 or 8154)
The need for, form of, administration of, and impact of government economic regulation of rail, highway, air, pipeline, and water transportation in the United States.

University College (UC)

105 Walter Library

CONTACT: Diane Grimm, 105 Walter Library, 373-4638

3501f, 3502w. THE SCIENCES AND THE HUMANITIES. (3 cr per qtr, §5501, §5502) Penn
A 2-quarter study of the alleged warfare between the sciences and the humanities. *3501:* Principal issues. Readings include Arnold, T. H. Huxley, Snow, Leavis, etc. *3502:* Diverse solutions to the problem. Readings include Bronowski, A. Huxley, Pirsig, Polyani, Barfield, etc.

3503s. SCIENCE AND THE PROBLEM OF VALUE. (3 cr, §5503) Penn
Is an ethic for scientists possible? Views of "moral neutralists" and "nonneutralists," and variations on these positions. Readings include Ravetz, Snow, Glass, Russell, Monod, Ellul, etc.

3701. ORIENTATION TO OVERSEAS STUDY. (3 cr; prereq ♯)
Designed to prepare students for overseas study through theoretical and experiential approaches.

3704. REENTRY: A TRANSITION FROM OVERSEAS TO THE U.S. (3 cr; prereq ♯)
Designed to reintegrate the student to the U.S. after a period of overseas study. Makes use of both theory and simulations developed by a variety of disciplines.

5501f, 5502w. THE SCIENCES AND THE HUMANITIES. (3 cr per qtr, §3501, §3502) Penn
Meets concurrently with 3501, 3502.

5503s. SCIENCE AND THE PROBLEM OF VALUE. (3 cr, §3503) Penn
Meets concurrently with 3503.

5504. RACE AND CULTURE: A CONCEPTUAL SURVEY. (5 cr) Penn
Stresses a conceptual-historical approach to the study of "race" with emphasis upon selected historical cases; e.g., Aristotle on slavery, Las Casas and Sepulveda on the Indian, the racial thought of Herder in the 18th century, Gobineau in the 19th, etc. Readings also include Sartre and Fanon.

5506. CULTURE THEORY IN THE SOCIAL SCIENCES. (3 cr) Penn
Conflicting humanistic and social scientific conceptions of "culture." Readings include Eliot, Steiner, Cassirier, Mannheim, Skinner, etc.

5507. SEMINAR: PHILOSOPHICAL ANTHROPOLOGY. (3 cr) Penn
Selected topics: "The Problem of Historicism in Anthropology" and others. Co-taught with R. Spencer, Anthropology.

University College also offers directed studies registrations to students enrolled in the following UC programs: University Without Walls, Experimental College, and University Scholars. Contact these individual programs for more information.

Urban Studies (UrbS)

College of Liberal Arts
909 Social Sciences

CONTACT: *Planning*—
John S. Adams, 909 Social Sciences, 373-2653

3101f, 3102w, 3103s. URBAN STUDIES COLLOQUIA. (2 cr per qtr; S-N only; limited to 20 students; prereq ♯)
Introduction to urban problems and problem-solving techniques. Topics vary quarterly.

3500f,w,s. WORKSHOPS. (4 cr per qtr; prereq jr or sr, ♯) Staff
Project focused workshops, subjects vary quarterly. Seminar-discussions, research, or development of alternative models for solving urban problems.

3900f,s. INTERNSHIP. (1 to 15 cr; prereq jr, sr, and △) Staff
Internships may be arranged for any quarter or summer term. A weekly seminar to integrate the internship experience with the academic program should be taken during or immediately after the internship.

3950. HONORS SEMINAR. (Cr ar; prereq approval of Urban Studies honors representative)
Supervised investigation of selected topics.

3970. DIRECTED STUDIES. (Cr ar; prereq ♯)

Zoology (Zool)

College of Biological Sciences
108 Zoology

CONTACT: *Environment*—
D. E. Gilbertson, 209 Zoology, 373-7987

5071s. INVERTEBRATE BIOLOGY. (5 cr; prereq Biol 1106 or 3011 or ♯) Barnwell
Morphology, physiology, behavior, ecology, and evolution of the invertebrate groups. Laboratory study of living marine, freshwater, and terrestrial representatives.

5077s. INTRODUCTORY ORNITHOLOGY. (5 cr; prereq Biol 1106 or 3011) Warner
Laboratory and field course in structure, classification, distribution, migration, habits, habitats, and identification of birds. Weekend trips scheduled.

5093f. INTRODUCTION TO ANIMAL PARASITOLOGY. (5 cr; prereq Biol 1106 or 3011) Wallace
Parasitic protozoa, worms, and arthropods, and their relation to diseases of man and animals.

5107f. PROTOZOOLOGY. (4 cr; prereq ⇄) Kerr
Introduction to taxonomy, morphology, physiology, development, and genetics of free-living protozoa.

5121s. ICHTHYOLOGY. (4 cr; prereq 15 cr incl Biol 1106 or 3011) Huver
Biology of fishes including development, systematics, anatomy, physiology, and ecology.

5124w. VERTEBRATE BIOLOGY. (4 cr; prereq Biol 1106 or 3011) Underhill
Vertebrates; their biology, taxonomy, and distribution.

5128s. HERPETOLOGY. (5 cr; prereq 5124 or ⇄) Regal
Distribution, classification, and evolution of amphibians and reptiles of the world. Physiological, morphological, and behavioral aspects of adaptive trends. Laboratory and lecture.

5129f. MAMMALOGY. (5 cr, §FW 5129; prereq 5124 or ⇄) Birney
Recent families and orders of mammals of the world and genera and species of mammals of North America, with emphasis on morphology, evolution, and zoogeographic history.

5144w. PARASITIC PROTOZOA. (4 cr; prereq 15 cr incl Biol 1106 or 3011, ⇄) Wallace
Structure, life histories, and economic relations of protozoal parasites of man and animals; laboratory diagnosis.

5146w. EXPERIMENTAL PARASITOLOGY. (4 cr; prereq 5093 or ⇄; offered 1978-79 and alt yrs) Gilbertson
Discussion sessions and laboratory investigations designed to illustrate the relationships between metazoan parasites and their hosts.

5814su. NATURAL HISTORY OF INVERTEBRATES. (5 cr; prereq Biol 1106; offered at Itasca)
Advanced taxonomic and ecological survey of local fauna and independent ecological studies of several taxonomic groups.

5819su. NATURAL HISTORY OF VERTEBRATES. (5 cr; prereq Biol 1106; offered at Itasca)
Taxonomic survey of local vertebrates, exclusive of birds; morphological, physiological, and behavioral adaptations to different habitats.

5834su. FIELD ORNITHOLOGY. (5 cr; prereq Biol 1106; offered at Itasca)
Field and laboratory studies including bird identification, ecology and behavior, taxonomy.

5843su. ANIMAL PARASITES. (5 cr; prereq Biol 1106; offered at Itasca)
Parasites of local fauna with special reference to helminths.

SPECIAL CENTERS AND SERVICES

Many organizations in the Twin Cities participate in environmentally related activities. Although these various groups do not usually offer courses, they are frequently engaged in research and other projects in which interested students, faculty members, and others might become involved. In some cases students may obtain credit for work completed in such outside activities.

All-University Council on Environmental Quality

Dean E. Abrahamson, Chairperson, 967 Social Sciences Building, 267 19th Avenue S., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-7796

The All-University Council on Environmental Quality was established in October of 1971. Its rotating membership includes representatives from most colleges and campuses of the University.

The council is one of the first formal mechanisms at the University of Minnesota designed to further multidisciplinary and intercollegiate teaching, research, and public service activities. Specifically, the council's responsibilities and objectives lie in the following areas:

1. Information—The council gathers and disseminates information regarding the various environmentally related activities being carried on throughout the University. This bulletin is a part of this effort.
2. Instruction—The council encourages and supports the development of multidisciplinary courses and seminars and directed studies type programs. Although the council does not grant degrees, one of its missions is to investigate the possibility of instituting a 4-year environmental, problem-oriented undergraduate program.
3. Administration—The council assists students in arranging to earn credit for innovative, multidisciplinary study and assists faculty members by encouraging recognition and financial support for work done in new multidisciplinary courses and seminars and in environmental research.
4. Public Service—The council actively seeks to develop and fund public education lecture series and acts as a clearing house for requests from private organizations and from state and local government for consultant opinions on environmental questions.

More information about the council can be obtained from the chairperson.

James Ford Bell Museum of Natural History

Harrison B. Tordoff, Director, 10 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-2423

The museum maintains exhibits and public education programs on natural history and supports research in ecology, systematics, and behavior of vertebrates and in paleontology. Eleven scientists are on the staff, all of whom also teach in academic departments such as Ecology and Behavioral Biology or Zoology. A natural history library which emphasizes collections in vertebrate zoology, behavior, and basic ecology is located in the museum.

In addition, the Cedar Creek and Itasca Field Stations are administered through the museum.

Department of Conferences

Dr. M. Allen Brown, Director, 131 Nolte Center for Continuing Education, 315 Pillsbury Drive S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-3151

The Department of Conferences, with support from the University of Minnesota academic faculty, assists groups in developing and presenting continuing education programs.

The department has a professional staff to assist interested parties in the planning, publicizing, administration, and evaluation of continuing education programs.

Continuing Education in Public Policy

William Rogers, Director, 306 Wesbrook Hall, 77 Pleasant Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-3799

The Department of Continuing Education in Public Policy occasionally sponsors programs for the general public in the field of environment, urban problems, and planning. For further information contact the director.

Environmental Health Research and Training Center

(School of Public Health)

Conrad Straub, Director, 1158 Mayo, 420 Delaware Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-8080

The Environmental Health Research and Training Center is concerned with examination and evaluation of environmental factors in relation to the health and well-being of humans. The center attempts to solve health-related problems through an interdisciplinary approach, using vital statistics data, epidemiological methodology, and other environmental information.

Freshwater Biological Institute

J. M. Wood, Director, P.O. Box 100, County Roads 15 and 19, Navarre, Minnesota 55392; phone: (612) 471-8476

As a new department in the College of Biological Sciences, the Freshwater Biological Institute has two major responsibilities: 1) to conduct fundamental research on freshwater systems, and 2) to conduct a graduate program that prepares scientists and teachers qualified to protect water resources. The institute's program is directed toward the study of geochemical processes, biological perturbations on geochemical processes, and environmental perturbations on both these geochemical processes and biological perturbations.

The Freshwater Biological Institute is a multidisciplinary unit, drawing faculty members from physics, chemistry, biochemistry, microbiology, limnology (plants, animals), and toxicology. When fully staffed the institute will have a graduate program with 80 full-time research and postdoctoral students.

The institute also houses a library with publications and materials related to environmental problems in fresh water.

Limnological Research Center

Herbert Wright, Director, 220 Pillsbury Hall, 310 Pillsbury Drive S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone (612) 373-4508

This center conducts research on the physical, chemical, biological, and geological aspects of lakes, especially those in Minnesota. Studies of lake history are made through analyses of microfossils and of the chemical and mineral components of sediments.

An evening seminar on current problems in limnological research is presented every winter quarter. Courses and degree programs in limnology are coordinated primarily through the Departments of Geology, and Ecology and Behavioral Biology.

Minnesota Environmental Sciences Foundation, Inc.

Michael J. Naylon, 5400 Glenwood Avenue, Golden Valley, Minnesota 55422; phone: (612) 544-8971

The Minnesota Environmental Sciences Foundation, Inc., offers a variety of in-service programs for teachers and the public throughout the metropolitan area. In addition, the center is very active in curriculum development in the area of environmental sciences, with the intent of improving teacher training in environmental education. In-service teachers and students are invited to participate in planning the foundation's programs.

The University of Minnesota does not accept for graduate credit courses and programs conducted by the foundation, but may allow undergraduate credit for them. Decisions to award undergraduate credit for foundation activities are made on a case by case basis by the department involved.

Minnesota Geological Survey

Matt S. Walton, Director, 1633 Eustis Street, St. Paul, Minnesota 55108; phone: (612) 373-3372

The Minnesota Geological Survey is engaged in a number of activities related to the environment, urban problems, and planning. These include developing a groundwater quality monitoring system for the state of Minnesota, compiling subsurface engineering geological maps for the Twin Cities metropolitan area as a basis for siting major structures and developing underground systems, studying the geological environment of Minnesota's peat resources in connection with the state's peat inventory program, participating in the regional environmental impact studies of the Copper-Nickel Task Force of Minnesota, and a number of other investigations related to the resources and environment of the state. Approximately 30 students are employed by the survey as aides and research assistants. Whenever possible their work forms part of the research for a Master's thesis or Ph.D. dissertation. Thus the Minnesota Geological Survey is a potential source of employment and research support in geologically related aspects of the environment, urban problems, and planning.

The Minnesota Geological Survey maintains a complete inventory of topographic, geologic, and soils atlas maps of the state, as well as publications on the state's geology and resources. For further information contact the director.

Minnesota Public Interest Research Group (MPIRG)

3036 University Avenue S.E., Minneapolis, Minnesota 55414 (campus office in Coffman Union, Minneapolis Campus); phone: (612) 376-7554, or 376-4798.

MPIRG is a nonprofit, nonpartisan organization representing Minnesota college students and working for constructive social change to benefit all Minnesotans. MPIRG activities focus on such issues as environmental protection, consumer protection, health care delivery, housing, human rights, occupational safety, and similar matters in the public interest.

MPIRG is funded by nearly 65,000 students on 18 Minnesota college and university campuses who pay a special fee of $1 per quarter or $3 per year for its support. The fee is refunded to students who do not wish to support the group.

MPIRG is directed by a board of elected student representatives from the participating institutions. The board holds open meetings at least once a month. All matters of organizational business—from hiring staff, to allocating a $150,000 annual budget, to selecting projects for the organization—are handled by the board. Any enrolled, fee-paying student may seek election to the board. Annual elections are held in the spring.

MPIRG employs a full-time staff of eleven people including two attorneys, five researchers, two community organizers, and support staff.

After careful investigation of selected problem areas, the MPIRG professional staff members and student participants work together in coordinated programs that involve publication of research findings and recommendations for public action, active representation before government administrative and regulatory agencies, law reform through legislative action, and, where necessary, legal action through the courts.

Whether as volunteers participating for personal reasons or to fulfill an academic requirement, or as part-time employees for minimal pay, students involved with MPIRG find an opportunity for experiential learning exploring the possibilities and difficulties of effecting social change. Students work with the MPIRG professionals at all levels of MPIRG activity, from initial research, information gathering, and drafting of reports to representations before public forums and interaction with community groups.

Physical Plant Environmental Engineering

Robert A. Reid, Principal Plant Engineer (Environmental), Physical Plant Maintenance and Operations, 200 Shops Building, 319 15th Avenue S.E., Minneapolis, Minnesota 55455; phone: (612) 373-0392

The University Physical Plant maintains facilities equivalent to those of a major Minnesota city, and provides an opportunity for students to investigate practical environmental engineering problems and principles. All possible support is given to students who wish to explore the application of environmentally related innovations at the University. Credit may be earned for worthy projects of sufficient difficulty when arranged through appropriate departments.

Center for Population Studies

Harry Foreman, Director, 4208 Powell Hall, 500 Essex Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-9656

The center coordinates graduate programs in family planning administration and in population studies.

St. Anthony Falls Hydraulic Laboratory

John F. Ripken, Acting Director, Mississippi River at 3rd Avenue S.E., Minneapolis, Minn 55414; phone: (612) 373-2782

The St. Anthony Falls Hydraulic Laboratory conducts research on the flow of water in streams, rivers, estuaries, lakes, and man-made pipes, channels, and reservoirs. Transport of sediment, heat, and dissolved substances as well as natural and artificial water storage, drainage, runoff, and other hydrological processes are part of the research program.

The laboratory provides academic and financial assistance to graduate and undergraduate students interested in water related programs.

Office for Special Learning Opportunities (OSLO)

Meryl Weinreb, 201A Wesbrook Hall, 77 Pleasant Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-7550

See the College of Liberal Arts listing in the Programs section of this bulletin.

Center for Studies of the Physical Environment

(Institute of Technology)

Perry Blackshear, Director, 313 Mechanical Engineering, 111 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-3014 or 373-7914

The Center for Studies of the Physical Environment coordinates the environmental resources and activities of the Institute of Technology in the areas of solid waste management and energy utilization. The Renewable Energy and Environment (TREE) collection, which contains information on solid waste management, solar energy, and biomass utilization, is maintained by the center. The center also sponsors and directs two interdisciplinary study groups composed of representatives of government, business, and the University that meet monthly to discuss research on and environmental aspects of energy from the biomass and direct solar energy utilization. In other projects, the center promotes and coordinates interdisciplinary research in renewable energy and related environmental effects.

Center for Urban and Regional Affairs (CURA)

John Borchert, Director, 311 Walter Library, 117 Pleasant Street S.E., University of Minnesota, Minneapolis, Minnesota 55455; phone: (612) 373-7833

The Regents established the Center for Urban and Regional Affairs to help make the University more responsive to the needs of the larger community, and to increase the constructive interaction between faculty and students, on the one hand, and those dealing directly with major public problems, on the other hand.

The specific projects of the center are selected from a half-dozen broad problem areas. These reflect the major weaknesses in the American urban system in this generation: housing, human relations, urban transportation, waste management, local government reorganization, and the diffusion of information about these topics. These problems cut across a wide and changing array of disciplines.

CURA's role is to help coordinate and stimulate projects in these problem areas. It works with the faculty and students of all academic units of the University. All CURA programs are pilot, experimental, or short term. The goal is to probe and evaluate, complete short-term projects, discard unsuccessful ones, and help build successful ones into the appropriate part of the academic structure. CURA does not have a permanent faculty or research staff and does not offer degrees. It confines itself to projects for which there is currently no other practical administrative home.

The center also publishes a newsletter, the *CURA Reporter*. Information about both the newsletter and the center may be obtained from the CURA office.

Water Resources Research Center

John Waelti, Acting Director, 107 Hubbard Building, 2675 University Avenue, St. Paul, Minnesota 55114; phone (612) 646-6309

The Water Resources Research Center was established in the Graduate School on September 1, 1964. The center has responsibility for stimulating water resources research at the University of Minnesota and at state and private colleges through administration of funds associated with the Federal Water Resources Research Act of 1964; coordinating the research with programs of local, state, and federal agencies and private organizations throughout the state; and assisting in training additional scientists for work in the field of water resources through research. The following state and private colleges participate in the center's programs: St. Mary's College, St. Cloud State College, Gustavus Adolphus College, Bemidji State College, and Winona State College.

The center does not conduct research nor does it have research facilities. The center supports water resources research activities of departments and schools and assists in expanding interdisciplinary research. It plans and arranges for divisions of the University of Minnesota and state and private colleges to conduct competent research of either a basic or practical nature in relation to the physical-biological-economic-social-political aspects of water resources.

One of the purposes of the center is to stimulate and review educational offerings which will prepare students for careers in the field of water resources.

The center assists in recruiting students and in guiding them into appropriate programs of study. The center has been helpful to the University of Minnesota in developing many new courses in the area of water resources, a new graduate option in hydrology, and a graduate program in water resources.

The center publishes and distributes quarterly newsletters and information circulars to people throughout the state. Research projects generate many technical reports and theses. Upon request, the center distributes copies of its publications to people throughout the state and nation. To provide an opportunity for professional people and students working in the field of water resources to meet and exchange information, the center also sponsors interdisciplinary seminars and short courses.

LIBRARIES

Twin Cities area libraries which have collections with an environmentally related emphasis are described below.

University Libraries

The University's collection is so enormous, so diverse, and so dispersed that the best approach is through the main card catalog at Wilson Library. For information about the collection, one may call:

Catalog Information Desk—373-9985
Reference Services Department—373-3082

Several of the small University libraries maintain environmentally related collections either as part of their permanent collections or as reserve materials for courses or research groups. These include the following:

ANDERSEN HORTICULTURAL LIBRARY

University of Minnesota Landscape Arboretum, Chaska, Minnesota 55318; phone: 443-2773; hours: 8:00 to 4:30 Monday-Friday, 11:30 to 4:30 Saturday-Sunday

This library has a noncirculating collection of materials on horticulture, botany, ornithology, and natural history. It serves the needs of the Landscape Arboretum staff and visitors.

ARCHITECTURE LIBRARY

160 Architecture; phone: 373-2203; hours: 8:00 to 9:00 Monday-Thursday, 8:00 to 5:00 Friday, 12:00 to 4:00 Saturday, 8:00 to 4:30 in the summer

The holdings of this library center on architecture, city and regional planning, and landscape architecture. These areas include such topics as housing, urban sociology, land resources and use, environmental psychology, energy conservation, and the built environment (design methodology, urban design, and interior design).

BELL MUSEUM OF NATURAL HISTORY LIBRARY

Librarian—Rose Mary Schaefer; 205 Bell Museum of Natural History; phone 373-7771; hours: 9:00 to 5:00 Monday-Friday (closed during lunch)

A small library is located in the Bell Museum of Natural History. Its collection emphasizes vertebrate zoology and basic ecology.

BIOCHEMISTRY LIBRARY

406 Biological Sciences Center, St. Paul Campus; phone: 373-1582; hours: 7:45 to 4:30 Monday-Friday

In addition to the main subject areas—biochemistry, genetics, and cell biology—resources are available in other relevant areas: food herbicides, water pollution, chemical and biological warfare, and insecticides.

BIOMEDICAL LIBRARY

Diehl Hall; phone: circulation—373-2565, reference—373-5584; hours: 8:00 to 11:00 Monday-Friday, 8:00 to 5:00 Saturday, 2:00 to 10:00 Sunday, closed Friday and Sunday evenings in the summer

Included in the library's holdings are books, periodicals, and conference proceedings, primarily of a technical nature, relating to ecology and the environment. The subject emphasis in these areas is on environmental health, animal ecology and the physiological effects of various types of pollution. The library also has a number of specialized indexes and abstracts for material in these fields.

EDUCATION LIBRARY

Second floor, Walter Library; phone: 373-3841; hours: 8:00 to 10:00 Monday-Thursday, 8:00 to 5:00 Friday, 9:00 to 6:00 Saturday, 1:00 to 10:00 Sunday

Materials on environmental education are included in this collection which covers all aspects of education and psychology.

ENGINEERING LIBRARY

128 Lind Hall; phone: 373-2957; hours: 8:00 to 9:45 Monday-Thursday, 8:00-5:45 Friday, 11:00-2:45 Saturday; summer hours: 8:00-5:45 Monday-Tuesday, 8:00-7:00 Wednesday, 8:00-5:45 Thursday-Friday

The library's collection includes the areas of water pollution and water resources, noise pollution, transportation, meteorology/climatology, power generation, and some solar and wind technology.

ENTOMOLOGY LIBRARY

375 Hodson Hall; phone: 373-1741; hours: 7:45 to 6:00 Monday and Thursday, 7:45 to 9:00 Tuesday and Wednesday, 7:45 to 4:30 Friday, 12:00 to 5:00 Saturday; summer hours: 7:45 to 4:30 Monday-Friday

The library's collection covers three major fields—entomology, fisheries, and wildlife.

FORESTRY LIBRARY

Librarian—Jean Albrecht; 203 Green Hall; phone: 373-1407; hours: 8:00 to 5:00 Monday-Friday (8:00 to 9:00 Tuesday, winter quarter only), 9:00 to 1:00 Saturday during fall, winter, and spring quarters only

The Forestry Library collection includes the fields of forestry, forest products, and forest resources as well as the related areas of outdoor recreation, hydrology, climatology, aerial photography and remote sensing, and range management.

GEOLOGY LIBRARY

204 Pillsbury Hall; phone: 373-4052; 8:00 to 4:30 Monday-Friday

The collection contains materials on all fields of geology. Among areas included are environmental geology, geochemistry, lakes, mineral analysis, mineral resources, rivers, water pollution, and water quality. The library also has a map collection which contains over 65,000 topographic and geologic maps.

GOVERNMENT PUBLICATIONS

Fourth floor, Wilson Library; phone: 373-7813; hours: 8:00 to 10:00 Monday-Thursday, 8:00 to 5:00 Friday, 9:00 to 5:00 Saturday, 1:00 to 6:00 Sunday

The collection includes publications from government departments and agencies at all levels: national, state, and local. Because government is involved with environmental problems and planning, this in many respects is the only collection on campus containing some material on every aspect of environmental studies. Among federal agencies represented are: the Council on Environmental Quality, Environmental Protection Agency, and Energy Research and Development Administration. Among state agencies included are: the Pollution Control Agency, State Planning Agency, Energy Agency, and Environmental Quality Council.

LAW LIBRARY

202 Fraser Hall; phone: 373-5541; hours: 7:45 to 10:00 Monday-Thursday, 7:45 to 7:30 Friday, 9:00 to 5:00 Saturday, 12 noon to 5:00 Sunday
Environmental law materials form part of this collection.

MINES, METALLURGY, AND CHEMICAL ENGINEERING LIBRARY

132 Chemical Engineering; phone: 373-2313; hours: 7:45 to 4:30 Monday-Friday

The library contains some books and periodicals relating to industrial pollution control.

PLANT PATHOLOGY LIBRARY

Library assistant—Nina Jorgensen; 202 Stakman Hall; phone: 373-1669; hours: 7:45 to 4:30 Monday-Friday

The Plant Pathology Library contains approximately 5,000 books, 5,400 government documents, and 125 serials dealing with plant diseases and their control, mycology, nematology, and supporting material in virology. A librarian is on duty in the afternoon only. Since it is open mornings without a librarian, the library depends on the honor and integrity of the people who use its services.

PUBLIC ADMINISTRATION LIBRARY

365 Blegen; phone: 373-2892; hours: 8:30 to 8:00 Monday-Thursday, 8:30 to 5:30 Friday, 10:00 to 5:00 Saturday; Summer hours: 8:00 to 5:00 Monday-Friday

The Public Administration Library maintains a special collection of reference materials published by and about government—municipal, state, federal, and some foreign governments. The collection includes some 40,000 books, pamphlets, periodicals, documents, and other materials in every field of policy and administration. Useful for current information are an extensive clipping file from selected newspapers and an index to periodical articles.

New acquisitions reflect a responsiveness to materials relevant to policy —journals in which dialog about this changing field is published, reports of studies conducted by various institutes across the country, and a variety of up-to-date literature. Key works are being accumulated in all disciplines concerned with the application of quantitative analysis to policy matters.

ST. PAUL CAMPUS LIBRARY

Buford Street; Reference Division phone: 373-0903; hours 8:00 to 11:00 Monday-Thursday, 8:00 to 6:00 Friday, 12 noon to 6:00 Saturday, 1:00 to 9:00 Sunday

The St. Paul Campus main library, as well as the five smaller subject libraries, includes materials on ecology and the fields of agriculture, conservation, fisheries and wildlife, pesticides, food and nutrition, water, pollution, and animal health. Its card catalog indexes the books and periodicals housed in the main library as well as those in the following libraries: Andersen Horticultural; Biochemistry; Entomology, Fisheries, and Wildlife; Forestry, Plant Pathology; and Veterinary Medicine.

STRAUB MEMORIAL LIBRARY,
ST. ANTHONY FALLS HYDRAULIC LABORATORY

Mississippi River at Third Avenue S.E.; phone: 373-2782; hours 8:00 to 4:30 Monday-Friday

The library has a collection of books as well as over 18,000 monographs, U.S. government publications, and other reports dealing with water resources and the environment.

THE RENEWABLE ENERGY ENVIRONMENT COLLECTION (TREE)

Librarian—Louise Lalonde; 114 Space Science Center; phone: 373-7970; hours: varying

Technical research materials on renewable energy forms such as solar, wind, geothermal, sea, and biomass energies are the focus of this collection. Included are National Technical Information Service (NTIS) publications on energy.

URBAN TRANSPORTATION LITERATURE COLLECTION

150 Experimental Engineering; phone: 373-2509; hours: daytime only—phone or information

Specific topic areas of this collection include urban transportation as it relates to air pollution, noise, natural resources, open space, energy consumption, exhaust emissions, and recreation.

O. MEREDITH WILSON LIBRARY

West Bank; Reference Division phone: 373-3082; hours: 8:00 to 10:00 Monday-Thursday, 8:00 to 5:00 Friday, 9:00 to 6:00 Saturday, 1:00 to 10:00 Sunday

Wilson Library contains materials on the following subjects: economics, political science, geography, and sociology. It also contains most social sciences and humanities materials unless there is a separate subject library for a specific branch of one of these areas.

Environmental Conservation Library (ECOL)

Minneapolis Public Library, 300 Nicollet Mall, Minneapolis, Minnesota 55401; phone: 372-6609; hours: 9:00 to 5:30 Monday-Saturday; summer hours: 9:00 to 5:30 Monday-Friday

ECOL, a special collection within the Minneapolis Public Library, brings together materials from various subject fields that relate to the physical environment and man's impact on it. ECOL has books, periodicals, newslet-

ters, pamphlets, bibliographies, posters, and government documents relating to such topics as air and water pollution, solid waste, wildlife, conservation of natural resources, land use planning, environmental law, and environmental education. ECOL was designated by the Minnesota Legislature as a state center for environmental information and receives publications of many state agencies, including environmental impact statements. A catalog of the collection has been printed, and copies are available in libraries on all campuses of the University.

Minnesota Department of Health Library

Librarian—Doug Schmidt; 717 Delaware Street S.E., Minneapolis, Minnesota 55440; phone: 296-5240

This collection has been developed with the needs of public health professionals in mind. Consequently, it is essentially a specialized library with technical, as opposed to popular, literature. It is a reference collection only and extends no loan privileges. The library subscribes to some 270 periodicals, and the library staff prepares weekly a mimeographed subject index of new articles of public health significance.

Minnesota Pollution Control Agency (MPCA)

1935 W. County Road B-2, Third floor, Roseville, Minnesota; phone: 296-7373
Call for information.

Population Resource Center

1562 University Avenue, St. Paul, Minnesota 55104, phone: 646-9603; hours: 9:00 to 4:30 Monday-Friday

The Population Resource Center of Planned Parenthood of Minnesota is a multimedia library which contains materials on population growth, contraceptive technology, sociology of family planning, abortion, human sexuality, history of the birth control movement, and related subjects. Books may be borrowed at no charge, films and filmstrips may be rented, and other material may be photocopied. Annotated bibliographies and numerous pamphlets are also available. All requests for information or materials can be filled by mail.

III. UNIVERSITY OF MINNESOTA, DULUTH

Duluth, Minnesota 55812

CONTACTS: *Environment*—
John C. Green, Department of Geology, (218) 726-7208
Urban Studies—
Dale W. Olsen, Department of Political Science, (218) 726-8164

The *UMD Bulletin* contains details of the various majors and other programs which deal with environmental topics. A detailed subject index of environmentally related courses follows the description of the Urban Studies Program below.

The Urban Studies Program is designed in part as a preparation for junior-level positions in planning, administrative, and problem-solving agencies at city, county, regional, state, and federal levels. Graduates of the program may pursue graduate work in urban affairs, planning, public administration, and related disciplines. Some will prepare for the study of law. Liberal education aspects of the program will appeal to persons who simply seek a better understanding of the complexities of life in urban America.

MAJOR IN URBAN STUDIES FOR THE B.A. DEGREE

Prerequisites
Freshman, Sophomore Years

Econ 1004—Principles of Economics: Micro (4)
Econ 1005—Principles of Economics: Macro (4)
Geog 1303—Cultural Geography (4)
Geog 1403—Physical Geography (4)
Pol 1010—American Government and Politics (5)
Psy 1003—General Psychology (5)
Soc 1400—Social Inquiry I (5)
Soc 1410—Social Inquiry II (5)
Subtotal (36)

Required Core
Junior, Senior Years

Econ 3346—Principles of Urban Economics (4)
Geog 3331—Urban Geography (3)
Pol 3030—Urban Government and Politics (4)
Pol 3220—Introduction to Public Administration (5)
Pol 3399—Seminar: Urban Affairs (3)
Soc 3830—Sociology of Community (4)
Subtotal (23)

Departmental Concentrations: 14 credits (minimum) to be selected in consultation with adviser from one of the following groupings:

Business Administration (BA)

3030—Business Environment (4)
3304—Fundamentals of Management (3)
3361—Business Policy (5)
3804—Personnel Administration (3)
3821—Human Relations in Administration (4)

Economics (Econ)

3803—Public Finance (5)
5361—Regional Economics, Location Theory (5)
5362—Urban Economics (4)

Geography (Geog)

1305—Environmental Conservation (4)
3324—Geography of Industrial Location (4)
3341—Geography of Transportation and Trade (4)
3521—Cartography and Map Interpretation (5)
3611—Field Techniques (4)
5701—Settlement Geography (4)

Political Science (Pol)

3020—State Government (4)
3221—Public Administration in a Democracy (4)
3310—Public Opinion and Propaganda (4)
5160—Legislative Process (4)
5170—Political Interest Individuals and Groups (4)
5330—The Judicial Process (4)
5340—Metropolitan Government and Politics (4)
5350—State and Local Finance (4)

Sociology-Anthropology (Soc)
3830—Sociology of Community (4)
3850—Complex Organization (4)
5120—Independent Study in Sociology (maximum of 5 cr)
5170—Urban Sociology (4)
5820—Community Research (4)

Interdepartmental
A selection of course offerings designed to attain a very specific educational objective. To be approved by the program coordinator in consultation with the Urban Studies Committee.
Subtotal (14)

Options: 6-8 additional credits in two fields to be selected in consultation with the adviser.
Subtotal (6-8)
Total (79-81)

Urban studies majors are encouraged to investigate fieldwork and internship opportunities available through University College and through the Departments of Political Science and Sociology-Anthropology. It is also suggested that majors pursue additional work in appropriate mathematics courses. History 3361, The American City, is also recommended.

SUBJECT INDEX

The following key words indicate the subject content of the environmentally related courses offered at Duluth and described in this bulletin.

BIOLOGY
Biol 1102. Biology and Man

BUSINESS
BA 3030. Business Environment
BA 3104. The Functions of Law

CONSUMER PROTECTION
Econ 5003. Consumer Economics

CULTURE/ATTITUDES
Anth 1604. Cultural Anthropology
Anth 5630. Human Ecology
Hum 1031. American Colonial Heritage
Hum 1032. American Frontier Heritage
Hum 1033. American Establishments. Minorities
Hum 3073. Humanities in the United States
Soc 1100. Problems of American Society
Soc 3900. Social Issues and Social Change

ECOLOGY
Biol 3773. General Ecology
Biol 3774. General Ecology Laboratory

ECONOMICS/COST-BENEFIT
Econ 1002. Introduction to Economics
Econ 5361. Regional Economics, Location Theory
Geol 5630. Economic Aspects of Geology

ENERGY
Geol 1100. Topics: Limits of Earth Resources; Man and Resources
IS 3100. Man's Environment and His Future

ENVIRONMENTAL HEALTH

Ind 3951. Industrial Practices and Processes

ENVIRONMENTAL IMPLICATIONS

Design

Art 1001. Art Today
Art 3800. Community Involvement Through Art

Geography

Geog 1201. Man and His Habitat
Geog 1403. Physical Geography

Technology

Chem 3106. Chemistry in Modern Life
Geol 1100. Topics in Geology
Geol 3150. Environmental Geology
Geol 5021. Mineral Resources and Environment
Ind 1302. Fundamentals of Power
Ind 3951. Industrial Practices and Processes

ENVIRONMENTAL SURVEY COURSES

Biol 1102. Biology and Man
Geog 1305. Environmental Conservation
IS 3100. Man's Environment and His Future
Soc 3912. Issues and Change—Special Topics

FIELD STATIONS—LAKESIDE

PubH 8248. Water Quality Investigation and Research Techniques
PubH 8249. Water Quality Research

FOOD/NUTRITION

HE 1470. Survey of Human Nutrition

FOREST

Ind 3140. Wood in Industry

GEOLOGY

Geol 1100. Topics in Geology
Geol 1110. Introductory Geology
Geol 3131. Oceanography
Geol 3150. Environmental Geology
Geol 3200. Geomorphology
Geol 3310-3311-3312. Earth Materials I-II-III
Geol 3600. Economic Geology
Geol 5020. Environmental Geology of Minnesota
Geol 5211. Glacial and Quaternary Geology

LIMNOLOGY

Biol 5773. Limnology

METEOROLOGY/CLIMATOLOGY

Geog 3412. Weather Elements
Geog 3422. Climatology

MONITORING AND MEASUREMENTS/SAMPLING

PubH 8248. Water Quality Investigation and Research Techniques
PubH 8249. Water Quality Research

PUBLIC POLICY

Econ 5362. Urban Economics
Pol 3020. State Government
Pol 3030. Urban Government and Politics
Pol 3060. National Policy Issues
Pol 3080. Government and Conservation
Pol 3089. Conservation Problems
Pol 3220. Introduction to Public Administration
Pol 5340. Metropolitan Government and Politics

RESOURCES

Geol 1100. Topics in Geology
Geog 1305. Environmental Conservation
Geol 3600. Economic Geology
Geol 5630. Economic Aspects of Geology
Ind 3140. Wood in Industry
Pol 3080. Government and Conservation
Pol 3089. Conservation Problems

TRANSPORTATION

Ind 1302. Fundamentals of Power
Ind 3354. Automotive Fuel and Electrical Systems

URBAN/COMMUNITY

Geog 3331. Urban Geography
HE 1560. Introduction to Housing
HE 3575. Community Housing
Pol 3399. Seminar: Urban Affairs
Pol 5340. Metropolitan Government and Politics
Soc 3180. Community and Social Organization
Soc 3190. Current Social Issues
Soc 5170. Urban Sociology

WATER

PubH 8248. Water Quality Investigation and Research Techniques
PubH 8249. Water Quality Research

COURSE DESCRIPTIONS

Anthropology (Anth)

1604. CULTURAL ANTHROPOLOGY. (5 cr)
Analysis of the range of variation and degree of uniformity in human behavior as revealed through comparative ethnographic study of the major institutions of preliterate societies in all parts of the world.

5630. HUMAN ECOLOGY. (4 cr; prereq 1604 and ♯)
An in-depth study of some of the methods and concepts concerning the interrelations of certain human populations and their environments in diverse natural, cultural, historical, and evolutionary settings.

Art (Art)

1001. ART TODAY. (4 cr)
Introductory survey of the influence of art in daily life as seen in city planning, the home, other architecture, painting, sculpture, religion, commerce, and industry.

3800. COMMUNITY INVOLVEMENT THROUGH ART. (Cr ar [may be repeated for a max of 6 cr]; 1 cr for each 25 hrs of fieldwork)
For the student interested in gaining actual experience working with public and private social agencies through an art program.

Biology (Biol)

1102. BIOLOGY AND MAN. (5 cr; 4 hrs lect, 2 hrs lab)
Principles of modern biology; origin and nature of life, genetics, eugenics, evolution, population dynamics, ecology, pollution, pesticides, radiation, drugs, and other problems of man in his environment.

3773. GENERAL ECOLOGY. (3 cr; prereq 10 cr in general biology; may be taken without lab 3774)
Introduction to the principles and theory of environmental biology; functional approach to ecosystems.

3774. GENERAL ECOLOGY LABORATORY. (2 cr; prereq concurrent regis or prior cr in 3773; 3 hrs lab)
Experience in methods of measuring environmental factors, interpreting data.

5773. LIMNOLOGY. (4 cr; prereq 3773, 3774, organic chemistry or ♯; 2 hrs lect, 4 hrs lab) Gerhart
Biological, chemical and physical aspects of lakes and streams. Extensive laboratory and field analysis of the ecological relationships between aquatic organisms and their environment.

5871. WATER POLLUTION BIOLOGY. (3 cr; prereq 5773 or ♯; 2 hrs lect, and 2 hrs lab) Gerhart
A consideration of the responses of aquatic organisms, communities, and ecosystems to pollutants and human use.

Business Administration (BA)

3030. BUSINESS ENVIRONMENT. (4 cr; offered when feasible)
Business as a part of a larger system—economic, political, social. Special emphasis on the external environment—economics, culture, government, technology, international relations, labor—within which business operates. Social responsibility.

3104. THE FUNCTIONS OF LAW. (4 cr)
Investigation of the formal legal processes, the laws of contracts, and the laws of labor to obtain an understanding of the functions of law in society and business.

Chemistry (Chem)

3106. CHEMISTRY IN MODERN LIFE. (4 cr; will not satisfy requirements for a major or minor in chemistry; primarily for majors in the humanities and social sciences)
Consideration of chemistry from standpoint of its effect and influence on contemporary problems. No science background is assumed.

Economics (Econ)

1002. INTRODUCTION TO ECONOMICS. (4 cr [cr not allowed toward economics major or minor]; designed specifically for liberal education purposes)
General description of the economy of the U.S. and an analysis of contemporary economic problems. Will introduce the student to the major economic issues and problems of the day and provide a simple framework, used by the economist, for analysis of these issues and problems.

3346. PRINCIPLES OF URBAN ECONOMICS. (4 cr) Lichty
Analysis of the growth of urban centers in a developed economy and problems associated with this growth.

5003. CONSUMER ECONOMICS. (4 cr; prereq 1005 or ♯)
Application of economic principles to major decisions of consumers. Concept of alternative choice. Opportunity cost. How to use income most effectively; use of credit; saving; insurance principles; analysis of advertising as it affects the consumer; sources of consumer information; product testing agencies; analysis of contracts common to consumers; government efforts to protect consumers.

Education (Educ)

5236. ENVIRONMENTAL EDUCATION FOR TEACHERS. (1-3 cr [may be repeated for max 3 cr]; prereq ♯)
Combines environmental study with field experiences to prepare preservice and in-service teachers for implementation of environmental learning experiences in the school curriculum, grades K-12, all subjects.

Geography (Geog)

1201. MAN AND HIS HABITAT. (4 cr)
The geography of human groups in diverse physical settings. Description and analysis of favorable and unfavorable habitats for human occupation including geographical analysis of selected countries. Emphasis on man's use and misuse of his environment.

1305. ENVIRONMENTAL CONSERVATION. (4 cr)
Natural resources of the earth and man's cultural modification of them. Emphasis on planning for and control of man's use of his environment.

1403. PHYSICAL GEOGRAPHY. (4 cr)
Earth-sun relations, maps and globes, and major factors of the natural environment including water resources, landforms, weather and climate, natural vegetation, and soils.

3324. GEOGRAPHY OF INDUSTRIAL LOCATION. (4 cr; prereq 1303, 1312)
Locational analysis of industry and industrial patterns. Introduction to spatial theory and model building with emphasis on integrating real world phenomena with theoretical, industrial location factors.

3331. URBAN GEOGRAPHY. (3 cr; prereq 1303 and 1403)
Function and distribution of cities in present-day world, including analysis of their development. Emphasis on American cities, their internal structure, form, and planning processes.

3412. WEATHER ELEMENTS. (4 cr; prereq 1403 or ♯)
Topics include atmospheric composition, structure, stability and motion; precipitation processes, air masses, fronts, cyclones and anticyclones; general weather patterns.

3422. CLIMATOLOGY. (2 cr; prereq 1403 and 3412 or ♯)
Various climatic classifications; analysis of climatic regions of continents based on the Trewartha (modified Koppen) system. Individual student projects.

Geology (Geol)

1100. TOPICS IN GEOLOGY: "MAN AND RESOURCES;" "LIMITS OF EARTH RESOURCES." (1 cr [may be repeated for max 6 cr]; 2 lect-rec hrs per wk; 5 wks)
Selected topics of geologic interest collectively related to virtually all aspects of geology with individual short courses providing in-depth analysis of selected geoscience subjects.

1110. INTRODUCTORY GEOLOGY. (5 cr; 4 lect and 2 lab hrs per wk)
An integrated study of the earth's composition, structure, and processes together with earth history and the evolution of life.

3131. OCEANOGRAPHY. (4 cr, §3130; prereq upper division standing; 3 hrs lect) Darby, Gerhart
First half of quarter: The history of oceans and basins; physical and chemical aspects of marine waters; processes; ocean and continental relations, resources. Second half of quarter: The marine biota; ecology of organisms; trophic levels, productivity, measuring techniques, pollution; Great Lakes as freshwater seas. Outside work in the form of a paper will be required.

3150. ENVIRONMENTAL GEOLOGY. (4 cr; prereq 1110 or ♯) Green
The interactions between man and his physical environment; the restraints and influences on man's activities imposed by geologic processes, history, and the constitution of the earth. Engineering-geological strategies for dealing with some of these problems. Field investigation of an environmentally relevant local geologic problem

3200. GEOMORPHOLOGY. (4 cr; prereq 1110; 3 hrs lect, 2 hrs lab) Matsch
Geologic processes of the earth's surface environment that produce the major elements of the landscape. Aerial photographs and topographic maps as tools for interpreting the origin and geological history of landscapes. Field trips.

3310-3311-3312. EARTH MATERIALS I-II-III. (5/4/4 cr; prereq 1110 and 1 yr high school chemistry or 1 qtr college chemistry; 3 hrs lect and 4 hrs lab for 3310...2 hrs lect and 4 hrs lab each for 3311 and 3312) Grant, Green, Ojakangas
The study of the common and important rocks and minerals including their origin, composition, classification, identification, and use. 3310: includes introduction to crystallography, crystal chemistry, and the use of the polarizing microscope. Field trips.

3600. ECONOMIC GEOLOGY. (4 cr; prereq 3312; 3 hrs lect and 2 hrs lab) Marsden
The geologic description, geographic distribution, and origin of economic mineral materials including petroleum, coal, and groundwater.

5020su. ENVIRONMENTAL GEOLOGY OF MINNESOTA. (5 cr [cr not allowed toward MA degree in geology]; prereq 1110 or ♯) Staff
Rocks, minerals, waters, landforms, geological history, and mineral resources—both developed and potential—of Minnesota. Technical, economic, and cultural aspects of the use and preservation of Minnesota's natural resources stressed. Laboratory includes a number of local field trips and one 2-day field trip to emphasize the geological history of Minnesota and the significance of geology in land use and development, and environmental problems.

5021. MINERAL RESOURCES AND ENVIRONMENT. (6 cr; prereq 1110 or ♯; not usable toward MS degree in geology; offered summer only) Marsden
Geological, technical, environmental, economic, and land use aspects of developed and potential mineral resources of Minnesota. Field trips to operating mines, research centers, and mineral resource centers.

5211. GLACIAL AND QUATERNARY GEOLOGY. (4 cr, §5210; prereq 1110 or ♯; 3 hrs lect and 2 hrs field lab) Matsch
Physics of glaciers (glaciology), including their erosional and depositional activities. Survey of geological and biological responses to the changing environment resulting from climatic fluctuations during the last three million years of earth history. Field studies on the glacial deposits of Minnesota.

5630. ECONOMIC ASPECTS OF GEOLOGY. (2 cr; prereq 3600 or ♯) Marsden
Political, economic, and environmental factors influencing the mineral industries. Term paper.

Home Economics (HE)

1470. SURVEY OF HUMAN NUTRITION. (3 cr, §1330)
A survey of the nutrients with emphasis on the foundation of a balanced diet required for physical well-being.

1560. INTRODUCTION TO HOUSING. (4 cr, §1810; prereq 1500 or ♯; 2 lect and 4 lab hrs per wk)
The physical, social, economic, and environmental aspects of choosing and maintaining a home.

3575. COMMUNITY HOUSING. (3 cr, §3510; prereq Soc 1100 or Soc 1400; 2 lect and 2 lab hrs per wk)
Historic, economic, sociological, and psychological aspects of housing; government involvement in housing.

Humanities (Hum)

1031. AMERICAN COLONIAL HERITAGE. (3 cr)
Pervasive ideas and themes of the colonial past as evidenced in works of art, architecture, music, literature, theology, and politics, with emphasis on New England.

1032. AMERICAN FRONTIER HERITAGE. (3 cr)
The frontier experience examined in primary documents with emphasis on the development of the American character as shown in nineteenth-century popular arts, myth, literature, and historiography.

1033. AMERICAN ESTABLISHMENTS, MINORITIES. (3 cr)
Immigrant and ethnic experiences in twentieth-century as depicted in prose, poetry, drama, and the arts; patterns of contemporary prestige and status.

3073. THE GREAT DEPRESSION AND THE ARTS. (3 cr)
The interaction of arts, economics and politics in American literature, theatre, film, photography, painting, and music.

Industrial and Technical Studies (Ind)

3140. WOOD IN INDUSTRY. (3 cr; offered when feasible; 2 hrs lect and 4 lab hrs)
Industrial application of wood and wood products. Present and future sources of lumber; processes and future trends.

3354. AUTOMOTIVE FUEL AND ELECTRICAL SYSTEMS. (4 cr; §3351; prereq 1353 and 1805 or ♯; 2 hrs lect and 4 hrs lab)
Study of automotive fuel and electric components and circuit design incorporated in the modern automobile. Study of emission control equipment included.

3951. INDUSTRIAL PRACTICES AND PROCESSES. (3 cr)
Industrial materials; manufacturing processes and current practices; industrial plants, plant organization, products, production methods, and product development.

Interdisciplinary Studies (IS)

3100. MAN'S ENVIRONMENT AND HIS FUTURE. (3 cr; 2 hrs lect, 1 hr discussion-rec)
Man's relationship to the animate and inanimate world in and on which he lives, the consequences to the environment of man's actions, the implications of various philosophical and economic principles on man's future existence, and some of the possible choices man has for long-term survival in a world of finite resources. Several lectures; term paper; discussion groups.

Political Science (Pol)

3020. STATE GOVERNMENT. (4 cr; prereq 1010)
The states in the American federal system; governmental institutions and processes; intergovernmental relations. Special reference to Minnesota.

3030. URBAN GOVERNMENT. (4 cr; prereq 1010)
Legal, administrative, political, and social aspects of American local government; emphasis on intergovernmental relations and regional cooperation.

3060. NATIONAL POLICY ISSUES. (4 cr; prereq 1010 or ♯)
Critical issues of contemporary national government; emphasis on finance, foreign and military policy, and environmental policy decisions.

3080. GOVERNMENT AND CONSERVATION. (4 cr; prereq 1010 or ♯)
American natural resource problems with special attention to conservation activities at the national, state, and local levels; development of conservation agencies in Minnesota.

3089. CONSERVATION PROBLEMS. (3 cr; prereq 3080 or ♯)
Detailed examination of crucial contemporary American resource problems; analysis of environmental preservation concepts and their implications; appraisal of specific situations.

3220. INTRODUCTION TO PUBLIC ADMINISTRATION. (5 cr, §3210; prereq 1010)
Introduction to the internal operations of bureaucratic organizations and the role of the latter in governmental policy making. Capability of modern bureaucracy jn meeting its own goal of technical efficiency; impact of bureaucratic forms of organization on a democratic society.

3399. SEMINAR: URBAN AFFAIRS. (3 cr; prereq 8 cr in relevant upper division urban studies courses and ♯; offered when feasible)
Supervised research and writing in urban processes and problems.

5340. METROPOLITAN GOVERNMENT AND POLITICS. (4 cr, §5318; prereq 3030) Olsen
Development of political and governmental problems in metropolitan areas; systems and structures for area-wide local government; emerging trends, potentials and limitations for metropolitan government in United States and elsewhere; politics of metropolitan reform.

5350. STATE AND LOCAL FINANCE

Public Health (PubH)

8248. WATER QUALITY INVESTIGATION AND RESEARCH TECHNIQUES. (6 cr; prereq ♯) Odlaug, Swain
Introduction to field techniques and special research methods applicable to public health problems of water quality control. Procedures for establishing pollution baselines; appraisal and recognition of advancing eutrophication in surface and ground waters.

8249. WATER QUALITY RESEARCH. (6 cr; prereq ♯) Odlaug, Swain
Design logistical planning and implementation of an independent short-term research activity basic to water quality evaluation. Literature review, statistical design and data processing. Field testing of sampling techniques and laboratory operations.

Sociology-Anthropology (Soc)

1100. PROBLEMS OF AMERICAN SOCIETY. (5 cr [cr not allowed toward sociology-anthropology major or minor], §1101, §1105)
Application of the sociological perspective to social problems within the United States.

3180. COMMUNITY AND SOCIAL ORGANIZATION. (4 cr; prereq 1100 or ♯; nonmajors only)
Examination of community and societal structures and processes with specific attention to the functioning of voluntary associations and complex organizations.

3190. CURRENT SOCIAL ISSUES. (4 cr; prereq 1100 or ♯; nonmajors only)
Application of sociological theory and research to current topics; analysis of community life, social movements, and social conditions.

3900. SOCIAL ISSUES AND SOCIAL CHANGE. (4 cr, §3190; prereq 3420 or ♯)
Analysis of the forces of social change and social issues as they affect social life. Emphasis on the use of social theory and research in comprehending the dynamics of issues and change.

5170. URBAN SOCIOLOGY. (4 cr, §5121; prereq ♯)
Cities; urban ecology; urban institutions; and urban way of life.

IV. UNIVERSITY OF MINNESOTA, MORRIS

Morris, Minnesota 56268

CONTACTS: *Environment*—
Thomas E. Straw, Division of Science and Mathematics, Science Building, (612) 589-2211
Merle N. Hirsh, Chairman, Division of Science and Mathematics, Science Building, (612) 589-1644

The Division of Science and Mathematics offers a bachelor of arts degree with majors in biology, chemistry, geology, mathematics, and physics plus minors in geology and earth science. There is also an individual curriculum option which allows students to design their own major program. See the *UMM Bulletin* for more information about these programs as well as additional course listings.

Note also that in addition to its regular offerings each discipline has a series of directed studies courses in which a student and faculty member may cooperate to design a course experience to meet special needs of the student's program.

COURSE DESCRIPTIONS

Biology (Biol)

3100f. BIOLOGY AND MAN'S FUTURE. (5 cr; cannot be used to satisfy GER in Natural Sciences and Mathematics; not offered 1976-77)
Biological factors influencing man's future; e.g., population size and structure, applied genetics, biochemical control of behavior, biological basis of social organization, food supply, environmental change, biological aspects of ethics and morals, space biology.

3110w. BIOETHICS. (5 cr; prereq jr or sr status and one science course; 4 hrs lect and discussion; not offered 1975-76)
Ethical problems related to the discovery, dissemination, and applications of biological information to man. The "nature" of man, the concept of purpose, the use of humans in research, birth control, death control, medical priorities, biochemical control of behavior, transplants, genetic engineering and other manipulations of the genetic composition of human populations.

3850s. ECOLOGY. (5 cr; prereq 1111; 3 hrs lect, 6 hrs lab, and field study; lab fee required)
Relationship of organisms to each other and to their nonliving environment; biogeography with emphasis on North America.

3860f,w,s. STUDIES IN FIELD BIOLOGY. (0-1 cr; prereq ♯; students may not apply more than 6 cr toward their requirements for the major or minor)
Biological field studies of selected habitats.

Geology (Geol)

1100f. THE EARTH I—OUR PHYSICAL ENVIRONMENT. (5 cr; 3 hrs lect, 4 hrs lab; lab fee required)
Introduction to the materials that make up the earth; the earth's structure, surface features, and geologic processes involved in their development; man as a geological agent. Laboratory work includes the study of rocks and minerals and of geologically interesting features on maps and aerial photographs.

1110w. THE EARTH II—A HISTORICAL PERSPECTIVE. (5 cr; prereq 1100; 3 hrs lect, 4 hrs lab; lab fee required)
Significant events in the earth's history and the development of life as interpreted from the rock and fossil record in association with the theories of sea floor spreading and drifting continents; emphasis on the geologic history of North America. Laboratory experience devoted largely to methods of interpreting earth's history and fossil classification and identification.

1120s. EARTH SCIENCE. (5 cr; 3 hrs lect, 4 hrs lab; lab fee required)
An introduction to astronomy and meteorology. Topics in astronomy include motions of planets and stellar bodies, size and distance measurements, properties of solar and stellar bodies, interstellar matter, galaxies, and the tools of the astronomer. Topics in meteorology include atmospheric composition, air masses, circulation patterns, atmospheric disturbances, meteorological instruments, weather forecasting, and some effects of man's activities.

3200w. EARTH MATERIALS I—THE MINERALS. (5 cr; prereq 1100, Chem 1301 or 1501, or ♯; 3 hrs lect, 4 hrs lab; lab fee required)
Introduction to mineralogy and crystallography; classification, identification, physical, and chemical properties; origin and natural occurrence of major mineral groups. Laboratory study of crystal systems by use of models; optical aspects and physical and chemical testing.

3210s. EARTH MATERIALS II—THE ROCKS. (5 cr; prereq 3200; 6 hrs lect-lab and field trips; lab fee required)
Classification, composition, genesis, and natural occurrence of igneous metamorphic and sedimentary rocks; laboratory study and identification of rocks by various macroscopic, microscopic (including petrographic), and chemical means.

3400s. EARTH PROCESSES I—LANDFORM DEVELOPMENT. (5 cr; prereq 1100; 3 hrs lect, 4 hrs lab and field trips; lab fee required)
(Same as Geog 3400) Introduction to geomorphology and environmental geology; processes at work at the earth's surface; the resulting landforms and products; interrelationships between man's activities and geomorphic processes; laboratory study of aerial photographs, topographic and surficial geology; evaluation of local geomorphic processes.

3410f. EARTH PROCESSES II—STRUCTURAL. (5 cr; prereq 3210 or ♯; 6 hrs lect-lab and field trips; lab fee required)
Theory of rock deformation; description and classification of structures of the earth's crust; application of geometric, graphic, and map interpretation techniques to solution of structural problems; field mapping problem.

3450f. STRATIGRAPHY AND SEDIMENTATION. (5 cr; prereq 1110, 3210, or ♯; 6 hrs lect-lab and field trips; lab fee required)
An introduction to the principles of stratigraphy and processes of sedimentation. Emphasis on correlation problems, use and construction of thickness and facies maps and cross sections; origin, transportation, and deposition of sediments; recognition and interpretation of ancient sedimentary environments.

3460w. INTRODUCTION TO INVERTEBRATE PALEONTOLOGY. (5 cr; prereq 1110 or ♯; 3 hrs lect, 4 hrs lab; lab fee required)
The morphology and evolutionary record of the major invertebrate groups characterized by significant fossil representation. Principles of evolution, paleoecology, and paleoenvironmental interpretations of fossil assemblages.

3550s. GEOLOGICAL FIELD METHODS. (3 cr; prereq 3410; field trips)
Introduction to geologic sampling, mapping, and note-taking; study of topographic and geologic maps and aerial photographs; preparation of geologic maps and reports.

3600su. FIELD GEOLOGY. (9 cr; prereq 3550; 6 wks in field)
Field training in geologic mapping, measuring sections, and interpreting geologic history using the alidade, Brunton compass, topographic maps, and aerial photos. A comprehensive report complete with geologic map, columnar sections, and cross sections is required.

3900w. GEOLOGY SEMINAR. (1-3 cr; 1 cr required for geology major; prereq ♯)
The seminar approach to the study of any of a number of selected topics of geologic interest.

3950f, 3951w, 3952s. DIRECTED STUDIES. (1-5 cr per qtr; prereq ♯)

Physical Science (PSci)

1100-1101. CONCEPTS AND METHODOLOGY IN PHYSICAL SCIENCE. (5 cr per qtr; 3 lect, 1 rec, and 2 lab hrs per wk; lab fee required)
Topics selected from everyday experiences in the physical world to foster an understanding of the development and formulation of the laws of physical science. Utilization of these laws and principles by individuals and society as a whole. Concepts of observation, measurement, motion, energy, etc., from both the pure and the applied scientific points of view.

V. UNIVERSITY OF MINNESOTA TECHNICAL COLLEGE, CROOKSTON

Crookston, Minnsota 56716

CONTACT: *Environment*—
Philip Buckley, Division of Agriculture, (218) 281-6510

The associate of applied science curricula at the University of Minnesota Technical College, Crookston, are designed to emphasize preparation for entrance into semiprofessional or midmanagement occupations. Associate of applied science curricula are available in the following environmentally related areas: natural resources conservation; park and recreational area management; biological laboratory technology; and soil, water, and civil engineering technology. For further details, consult the *Technical College, Crookston, Bulletin.*

The Red River Valley Natural History Area, a tract of approximately 85 acres located in the flat lake bed of glacial Lake Agassiz in northwestern Minnesota, was established by the University of Minnesota as a living museum and teaching laboratory. The area contains an interesting assortment of habitats including prairie, aspen forest, cottonwood forest, willow swamp, and cattail marsh. Each of these habitat types supports a particular group of plant and animal species, some of which are becoming rare because of intensive land use. Nature trails wind throughout the different habitats allowing educational groups to experience the diverse plant and animal life present and to view ecological research demonstrations.

COURSE DESCRIPTIONS

Agricultural Engineering Technology (AgEn)

1613f,s. SOIL AND WATER ENGINEERING PRACTICES. (3 cr; prereq 1044, 1404; 2 lect and 2 lab hrs per wk)
Engineering techniques and design in wind and water erosion control and management. Relationship of engineering factors to soil and vegetation for wise utilization of basic resources.

Biology (Biol)

1013. ELEMENTARY BIOLOGY. (3 cr)
A general survey of biological concepts and living organisms. For students with little or no previous background in biology, for those not planning further study in biology, and as a prerequisite to Biol 1104 for those students who have not had high school biology with a "C" or higher grade. Lecture and laboratory.

1104. GENERAL BIOLOGY. (4 cr; prereq high school chemistry, 1013 or ¶1013)
Introduction to the major biological concepts common to both plants and animals. Lecture and laboratory.

1204. INTRODUCTION TO LIMNOLOGY. (4 cr; prereq 1104, Chem 1104)
Ecology of lakes, streams, and ponds emphasizing factors which affect biological productivity. Laboratory and in-field study stressed. Modern techniques for water sampling and analysis will be employed to determine the identity and quantity of biological and chemical materials present.

1214. GENERAL BOTANY. (4 cr; prereq 1104)
Fundamental principles of plant biology with emphasis on morphology, physiology, and classification of plants. Lecture and laboratory.

1224. GENERAL ZOOLOGY. (4 cr; prereq 1104)
Survey of the major animal phyla and principles of animal biology. Anatomy and physiology of mammals emphasized. Lecture and laboratory.

1304. INTRODUCTION TO PLANT PHYSIOLOGY. (4 cr; prereq 1104, 1214)
General metabolic processes; photosynthesis, respiration, nutrition, absorption, germination, flowering, and growth, with emphasis on influences of environmental and hormonal control.

1565. MICROBIOLOGY. (5 cr; prereq 1104, Chem 1214)
Microorganisms and the application of microbiology to man and industry. The relationship of microorganisms to the diseases of man, animals, and plants.

Chemistry (Chem)

1483s. ENVIRONMENTAL POLLUTION CHEMISTRY. (3 cr; prereq 1104 and Biol 1013 or 1104)
Quantitative and qualitative chemical determinations of pollutants and additions in water, soils, and atmosphere.

General Agriculture (GnAg)

1344f,w,s. CROP PROTECTION. (4 cr; prereq Biol 1104 or ♯; 3 class hrs and one 2-hr lab per wk)
Principles involved in controlling plant diseases and insects. Insects and diseases in relation to man, crops, livestock, and products; habits, biology, classification, and problems of control.

1643w,s. AGRICULTURAL CHEMICALS. (3 cr; prereq Soil 1294, Biol 1104; 2 class hrs and one 2-hr lab per wk)
The nature and properties of agricultural chemicals primarily used as fertilizers, herbicides, insecticides, fungicides, and plant regulators.

Horticulture (Hort)

1213f,w. INTRODUCTORY HORTICULTURE. (3 cr; 3 class hrs and one 2-hr lab per wk)
Fruit, vegetable, and ornamental plants in Minnesota. Factors which influence their culture, importance, and economic value. Laboratory, greenhouse, and field experience.

1414f. PLANT MATERIALS. (4 cr; prereq 1213, Biol 1014 or 1104; 3 class hrs and one 2-hr lab per wk)
The identification, ecology, and use of deciduous and evergreen trees and shrubs vines, and selected herbaceous plants used in landscape plantings.

1422f,s. LANDSCAPE PRACTICES LABORATORY. (2 cr; prereq 1213 or ¶1213; two 2-hr labs per wk)
An applied laboratory course covering culturing requirements, pruning, spraying, digging, handling, storage, and planting of horticulture plants.

1523w. FLORICULTURE. (3 cr; prereq 1213, 1323; 2 class hrs and one 2-hr lab per wk)
Working knowledge identification, propagation, culture, and uses of common garden flowers; greenhouse flowering and house plants; annuals, biennials, perennials and their growth and use in landscape plans and flower borders; flower shop arrangements and design.

Natural Resources (NatR)

1102f,w. ENVIRONMENTAL PROBLEMS. (2 cr; prereq Biol 1104; 3 class hrs per wk)
Various aspects of environmental crises, such as population control, natural resource misuse, pesticide, urban problems, and environmental pollution. Emphasis on the role of the individual in the total environment. Current literature regarding environmental problems. Appropriate lecturers, videotapes, and films utilized.

1223f,w. INTRODUCTION TO NATURAL RESOURCES. (3 cr; 3 class hrs per wk)
Survey of our natural resource heritage. Various fields within natural resources examined in terms of conservation practices and importance to our way of life. Career opportunities in natural resource related fields.

1233f,w. GENERAL FORESTRY. (3 cr; 2 class hrs and one 2-hr lab per wk)
Survey of the field of forestry. Management of the modern forest, including conservation and recreation.

1352s. NATIVE PLANT IDENTIFICATION. (2 cr; prereq Biol 1214; two 2-hr labs per wk)
An introduction to principles of plant taxonomy with emphasis on higher vascular plants of Minnesota; their ecology, values to man, and importance to wildlife as food and cover.

1452f,s. WILDLIFE IDENTIFICATION. (2 cr; prereq Biol 1224 or ♯; 1 class hr and one 2-hr lab per wk)
An introduction to identification techniques applicable to Minnesota birds, mammals, fish, reptiles, and amphibians. Includes field identification as well as the use of museum specimens.

1453f. PRINCIPLES OF WILDLIFE CONSERVATION. (3 cr; prereq 1223, 1553, Biol 1104 or ♯; 2 class hrs and one 2-hr lab per wk)
An introduction to the field of fish and wildlife management. Fish and wildlife examined in terms of habitat requirements, population dynamics, and management practices. Public agencies and private organizations concerned with the management of these resources.

1523w. PARK AND RECREATIONAL MANAGEMENT. (3 cr)
Principles and techniques involved in the management of park and recreational areas, both public and private. Outdoor recreation activities other uses of natural resources. Planning, budgeting, execution, and supervision of field maintenance and operations.

1533s. CAMPING AND OUTDOOR RECREATION TECHNIQUES. (3 cr; prereq 1523; 2 class hrs and one 2-hr lab per wk)
The needs of individuals involved in the pursuit of outdoor leisure activities. Familiarization with the various equipment utilized in outdoor leisure activities and experience in the art of campcraft.

1543w. SITE PLANNING AND DEVELOPMENT. (3 cr; prereq 1523, Soil 1553, or ♯; 2 class hrs and one 2-hr lab per wk)
Discussion of and practice in techniques and principles of site selection; planning and development of recreational facilities for parks and campgrounds.

1553f,s. ECOLOGY. (3 cr; prereq Biol 1214 or 1224; 2 class hrs and one 2-hr lab per wk)
Interrelationships of plants, animals, and environment. Habitats, population, and community structure of animal life.

1652w,s. NATURAL RESOURCES SEMINAR. (2 cr; prereq soph, 6 cr in natural resources; 2 class hrs per wk)
Current topics related to the fields of natural resource conservation and recreation. Oral reports and discussion by staff and students.

Science (Sci)

1022s. CONTEMPORARY TOPICS IN SCIENCE. (2 cr)
Appreciation of contemporary scientific topics from a biological, chemical, and physical perspective. Emphasis on pollution, population, nutrition, contraception, radiation, and abortion. Designed for nonscience majors and others interested in current scientific problems of social concern.

Soil Science (Soil)

1294f,w,s. SOIL SCIENCE. (4 cr; prereq Chem 1104; 3 class hrs and one 2-hr lab per wk)
Formation, classification, and composition of soils with attention to the chemical and physical properties that affect growth and nutrition.

1414f,w. SOIL FERTILITY AND PLANT NUTRITION. (4 cr; prereq 1294; 3 class hrs and one 2-hr lab per wk)
Soil fertility as related to soil, plant, and climatic factors. Soil and plant tissue tests and interpretations.

1553f,w. SOIL AND WATER MANAGEMENT AND CONSERVATION. (3 cr; prereq 1294 or ♯; 3 class hrs per wk)
Management principles and practices related to production and maintenance of soil. Wind and water control techniques necessary to the conservation of soil resources stressed.

1692s. SOIL SEMINAR. (2 cr; prereq soph, 6 cr soil science; 2 class hrs per wk)
Studies and discussions of problems in soil. Reports on current research and topics concerning the physical and chemical problems of soil as they relate to soil fertility and soil conservation.

VI. UNIVERSITY OF MINNESOTA TECHNICAL COLLEGE, WASECA

Waseca, Minnesota 56093

CONTACT: *Environment*—
Kathryn Hoelmer, Related Education Division,
(507) 835-1000

UMW has a single mission—to prepare students for semiprofessional and midmanagement positions in the broad fields related to agriculture. In a sense, all seven program areas and a majority of the courses are concerned with problems of environmental quality. These programs and courses deal with such areas as entomology, pathology, agronomy, animal science, food science, horticulture, soils, and mechanized agriculture.

In addition, the Related Education Division, which includes such areas as the biological sciences, physical sciences, social sciences, and communications, offers courses which support and are relevant to technical agriculture. Many of the discussions in these related education courses use examples from agriculture and related problems.

AgSc 1343. ECONOMIC ENTOMOLOGY. (3 cr; prereq BiSc 1104; 4 hrs per wk)
Principles involved in controlling insects; relation of insects to man, man's crops, livestock, and products; habits, biology, identification and classification.

BiSc 1014. PRINCIPLES OF BIOLOGY
Introduction to biological concepts of living organisms, both plant and animal.

BiSc 1052. MAN, AGRICULTURE, AND ENVIRONMENT
Fundamentals of human and occupational ecology as they relate to environmental quality with emphasis on natural resources, agricultural pollution, and population problems.

BiSc 1205. ANIMAL BIOLOGY II. (5 cr; 7 hrs per wk)
Fundamentals of animal biology; animal genetics, ecology and evolution of the animal kingdom.

BiSc 1215. PLANT BIOLOGY II. (5 cr; 7 hrs per wk)
Metabolic functions including photosynthesis, respiration, nutrition, water relations, and regulation of growth and development, with emphasis on the influence of environment and hormones in controlling plant metabolism.

Soil 1054. SOIL SCIENCE. (4 cr; prereq Chem 1104; 5 hrs per wk)
Introduction to the physical and chemical properties of the soil system. Emphasis on functions of the soil as a medium to support plant life under varying biological, chemical, and physical conditions.

Soil 1222. SOIL AND PLANT TESTING. (2 cr; 3 hrs per wk)
Sampling and preparation of soil and plant materials, analysis of soil and plant materials in order to generate data for making recommendations, and basic research needed in making recommendations.

Soil 1251. SOIL AND LAND EVALUATION. (1 cr; prereq 1054; 2 hrs per wk)
Field instruction in important properties of soil and land which lead to land capability ratings, management practices. Soil genesis and classifications.

Soil 1331. FERTILIZERS. (1 cr; prereq 1054 or consent; 2 hrs per wk)
Differences in the chemical and physical properties of solid, liquid, and gaseous fertilizers and other soil amendments as related to handling, formulation, and usage.

Soil 1333. SOIL FERTILITY. (3 cr; prereq 1054; 4 hrs per wk)
Principles involved in supplying essential elements for growing plants; effects of other growth factors; nutrient requirements of plants; deficiency symptoms; methods of application and economics of fertilizers, amendments and organic materials.

Soil 1553. SOIL CONSERVATION AND WATER MANAGEMENT. (3 cr; prereq 1054; 4 hrs per wk)
Principles of conservation of soil resources; relation of soil physical properties and land morphology in erosion and water problems; elementary surveying, open and tile drainage systems; contouring, farm ponds, and conservation planning as applied to soil and water.

Soil 1643. AGRICULTURAL CHEMICALS. (3 cr; prereq Chem 1104 or consent; 4 hrs per wk)
Types, properties, production, use practices, and safeguards of agricultural chemicals used as herbicides, insecticides, fungicides, and plant regualtors.

VII. FACULTY LISTING

(E) denotes environmental contact
(P) denotes planning contact

Minneapolis/St. Paul Campuses

Aerospace Engineering and Mechanics, (E) T. A. Wilson, 120 Aeronautical Engineering, 373-2169

Afro-American Studies, (P) G. H. Southall, 214 Social Sciences, 373-7217

Agricultural and Applied Economics, (E) J. Waelti, 231D Classroom—Office Building, 373-1604; (P) W. Maki, 248 Classroom—Office Building, 376-3433

Agricultural Engineering, (E) C. L. Larson, 207 Agricultural Engineering, 373-1331

American Indian Studies, (P) W. R. Buffalohead, 810 Social Sciences, 373-0146

Anthropology, (E and P) J. Spector, 215 Ford Hall, 376-7148

Architecture and Landscape Architecture, (E) D. Holloway, 110 Architecture, 373-2198; (P) W. K. Vivrett, 110G Architecture, 373-5336

Biology, (E) E. Gorham, 750 Biological Sciences Center, 373-5619

Botany, (E) D. C. Pratt, 220 Biological Sciences Center, 373-2211

Business, Government, Society, (E) R. J. Holloway, 1235 Business Administration, 373-4407

Chemical Engineering, (E) H. Tsuchiya, 251 Chemical Engineering, 373-2306; A. Fredrickson, 431 Chemical Enginerring, 373-2312

Chicano Studies, (P) M. P. Guerrero, 489 Ford Hall, 373-9707

Child Psychology, (P) W. Hartup, 190 Child Development, 373-9853

Civil Engineering, (E) W. Maier, 296 Experimental Engineering, 373-2517

Communication Disorders, (E) W. D. Ward, 2630 University Avenue S.E., 373-4565

Criminal Justice Studies, (P) J. DeConcini, 314 Social Sciences, 373-2613 or 373-9918

Design, (P) G. Esteros, 240E McNeal Hall, 373-1015

Ecology and Behavioral Biology, (E) M. B. Davis, 310 Biological Sciences Center, 373-5177

Economics, (E and P) E. Coen, 1935 Business Administration, 373-3690; H. Smith, 1149 Business Administration, 373-3572

Entomology, Fisheries, and Wildlife, (E) H. Chiang, 212 Hodson Hall, 373-1713; L. Frenzel, 143 Hodson Hall, 373-1715; T. Waters, 120 Hodson Hall, 373-1706

Environmental Health, (E) R. Singer, 1160 Mayo, 373-8080

Extension Classes, (E) B. Sinniger, 180 Wesbrook Hall, 373-0115

Family Social Science, (P) S. Henry, 205 North Hall, 373-1549

Fisheries and Wildlife (see Entomology, Fisheries, and Wildlife)

Food Science and Nutrition, (E) E. Caldwell, 228 Food Science and Nutrition, 373-1073

Forest Resources, (E) K. Winsness, 12 Green Hall, 373-0842

General College, (E) A. Johnson, 113 Folwell Hall, 373-3723

Geography, (E) R. Skaggs, 414B Social Sciences, 373-2662; (P) J. Adams, 368 Social Sciences, 376-7106

Geological Engineering (see Civil Engineering)

Geology and Geophysics, (E) H. Pfannkuch, 2D Pillsbury Hall, 373-5678

History, (P) S. Schwartz, 614 Social Sciences, 373-2705

Horticultural Science (see Landscape Architecture)

Humanities, (E) P. D'Andrea, 314 Ford Hall, 373-3516; (P) M. Roshwald, 384 Ford Hall, 373-4883

Industrial Relations, (E) G. England, 547 Business Administration, 373-3853; (P) M. Bognanno, 537 Business Administration, 373-3826; G. O'Connell, Labor Education Service, fourth floor, Business Administration, 373-5380

International Relations, (P) R. Kudrle, 1246A Social Sciences, 373-2691

Journalism and Mass Communication, (E) P. Tichenor, 35 Murphy Hall, 376-7104; (P) R. Jones, 112 Murphy Hall

Landscape Architecture (see Architecture and Landscape Architecture)

Law School, (E) M. Gelpe, 245 Fraser Hall, 376-7234

Marketing, (E) R. Holloway, 1235A Business Administration, 373-4407
Mechanical Engineering, (E) K. Whitby, 130 Mechanical Engineering, 373-3049; or instructor listed
Mineral Engineering, (E) N. Schulz, Mineral Resources Research Center, 373-3341
Natural Science, (P) Director, Cross-Disciplinary Studies, 106 Johnston Hall, 373-3507
Pharmacology, (E) M. W. Anders, 105 Millard Hall, 373-5112
Philosophy, (P) H. E. Mason, 399 Ford Hall, 373-3613
Physics, (E) G. Freier, 238 Physics, 373-3347; W. Zimmerman, 48 Physics, 373-9787
Political Science, (P) S. Krislov, 1414 Social Sciences, 373-2651; C. Backstrom, 1380 Social Sciences, 373-2686
Public Affairs, (E) D. Abrahamson, 967 Social Sciences, 373-7796; (P) J. Adams, 909 Social Sciences, 373-2653
Public Health, (P) B. Dornblaser, 1260 Mayo, Box 97, 373-8052
Resource and Community Development, (E) D. White, 280 Coffey Hall, 373-0921
Rhetoric, (P) L. D. Schuelke, 202 Haecker Hall, 373-0917
Social Science, Director, Cross-Disciplinary Studies, 106 Johnston Hall
Social Work, (P) James Goodman, 400 Ford Hall, 373-2837
Sociology, (E) R. Kennedy, 1114A Social Sciences, 373-2643; (P) D. Cooperman, 1114 Social Sciences, 376-3930
Soil Science, (E) R. Adams, Jr., Soil Science, 373-1361
Speech-Communication, (P) G. Shapiro, 401A Folwell Hall, 373-2568
Technology, Institute of, (E) R. Goldstein, 240 Mechanical Engineering, 373-3042
Textiles and Clothing, (E) R. Johnson, 354 McNeal Hall, 373-1696
Transportation, A. K. Wickesberg, 804 Business Administration, 373-3486
University College, Diane Grimm, 105 Walter Library, 373-4638
Urban Studies, (P) J. Adams, 909 Social Sciences, 373-2653
Zoology, (E) D. Gilbertson, 209 Zoology, 373-7987

Duluth Campus

Business, Donald W. Ireland, 218 Social Sciences Building, 726-7150
Economics, Richard Lichty, 180 Library, 726-7219; Raymond Raab, 168 Library, 726-8508
Education, George Starr, 226 Bohannon Hall, 726-8107
Geology, J. C. Green, 229 Mathematics-Geology Building, 373-7237
Political Science, D. W. Olson, 254 Home Economics Building, 726-8164
Special Programs, Roy Hoover, 409 Administration Building, 726-7517

Morris Campus

(E) T. E. Straw, Division of Science and Mathematics, 589-2211; M. N. Hirsh, Division of Science and Mathematics, 589-1655

Crookston Campus

(E), P. Buckley, Division of Agriculture, (218) 281-6510

Waseca Campus

(E), K. Hoelmer, Department of Biological Sciences, (507) 835-1000

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Perry Blackshear, Professor, Department of Mechanical Engineering
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Alan Freeman, Associate Professor, Law School
John Green, Professor, Department of Geology (Duluth)
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Roger Johnson, Associate Professor, College of Education
Richard Skaggs, Associate Professor, Department of Geography
Thomas Straw, Associate Professor, Division of Science and Mathematics (Morris)
John Tester, Professor, Department of Ecology and Behavioral Biology
John Waelti, Associate Professor, Department of Agriculture and Applied Economics
Donald White, Professor, Department of Horticultural Science

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