

Forestry  
University of Minnesota Bulletin  
1988-90





UNIVERSITY OF MINNESOTA  
TWIN CITIES

Office of the Dean

College of Forestry  
110 Green Hall  
1530 N. Cleveland Avenue  
St. Paul, Minnesota 55108

February 2, 1988

To: Those on the College of Forestry Bulletin Mailing List  
From: Office for Student Affairs - College of Forestry  
Re: Fisheries and Wildlife Curriculum

We are writing to inform you that there has been a major change in the structure and course requirements of the Fisheries and Wildlife curriculum for undergraduates as described in the 1988-90 College of Forestry Bulletin. Prior to the 1988-90 Bulletin, undergraduate students would complete 90 credits in the Pre-Fisheries and Wildlife curriculum and then pursue a major in Fisheries OR Wildlife by completing an additional 102 credits in their chosen area. The students completing the Fisheries major were granted a degree through the College of Forestry in Fisheries and those completing the Wildlife major were granted a degree through the College of Forestry in Wildlife.

However, new Fisheries and Wildlife undergraduates entering the College of Forestry beginning Fall, 1988 will follow a similar Fisheries and Wildlife curriculum which is described on pp. 17-18. Please note in particular the second paragraph below the Fisheries and Wildlife heading which describes the general requirements. The students who complete the "new" (1988-90) curriculum will receive the degree in Fisheries AND Wildlife.

If you have questions concerning this matter feel free to phone the Office for Student Affairs at 612-624-6768. We hope this information is helpful.

cc: Dr. Ira Adelman - FW Department Head

# Forestry

---

General Information	5
---------------------	---

---

Baccalaureate Programs	11
------------------------	----

---

Course Descriptions	31
---------------------	----

---

Administration and Faculty	41
----------------------------	----

---

Campus Maps	44
-------------	----

---

Index	47
-------	----

---

# Introduction

## Policies

**Bulletin Use**—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

**Equal Opportunity**—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended: 38 U.S.C. 2012; by the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547); to the Director of the Office of Civil Rights, Department of Education, Washington, DC 20202; or to the Director of the Office of Federal Contract Compliance Programs, Department of Labor, Washington, DC 20210.

**Access to Student Educational Records**—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards, honors received, and degrees earned—is considered public or directory

information. To prevent release of such information outside the University while in attendance at the University, students must notify the records office on their campus.

Students are notified annually of their right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

## Postal Statement

Volume 91, Number 1  
January 4, 1988

University of Minnesota Bulletin  
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications Center, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455, once in January, March, April, May, September, and October; twice in February and July; and five times in June. Second-class postage paid at Minneapolis, Minnesota. POSTMASTER: Send address changes to University of Minnesota Bulletin, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

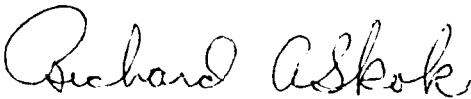
Cover photo by Tim Rummelhoff. Black and white photos by Tim Rummelhoff and Dan Schlies.

## Letter from the Dean

The educational opportunities you will find described in this bulletin were developed for students who have a strong interest in the renewable natural resources. The uses, management, and protection of forest, fish, and wildlife resources are the focus of curricula in Forest Products, Forest Resources, Renewable Resource Science, Recreation Resource Management, Urban Forestry, and Fisheries and Wildlife. These programs are designed to help students integrate scientific knowledge with the management and communication skills necessary for professional success.

Forests, fisheries, and wildlife play important roles in the lives of people worldwide. As a source of firewood or food, physical challenge or psychological reward, these resources touch on the economic, environmental, social, and cultural well-being of each of us. If you would like to help make the most of these renewable resources now and in the future, I am sure you will find this bulletin presents interesting opportunities for preparing for such a role.

The College of Forestry is recognized nationally for its excellence. It has been accredited continuously since 1935, when forestry program accreditation was first offered. Graduates have played leadership roles in industry, public agencies, research, and education. Our strength is in the quality of our faculty, students, and staff and in the richness of the University as an educational, scientific, and cultural resource.



Richard A. Skok  
Dean, College of Forestry



### Placement

Placement of graduates is a concern for any prospective or currently enrolled College of Forestry student. It may come as a surprise to learn that some programs offer virtually 100% placement. Forest Products majors, particularly those pursuing a degree in Paper Science and Engineering, find the job market very strong. Starting salaries for Paper Science and Engineering graduates range upwards from \$30,000 per year.

Forest Resources and Fisheries and Wildlife graduates face a more competitive job market. Graduates from curricula in these departments can enhance their success in finding employment upon graduation by (1) being flexible in choosing where to work, (2) maintaining above average academic records, and (3) gaining related work experience before graduation. Starting salaries for Forest Resource and Fisheries and Wildlife graduates typically range from \$16,000 to \$21,000 per year.

The College of Forestry helps students locate summer jobs in fisheries and wildlife, forestry, and forest products as well as permanent employment following graduation. Placement services for Fisheries and Wildlife and Forest Resources students are provided by the career opportunities coordinator in 110j Green Hall. Students in the Forest Products paper science and engineering specialization receive assistance in 206 Kaufert Lab; all other Forest Products students, in 240 Kaufert Lab. Faculty providing placement service advise students on carrying out job searches, publicize openings, help arrange interviews, and periodically hold information meetings.

### Notice to Students

At the time this bulletin goes to press, the College of Forestry will be in the process of moving many of its offices and classrooms into a new building adjacent to Green Hall and into other St. Paul campus buildings. It is planned that this move will be completed in early 1988.

*This move will mean that many room numbers published in this bulletin for College of Forestry classrooms, resource facilities, and faculty and administrative offices will change in early 1988.* Specifically, the Dean's Office, Office for Student Affairs, Forestry Library, and College Computer Center will move from Green Hall into the new building. Department of Forest Resources classrooms, laboratories, and faculty and administrative offices will be relocated temporarily from Green Hall into other buildings on the St. Paul campus. After Green Hall is vacated, it will be renovated during 1988.

For information about new room numbers for College of Forestry offices, classrooms, and facilities, please contact the Office for Student Affairs (612/624-6768).

# General Information



# General Information

## Mission

The College of Forestry—through its departments of Forest Resources, Forest Products, and Fisheries and Wildlife—seeks to increase the economic, social, and environmental benefits of our most important renewable natural resources. The only institution of higher learning in the state offering B.S., M.S., and Ph.D. programs in these natural resource disciplines, it is engaged in undergraduate and graduate education, basic and applied research, extension, continuing education, and public service.

A recent survey rated the College of Forestry among the top forestry schools in the United States. The University of Minnesota has offered a bachelor's degree program in forestry since 1903. Its forestry curriculum is one of only a few in the country to have been continuously accredited by the Society of American Foresters since 1935. Undergraduate and graduate degrees in fisheries and wildlife science have been offered at the University for nearly half a century. Curricular programs meet education certification requirements for the fisheries and wildlife professional societies. The Forest Products curriculum is oriented to employment in the private sector in the production and marketing of products from wood. The Urban Forestry curriculum addresses the city's high density environment and management of tree cover for functional and aesthetic purposes.

## Facilities

Currently the College of Forestry is based in three buildings on the St. Paul campus: Green Hall, the Kaufert Laboratory of Forest Products and Wood Science, and Hodson Hall. In early 1988, however, the college will move some of its facilities into a new building that lies adjacent to Green Hall. Green Hall will then be closed for renovations.

The Dean's Office, Office for Student Affairs, and Forestry Library are currently located in Green Hall but will move

to the new building Winter Quarter 1988. The Forest Resources Department and Remote Sensing Laboratory will make a temporary move out of Green Hall in early 1988 into other St. Paul campus buildings. For information about new room numbers for these offices, classrooms, and facilities, please contact the Office for Student Affairs (612/624-6768).

The Forest Products Department is in the Kaufert Laboratory, which has well-equipped laboratories for teaching and research in such areas as wood products manufacturing, wood chemistry, mechanical testing, biodeterioration, and wood drying. The Department of Fisheries and Wildlife office, library, lecture, laboratory, and faculty facilities are in Hodson Hall. Also on the St. Paul campus, adjacent to college facilities, is the regional headquarters of the North Central Forest Experiment Station of the U.S. Forest Service.

The College of Forestry uses several field centers for its programs: The University's *Lake Itasca Forestry and Biological Station* is located in Itasca State Park in north central Minnesota. Minnesota's largest state park embraces 50 square miles of virgin and second-growth forest, bogs, streams, and lakes, including Lake Itasca, the source of the Mississippi River. The station offers housing, dining, library, and laboratory facilities. Fisheries and Wildlife, Forest Resources, Renewable Resource Science, and Urban Forestry majors spend a 3<sup>1</sup>/<sub>2</sub>-week summer term at the station studying botany, ecology, fisheries and wildlife techniques, and forest measurement.

The college's *Cloquet Forestry Center* includes more than 3,700 acres of virgin and second-growth timber in a major forest products manufacturing area of northeastern Minnesota. Forest Resources seniors spend their fall quarter at the center taking 18 credits of field-oriented instruction. Students interact with representatives of local industries and nearby state and federal resource agencies. The center has housing, dining,



classroom, laboratory, and library facilities. A nationally known forest wildlife research project is based there.

The 300-acre *John H. Allison Forest*, about 10 miles from the St. Paul campus, is available for field laboratory work throughout the year.

Other field experiences, such as trips to southeastern Minnesota's hardwood forests, the industrial forest lands of the southern United States, and the Lake States' forest products mills and factories, are also available to students.

## Degrees Offered

**Baccalaureate Degrees**—The bachelor of science (B.S.) degree is awarded to College of Forestry students who satisfactorily complete 192 required and elective credits in one of six major programs: Fisheries and Wildlife, Forest Products, Forest Resources, Renewable Resource Science, Recreation Resource Management, or Urban Forestry. Curricular requirements are fully explained in the Baccalaureate Programs section of this bulletin. The degree may be earned "with distinction" or "with high distinction."

**Graduate Degrees**—The master of science (M.S.) and the doctor of philosophy (Ph.D.) in Forestry, Fisheries, or Wildlife, and the master of forestry (M.F.) degrees are offered through the Graduate School in cooperation with the College of Forestry. For detailed information, consult the appropriate Director of Graduate Studies (301f Green Hall, 624-2774, for Forestry; 200 Hodson Hall, 624-3600, for Fisheries and Wildlife) or the *Graduate School Bulletin*. Interested students should apply for admission through the Graduate School, 306 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, MN 55455 (625-3014).

## Administration

The undergraduate curricula of the College of Forestry are organized within three academic departments—Fisheries and Wildlife (200 Hodson Hall); Forest

Products (203 Kaufert Lab); and Forest Resources (110 Green Hall), which also offers the Renewable Resource Science, Recreation Resource Management, and Urban Forestry programs. The chief administrator of each department is the department head.

Each department has a Student Scholastic Standing Committee, composed of faculty members, which is responsible for interpreting and administering college policies and requirements regarding admission, transfer of credit, curricula, academic standards, student credit loads, and other academic matters.

The college's Office for Student Affairs, 10 Green Hall, provides admission, registration, advising, placement, and other assistance to all undergraduate students.

## Admission

Students seeking admission to the College of Forestry as undergraduates should apply through the Office of Admissions, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (625-2008). A \$20 nonrefundable application fee is required.

**Freshman Admission**—High school graduates must submit scores from the Preliminary Scholastic Aptitude Test (PSAT), Scholastic Aptitude Test (SAT), or American College Test (ACT) along with their high school rank percentile (HSR). High school courses required by the College of Forestry are three years of English, three years of mathematics (including elementary and higher algebra and plane geometry, with trigonometry recommended), and at least one year of natural science.

The College of Forestry uses the following admission criteria:

<i>Formula</i>	<i>Minimum Score</i>
HSR Percentile + PSAT	
Verbal + PSAT Math	140
HSR Percentile + (SAT	
Verbal ÷ 10) + (SAT Math ÷ 10)	140
HSR Percentile + (2 x ACT	
Composite score)	100

## General Information

Applicants who attain at least the minimum score and meet course requirements will be admitted routinely. Others will be considered on an individual basis, taking into account such factors as high school performance and educational objectives.

**Admission with Advanced Standing—**Appropriate credits earned at other accredited colleges and universities or within other units of the University may be applied toward College of Forestry programs. Most students find they must transfer before their junior year to meet residence and upper-level course requirements of the College of Forestry.

Credits earned through special examination or Continuing Education and Extension may transfer to the College of Forestry.

**Adult Special Admission—**Students may be admitted, after college approval, as adult specials. Such students are not degree candidates, but complete courses to satisfy individual needs.

### Financial Aid

Scholarships, grants, loans, and work-study programs available University-wide to eligible students are administered through the Office of Student Financial Aid (210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455, 624-1665; or 199 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108, 625-9225). Application forms are available from either of these Student Financial Aid offices and from most Minnesota high school guidance offices. Students should apply as soon after January 1 as possible. The ACT Family Financial Statement is the official need analysis document used in selecting financial aid recipients.

Scholarships and awards available only to College of Forestry students are listed below. These awards are administered by the college's scholarship committees. *Awards may vary depending on earnings and availability of funds.* Those available to incoming freshmen and/or transfer students are normally awarded the spring before the academic year of

their use. Contact the college's Office for Student Affairs for application information.

### College of Forestry Scholarships and Awards

**Mary Dwight Akers Loan—**Sponsor anonymous. Limited loans as needed and approved by the dean. Up to \$1,000 each.

**John H. Allison Scholarship—**Sponsored by former members of the Beta Chapter, Tau Phi Delta. For students with special interests in forest economics, forest management, and related areas. One \$500 award annually.

**Andersen Corporation Scholarships—**Sponsored by Andersen Corporation, Bayport, Minnesota. For incoming Forest Products juniors and seniors in the marketing and production management specializations on the basis of academic achievement and professional promise. Three \$1,500 awards annually.

**R. M. Brown Scholarship—**Sponsored by donations to the College of Forestry. For a Forest Resources or Renewable Resource Science senior with a special interest in mensuration or statistics. One \$500 award annually.

**Carolind Scholarships—**Sponsored by the late Dr. Ralph M. Lindgren. For deserving and outstanding undergraduate students. Six \$300 to \$400 awards annually.

**E. G. Cheyney Memorial Scholarships—**Sponsored by the Minnesota Forestry Alumni Association. For juniors or seniors who have demonstrated outstanding ability and improvement in creative writing and speaking skills. Two \$300 awards annually.

**Caleb Dorr Scholarships—**Sponsored by the Caleb D. Dorr Fund. For the student in each class with the highest grade point average. Four \$500 awards annually.

**Edward A. Everett Memorial Scholarship**—Sponsored by the late Edward A. Everett. For upper-division forestry students on the basis of financial need, acceptable scholarship, and professional promise. Number per year varies. \$300 to \$500 each.

**Federated Garden Clubs of Minnesota Scholarships**—Sponsored by the Federated Garden Clubs of Minnesota. For forestry students on the basis of special interest in Urban Forestry, academic aptitude, and personal attributes. Number per year varies. \$200 each.

**Forest Products Marketing Scholarships**—Sponsored by the Forest Industry Fraternity of Minneapolis and St. Paul. For deserving and promising Forest Products juniors or seniors in the marketing specialization. One or two \$1,000 awards annually.

**Robert L. Goudy Memorial Scholarships**—Sponsored by Mr. and Mrs. F. X. Corbett, Georgetown, Colorado. For outstanding incoming Forest Resources transfer students on the basis of academic ability, vocational promise, extracurricular activities, personality, and financial need. Two \$300 awards annually.

**Samuel B. Green Scholarship Medal**—Sponsored by the late Mrs. Samuel B. Green in memory of her husband. For the senior with the highest scholastic average at the end of fall quarter. One honorary medal annually.

**Dayton Kirkham Scholarship**—Sponsored by the late Mr. Dayton Kirkham. For entering high school seniors and transfer students on the basis of outstanding academic ability and strong desire to pursue careers in natural resource management. Six or more \$1,000 awards annually.

**Oscar L. Mather Scholarship**—Sponsored by the Minnesota Federation of Women's Clubs and Mrs. Oscar L. Mather, Madison Lakes, Minnesota, in memory of her husband. Book awarded to a forestry student displaying outstanding scholarship, leadership, and character.

**Ken Merriam Scholarship**—Sponsored by Dr. Lawrence Merriam. For a physically handicapped and/or Recreation Resource Management junior or senior. Professional promise emphasized. One \$500 award annually.

**William R. Miles Scholarship**—Sponsored by the William R. Miles Fund. For a Forest Resources junior on the basis of professional promise, character and integrity, academic aptitude, and leadership. One \$500 award annually.

**Minnesota Forestry Association Scholarship**—Sponsored by the Minnesota Forestry Association. For a junior or senior enrolled in either the Forest Resources or Forest Products curriculum, on the basis of professional promise and academic ability. One \$500 award annually.

**C. J. Mulrooney Endowed Memorial Scholarships**—Sponsored by WCCO AM and FM Radio and Television. For Forest Products juniors and seniors with a specialization in marketing. One award of \$1,500 or more annually.

**Leiton Nelson Scholarship**—Sponsored by L. E. Nelson Endowment. For a Forest Resources or Forest Products senior demonstrating outstanding academic ability and strong professional promise. One \$1,200 award available alternate years. (Available to qualified graduate student for interim year.)

**Charles Lathrop Pack Awards in Forestry**—Sponsored by the Charles Lathrop Pack Foundation. For regularly enrolled undergraduate students who write the best essays of a popular nature on forestry or conservation subjects. Three awards annually of \$300, \$200, and \$100.

**Paper Science and Engineering Scholarships**—Sponsored by manufacturing and supply companies representing the pulp, paper, and allied support industries, and by Paper Science and Engineering alumni. Administered by the U of M Paper Science and Engineering Council and the Department of Forest Products. For

Paper Science and Engineering students on the basis of academic performance and professional promise. \$1,000 to \$2,000 annually. Current sponsors include Blandin Paper Company; Buckman Laboratories, Inc.; Consolidated Papers Foundation, Inc.; H. B. Fuller Company Foundation; Minnesota Section, Technical Association of the Pulp and Paper Industry (TAPPI); North Central Division, Paper Industry Management Association (PIMA); Potlatch Foundation for Higher Education; Nalco Chemical Company; and Waldorf Corp.

**Henry Schmitz Forest Products Engineering Scholarship**—Sponsored by Dr. Stanley J. and Mertie W. Buckman, Memphis, Tennessee. For a Forest Products junior or senior on the basis of academic achievement and professional promise. One \$1,000 award annually.

**Henry Schmitz Student Leadership Awards**—Sponsored by Dr. Stanley J. and Mertie W. Buckman, Memphis, Tennessee. For juniors or seniors on the basis of demonstrated leadership and acceptable scholarship. Up to four \$300 awards annually.

**Augustus L. Searle Scholarship**—Sponsored by Augustus L. Searle. For women in the college, with preference given to Minnesota residents. Number per year varies. \$500 each.

**K. E. Winsness Scholarship**—Sponsored by family and friends of the late professor Winsness. For a junior or senior in the College of Forestry who is pursuing a degree while coping with unusual hardships. One \$500 award annually.

**Helen A. Young Memorial Scholarship**—Sponsored by John Young, Rochester, Minnesota. To help qualified, competent, and needy students initiate and complete their forestry education. One \$200 award annually.

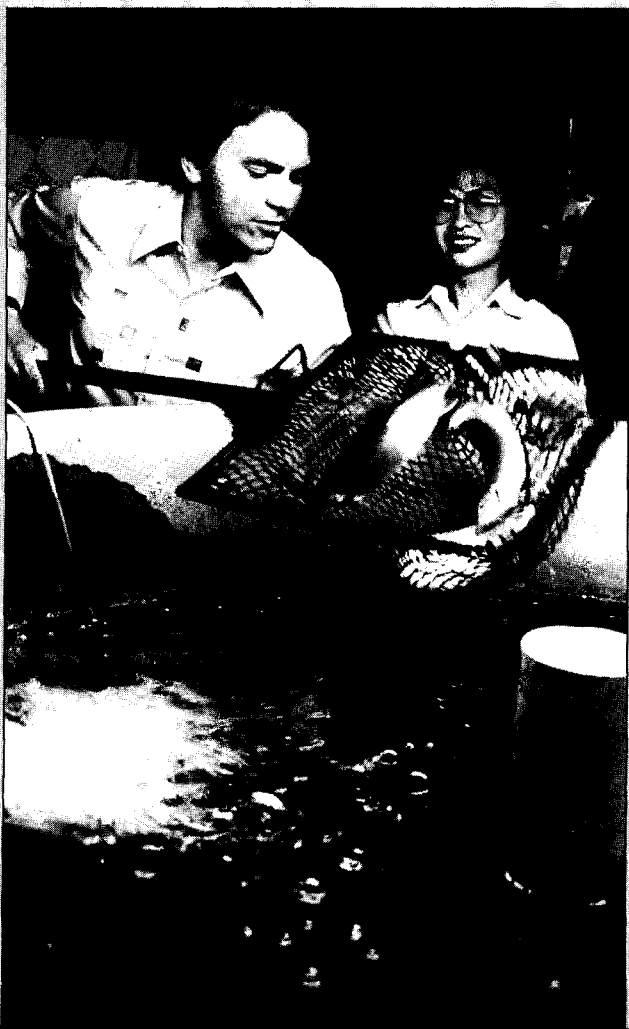
**Lake Itasca Summer Biology Session Scholarships**—Available to Fisheries and Wildlife students.

## Student Activities

**Governance**—Students have opportunities to participate in governance activities at the department, college, and campus levels. Within each department, several committees (including curriculum committees) have student representatives. Students also serve on College of Forestry committees and on the college's Student-Faculty Board, which advises the dean on student problems and concerns. Students also participate in the St. Paul Campus Board of Colleges, which directs student activities and acts as a liaison between the student body and administration, and on the Student Center Board of Governors, which establishes programs, operation policies, and budgets for the St. Paul Student Center.

**Clubs**—Student clubs in the college include the Forestry Club, student chapter of the Society of American Foresters, Recreation Resource Management Club, Forest Products Club-Forest Products Research Society, Technical Association of the Pulp and Paper Industry (TAPPI), and Fisheries and Wildlife Club (with an affiliated student chapter of the Wildlife Society). Through these clubs, students hold an annual Foresters Day and a spring picnic, support a scholarship fund by selling Christmas trees, attend events like the Midwestern Foresters Conclave, and produce and market wood identification kits. Xi Sigma Pi Honor Society stages an annual banquet and administers a student speakers bureau. Forestry students also produce one of the few remaining University yearbooks, the *Gopher Peavey*.

# Baccalaureate Programs



# Baccalaureate Programs

## Six Major Curricula

The College of Forestry offers six major curricula leading to the bachelor of science (B.S.) degree: (1) Fisheries and Wildlife; (2) Forest Products (with specializations in marketing, production management, paper science and engineering, and wood science); (3) Forest Resources; (4) Renewable Resource Science (with specializations in natural science and social and managerial sciences); (5) Recreation Resource Management; and (6) Urban Forestry. Because the first year of coursework is somewhat similar, students may transfer between curricula at the end of their freshman year with little loss of credit.

## Academic Policies

**Adviser**—Each student, with assistance from an adviser, is responsible for studying curricular and graduation requirements and developing a course program and timetable to meet them. Freshmen and first-year transfer students in the Forest Resources curriculum are assigned an adviser in the college's Office for Student Affairs. All other students are assigned a faculty adviser within their department.

**Credit Load**—The typical course load for each quarter is 14 to 18 credits, but may vary according to individual ability and circumstances. A credit requires an average of three hours of work per week, including class, laboratory, and preparation time. To carry more than 21 credits, a student must have at least a B average the previous quarter and permission from the department Student Scholastic Standing Committee.

**Repeating Courses**—Students may repeat a course, even if a passing grade was received. The grade received for the course the second time becomes the permanent grade. The original grade and credits are not included in the student's cumulative number of completed credits

or grade point average. It is the student's responsibility to report any repeated courses to the Office for Student Affairs.

**Auditing**—Students who register for a course as an auditor pay regular tuition and fees, but do not take examinations or earn grades or credits.

**Extra Credit**—Students may register for one to three extra credits in some courses, with the instructor's approval. The extra work is mutually agreed upon and conducted independently of class. Contact the Office for Student Affairs for more information.

**Independent Study**—With the instructor's approval, students may register to take regularly offered courses through independent study, without attending class. Contact the Office for Student Affairs for more information.

**Class Attendance**—When students willfully miss class, instructors are under no obligation to help them make up work. The following reasons, however, are accepted to justify absences and make-up requests: (a) illness certified by the University Health Service or another physician, (b) death or serious illness in the immediate family, (c) participation, certified by the Office of Student Affairs (190 Coffey Hall), in University-approved cocurricular activities, and (d) approval of the absence by the department Student Scholastic Standing Committee, which becomes involved only in special emergencies or as an appeal agency.

**Class Standing**—Students are classified according to the number of credits they have completed, as follows: freshmen—45 credits or under, sophomores—46 to 90 credits, juniors—91 to 135 credits, seniors—136 credits or above. Freshmen and sophomores are considered lower division; juniors and seniors, upper division.

**Registration**—General registration instructions are contained in the quarterly *Class Schedule*.

Forest Resources and Forest Products juniors and seniors and Fisheries and Wildlife majors may sign their own course request forms. All other students in the college, regardless of class standing, must have their advisers sign their registration materials.

Students who find it necessary to cancel or add courses after registering for the quarter should contact the Office for Student Affairs for instructions and forms.

During the first week of the quarter, a course may be added to a student's schedule with the approval of only the adviser (providing the course is open). But after the first week, the approval of both the adviser and the instructor is needed to add a course.

During the first six weeks of a quarter, the adviser's approval is sufficient to cancel a course with a W (withdrawal). But after the sixth week, the approval of the adviser, the instructor, and the department Student Scholastic Standing Committee is necessary. A student doing passing work may be permitted to cancel a course after the sixth week with a W; if failing, an F (no credit) will be reported.

If a student withdraws from the college at any time, all classes should be officially cancelled. Cancellation through the first three weeks entitles the student to a refund (a 100% refund through the first week, 75% through the second week, and 50% through the third week).

**Grading**—Two grading options, A-B-C-D-F and S-N, are offered, although use of the S-N option is limited. A grading option is chosen for each course at the time of registration. The following restrictions on the use of the S-N option apply to College of Forestry students:

1. A maximum of 25% of the residence credits presented for the baccalaureate degree may be in courses in which a grade of S was received.

2. All required courses must be taken under the A-F option. Prerequisites for required courses and courses in the major

must also be taken A-F unless an exception is made.

University grading policies and letter definitions are explained in the quarterly *Class Schedule*.

**Honor System**—Under an honor system adopted on the St. Paul campus, students accept responsibility for the supervision of student behavior during examinations and pledge not to give or receive aid. A student or faculty member who observes an act of dishonesty may report the incident to the college Honor Case Commission, a committee of the Student-Faculty Board. For more information on how the honor system works, contact the Office for Student Affairs.

**Satisfactory Progress**—Students in the College of Forestry are expected to meet certain minimum academic standards. Students not meeting these standards are subject to probation and suspension actions by their department Student Scholastic Standing Committee. The following chart details conditions under which these actions will be taken:

<i>Probation</i>	Cumulative GPA after first two quarters in college below 1.90 (freshman) or 2.00 (sophomore, junior, senior) <i>or</i> Any combination of three D and N or F grades in any one quarter
<i>Suspension</i>	Cumulative GPA after first two quarters in college below 1.60 (freshman) or 1.90 (sophomore, junior, senior) <i>or</i> Any combination of four D and N or F grades in three consecutive quarters <i>or</i> Two consecutive quarters of probation

## Baccalaureate Programs

A probation action puts a student on notice that repeated low academic performance will lead to a suspension. A suspension action lasts two academic quarters, and reinstatement in the program requires a petition to the department Student Scholastic Standing Committee. Students placed on probation or suspension may appeal the action.

The Itasca session for Fisheries and Wildlife, Forest Resources, and Renewable Resource Science students is not counted as a separate quarter. Itasca grades are included with the fall quarter grades.

Students who are performing poorly academically should contact their adviser as soon as possible to take corrective action. Probation and suspension actions are rarely waived.

To appeal a suspension or probation action, the student must submit a written statement to the chair of the department Student Scholastic Standing Committee explaining the reasons for the appeal and including any supporting documents. The final decision rests with the department head, who will explain the decision on the appeal in a letter to the student.

**Policy Waivers**—Occasionally it may be to the educational advantage of both the student and the department to waive an academic policy or curricular requirement, provided the basic spirit of the regulation is maintained. A student may request, by petition, a departure from normal procedure. If approved by the adviser, the petition is routed to the department Student Scholastic Standing Committee for a final decision. Contact the Office for Student Affairs for more information.

### Graduation Requirements

To receive the bachelor of science (B.S.) degree, College of Forestry students must meet the following requirements:

1. Complete a minimum of 192 credits, including required and elective courses in

the chosen curriculum. No more than 9 credits in physical education may be applied toward the degree. No more than 9 credits in music may be applied as elective credits toward the degree, with no more than 6 of these in Mus 1430 or concert band.

2. Achieve a grade point average of 2.00 or higher with no more than 5 credits of D in required forestry or fisheries and wildlife courses and 5 credits of D in other required courses.

3. Satisfy liberal education requirements (see below).

4. Satisfy residence and other general University requirements for graduation.

**Graduation With Honors**—The B.S. degree may be earned "with distinction" or "with high distinction." Students who achieve a grade point average of at least 3.85 may be recommended to the faculty for graduation with high distinction. The recommendation is made on the basis of scholarship and other evidence of satisfactory achievement in the curriculum. Students who achieve a grade point average between 3.35 and 3.85 may be recommended for graduation with distinction.

Transfer students who have completed less than half the credits required for graduation while in residence in the College of Forestry are not eligible to graduate with honors.

**Quality Credits**—The number of free elective credits required for graduation may be decreased by one for every five grade points in excess of those required to reach a grade point average of 3.35. Free electives may be chosen without regard to curricular or college requirements. No more than one-twelfth of the total number of credits required for graduation may be gained through quality credits.

**Special Examinations for Credit**—Currently enrolled students who believe their knowledge of a subject is equal to that required to complete a particular course may request to take an examination for



credit. If the Student Scholastic Standing Committee and the department approve, arrangements can be made with an appropriate instructor to take an examination. Usually no grade is assigned. A \$30 fee is assessed for each examination. Credit by special examination is not granted for language or mathematics courses taken in high school.

**College Level Examination Program (CLEP)**—Students may earn credit for the CLEP social science and humanities examinations prepared by the College Entrance Examination Board. CLEP also offers a number of subject examinations for credit. Information may be obtained from the Office for Student Affairs.

**Liberal Education Requirements**—The University of Minnesota believes that all students, regardless of their area of specialization or vocational goals, should have a broad liberal education. Therefore, in addition to its own curricular requirements, the College of Forestry requires coursework in each of four liberal education categories. The minimum number of credits required in each category and a partial list of courses follow. *Note:* Individual College of Forestry curricula may require more credits in any of the four categories and place restrictions on which courses to complete and when. Students in doubt about the use of specific courses should consult the Office for Student Affairs.

All College of Forestry students must take Rhet 1101, 1104, 1151, 1222, and 3562 (except that Recreation Resource Management majors may substitute 3551 for 3562). Students who pass an English proficiency examination, administered by the Rhetoric Department, may be exempted from Rhet 1101 and/or 1104. Students with above average writing skills may also take exemption examinations, administered once each quarter by the Rhetoric Department, for Rhet 3562. Note that advanced composition courses taken at other institutions can be used to satisfy the Rhet 3562 requirement.

The College of Forestry accepts CLEP scores at the 75th percentile or higher for exemption from up to 8 credits in category D and, in special cases by petition in category C.

**A. Communication, Language, Symbolic Systems**—26 credits minimum

1. *English and Foreign Language Communication Skills*  
Comp 1011, 1012, 1013, 1027  
Rhet 1101, 1104, 1151, 1222, 3254, 3266, 3562  
Spch 1101, 1102, 3605
2. *Linguistics, Logic, and Philosophic Analysis*  
Clas 1048  
Ling—all courses except 1005, 3970, 5970  
Phil 1001, 1005, 5105, 5201
3. *Mathematics*  
Math—all courses except 0009, 1005-1006, 5703  
Stat 3011, 3091, 5021

**B. Physical, Biological, and Analytical Sciences**—25 credits minimum

1. *The Physical Universe*  
Ast 1011, 1021  
BioC 1301-1302  
Chem 1001-1002, 1003, 1004-1005, 1006  
Geo 1001, 1002, 1111  
Phys 1041, 1042, 1045, 1046, 1271-1281-1291  
Soil 1122, 1262
2. *The Biological Universe*  
Biol 1009, 1103, 1106  
Bot 1009, 1012  
Ent 1005  
GCB 3022  
Phsl 1002

**C. The Individual and Society**—8 credits minimum (with no more than 6 credits in any one discipline)

1. *Analysis of Human Behavior and Institutions*  
Afro 1025, 3055, 3061-3062, 3072, 3091  
AgEc 1020, 1030  
Anth 1102  
Econ 1001-1002, 1004-1005, 3001-3002  
FR 1201 (except Fisheries and Wildlife)  
FSoS 1001, 1025  
Geog 1301, 1401  
Pol 1001, 1025, 1026, 1027  
Psy 1001, 1004-1005  
Rhet 5165  
Soc 1001, 1002, 3101  
Spch 3401
2. *Development of Civilization: Historical and Philosophical Studies*  
Afro 1015, 1025, 1441  
Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3071, 3072, 3073  
Fren 3501, 3502  
Hist—all courses through 1954  
Ital 3501, 3502  
Jour 5601

## Baccalaureate Programs

Phil 1002, 3001, 3002, 3003, 3004  
Pol 1041  
Rhet 1310, 1311, 3375  
Span 3501, 3502

### D. Literature, Humanities, and Fine Arts—8 credits minimum

#### 1. Literature

Engl—all literature courses  
Foreign languages—all literature courses  
Rhet—all literature and humanities courses

#### 2. The Arts

Afro 1301, 3105, 3301  
Arch 1021, 1022, 1023  
Arth—all courses except 5521, 5950, 5960, 5970, 5990, 5991  
ArtS—all courses except 3530, 3970, 3980, 5530, 5970  
Dsgn 1501, 1521  
Mus—all courses except 1052, 1053, 1340, 1351, 1602, 3970, 3980, 5253, 5330, 5340, 5364, 5365, 5540, 5667, 5950  
Th—all courses except 3412, 3980, 5321, 5540, 5950, 5970

**Itasca Session**—Forest Resources, Renewable Resource Science, Urban Forestry, and Fisheries and Wildlife majors are required to complete a 3½-week Lake Itasca Forestry and Biological Station summer term between their freshman and sophomore, or sophomore and junior years. To attend, students must have completed 40 credits and attained a minimum cumulative grade point average of 2.00. Forest Resources, Renewable Resource Science, and Urban Forestry students must have also completed the following courses with a grade of C or better: Biol 1103, Chem 1001 or 1004, and Math 1008 (students with a C or better in high school trigonometry are exempt from Math 1008). Fisheries and Wildlife students must have completed the following courses with a grade of C or better: Biol 1009, 1103, 1106, 5041, and FW 3052. Fisheries students must also complete Chem 1005 with a grade of C or better. The session is also open to students who are not enrolled in the College of Forestry.

It is the responsibility of all transfer students to provide the Office for Student Affairs with transcripts of all coursework and an application by July 15 before the start of the Itasca session they wish to attend.

**Cloquet Session**—Students in Forest Resources and Renewable Resource Science are required to complete the Cloquet Forestry Session in the fall of their senior year. To attend, students must have attained a minimum cumulative grade point average of 2.00 at the end of the preceding quarter and completed the Itasca Forestry Session and FR 1100, 5100, 5114, 5200, and 5212. In addition, Forest Resources students must have completed FR 3103, 3232, 3300, 5215, Soils 1122, and FW 3052.

### Minnesota-Idaho Student Exchange

Forest Resources students at the University of Minnesota who are pursuing a management or biological sciences emphasis may study timber harvesting in Idaho during their senior year under an exchange agreement with the University of Idaho. Minnesota students return from this period of study in Idaho to be awarded their baccalaureate degree from the department of Forest Resources. In turn, Idaho students take coursework in paper science and engineering at the University of Minnesota.

### Forest Products Cooperative Education Program

Students in this program alternate periods of employment in their career fields with periods of academic study. The program leads to a bachelor of science in Forest Products, with a specialization in paper science and engineering, production management, marketing, or wood science. Full-time students who have declared a major in Forest Products in the College of Forestry and who have a 2.70 grade point average (GPA) may apply.

Students must complete at least two quarters of academic study before their first quarter of work. At the end of each work quarter, students submit a written report on their work assignments and learning experiences to a faculty member. Successful reports are graded "S" (satisfactory) and 1 credit is awarded for completing a work quarter. Continuation of the program is based on indication of nor-

mal progress toward the degree, a 2.50 cumulative GPA, and satisfactory work progress. For more information, contact Dr. James Bowyer, Forest Products Department Head, 209 Kaufert Laboratory (612/624-4292).

**Fisheries and Wildlife Field Trip—** Fisheries and Wildlife majors will be eligible to participate in a field trip during spring break of their senior year. Selection for participation is competitive, based on previous academic performance. Students will travel with a faculty member to different regions of the U.S. to observe and discuss ongoing fisheries and wildlife management activities. Local agency personnel will provide on-site information.

### Fisheries and Wildlife

This curriculum offers basic education in the biological and physical sciences and related nonscience disciplines to provide the broad background necessary for professional careers in fisheries and wildlife, natural resources, and other biological sciences. Undergraduates should recognize that they will satisfy only minimum requirements for professional employment; graduate-level study will enhance career opportunities. (The master's degree is required for many management, administrative, and research positions. The doctorate may be required for some positions and for college teaching.)

All students take the core curriculum of 179-184 credits, including six credits at the Itasca Field Session and three credits of a senior problem, completed as a group activity with classmates over three quarters. The 8-13 elective credits may be used for concentration in a specific field of interest or spread among different disciplines. Electives are chosen in consultation with the student's adviser.

#### Freshman and Sophomore Years—95-96 credits

- A. *Communication, Language, and Symbolic Systems*—31-32 credits
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1)
- Rhet 1151—Writing in Your Major (4)

- Rhet 1222—Public Speaking (4)
- Rhet 3266—Communication and Discussion in Small Group Decision Making (4)
- Choose one of the following groups:

- Math 1211, 1221, 1231—Calculus I, II, III (5,5,5)
- or Math 1211, 1221, 3142—Calculus I, II, and Introduction to Linear Algebra (5,5,4)
- or Math 1142, 1131, Phil 1001—Short Calculus, Finite Mathematics, Introduction to Logic (5,5,5)

#### B. *Physical, Biological, and Analytical Sciences*—42 credits

- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Biol 1106—General Zoology (5)
- Biol 5041—Ecology (4)
- Bot 3201—Introductory Taxonomy (4)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- FR 1201—Conservation of Natural Resources (3)
- FW 1101—Ethics and Values in Resource Management (3)
- FW 3052—Introduction to Fisheries and Wildlife (3)

#### C. *The Individual and Society*—14 credits

- AgEc 1020—Principles of Macroeconomics (5)
- Pol 1001—American Government and Politics (5)
- Mgmt 3001—Fundamentals of Management (4)
- or Mgmt 3002—Psychology of Management (4)
- or IR 3010—The Individual in the Organization (4)

#### D. *Literature, Humanities, and Fine Arts*—8 credits

See suggestions under Liberal Education Requirements.

#### Junior and Senior Years—97-98 credits

##### *Itasca Session*—6 credits

- FW 3600—Fisheries and Wildlife Field Techniques (5)
- FR 3201—Field Forest Measurements (1)

##### *Required Courses*—78-82 credits

- GCB 3022—Genetics (4)
- EBB 5608—Ecosystems: Form and Function (4)
- EBB 5156—Comparative Animal Physiology (5)
- EBB 5044—Evolution (4)
- or VB 1120—Vertebrate Morphology (5)
- EBB 5601—Limnology (4)
- or Geol 1601—Oceanography (4)
- EBB 5136—Ichthyology (4)
- or EBB 5606—Ecology of Fishes (5)
- FW 5129—Mammalogy (5)
- or EBB 5134—Ornithology (5)
- FW 5601—Assessment and Management of Vertebrate Populations (5)
- FW 5602—Fisheries and Wildlife Planning and Policy (4)
- FW 5603—Wildlife Habitat Relationships and Management (3)
- FW 5604—Fishery Management in Inland Waters (3)
- FW 5701, 5702, 5703—Senior Problem (3 cr; 1/qtr)
- BioC 1301, 1303—Elementary Biochemistry and Lab (5,2)
- or Chem 3301, 3305—Elementary Organic Chemistry I and Lab (4,2)
- PubH 5450—Biometry I (4)

## Baccalaureate Programs

PubH 5452—Biometry II (4)  
Rhet 3562—Writing in Your Profession (4)  
Phys 1041—Introductory Physics (4)  
Phys 1042—Introductory Physics (4)  
Geol 1111—Introductory Physical Geology (5)  
or Geol 1001—Introduction to Geology (4)

### *Suggested Electives*—8-13 credits

Choose from this list. Unlisted courses may be taken after consultation with the adviser.

EBB 3111—Introduction to Animal Behavior (4)  
EBB 5052—Theoretical Population Ecology (4)  
EBB 5116—Introduction to Animal Parasitology (5)  
Ent 5360—Aquatic Entomology (2)  
FR 5100—Silviculture (3)  
FR 5200—Aerial Photo Interpretation (3)  
FR 5212—Natural Resources Inventory (3)  
FR 5231—Range Management (3)  
FR 5240—Natural Resource Policy and Administration (3)  
FR 5262—Remote Sensing of Natural Resources (4)  
FR 5458—Water Quality Management: Ecosystem Approaches (4)  
FW 5610—Renewable Natural Resources and Public Policy (2)  
FW 5455—Aquaculture (4)  
FW 5459—Environmental Physiology of Fishes (3)  
PA 5721—Environmental Policy (3)

## Fisheries and Wildlife Minor

This minor enables majors in the natural resource areas or fields like communications and education to develop a secondary concentration in fisheries and wildlife resources. An overview of fish and wildlife natural history and the general principles applied to managing their populations and habitats is provided. Open to students who have completed the required background courses or their equivalent; the minor is declared once minor core and optional courses are completed.

### **Required Background Courses**—18-19 credits

Biol 1103—General Botany (5)  
Biol 1106—General Zoology (5)  
Biol 5041—Ecology (4)

One vertebrate biology course from the following:

EBB 5114—Vertebrate Biology (4)  
FW 5129—Mammalogy (5)  
EBB 5134—Introductory Ornithology (5)  
EBB 5834—Field Ornithology (5) (Itasca)  
EBB 5136—Ichthyology (4)  
EBB 5606—Ecology of Fishes (5)  
FW 5456—Field Ecology of Fishes (5) (Itasca)

### **Minor Core Courses**—12 credits

FW 1101—Ethics and Values in Resource Management (3)  
FW 3052—Introduction to Fisheries and Wildlife (3)

FW 5603—Wildlife Habitat Relationships and Management (3)  
FW 5604—Fishery Management in Inland Waters (3)

### **Optional Courses**—Choose one course

FW 5459—Environmental Physiology of Fishes (3)  
FW 5455—Aquaculture (4)  
FW 5602—Fisheries and Wildlife Planning and Policy (4)  
FW 5601—Assessment and Management of Vertebrate Populations (5)

## Forest Products

This curriculum is for students interested in careers in the development, production, marketing, and utilization of the thousands of products that flow from forests— from paper, plywood, and furniture to biomass for energy. Courses emphasize the chemical, physical, and mechanical properties of wood and the newest technologies for converting this raw material into its many final forms.

**Marketing**—This specialization is for students interested in the marketing, sales, and distribution of forest products. The technical emphasis is on the physical-mechanical nature of wood-based building materials including lumber, plywood, fiberboard, particleboard, and newer composite products. In addition, coursework focuses on marketing principles and analysis, management science, computer applications, and economics. Career opportunities include purchasing and selling all types of forest products at the wholesale and retail levels, technical sales, product promotion, and specialized marketing research.

### **Freshman Year**—40 required credits

AgEc 1020—Principles of Macroeconomics (5)  
AgEc 1030—Principles of Microeconomics (4)  
Biol 1009—General Biology (5)  
Chem 1001—Chemical Principles and Covalent Systems (5)  
Chem 1002—Chemical Principles and Covalent Systems (5)  
ForP 1001—Forest Products Orientation (1)  
Math 1142—Short Calculus (5)  
Psy 1001—General Psychology (5)  
Rhet 1101—Writing to Inform and Persuade (4)  
Rhet 1104—Library Laboratory (1)  
Electives and liberal education requirements

### **Sophomore Year**—44 required credits

Act 1024—Principles of Financial Accounting I (3)

Acct 1025—Principles of Financial Accounting II (3)  
 Acct 3001—Managerial Accounting (4)  
 ForP 1301—Wood as a Raw Material (4)  
 ForP 1303—Wood Structure and Identification (2)  
 FR 1100—Dendrology (4)  
 Phys 1041—Introductory Physics (4)  
 Phys 1042—Introductory Physics (4)  
 Phys 1045—Introductory Physics Lab (1)  
 Phys 1046—Introductory Physics Lab (1)  
 Jour 1001—Introduction to Mass Communication (2)  
 Rhet 1151—Writing in Your Major (4)  
 Rhet 1222—Public Speaking (4)  
 Stat 3011—Statistical Analysis (4)  
 Electives and liberal education requirements

**Junior Year**—42 required credits

BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)  
 CSci 3101—A FORTRAN Introduction to Computer Programming (4)  
 or CSci 3102—Introduction to Pascal Programming (4)  
 or AgET 3030—Introduction to Problem Solving With Computers (4)  
 ForP 3300—Wood Industry Tours (2)  
 ForP 3303—Forest Products Marketing (3)  
 ForP 3312—Building Materials Estimating (2)  
 ForP 5300—Wood-Fluid Relationships (3)  
 ForP 5301—Mechanical Properties (3)  
 ForP 5303—Wood Deterioration (3)  
 ForP 5331—Undergraduate Seminar (2)  
 Mgmt 3001—Fundamentals of Management (4)  
 Mktg 3000—Principles of Marketing (4)  
 Mktg 3010—Buyer Behavior and Marketing Analysis (4)  
 Mktg 3020—Marketing Operations Management (4)  
 Electives and liberal education requirements

**Senior Year**—37 required credits

ForP 5304—Wood Drying and Preservation Processes (4)  
 ForP 5306—Analysis of Production Systems (3)  
 ForP 5307—Wood-Base Panel Technology (4)  
 ForP 5355—Mechanics and Structural Design With Wood Products (4)  
 ForP 5356—Advanced Forest Products Marketing (3)  
 BME 5260—Professional Sales (3)  
 BFin 3000—Finance Fundamentals (4)  
 Mktg 3030—Sales and Distribution Management (4)  
 Psy 5751—Psychology of Advertising (4)  
 Rhet 3562—Writing in Your Profession (4)  
 Electives and liberal education requirements

**Directed Electives**—at least two courses

Acct 3160—Financial Statement Analysis (4)  
 Jour 3159—Public Relations (4)  
 Jour 5721—Mass Media in a Dynamic Society (4)  
 Mgmt 3002—Psychology in Management (4)  
 Mktg 3050—Marketing Communications (4)  
 Mktg 3065—Retail Management (4)  
 LM 3010—Principles of Transportation (4)  
 LM 3020—Advanced Logistics Management (4)

**Total Graduation Requirements**—192 credits  
 Required courses listed above (163 credits), liberal education requirements in category D (8 credits), and electives (13 credits).

**Production Management**—This specialization is for students interested in production management careers in industries that manufacture lumber, plywood, particleboard, furniture, and other wood products. In addition to a basic wood science background, students gain knowledge in industrial engineering, labor management, and economics.

**Freshman Year**—35 required credits

AgEc 1020—Principles of Macroeconomics (5)  
 AgEc 1030—Principles of Microeconomics (4)  
 Biol 1009—General Biology (5)  
 Chem 1004—General Principles of Chemistry (5)  
 Chem 1005—General Principles of Chemistry (5)  
 ForP 1001—Forest Products Orientation (1)  
 Math 1142—Short Calculus (5)  
 Rhet 1101—Writing to Inform and Persuade (4)  
 Rhet 1104—Library Laboratory (1)  
 Electives and liberal education requirements

**Sophomore Year**—42 required credits

BioC 1301—Elementary Biochemistry (5)  
 ForP 1301—Wood as a Raw Material (4)  
 ForP 1303—Wood Structure and Identification (2)  
 FR 1100—Dendrology (4)  
 Phys 1041—Introductory Physics (4)  
 Phys 1042—Introductory Physics (4)  
 Phys 1045—Introductory Physics Lab (1)  
 Phys 1046—Introductory Physics Lab (1)  
 Psy 1001—General Psychology (5)  
 Rhet 1151—Writing in Your Major (4)  
 Rhet 1222—Public Speaking (4)  
 Stat 3091—Probability and Statistics (4)  
 Electives and liberal education requirements

**Junior Year**—43 required credits

CSci 3101—A FORTRAN Introduction to Computer Programming (4)  
 or AgET 3030—Introduction to Problem Solving With Computers (4)  
 ForP 3300—Wood Industry Tours (2)  
 ForP 3303—Forest Products Marketing (3)  
 ForP 3361—Introduction to Adhesives (3)  
 ForP 5300—Wood-Fluid Relationships (3)  
 ForP 5301—Mechanical Properties (3)  
 ForP 5303—Wood Deterioration (3)  
 ForP 5331—Undergraduate Seminar (2)  
 ForP 5355—Mechanics and Structural Design with Wood Products (4)  
 IEOB 3000—Introduction to Industrial Engineering Analysis (4)  
 IEOB 5030—Quality Control and Reliability (4)  
 IEOB 5040—Introduction to Operations Research (4)

## Baccalaureate Programs

IR 3002—Industrial Relations Systems: Labor Markets and the Management of Human Resources (4)

Electives and liberal education requirements

**Senior Year**—38 required credits

ForP 5304—Wood Drying and Preservation Processes (4)

ForP 5305—Pulp and Paper Technology (4)

ForP 5306—Analysis of Production Systems (3)

ForP 5307—Wood-Base Panel Technology (4)

IEOR 5010—Introduction to Work Analysis (4)

IEOR 5020—Engineering Cost Accounting, Analysis and Control (4)

IEOR 5311—Management for Engineers (3)

IEOR 5361—Inventory and Production Control (4)

IR 3007—Collective Bargaining Negotiations and Modern Labor Relations (4)

Rhet 3562—Writing in Your Profession (4)

Electives and liberal education requirements

**Total Graduation Requirements**—192 credits

Required courses listed above (158 credits), liberal education requirements in category D (8 credits), and electives (26 credits).

**Paper Science and Engineering**—This specialization provides in-depth training in mathematics, physics, chemistry, engineering, and wood and fiber science and technology. It also includes specialized pulp and paper and related engineering courses on the technology of the pulping and papermaking processes. Graduates find careers in process engineering, manufacturing operations, technical services, marketing, plant management, and research and development.

**Freshman Year**—44 required credits

AgEc 1020—Principles of Macroeconomics (5)

Chem 1004—General Principles of Chemistry (5)

Chem 1005—General Principles of Chemistry (5)

Chem 1006—Principles of Solution Chemistry (4)

ForP 1001—Forest Products Orientation (1)

Math 1211—Calculus I (5)

Math 1221—Calculus II (5)

Math 1231—Calculus III (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1)

Rhet 1222—Public Speaking (4)

Electives and liberal education requirements

**Sophomore Year**—46 required credits

Chem 3301—Elementary Organic Chemistry I (4)

Chem 3302—Elementary Organic Chemistry II (4)

Chem 3305—Elementary Organic Chemistry Lab I (2)

Chem 3306—Elementary Organic Chemistry Lab II (2)

CSci 3101—A FORTRAN Introduction to Computer Programming (4)

or AgET 3030—Introduction to Problem Solving With Computers (4)

ForP 1301—Wood as a Raw Material (4)

ForP 1303—Wood Structure and Identification (2)

Math 3221—Introduction to Linear Algebra and Linear Differential Equations (5)

Phys 1271—General Physics (4)

Phys 1275—General Physics Lab (1)

Phys 1281—General Physics (4)

Phys 1285—General Physics Lab (1)

Phys 1291—General Physics (4)

Phys 1295—General Physics Lab (1)

Rhet 1151—Writing in Your Major (4)

Electives and liberal education requirements

**Junior Year**—48 required credits

Chem 5520—Elementary Physical Chemistry (3)

CE 3400—Fluid Mechanics (4)

ForP 3300—Wood Industry Tours (2)

ForP 5300—Wood-Fluid Relationships (3)

ForP 5301—Mechanical Properties (3)

ForP 5302—Wood Chemistry I (3)

ForP 5305—Pulp and Paper Technology (4)

ForP 5310—Pulp and Paper Process Laboratory (3)

ForP 5312—Pulp and Paper Process Calculations (4)

ForP 5313—Pulp and Paper Process Operations (5)

ForP 5315—Paper Engineering Laboratory (2)

ForP 5331—Undergraduate Seminar (2)

ForP 5353—Wood Chemistry II (3)

ForP 5361—Adhesion and Adhesives (3)

ME 3301—Thermodynamics (4)

**Senior Year**—20 required credits

AgEn 5070—Automatic Control and Instrumentation (4)

ForP 5306—Analysis of Production Systems (3)

ForP 5316—Coated Product Development (2)

ForP 5359—Surface and Colloid Chemistry of Papermaking (3)

Rhet 3562—Writing in Your Profession (4)

Stat 3011—Statistical Analysis (4)

**Suggested Electives**

CE 3500—Introduction to Environmental

Engineering Problems and Analysis (4)

CE 5500—Analysis and Design of Water Supply Systems (4)

CE 5501—Analysis and Design of Wastewater Systems (4)

Chem 5521—Elementary Physical Chemistry (3)

ChEn 5001—Computational Methods in Chemical

Engineering and Material Science (4)

ChEn 5101—Principles of Chemical Engineering I (4)

ChEn 5102—Principles of Chemical Engineering II (4)

IEOR 5020—Engineering Cost Accounting, Analysis and Control (4)

- ME 3201—Mechanical Engineering Systems Analysis (4)  
 ME 3303—Applied Thermodynamics (4)  
 ME 3701—Basic Measurements Lab I (2)  
 ME 3702—Basic Measurements Lab II (2)  
 ME 5283—Industrial Instrumentation and Automatic Control (4)  
 ME 5342—Heat Transfer (4)  
 Stat 3012—Statistical Analysis (4)

**Total Graduation Requirements**—192 credits  
 Required courses listed above (158 credits), liberal education requirements in categories C and D (11 credits), and electives (23 credits).

**Wood Science**—This specialization is designed for students who want broad and in-depth education in forest products. It provides a strong background in mathematics, the biological and physical sciences, the fundamental properties of wood, and the technology of wood products manufacturing.

- Freshman Year**—45 required credits  
 Biol 1009—General Biology (5)  
 Biol 1103—General Botany (5)  
 Chem 1004—General Principles of Chemistry (5)  
 Chem 1005—General Principles of Chemistry (5)  
 Chem 1006—Principles of Solution Chemistry (4)  
 ForP 1001—Forest Products Orientation (1)  
 Math 1211—Calculus I (5)  
 Math 1221—Calculus II (5)  
 Math 1231—Calculus III (5)  
 Rhet 1101—Writing to Inform and Persuade (4)  
 Rhet 1104—Library Laboratory (1)  
 Electives and liberal education requirements

- Sophomore Year**—46 required credits  
 Chem 3301—Elementary Organic Chemistry I (4)  
 Chem 3302—Elementary Organic Chemistry II (4)  
 Chem 3305—Elementary Organic Chemistry Lab I (2)  
 Chem 3306—Elementary Organic Chemistry Lab II (2)  
 ForP 1301—Wood as a Raw Material (4)  
 ForP 1303—Wood Structure and Identification (2)  
 FR 1100—Dendrology (4)  
 Math 3211—Multivariable Calculus (5)  
 Phys 1271—General Physics (4)  
 Phys 1275—General Physics Lab (1)  
 Phys 1281—General Physics (4)  
 Phys 1285—General Physics Lab (1)  
 Phys 1291—General Physics (4)  
 Phys 1295—General Physics Lab (1)  
 Rhet 1151—Writing in Your Major (4)  
 Electives and liberal education requirements

- Junior Year**—41 required credits  
 AgEc 1020—Principles of Macroeconomics (5)  
 AgEc 1030—Principles of Microeconomics (4)  
 Chem 3100—Quantitative Analysis Lecture (3)  
 Chem 3101—Quantitative Analysis Lab (2)  
 Chem 5520—Elementary Physical Chemistry (3)

- ForP 3300—Wood Industry Tours (2)  
 ForP 5300—Wood-Fluid Relationships (3)  
 ForP 5306—Analysis of Production Systems (3)  
 ForP 5302—Wood Chemistry I (3)  
 ForP 5303—Wood Deterioration (3)  
 ForP 5331—Undergraduate Seminar (2)  
 Rhet 1222—Public Speaking (4)  
 Stat 3011—Statistical Analysis (4)  
 Electives and liberal education requirements

- Senior Year**—33 required credits  
 AgET 3030—Introduction to Problem Solving With Computers (4)  
 or CSci 3101—A FORTRAN Introduction to Computer Programming (4)  
 ForP 5304—Wood Drying and Preservation Processes (4)  
 ForP 5305—Pulp and Paper Technology (4)  
 ForP 5306—Analysis of Production Systems (3)  
 ForP 5307—Wood-Base Panel Technology (4)  
 ForP 5353—Wood Chemistry II (3)  
 ForP 5355—Mechanics and Structural Design With Wood Products (4)  
 ForP 5361—Adhesion and Adhesives (3)  
 Rhet 3562—Writing in Your Profession (4)  
 Electives and liberal education requirements

**Total Graduation Requirements**—192 credits  
 Required courses listed above (165 credits), liberal education requirements in categories C and D (11 credits), and electives (16 credits).

## Forest Resources

This curriculum prepares students to manage forest lands for timber, wildlife, recreation, water production, and environmental enhancement. Graduates may become directly involved in land management or play specialized supporting roles in areas ranging from nursery management to public relations. Still others find employment in related fields such as environmental education and interpretation.

All students take the *core curriculum* of required courses (including the Itasca and Cloquet sessions) listed by year below. In addition, students must complete a minimum of 20 credits in one of the seven *areas of emphasis* listed below. A student may also submit a proposal for an individual area of emphasis, including an explanation of its professional relevance and the courses to be completed, to the faculty for their review and approval.

# Baccalaureate Programs

## Core Curriculum

**Freshman Year**—50 required credits

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

Chem 1001—Chemical Principles and Covalent Systems (5)

or Chem 1004—General Principles of Chemistry (5)

Chem 1002—Chemical Principles and Covalent Systems (5)

or Chem 1005—General Principles of Chemistry (5)

FR 1001—Forest Resources Orientation (1)

Geo 1001—Physical Geology (5)

Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)

Math 1111—College Algebra and Analytic Geometry (5)

or Math 1201—Pre-Calculus (5)

Math 1142—Short Calculus (5)

or Math 1211—Calculus I (5)

Phys 1001—The Physical World (4)

Phys 1005—Physics Laboratory (1)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1)

Electives and liberal education requirements

**Sophomore Year**—31-35 required credits

AgEc 1020—Principles of Macroeconomics (5)

AgEc 1030—Principles of Microeconomics (4)

FR 3300—Elements of Surveying (2)<sup>1</sup> (offered at the Cloquet Forestry Center)

or CE 3100—Introduction to Surveying and Mapping (4)<sup>2</sup>

CSci 3101—A FORTRAN Introduction to Computer Programming (4)

or CSci 3102—Introduction to Pascal Programming (4)

or AgET 3030—Introduction to Problem Solving With Computers (4)

or GC 3572—Computer Applications and Programming Applied to Forestry (5)<sup>3</sup>

ForP 1301—Wood as a Raw Material (4)

Rhet 1151—Writing in Your Major (4)

Rhet 1222—Public Speaking (4)

Stat 3011—Statistical Analysis (4)

or Stat 5021—Statistical Analysis (5)

Electives and liberal education requirements

**Itasca Session**—6 required credits

This summer term is to be taken between the freshman and sophomore, or sophomore and junior, years.

FR 3100—Minnesota Plants (2)

FR 3101—Field Forest Ecology (3)

FR 3201—Field Forest Measurements (1)

**Junior Year**—33 required credits

FR 1100—Dendrology (4)

FR 1122—Introductory Soil Science (4)

FR 3103—Meteorology and Climatology for Natural Resource Managers (2)

FR 3104—Forest Ecology (3)

FR 3232—Management of Recreational Lands (3)

FR 5100—Silviculture (3)

FR 5114—Forest Hydrology (3)

FR 5200—Aerial Photo Interpretation (3)

FR 5212—Natural Resources Inventory (3)

FR 5215—Forest Fire Management (2)

FW 3052—Introduction to Fisheries and Wildlife (3)  
Electives and liberal education requirements

**Senior Year**—30 required credits

*Fall Quarter—Cloquet Session*

FR 5101—Field Silviculture (4)

FR 5115—Forest Hydrology, Field Applications (2)

FR 5126—Silviculture: Soil Site Relationships (2)

FR 5220—Remote Sensing, Forest Resources Inventory (4)

FR 5236—Forest Recreation Planning (1)

FR 5248—Harvesting and Engineering (3)

FW 3167—Techniques of Forest Wildlife Management (2)

*Winter and Spring Quarters—On Campus*

FR 5115—Forest Economics and Planning (5)

FR 5240—Natural Resource Policy and Administration (3)

Rhet 3562—Writing in Your Profession (4)

Electives and liberal education requirements

**Total Graduation Requirements**—192 credits

Required courses listed above (150-154), liberal education requirements in categories C and D (11 credits), and electives and credits to satisfy area of emphasis (27-31 credits).

## Areas of Emphasis

**Forest Hydrology**—This interdisciplinary emphasis is primarily concerned with developing skills to solve water resource problems. Students will qualify as hydrologists on the Civil Service register, and also meet the qualifying criteria for forest and range hydrologists as established by the Association of University Watershed Scientists. For more information, contact Dr. Kenneth N. Brooks, 301f Green Hall (612/624-2774) or Dr. James A. Perry, 301c Green Hall (612/624-9796).

<sup>1</sup>FR 3300 may be taken as part of the Cloquet Session.

<sup>2</sup>Students need override from the Civil Engineering Department to register.

<sup>3</sup>Students who wish to take FR 5110 should not take GC 3572.



**Required Courses—26 credits**

- Math 1211, 1221—Calculus I, II (10)
- FR 5153—Advanced Forest Hydrology (4)
- CE 5401—Water Resources Engineering (4)
- CE 5405—Hydrology, Hydrologic Design (4)
- FR 5458—Water Quality Management: Ecosystem Approaches (4)

**Recommended Electives—at least four courses**

- FR 5231—Range Management (3)
- FR 5262—Remote Sensing of Natural Resources (4)
- FR 5264—Quantitative Techniques in Forest Management (3)
- AgEn 5540—Erosion Control, Watershed Engineering (4)
- AgEn 5550—Drainage and Irrigation Engineering (4)
- CE 3400—Fluid Mechanics (4)
- CE 3500—Introduction to Environmental Engineering Problems and Analysis (4)
- CE 5402—Computational Hydraulics (4)
- CE 5410—Open Channel Hydraulics (4)
- CE 5425—Groundwater Mechanics (4)
- CE 5505—Water Quality Engineering (4)
- CE 5506—Environmental Water Chemistry (4)
- CE 5420—Introduction to Water Resources Management (4)
- Geo 5251—Geomorphology (Cr ar)
- Geo 5611—Groundwater Geology (3)
- Soil 5232—Soil Physics (5)
- Soil 5310—Soil Chemistry (4)
- Soil 5240—Microclimatology (4)
- Soil 5710—Advanced Forest Soils (Cr ar)

**Forest Soils**—This emphasis covers forest soil science, land use, management planning, and forest production. Students will qualify as soil scientists on the Civil Service register as well as satisfy requirements for a soil science minor (which can be entered directly on the transcript). For more information, contact Dr. David F. Grigal, 556 Borlaug Hall (612/625-4232).

**Required Courses—23-24 credits**

- FR 1122—Introductory Soil Science (4)
- Soil 3416—Soil Fertility (5)
- Soil 3520—Soil Morphology, Classification, and Genesis (4)
- Soil 5710—Advanced Forest Soils (3)
- Soil 3210—Soil Physical Management and Tillage (4)
- Soil elective (3-4)

**Recommended Electives—at least two courses (including 3 cr in Soil Science)**

- FR 3104—Forest Ecology (3)
- FR 5120—Introductory Tree Physiology and Genetics (4)
- FR 5153—Advanced Forest Hydrology (4)
- FR 5231—Range Management (3)
- FR 5262—Remote Sensing of Natural Resources (4)

**FR 5264—Quantitative Techniques in Forest Management (3)**

- Ent 5050—Forest Entomology (4)
- Geo 5251—Geomorphology (4)
- Geo 5261—Glacial Geology (4)
- Soil 5610—Soil Biology (4)
- Soil 3xxx—Seminars on Special Topics (1 each)
- Soil 5230—Soil-Plant Water Relations (3)
- Soil 5232—Soil Physics (5)
- Soil 5240—Microclimatology (4)
- Soil 5515—Soil Development, Classification, and Geography (4)
- Soil 5550—Peatlands (3)
- Soil 5560—Uses and Interpretation of Soil Survey Information (3)
- PIPa 5050—Forest Pathology (4)

**Management and Administration—**

This emphasis is for students interested in administrative careers in public resource agencies or forest industries. Concepts and techniques used in managing people and processes in large organizations are explored, providing a framework for systematic individual development through experience and continuing education. For more information, contact Dr. Paul V. Ellefson, 110i Green Hall (612/624-3735); Dr. Hans M. Gregersen, 301d Green Hall (612/624-6298); or Dr. Dietmar W. Rose, 101b Green Hall (612/624-9711).

**Required Courses—13 credits**

- Mgmt 3001—Fundamentals of Management (4)
- Acct 1024—Principles of Financial Accounting I (3)
- Acct 1025—Principles of Financial Accounting II (3)
- FR 5241—Natural Resource Management: Political and Administrative Processes (3)  
or FR 5264—Quantitative Techniques in Forest Management (3)

**Recommended Electives—28 credits**

- Acct 3001—Managerial Accounting (4)
- BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)
- BGS 3002—Business and Society (4)
- IR 3010—Human Relations and Applied Organization Theory (4)
- Mgmt 3002—Psychology in Management (4)
- MIS 5300—Management Information Systems (4)
- PA 5515—Introduction to Planning (4)

**Industrial Forest Management**—This emphasis is designed for students who wish to gain a more complete understanding of the management of industrial forests. Planning, decision-making, and

## Baccalaureate Programs

project implementation activities are stressed. For more information, contact Dr. Dietmar W. Rose, 101b Green Hall (612/624-9711).

### Required Courses—28-29 credits

- FP 3303—Forest Products Marketing (3)
- FP 3300—Wood Industry Tours (2)  
or FP 5306—Analysis of Production Systems (3)
- FR 5241—Natural Resource Management: Political and Administrative Processes (3)
- FR 5253—Forest Biometry (3) (*offered alt even years*)  
or FR 5255—Forest Resource Survey Design (3)  
(*offered alt odd years*)
- FR 5264—Quantitative Techniques in Forest Management (3)
- IEOR 5050—Engineering Economics Analysis (4)
- Math 1221—Calculus II (5)<sup>1</sup>
- Math 1231—Calculus III (5)

### Recommended Electives

- IEOR 5000—Introduction to Industrial Engineering Analysis (4)
- IEOR 5020—Engineering Cost Accounting, Analysis and Control (4)
- IEOR 5040—Introduction to Operations Research (4)
- IEOR 5441—Operations Research II (4)
- MIS 5300—Survey of Computers and Management Information Systems (4)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)
- Stat 5021—Statistical Analysis (5)
- Stat 5301—Designing Experiments (5)
- Stat 5302—Applied Regression Analysis (5)

### Resource Measurements and Information Systems

This emphasis is for students with analytical skills who are interested in forest measurement and information systems. Focus is on such subjects as sampling, mathematical modelling, statistics, computer science, remote sensing, and decision support systems. For more information, contact Dr. Alan R. Ek, 110d Green Hall (612/624-3098), Dr. Thomas E. Burk, 209a Green Hall (612/624-6741), or Dr. Sean C. Ahearn, 314 Green Hall (612/624-6709).

### Required Courses—22 credits

- FR 5253—Forest Biometry (3; *offered alt even yrs*)  
or FR 5255—Forest Resource Survey Design (3; *offered alt odd yrs*)
- Stat 5021—Statistical Analysis (5)
- Math 1221—Calculus II (5)
- Math 1231—Calculus III (5)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)  
or CSci 3102—Introduction to Pascal Programming (4)  
or other FORTRAN or Pascal (4)

### Recommended Electives—at least two courses

- FR 5264—Quantitative Techniques in Forest Management (3)  
or IEOR 5040—Introduction to Operations Research (4)
- FR 5262—Remote Sensing of Natural Resources (4)
- Stat 5302—Applied Regression Analysis (5)
- Stat 5301—Designing Experiments (5)

**Forest Harvesting**—This emphasis is for students interested in timber harvesting and its impact on other land management considerations. The coursework is interdisciplinary and requires careful preparation for spending the senior year at the University of Idaho earning 14 semester credits (21 quarter credits). Students are trained for careers in logging engineering firms, forest products companies, and government agencies. Typical work includes planning and designing timber sales, supervising logging crews, designing and laying out roads, and managing wood procurement. For more information, contact Dr. A. Scott Reed, Cloquet Forestry Center, Cloquet, MN 55720 (218/879-4528).

### Junior Year

*Fall Quarter (Minnesota)—10-12 credits*

- FR 3103—Meteorology and Climatology for Natural Resource Managers (2)
- FR 3104—Forest Ecology (3)
- FW 3052—Introduction to Fisheries and Wildlife (3)
- CE 3100—Introduction to Surveying and Mapping (4)<sup>2</sup>  
or FR 3300—Elements of Surveying (2) (*offered at the Cloquet Forestry Center*)

*Winter Quarter (Minnesota)—13 credits*

- Rhet 3562—Writing in Your Profession (4)
- FR 5100—Silviculture (3)
- FR 5200—Aerial Photo Interpretation (3)
- FR 5240—Natural Resource Policy and Administration (3)

*Spring Quarter (Minnesota)—13 credits*

- FR 5212—Natural Resources Inventory (3)
- FR 5215—Forest Fire Management (2)
- FR 5226—Forest Economics and Planning (5)
- FR 5231—Range Management (3)

### Senior Year

*Fall Quarter (Cloquet)—18 credits*

*Spring Semester (Idaho)—6 semester credits*

<sup>1</sup>Students should take Math 1201 and 1211 (which count toward the 36 credits required for operations research analysts) in their freshman year.

<sup>2</sup>Students need override from the Civil Engineering Department to register.

- For Pr 431—Production and Cost Control in Timber Harvesting (3 sem/4.5 qtr cr)  
 For Pr 433—Forest Tractor Systems Analysis (3 sem/4.5 qtr cr)  
 Electives  
*Fall Semester (Idaho)—8 semester credits*  
 For Pr 434—Cable Systems Analysis (3 sem/4.5 qtr cr)  
 For Pr 432—Low Volume Forest Roads (3 sem/4.5 qtr cr)  
 For 462—Watershed Management (2 sem/3 qtr cr)  
 Electives

- Recommended Electives (Idaho)*  
 Bus 370—Industrial Management (3 sem/4.5 qtr cr)  
 For Pr 522—Advanced Forest Roads (3 sem/4.5 qtr cr)  
 For Pr 534—Advanced Techniques of Timber Harvesting (3 sem/4.5 qtr cr)  
 For 463—Watershed Analysis and Planning (3 sem/4.5 qtr cr)  
 For 470—Introduction to Forest Resources Planning (2 sem/3 qtr cr)  
 For 476—Forest Investment Analysis (2 sem/3 qtr cr)  
 For 477—Forest Harvest Scheduling (2 sem/3 qtr cr)  
 For 478—Western Forestry Practices (1 sem/1.5 qtr cr)  
 For 575—Advanced Forest Management (2 sem/3 qtr cr)

- Recommended Electives (Minnesota)*  
 FR 5140—Application of Silviculture in North American Forest Types (3)  
 Soil 5710—Advanced Forest Soils (3)  
 FR 5153—Advanced Forest Hydrology (4)

**Silviculture/Forest Biology**—This emphasis is for students interested in the biological sciences, such as ecology, silviculture, and physiology. The subject matter provides background information for careers as forest resource managers and silviculturist specialists. For more information contact Dr. Alvin A. Alm, Cloquet Forestry Center, Cloquet, MN 55720 (218/879-4528), or Dr. Edward Sucoff, 2b Green Hall (612/624-7249).

*For the following required and recommended courses, course numbers followed by "w" are offered winter quarter and those followed by "s" are offered spring quarter.*

- Required Courses**—15 credits  
 FR 5120w—Introductory Tree Physiology and Genetics (4)  
 Soil 5710s—Advanced Forest Soils (3)  
 Ent 5050w—Forest Entomology (4)  
 PIPa 5050s—Forest Pathology (4)

**Recommended Electives**—12 credits minimum; at least three courses from the following list of FR courses; in addition any 5000 level course in Soils,

- Botany, or a related course may be used.  
 FR 5106w—Senior Silviculture Seminar (2-3)  
 FR 5110w—Forestry Applications of Microcomputers (3)  
 FR 5140s—Application of Silviculture in North American Forest Types (3)  
 FR 5152w—Forest Genetics (3)  
 FR 5231s—Range Management (3)  
 FR 5262w—Remote Sensing of Natural Resources (4)  
 FR 5700—Colloquium in Forest Biology (1-2)  
 FR 5121w—Tree Physiology Laboratory (1)

### Forest Resources Minor

The purpose of this minor is to enable students in natural resources or related areas to develop a solid understanding of forest resource dynamics, management, and the importance of forest resources to our society. The minor incorporates a fundamental science background plus coursework dealing with the multiple uses and manipulation of forest resources and their assessment and policy implications. Open to students who have completed the required background courses or the equivalent, the minor is awarded once the minor core and optional courses are completed.

- Minor Core**—13-16 credits  
 FR 1100—Dendrology (4)  
 FR 1200—Introduction to Forest Resources (3)  
     or FR 1201—Conservation of Natural Resources (3)  
     or FR 1202—Farm and Small Woodlands Forestry (3)  
     or FR 1203—Introduction to Minnesota's Natural Resources (3)  
     or FR 5406—Forestry Workshop for Teachers (5)  
 FR 3104—Forest Ecology (3)<sup>1</sup>  
     or Biol 5041—Ecology (4)  
 FR 5100—Silviculture (3)

**Optional Courses**—7 credits, with at least one course from each of these two categories:

- Management and Policy**  
 ForP 1301—Wood as a Raw Material (4)  
 FR 3102—Southern Forest Resource Tour (1)  
 FR 3232—Management of Recreational Lands (3)  
 FR 3250 or 5250—Role of Renewable Natural Resources in Developing Countries (2)  
 FR 5200—Aerial Photo Interpretation (3)

<sup>1</sup>This requirement can also be met by the following courses offered at Itasca: FR 3100—Minnesota Plants (2); FR 3101—Field Forest Ecology (3); FR 3201—Field Forest Measurements (1).

## Baccalaureate Programs

- FR 5212—Natural Resources Inventory (3)
- FR 5220—Remote Sensing, Forest Resources Inventory (4) (*Cloquet*)
- FR 5226—Forest Economics and Planning (5)
- FR 5231—Range Management (3)
- FR 5233—Principles of Outdoor Recreation Design and Planning (4)
- FR 5236—Forest Recreation Planning (1) (*Cloquet*)
- FR 5240—Natural Resource Policy and Administration (3)
- FR 5241—Natural Resource Management: Political and Administrative Processes (3)
- FR 5248—Harvesting and Engineering (3) (*Cloquet*)
- FR 5253—Forest Biometry (3)
- FR 5255—Forest Resource Survey Design (3)
- FR 5257—Recreation Land Policy (3)
- FR 5259—Analysis of Outdoor Recreation Behavior (3)
- FR 5262—Remote Sensing of Natural Resources (4)
- FR 5264—Quantitative Techniques in Forest Management (3)
- FR 5500—Urban Forest Management (3)  
or FR 5408—Forestry in the Urban Environment (3)

### *Biology*

- Ent 5050—Forest Entomology (4)
- FR 1122—Introductory Soil Science (4)
- FR 3103—Meteorology and Climatology for Natural Resource Managers (2)
- FR 5101—Field Silviculture (4) (*Cloquet*)
- FR 5114—Forest Hydrology (3)
- FR 5115—Forest Hydrology, Field Applications (2) (*Cloquet*)
- FR 5120—Introductory Tree Physiology and Genetics (4)
- FR 5121—Tree Physiology Laboratory (1)
- FR 5126—Silviculture: Soil-Site Relationships (2) (*Cloquet*)
- FR 5140—Application of Silviculture in North American Forest Types (3)
- FR 5152—Forest Genetics (3)
- FR 5153—Advanced Forest Hydrology (4)
- FR 5215—Forest Fire Management (2)
- FR 5217—Field Techniques for Prescribed Burning (1)
- FR 5218—Field Techniques for Forest Fire Control (1)
- FR 5458—Water Quality Management: Ecosystem Approaches (4)
- PIPa 5050—Forest Pathology (4)

## Renewable Resource Science

This flexible curriculum provides an individualized education in the natural, social, and managerial sciences relevant to renewable natural resources. The curriculum is designed to prepare students for graduate study and subsequent employ-

ment in research, teaching, resource analysis, and related fields. This degree also enables individuals to pursue careers as forest managers.

Renewable Resource Science students should be academically excellent. They are expected to maintain a minimum grade point average of 3.00. Specializations are offered in natural science, social science, and managerial science.

## Natural Science

**Freshman Year**—40 required credits

- Biol 1009—General Biology (5)
- Biol 1103—General Botany (5)
- Chem 1004—General Principles of Chemistry (5)
- Chem 1005—General Principles of Chemistry (5)
- Math 1211—Calculus I (5)
- Math 1221—Calculus II (5)
- Math 1231—Calculus III (5)
- Rhet 1101—Writing to Inform and Persuade (4)
- Rhet 1104—Library Laboratory (1)
- Electives and liberal education requirements

**Sophomore Year**—33 required credits

- AgEc 1020—Principles of Macroeconomics (5)
- Chem 3301—Elementary Organic Chemistry I (4)
- Chem 3305—Elementary Organic Chemistry Lab I (2)
- CSci 3101—A FORTRAN Introduction to Computer Programming (4)
- ForP 1301—Wood as a Raw Material (4)
- Phys 1041—Introductory Physics (4)
- Phys 1042—Introductory Physics (4)
- Phys 1045—Introductory Physics Laboratory (1)
- Phys 1046—Introductory Physics Laboratory (1)
- Rhet 1222—Public Speaking (4)
- Electives and liberal education requirements

**Itasca Session**—6 required credits

This summer term is to be taken between the freshman and sophomore, or sophomore and junior, years.

- FR 3100—Minnesota Plants (2)
- FR 3101—Field Forest Ecology (3)
- FR 3201—Field Forest Measurements (1)

**Junior Year**—15 required credits

- FR 1100—Dendrology (4)
- FR 5100—Silviculture (3)
- FR 5212—Natural Resources Inventory (3)
- Stat 5021—Statistical Analysis (5)
- Electives and liberal education requirements

**Senior Year**—27 required credits

*Fall Quarter—Cloquet Session*

- FR 5101—Field Silviculture (4)
- FR 5115—Forest Hydrology, Field Applications (2)
- FR 5126—Silviculture: Soil-Site Relationships (2)

FR 5220—Remote Sensing, Forest Resources Inventory (4)

FR 5236—Forest Recreation Planning (1)

FR 5248—Harvesting and Engineering (3)

FW 3167—Techniques of Forest Wildlife Management (2)

*Winter and Spring Quarters—On Campus*

FR 5226—Forest Economics and Planning (5)

Rhet 3562—Writing in Your Profession (4)

Electives and liberal education requirements

**Total Graduation Requirements**—192 credits

Required courses listed above (121 credits), liberal education requirements in categories C and D (11 credits), and electives (60 credits).

## Social and Managerial Sciences

**Freshman Year**—30 required credits

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

Math 1211—Calculus I (5)

Math 1221—Calculus II (5)

Math 1231—Calculus III (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1)

Electives and liberal education requirements

**Sophomore Year**—29 required credits

AgEc 1020—Principles of Macroeconomics (5)

AgEc 1030—Principles of Microeconomics (4)

Biol 5041—Ecology (4)

CSci 3101—A FORTRAN Introduction to Computer Programming (4)

ForP 1301—Wood as a Raw Material (4)

FR 1100—Dendrology (4)

Rhet 1222—Public Speaking (4)

Electives and liberal education requirements

**Itasca Session**—6 required credits

This summer term is to be taken between the freshman and sophomore, or sophomore and junior, years.

FR 3100—Minnesota Plants (2)

FR 3101—Field Forest Ecology (3)

FR 3201—Field Forest Measurements (1)

**Junior Year**—16 required credits

FR 5100—Silviculture (3)

FR 5212—Natural Resources Inventory (3)

Stat 5021—Statistical Analysis (5)

Stat 5301—Designing Experiments (5)

or Stat 5302—Applied Regression Analysis (5)

Electives and liberal education requirements

**Senior Year**—12 required credits

FR 5226—Forest Economics and Planning (5)

FR 3232—Management of Recreational Lands (3)

Rhet 3562—Writing in Your Profession (4)

Electives and liberal education requirements

**Total Graduation Requirements**—192 credits

Required courses listed above (93 credits), liberal education requirements in categories C and D (10 credits), and electives (89 credits).

## Recreation Resource Management

The objectives of this curriculum are to prepare students for careers in the comprehensive planning and management of land and water for recreation, with emphasis on natural non-urban areas; for participation in government resource-oriented recreation programs as well as private planning and consulting; and for graduate work in resource planning and management. The traditional core courses usually required for federal forester positions are listed under the Federal Forestry option.

### Required Courses

**Freshman Year**—47-51 required credits

Biol 1009—General Biology (5)

Biol 1103—General Botany (5)

Chem 1001—Chemical Principles and Covalent Systems (5)

or Chem 1004—General Principles of Chemistry (5)

Chem 1002—Chemical Principles and Covalent Systems (5)

or Chem 1005—General Principles of Chemistry (5)

FR 1201—Conservation of Natural Resources (3)

Geo 1001—Physical Geology (5)

Geog 1401—Physical Geography (5)

or Geog 1301—Human Geography (5)

Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)

Math 1111—College Algebra and Analytic Geometry (5)

or Math 1131—Finite Mathematics (5)

or Math 1201—Pre-Calculus (5)

Rhet 1101—Writing to Inform and Persuade (4)

Rhet 1104—Library Laboratory (1)

Soils 1122—Introductory Soil Science (4)

Electives and liberal education requirements

**Sophomore Year**—50-53 required credits

AgEc 1020—Principles of Macroeconomics (5)

AgEc 1030—Principles of Microeconomics (4)

Biol 5041—Ecology (4)

FR 1100—Dendrology (4)

LA 1024—Landscape Theory (4)

or LA 1031—Introduction to Landscape Architecture (4)

or LA 1001—Landscape Architecture—The Design of Environments (2)

Math 1142—Short Calculus (5)

or Math 1211—Calculus I (5)

## Baccalaureate Programs

Phys 1001—The Physical World (4)  
and Phys 1005—Physics Laboratory (1) (Students who have completed high school physics with a B or better may be exempt, but must first see their adviser)

Pol 1041—Contemporary Political Ideologies (4)  
or Pol 1031—Selected Problems in American Public Policy (4)  
or Pol 1001 American Government and Politics (5)

Psy 1001—General Psychology (5)  
Rhet 1151—Writing in Your Major (4)  
Rhet 1222—Public Speaking (4)

Soc 1001—Introduction to Sociology (4)  
Electives and liberal education requirements

**Junior Year**—32-36 required credits

AgEc 3610—Community Resource Development (4)  
or AgEc 5620—Regional Economic Analysis (4)

FR 5114—Forest Hydrology (3)  
FR 3232—Management of Recreational Lands (3)  
FW 3052—Introduction to Fisheries and Wildlife (3)  
FR 3300—Elements of Surveying (2) (offered at the Cloquet Forestry Center)

or Geog 3511—Introduction to Cartography (5)  
Rec 3550—Park and Recreation Administration (5)  
or Rec 3530—Recreation, Park Areas, and Facilities (5)

Rhet 3254—Advanced Public Speaking (4)  
or Rhet 3266—Communication, Discussion in Small Group Decision Making (4)

Rhet 3562—Writing in Your Profession (4)

Stat 3011—Statistical Analysis (4)  
or Stat 5021—Statistical Analysis (5)  
or Soc 3801—Sociological Methods I: Descriptive Statistics (5)

Electives and liberal education requirements

**Senior Year**—27-28 required credits

EBB 5014—Ecology of Plant Communities (5)  
or EBB 5016—Ecological Plant Geography (5)

FR 5200—Aerial Photo Interpretation (3)  
FR 5233—Principles of Outdoor Recreation Design and Planning (4)

FR 5259—Analysis of Outdoor Recreation Behavior (3)  
or FR 5257—Recreation Land Policy (3)

FR 5269—Interdisciplinary Seminar I (4)<sup>1</sup>

FR 5270—Interdisciplinary Seminar II (4)<sup>1</sup>

Soc 5401—Social Organizations (5)  
or Soc 5661—Rural Community Analysis (4)  
or Jour 5501—Communication and Public Opinion I (4)

Liberal education requirements

**Recommended Electives**

FR 5110—Forestry Applications of Microcomputers (3)

or other computer course

FR 5130—Geographic Information Systems in Natural Resource Planning (2)

Hort 1021—Plant Materials I (4)  
or Hort 1022—Plant Materials II (4)

Bot 1009—Minnesota Plant Life (4)

Rhet 5170—Managerial Communications (4)  
AgEc 1250—Principles of Accounting (5)\*  
AgET 3030—Introduction to Problem Solving with Computers (4)

or CSci 3104—Introduction to Pascal Programming (4)

or CSci 3101—A FORTRAN Introduction to Pascal Programming (4)\*

or GC 3572—Computer Applications and Programming Applied to Forestry (5)

BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)\*

Mgmt 3001—Fundamentals of Management (4)\*

Mgmt 3002—Psychology in Management (4)

Pol 1001—American Government, Politics (5)

Rec 5250—Financing Leisure Services (3)\*

Soc 1651—Rural Sociology (4)

FR 5231—Range Management (3)\*

**Total Graduation Requirements**—192 credits  
Required courses listed above (156-168 credits), liberal education requirements (8 credits), and electives (24-26 credits).

### Options

In addition to the required courses listed by year above, students may elect one of the following options (with the consent of their adviser and the Recreation Resource Management faculty).

### Law Enforcement

Approved internship proposal (8)

or FR 5269, 5270 (4,4)

Rec 5250—Financing Leisure Services (3)

or FR 5257—Recreation Land Policy (3)

or FR 5259—Analysis of Outdoor Recreation Behavior (3)

GC 3211—Statutory Definitions of Law: Minnesota Criminal Code (4)

GC 3212—Criminal Procedure (4)

GC 3614—Psychology of Crisis Intervention (4)

Soc 3101—Introduction to American Criminal Justice (4)

Soc 5102—Criminology (4)

Soc 5125—Policing in American Society (4)

Soc 5141—Juvenile Delinquency (4)

Soc 5104—Community-Based Corrections (4)

Soc 5147—Sociology of Mental Illness and Health (4)

or Soc 5148—Criminal Psychopathology (4)

**Federal Forestry** (minimum Civil Service qualifications)

FR 3100—Minnesota Plants (2) (*Itasca*)

FR 3101—Field Forest Ecology (3) (*Itasca*)

FR 3201—Field Forest Measurements (1) (*Itasca*)

FR 5212—Natural Resources Inventory (3)

FR 5226—Forest Economics and Planning (5)

PIPa 5050—Forest Pathology (4)

<sup>1</sup>An approved internship may be substituted for the seminar in the Law Enforcement or Recreation Site Management options.

\*Required for Recreation Site Management option.

- FR 5114—Forest Hydrology (3)  
 FR 5215—Forest Fire Management (2)

**Recreation Site Management**

- Approved internship proposal (8)  
 or FR 5269, 5270 (4,4)  
 FR 5257—Recreation Land Policy (3)  
 FR 5259—Analysis of Outdoor Recreation Behavior (3)  
 Soc 5161—Criminal Law in American Society (4)  
 Starred recommended electives under Senior Year above (23)

**Urban Forestry**

Urban forestry involves planning and managing vegetation and associated natural resources in and near urban communities—along streets and in parks, greenbelts, and open spaces. Urban foresters help communities plan and design their urban forests, supervise tree selection and planting, design insect and disease protection programs, and provide related services. City governments are the principal employers, as well as state and federal forestry agencies, forestry consulting firms, tree service firms, and utility companies. Graduates are also qualified for traditional professional forestry positions, including those in the federal government.

- Freshman Year**—34-38 required credits  
 Biol 1009—General Biology (5)  
 Biol 1103—General Botany (5)  
 Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)  
 Math 1111—College Algebra and Analytic Geometry (5)  
 Math 1142—Short Calculus (5)  
 Phys 1001—The Physical World (4)  
 Phys 1005—Physics Laboratory (1)  
 Rhet 1101—Writing to Inform and Persuade (4)  
 Rhet 1104—Library Laboratory (1)  
 Rhet 1222—Public Speaking (4)  
 Electives and liberal education requirements

- Sophomore Year**—44-46 required credits  
 AgEc 1020—Principles of Macroeconomics (5)  
 AgEc 1250—Principles of Accounting (5)  
 AgET 3030—Introduction to Problem Solving With Computers (4)  
 or CSci 3101—A FORTRAN Introduction to Computer Programming (4)  
 or CSci 3102—Introduction to Pascal Programming (4)

- or GC 3572—Computer Applications and Programming Applied to Forestry (5)  
 Chem 1001—Chemical Principles and Covalent Systems (5)  
 or Chem 1004—General Principles of Chemistry (5)  
 Chem 1002—Chemical Principles and Covalent Systems (5)  
 or Chem 1005—General Principles of Chemistry (5)  
 Soils 1122—Introductory Soil Science (4)  
 Hort 1021—Woody Plant Materials (5)  
 Hort 1373—Arboriculture (3) (*currently offered at Waseca campus*)  
 Rhet 1151—Writing in Your Major (4)  
 Stat 3011—Statistical Analysis (4)  
 or Stat 5021—Statistical Analysis (5)  
 Electives and liberal education requirements

**Itasca Session**—6 required credits  
 This summer term is to be taken between the freshman and sophomore, or sophomore and junior, years.

- FR 3100—Minnesota Plants (2)  
 FR 3101—Field Forest Ecology (3)  
 FR 3201—Field Forest Measurements (1)  
**Junior Year**—33 required credits and recommended electives  
 ForP 1301—Wood as a Raw Material (4)  
 FR 1100—Dendrology (4)  
 FR 3104—Forest Ecology (3)  
 FR 5100—Silviculture (3)  
 FR 5120—Introductory Tree Physiology and Genetics (4)  
 FR 5212—Natural Resources Inventory (3)  
 FR 5233—Principles of Outdoor Recreation Design and Planning (4)  
 or Hort 3030—Landscape Design of Residential and Small Commercial Sites (4)  
 PlPa 5050—Forest Pathology (4)  
 Rhet 3562—Writing in Your Profession (4)  
 Electives and liberal education requirements

- Senior Year**—28 required credits and recommended electives  
 Ent 5050—Forest Entomology (4)  
 FR 5200—Aerial Photo Interpretation (3)  
 FR 5226—Forest Economics and Planning (5)  
 FR 5241—Natural Resource Management: Political and Administrative Processes (3)  
 or FR 5501—Urban Forest Administration (3)  
 FR 5500—Urban Forest Management (3)  
 Hort 5046—Nursery Management and Production I (4)  
 Hort 5047—Nursery Scheduling and Enterprise Development (2)  
 Hort 5048—Nursery Management and Production II (4)  
 Liberal education requirements

- Recommended Electives** (must choose at least 16 credits)  
 BLaw 3058—Introduction to Law, the Law of Contracts and Sales Contracts (4)

## Baccalaureate Program

---

- Ent 5210—Integrated Pest Management (5)  
FW 3052—Introduction to Fisheries and Wildlife (3)  
ForP 1303—Wood Structure and Identification (2)  
FR 3103—Meteorology and Climatology for Natural  
Resource Managers (2)  
FR 3232—Management of Recreational Lands (3)  
FR 5114—Forest Hydrology (3)  
FR 5121—Tree Physiology Laboratory (1)  
FR 5240—Natural Resource Policy and  
Administration (3)  
Hort 1036—Plant Propagation (4)  
Hort 1100—Biology of Horticultural Production (4)  
Hort 3072—Turf Management (4)  
Hort 5026—Landscape Management (5)  
IR 3010—The Individual in the Organization (4)  
or IR 3002—Personnel and Industrial  
Relations (4)  
or Jour 5549—Public Relations (4)  
LA 1031—Introduction to Landscape Architecture (4)  
Mgmt 3001—Fundamentals of Management (4)  
PA 5231—Strategy and Tactics in Project Planning  
(4)  
Pol 1027—Urban Politics (4)

**Total Graduation Requirements**—192 credits  
Required courses listed above (145-151 credits),  
liberal education requirements in categories C and D  
(11 credits), and electives (30-36 credits).



# Course Descriptions



# Course Descriptions

## Course Numbering and Symbols—

Courses primarily for freshmen and sophomores are numbered 1000 through 1998; for juniors and seniors, 3000 through 3998; for juniors, seniors, and graduate students, 5000 through 5998. Courses numbered 8000 and above are restricted to students registered in the Graduate School.

The following symbols are used throughout the course descriptions:

§ Credit will not be granted if the equivalent course listed after this symbol has been taken for credit.

¶ Concurrent registration is allowed (or required) in the course listed after this symbol.

† All courses preceding this symbol must be completed before credit is granted for any quarter of the sequence.

△ Registration Override Permit, completed and signed by the unit offering the course, is required for registration.

# Registration Override Permit, completed and signed by the instructor, is required for registration.

When no abbreviated department prefix precedes the course number listed as a prerequisite, that prerequisite is in the same department as the course being described.

## Fisheries and Wildlife (FW)

### 1101. ETHICS AND VALUES IN RESOURCE MANAGEMENT. (3 cr)

Coverage of various aesthetic, economic, and ecological values of wildlife and fisheries resources. Short field exercises and class discussions on process of resource management and ethics of such controversies as sport harvest, subsistence harvest, and native peoples' harvest rights.

### 3052. INTRODUCTION TO FISHERIES AND WILDLIFE. (3 cr)

Introduction to general ecological principles applied to management of fish and wildlife populations and their habitats; survey of legislation, agencies, and policy affecting vertebrate populations; natural history of important Minnesota game and nongame vertebrates.

### 3167. TECHNIQUES OF FOREST WILDLIFE

MANAGEMENT. (2 cr; △; offered at Cloquet) Biology and management of important forest wildlife species; methods of evaluating forest wildlife populations and habitats.

### 3600. FISHERIES AND WILDLIFE FIELD

TECHNIQUES. (5 cr; prereq FW 3052; at Itasca) An introduction to various field techniques and skills; planning and implementing field projects; data collection and analysis using microcomputers; written reports and a field journal.

### 5129. MAMMALOLOGY. (5 cr, §EBB 5129; prereq Biol 1106 or 3011 or #)

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.

### 5278. SPECIAL LECTURES IN WILDLIFE. (Cr ar; offered when feasible)

Lectures and/or laboratories in special fields of wildlife biology given by a visiting scholar or regular staff member.

### 5279. SPECIAL LECTURES IN FISHERIES. (Cr ar; offered when feasible)

Lectures and/or laboratories in special fields of fisheries biology given by a visiting scholar or regular staff member.

### 5393. SPECIAL PROBLEMS IN FISHERIES BIOLOGY. (Cr ar; prereq #)

Individual field, library, and laboratory research in various lines of fisheries biology.

### 5398. SPECIAL PROBLEMS IN WILDLIFE BIOLOGY. (Cr ar; prereq #)

Individual field, library, and laboratory research in various areas of wildlife biology.

### 5455. AQUACULTURE. (4 cr; prereq Biol 1009, 1103, 1106 or equiv, Chem 1001-2 or 1004-5 or equiv or #; offered alt yrs)

Role of aquaculture in resource management and world food production; institutional and economic considerations; principles of husbandry of aquatic organisms; interactions between fish metabolism and water quality; nutrition and energetics; fish health and genetics.

### 5456. FIELD ECOLOGY OF FISHES. (5 cr; prereq introductory course in ecology; offered at Itasca)

Ecological studies, observation, and identification of fishes in their natural habitat including life histories, reproduction, behavior, food habits, interrelationships with other fishes, and general habitat requirements. Collection methods in streams and lakes.

### 5459. ENVIRONMENTAL PHYSIOLOGY OF FISHES. (3 cr; prereq Biol 5041 and EBB 5136 or equiv)

Examination of environmental factors such as temperature, oxygen, salinity, toxic substances and food; effects on fish physiology with an emphasis on bioenergetics.

**5601. ASSESSMENT AND MANAGEMENT OF VERTEBRATE POPULATIONS.** (5 cr; prereq 1101, 3052, FR 1201)

Conceptual models of populations, description of population characteristics, and computer-assisted estimation of population parameters for the purpose of management. Students select either a fisheries or wildlife laboratory.

**5602. FISHERIES AND WILDLIFE PLANNING AND POLICY.** (4 cr; prereq 3052)

Quantitative management methods such as linear programming, other decision-making methods. Extensive use of computer exercises. Policy and structure of management agencies.

**5603. WILDLIFE HABITAT RELATIONSHIPS AND MANAGEMENT.** (3 cr; prereq 5601 or #)

Management of habitats for birds and mammals based on their environmental interactions and requirements. Emphasis on regional settings and practices. Lab will include team projects and demonstrations.

**5604. FISHERY MANAGEMENT IN INLAND WATERS.** (3 cr; prereq Biol 5041 or #)

Fundamental concepts and applications of fisheries management; pond and reservoir fisheries; lake and stream investigations; rehabilitation; lake fisheries management; warm-water and trout stream management.

**5610. RENEWABLE NATURAL RESOURCES AND PUBLIC POLICY.** (2 cr; offered alt yrs)

Effect of public policy on leading issues in renewable natural resources. Primary focus is on decision-making of U.S. Congress, secondary is on state and county government. Case studies. Role playing and development of practical skills.

**5701, 5702, 5703<sup>+</sup>. SENIOR PROBLEM.** (3 cr, 1/4tr; prereq FW sr or grad, or #)

Three-quarter course providing problem-solving training. Management problem identification and analysis design (fall), information and data gathering and analysis (winter), and oral and written problem reporting (spring). Problem selection influenced by guest speakers, resource agency contacts, and group discussions; topic selected is a contemporary fisheries and wildlife management issue.

**5890. RESEARCH PROBLEMS AT ITASCA IN FISHERIES AND WILDLIFE.** (Cr ar; prereq #)

Undergraduate students may develop a short-term research project during one or both summer terms.

**For Graduate Students Only**

(For description, see *Graduate School Bulletin*)

**8200. SEMINAR**

**8364. RESEARCH IN FISHERIES BIOLOGY**

**8377. RESEARCH IN WILDLIFE BIOLOGY**

**8448. FISHERY SCIENCE**

**8451. PRODUCTION BIOLOGY OF FISHERY ENVIRONMENTS**

**8452. GENETICS AND DEMOGRAPHY IN FISHERIES AND WILDLIFE MANAGEMENT**

**8459. STREAM AND RIVER ECOLOGY**

**8574. WILDLIFE MANAGEMENT: UPLAND GAME**

**8575. WILDLIFE MANAGEMENT: WATER-FOWL**

**8576. WILDLIFE MANAGEMENT: LARGE MAMMALS**

**8579. ECOSYSTEM ANALYSIS AND SIMULATION: A NUMERICAL APPROACH**

**Forest Products (ForP)**

**1001. FOREST PRODUCTS ORIENTATION.** (1 cr)

Information about curricula offerings, specializations, career options, CLE requirements, financial aid, scholarships, summer employment, and other student related concerns.

**1100. WOOD IN AMERICAN LIFE.** (3 cr; prereq Math 1111 or #)

Past, present, and future uses of wood. Types of products, quantities of wood used, import/export balances, forest resource situation, prospects of substitution for wood and environmental trade-offs, wood conversion efficiency and impacts on quantities needed, wood for energy, and proper use of wood products.

**1102. LEADERSHIP AND MANAGEMENT SKILLS FOR COLLEGE OF FORESTRY STUDENTS.** (2 cr; S-N only)

Discussions and classroom exercises on management, planning, directing, controlling, and organization; group problem solving, the implications of organizational change, time management, and career planning and development.

**1301. WOOD AS A RAW MATERIAL.** (4 cr)

The physical and chemical nature of solid wood and wood fiber as it relates to the requirements of major wood-based industries. World supply and consumption. Weekly demonstration laboratories dealing with structure and properties of wood and with manufacture of solid, particle, and fiber products.

**1303. WOOD STRUCTURE AND IDENTIFICATION.** (2 cr; prereq 1301 or #)

Features of wood structure vital to identifying wood of various tree species and understanding the physical properties of wood. Lecture and laboratory.

**3300. WOOD INDUSTRY TOURS.** (2 cr; prereq 1301, jr or sr standing, or #)

A five-day bus tour consisting of visits to a dozen or more manufacturers representing a broad cross section of the wood-using industry. Scheduled during spring quarter break.

## Course Descriptions

**3301. INDUSTRIAL ASSIGNMENT.** (1 cr; prereq FP cooperative education student; S-N)  
Evaluation based on formal report written by student at end of each quarter or work assignment.

**3303. FOREST PRODUCTS MARKETING.** (3 cr)  
Survey of marketing in the forest products industry, including review of basic marketing concepts and terminology.

**3310. WOOD-FRAME BUILDING SYSTEMS AND MATERIALS.** (4 cr; prereq Phys 1001 or equiv)  
Light frame construction methods and material selection with an emphasis on wood-based products and components. Basic wood properties and products, cost estimating, building codes, construction practices, heat loss, and residential construction terminology.

**3312. BUILDING MATERIALS ESTIMATING.** (2 cr)  
Modern methods of estimating quantity, grade, and specifications of building materials for light frame construction.

**3325. DIRECTED STUDY EXPERIENCE.** (1-5 cr; prereq #)  
Opportunity to pursue experiences not available under independent study or extra credit registration. The student develops, in consultation with the adviser for the project, a prospectus, and completes progress reports and a final report on his or her project.

**3361. INTRODUCTION TO ADHESIVES.** (3 cr; prereq BioC 1301, Phys 1042; offered alt even yrs)  
Scope and utility of adhesive applications. Fundamental nature of adhesion; ideal adhesive joint. Adhesive polymers. Fabrication and mechanical properties of adhesively bonded assemblies.

**5300. WOOD-FLUID RELATIONSHIPS.** (3 cr; prereq 1301)  
Moisture in wood and its relationship to density and specific gravity, shrinking and swelling, electrical properties, strength properties, thermoconductivity, sorption isotherms, dimensional stabilization, permeability and diffusion. Lectures only.

**5301. MECHANICAL PROPERTIES.** (3 cr; prereq 1301 or #)  
Basic mechanics and strength of materials as applied to wood products.

**5302. WOOD CHEMISTRY I.** (3 cr; prereq Chem 3302)  
Molecular structure of wood cell wall. Structures, properties and reactions of monosaccharides and derivatives; oligosaccharides. Structure, properties, and biogenesis of cellulose; cellulose derivatives; comparison with starch.

**5303. WOOD DETERIORATION.** (3 cr; prereq 1301 or #)  
Deterioration of wood and wood products by bacteria, fungi, insects, marine organisms, fire, and weathering; methods of preservation and preservatives used. Lecture and laboratory.

**5304. WOOD DRYING AND PRESERVATION PROCESSES.** (4 cr; prereq 5300, 5303)  
Examination of materials, equipment, processes, and technical considerations inherent in the industrial drying and/or preservative treatment of wood products. Lectures, laboratory exercises, and plant visits.

**5305. PULP AND PAPER TECHNOLOGY.** (4 cr; prereq 5300 or #)  
Pulping processes, fiber refining and processing, manufacture of paper; fiber and paper properties; recycling of paper; and water requirements and effluent treatment. Lecture and laboratory.

**5306. ANALYSIS OF PRODUCTION SYSTEMS.** (3 cr; prereq 1301 or #, 3300 recommended)  
Engineering and economic analysis of manufacturing and distribution systems for wood-based products. Material balances, equipment selection, economic analysis, and presentation techniques.

**5307. WOOD-BASE PANEL TECHNOLOGY.** (4 cr; prereq 5300, 5301 or #)  
Design, manufacture, properties, and applications of structural and nonstructural wood-base panels. Adhesives and their application in the panel industry. Lecture and laboratory.

**5310. PULP AND PAPER PROCESS LABORATORY.** (3 cr; prereq 5305 or #)  
Chemical and mechanical pulping, pulp preparation, secondary fiber, de-inking, wet end additives. Laboratory problems and exercises supplemented by lectures.

**5312. PULP AND PAPER PROCESS CALCULATIONS.** (4 cr; prereq ME 3301 or #; recommended: CE 3400, ChEn 5101, CSci 3101 or AgET 3030)  
Chemical and physical process calculations; steady and unsteady state material and energy balances applied to pulping and papermaking processes; system calculations; introduction to computer-aided material balances.

**5313. PULP AND PAPER PROCESS OPERATIONS.** (5 cr; prereq 5305, 5312, 5353, CE 3400, ME 3301, or #; recommended: ChEn 5102 or ME 5342)  
Application of the principles of momentum, heat, and mass transfer to unit operations in the pulp and paper industry; fluid transport, filtration, sheet formation, sedimentation, drainage, pressing, heat exchange, evaporation, washing, bleaching, humidification and drying, chemical and energy recovery. Computer simulation of multiple-stage systems.

**5315. PAPER ENGINEERING LABORATORY.** (2 cr; prereq 5305, 5310 or #5310, 5312, or #; recommended: 5306)  
Experiments that illustrate and apply the principles of momentum, heat, and mass transfer. Operation and performance optimization of pilot-plant paper machine. Process engineering studies of industrial production systems.

**5316. COATED PRODUCT DEVELOPMENT.** (2 cr; prereq 5359)

Coating process and products (primarily paper); theory, techniques, and procedures for formulating and applying coatings; properties and uses of coated products.

**5317. INSTRUMENTATION AND PROCESS CONTROL.** (2 cr; prereq 5312)

Measurements, analog and digital control systems, instrumentation, computers, computer control, system maintenance, fluidics, special applications.

**5331. UNDERGRADUATE SEMINAR.** (2 cr; prereq ForP major; must be taken before sr yr)

Career planning, resumé preparation, discussion of job interviewing, and practice of technical presentation.

**5350. WOODY TISSUE MICROTÉCHNIQUE.** (2 cr; offered when feasible)

Use of sliding and rotary microtomes, maceration, differential staining, and special techniques in preparation of woody tissue for microscopic study. Laboratory.

**5353. WOOD CHEMISTRY II.** (3 cr; prereq 5302)

Composition, distribution, and structures of hemicelluloses and their interactions with cellulose. Biosynthesis, structure, and analytical degradation of lignins. Delignification of wood. Pulp bleaching chemistry. Lignin biodegradation.

**5355. MECHANICS AND STRUCTURAL DESIGN WITH WOOD PRODUCTS.** (4 cr; prereq 5301)

Mechanical behavior of lumber, plywood, and particleboard as applied to structural considerations in building construction. Lecture and laboratory.

**5356. ADVANCED FOREST PRODUCTS MARKETING.** (3 cr; prereq 3303 or #)

Marketing and market analysis, sales, and retail and wholesale distribution of forest products. Lectures and case studies.

**5359. SURFACE AND COLLOID CHEMISTRY OF PAPERMAKING.** (3 cr; prereq 5361 or #, Chem 3302, Chem 5520)

Principles of surface and colloid chemistry applied to basic problems in pulp and paper manufacturing operations and product uses.

**5360. STRUCTURE AND PROPERTIES OF IMPORTANT TROPICAL WOODS.** (2 cr; prereq 1303)

Structure and methods of identification of commercially important tropical woods. Properties and favored uses for these woods.

**5361. ADHESION AND ADHESIVES.** (3 cr; prereq Chem 3302, Chem 5520)

Scope and utility of adhesive applications. Fundamental nature of adhesion; ideal adhesive joint. Conformations of linear polymers. Statistical thermodynamics and polymer adsorption onto adherend surface. Adhesives in common use. Mechanical properties of adhesive joints.

**5401. SENIOR TOPICS.** (Cr ar; prereq sr, #)

Independent study in a field of interest to a forestry major. Planned with adviser.

**5405. PAPER IN TODAY'S WORLD.** (3 cr, \$5305; offered through CEE)

Intended primarily for elementary and secondary school teachers although other interested students may enroll. Successful completion of the course will enable a teacher to prepare a teaching unit on pulp and paper for use in an elementary, junior high, or senior high school science class. *Not open to Forest Products majors.*

**5410. USE OF WOOD MATERIALS IN BUILDING CONSTRUCTION.** (4 cr; offered through CEE)

For architects, builders, contractors, building materials sales people, and do-it-yourselfers. Emphasizes the nature, properties, limitations, and proper use of wood products. *Not open to Forest Products majors.*

**For Graduate Students Only**

(For description, see *Graduate School Bulletin*)

**8300. RESEARCH PROBLEMS**

**8301. RESEARCH PROBLEMS**

**8302. RESEARCH PROBLEMS**

**8303. ADVANCED TOPICS IN PANEL PRODUCTS TECHNOLOGY**

**8304. ADVANCED TOPICS IN WOOD DRYING**

**8306. SEMINAR: FOREST PRODUCTS**

**8307. ADVANCES AND METHODS IN FOREST PRODUCTS PATHOLOGY AND PRESERVATION**

**Forest Resources (FR)**

**1001. FOREST RESOURCES ORIENTATION.** (1 cr)

Information about curricula offerings, areas of emphasis, CLE requirements, and summer job and internship programs.

**1100. DENDROLOGY.** (4 cr; prereq Biol 1103)

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.

**1102. LEADERSHIP AND MANAGEMENT SKILLS FOR COLLEGE OF FORESTRY STUDENTS.** (2 cr; S-N only)

Discussions and classroom exercises on management, planning, directing, controlling, and organization; group problem solving, the implications of organizational change, time management, and career planning and development.

## Course Descriptions

**1122. INTRODUCTORY SOIL SCIENCE.** (4 cr; prereq Chem 1001 or 1004)

Basic physical, chemical, and microbiological properties of soil. Soil genesis, classification, and principles of soil fertility. Lectures and laboratory.

**1200. INTRODUCTION TO FOREST RESOURCES.** (3 cr)

Multiple forest resources and their management. History, policy, and current issues in forest resources. Lectures and laboratory (including field trips).

**1201. CONSERVATION OF NATURAL RESOURCES.** (3 cr)

Development of thought on natural resource conservation in the United States. Renewable resources and their management problems; resource conservation and environmental management related to basic ecological principles.

**1202. FARM AND SMALL WOODLANDS FORESTRY.** (3 cr for non-forestry majors, 2 cr for majors [3 cr with paper]; prereq for majors 1100 or 11100)

Status and problems of the small woodland owner. Factors influencing tree growth. Cutting practices for and marketing products of small woodlands. Establishment and care of plantations, shelterbelts, and windbreaks. Field trips.

**1203. INTRODUCTION TO MINNESOTA'S NATURAL RESOURCES.** (3 cr, §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.

**3100. MINNESOTA PLANTS.** (1 or 2 cr; prereq Biol 1103,  $\Delta$ ; given at Itasca)

Identification of plants as related to habitat.

**3101. FIELD FOREST ECOLOGY.** (3 cr; prereq Chem 1001 or Chem 1004,  $\Delta$ ; given at Itasca)

Field examination of succession, soils, silvical characteristics, tree classification, stand structure, and the ecology of regeneration.

**3102. SOUTHERN FOREST RESOURCE TOUR.** (1 cr; prereq FR jr or sr or #; offered alt odd yrs)

One-week field tour of selected southern forest industries and public forest management agencies. Walnut production, southern pine silviculture, hardwood utilization, various mill tours. Discussions, paper.

**3103. METEOROLOGY AND CLIMATOLOGY FOR NATURAL RESOURCE MANAGERS.** (2 cr; prereq Phys 1001, Phys 1005 or #)

Fundamentals of meteorology and climatology as applied to wildland resource management.

**3104. FOREST ECOLOGY.** (3 cr; prereq Itasca session)

Ecological concepts and principles as a basis for silvicultural practice. The forest as an ecosystem.

**3201. FIELD FOREST MEASUREMENTS.** (1 cr; prereq Math 1008,  $\Delta$ ; given at Itasca)

Introduction to land survey, tree and stand measurement, and basic forest sampling techniques.

**3225. DIRECTED STUDY EXPERIENCE.** (1-5 cr; prereq #)

Opportunity to pursue experiences not available under independent study or extra credit registration. The student develops, in consultation with the adviser for the project, a prospectus, and completes progress reports and a final report on his or her project.

**3232. MANAGEMENT OF RECREATIONAL LANDS.** (3 cr)

Recreational use of the forest and associated land and water. Policy problems arising from recreational demands.

**3250. ROLE OF RENEWABLE NATURAL RESOURCES IN DEVELOPING COUNTRIES** (2 cr)

International perspective on important resource issues, including integration of natural resource, social and economic considerations. Overviews of issues and case studies.

**3300. ELEMENTS OF SURVEYING.** (2 cr; prereq Math 1008 or high school trigonometry,  $\Delta$ ; given at Cloquet)

Basic concepts of elementary plane surveying for use in natural resource assessment. Introduction to public land and boundary surveys and geographic information systems. Lectures and labs.

**5100. SILVICULTURE.** (3 cr; prereq Itasca session, 1100, 3104, or #)

Introduction to silvics, forest regeneration and site preparation techniques, intermediate silvicultural practices, and silvicultural systems.

**5101. FIELD SILVICULTURE.** (4 cr; prereq 5100,  $\Delta$ ; given at Cloquet)

Regeneration surveys, plantation inspection, site preparation, and reforestation prescription. Practice in marking for thinning and determining effect on stands. Compartment examination and prescription. Written and oral reports.

**5103. ADVANCED FOREST TREE BIOLOGY.** (3 cr; prereq FR 3104)

Current applications and research in forest tree biology.

**5106. SENIOR SILVICULTURE SEMINAR.** (2 cr [3 cr with research paper]; prereq sr, 5100, or #)

Students prepare, present, and critique seminars on silvicultural topics of interest. Guest speakers.

**5110. FORESTRY APPLICATIONS OF MICROCOMPUTERS.** (3 cr; prereq Stat 3011 and AGET 3030 or equiv)

Use of commercial microcomputer software to solve forestry problems, applications programming, workings of hardware components. Hands-on access to microcomputers as well as lectures.

**5114. FOREST HYDROLOGY.** (3 cr; prereq Itasca session, 3103, Geo 1001 or #)

Introduction to the hydrologic cycle and hydrologic processes. Effects of forest management activities on water yield, storm flow, and water quality.

**5115. FOREST HYDROLOGY, FIELD APPLICATIONS.** (2 cr; prereq 5114,  $\Delta$ ; given at Cloquet)

Use of hydrologic instrumentation to measure precipitation, streamflow, infiltration capacity, soil moisture, air temperature, evaporation, and selected water quality constituents. Collection and interpretation of hydrologic information to evaluate forest-use impacts on water quantity and quality.

**5120. INTRODUCTORY TREE PHYSIOLOGY AND GENETICS** (4 cr; prereq Chem 1001 or 1004, 10 cr Biol)

Genetic variation in forest trees, underlying causes, use. Tree growth, nutrition, and water relations. Environmental and internal regulation of growth. Plant biochemistry and photo-chemistry. Physiology related to silviculturally and ecologically significant phenomena.

**5121. TREE PHYSIOLOGY LABORATORY.** (1 cr; prereq 5120 or 5120)

Laboratory study of aspects of tree biology. Emphasis on design and conduct of experiments.

**5126. SILVICULTURE: SOIL-SITE RELATIONSHIPS.** (2 cr; prereq 1122, 5100,  $\Delta$ ; given at Cloquet)

Field examination of forest soils and their relationship to site productivity and forest management.

**5130. GEOGRAPHIC INFORMATION SYSTEMS IN NATURAL RESOURCE PLANNING.** (2 cr; prereq grad or #)

Introduction to the application of Geographic Information Systems (G.I.S.) to natural resource and regional planning studies. Theory and technical points covered; emphasis on applications. Hands-on experience with microcomputer. Case study, including map digitizing, data processing, and generation of map products.

**5140. APPLICATION OF SILVICULTURE IN NORTH AMERICAN FOREST TYPES.** (3 cr; prereq 5100 or #)

Current regeneration methods and intermediate stand treatments. Economic and biological principles. Primarily lectures. Student presentations, discussion of current literature, and field trips may also be included, depending on enrollment.

**5152. FOREST GENETICS.** (3 cr; prereq sr or #)

Genetic variation of forest-tree species and underlying principles; application of plant breeding principles to forestry.

**5153. ADVANCED FOREST HYDROLOGY.** (4 cr; prereq 5114 or #)

Current hydrologic problems in the management of forested watersheds. Analytical methods to evaluate effects of vegetation management on the quantity and quality of runoff. Lecture and laboratory.

**5160. PRACTICUM IN FOREST BIOLOGY AND MEASUREMENTS.** (3 cr; prereq grad)

Plant identification, plant dynamics, land survey, tree measurement.

**5200. AERIAL PHOTO INTERPRETATION.** (3 cr)

Types, characteristics, procurement, preparation, viewing, and interpretation of color, black-and-white, and color infrared aerial photographs; basic aerial photography; introduction to mapping; applications to resource surveys.

**5212. NATURAL RESOURCES INVENTORY.** (3 cr; prereq Itasca session, AgET 3030 or equiv computer programming course with FORTRAN or BASIC language, Math 1142 or Math 1211, Stat 3011 or Stat 5021)

Measurement of stand variables, forest products, forest growth and yield. Elementary statistics. Sampling methods for estimating characteristics of natural resources and resource use for management decision making. Lecture and laboratory.

**5215. FOREST FIRE MANAGEMENT.** (2 cr; prereq 1100, Itasca session, 3103, 5100 or #)

Concepts, principles, and techniques of fire control and use in wildland management.

**5216. SPECIAL TOPICS IN FOREST FIRE MANAGEMENT.** (Cr ar; prereq 5215 or #)

Independent study in selected aspect of forest fire management.

**5217. FIELD TECHNIQUES FOR PRESCRIBED BURNING.** (1 cr; prereq 5215 or #; S-N only)

Field exercises in prescribed burn planning and execution.

**5218. FIELD TECHNIQUES FOR FOREST FIRE CONTROL.** (1 cr; prereq 5215 or #)

Supervised experience in presuppression and suppression activities.

**5220. REMOTE SENSING, FOREST RESOURCES INVENTORY.** (4 cr; prereq 5200, 5212,  $\Delta$ ; given at Cloquet)

Use of aerial photographs in property boundary location; interpretation and classification of forest vegetation types. Application of sampling methods for estimating natural resources and resource use for management decision making.

**5226. FOREST ECONOMICS AND PLANNING.** (5 cr; prereq 5212, AgEc 1030 or #)

Conduct and interpretation of economic analysis; forest planning concepts, principles, and techniques of forest regulation.

**5231. RANGE MANAGEMENT.** (3 cr; prereq Biol 1103 or #)

Important range plants; range livestock; range management methods and improvements; public grazing land administration; relationship of livestock grazing to wildlife, forest, watershed, and recreation management on public and private range lands.

## Course Descriptions

### **5233. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING.** (4 cr; prereq 3232 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.

### **5236. FOREST RECREATION PLANNING.** (1 cr; prereq 3232, Δ; given at Cloquet)

Recreation area and site planning, examples and managerial concerns. Field work and presentation.

### **5240. NATURAL RESOURCE POLICY AND ADMINISTRATION.** (3 cr; prereq For jr or sr or #)

Basic concepts of political and administrative processes in development of natural resource policies and programs. Policy processes, agenda setting, political decision rules, strategies for achieving agreement, participants in policy development, public means of implementing policies, and case examples.

### **5241. NATURAL RESOURCE MANAGEMENT: POLITICAL AND ADMINISTRATIVE PROCESSES.** (3 cr; prereq 5240 or #)

Advanced concepts of political and administrative processes important to the development of natural resource policies and programs. Issue creation and agenda-setting theories, incremental decision-making styles, role of analysis and analytical information, actions of major policy participants (e.g., courts, legislatures, interest groups, media), program planning, budgeting and staffing, and evaluation of natural resource case studies.

### **5248. HARVESTING AND ENGINEERING.** (3 cr; prereq CE 3100, Δ; given at Cloquet)

An introduction to harvesting systems, relationship to forest management, and preparation and administration of timber sales. Fundamentals of location, construction, and maintenance of forest roads.

### **5250. ROLE OF RENEWABLE NATURAL RESOURCES IN DEVELOPING COUNTRIES.** (2 cr)

International perspective on important resource issues, including integration of natural resource, social, and economic considerations. Overviews of issues and case studies. Term paper, other requirements.

### **5253. FOREST BIOMETRY.** (3 cr; prereq 5212, Stat 5021, or #; offered alt even yrs)

Topics in forest measurements and the modeling and analysis of forest characteristics, with emphasis on growth and change estimation.

### **5255. FOREST RESOURCE SURVEY DESIGN.** (3 cr; prereq 5212, Stat 5021, or #; offered alt odd yrs)

Advanced forest measurements, sampling, and survey design concepts and practices.

### **5257. RECREATION LAND POLICY.** (3 cr; prereq 3232 or #)

Policy issues affecting the use and management of lands devoted entirely or in part to recreational objectives.

### **5259. ANALYSIS OF OUTDOOR RECREATION BEHAVIOR.** (3 cr; prereq 3232, RRM major or grad student or #)

Development of environmental framework for understanding recreation behavior. Contributions of several disciplines, current cultural trends, management implications.

### **5262. REMOTE SENSING OF NATURAL RESOURCES.** (4 cr)

Introduction to remote sensing for natural resource inventories, land use analyses, and environmental monitoring activities; photographic, thermal, multi-spectral, and radar sensing procedures; airborne and satellite systems; visual and computer-assisted analysis techniques; oriented toward an interdisciplinary audience.

### **5264. QUANTITATIVE TECHNIQUES IN FOREST MANAGEMENT.** (3 cr; prereq 5212, 5226, or #)

Forestry applications of quantitative techniques in allocation and other decision-making problems. Mathematical programming, simulation, and other techniques.

### **5269. INTERDISCIPLINARY SEMINAR I.** (4 cr)

Resource and community development analysis, implications for resource allocation. Selected speakers, readings, and discussion topics. Diverse disciplinary contributions reflected.

### **5270. INTERDISCIPLINARY SEMINAR II.** (4 cr)

Development of ability to identify and analyze resource development problems. Student participation as team members; guest speakers. Diverse disciplinary contributions reflected.

### **5401. SENIOR TOPICS.** (Cr ar; prereq sr in forestry or #)

Independent study in a field of interest to the student. Work must be planned with a forestry faculty member.

### **5403. FUNDAMENTALS OF NATURAL RESOURCE EDUCATION.** (3 cr; offered through CEE)

Intended for elementary teachers. Study of soil, water, forest, and wildlife resources of Minnesota and the biological principles and ecological implications of management. Discussion of environmental issues developed through natural resource manipulation. Development of outdoor teaching skills in environmental education in a metropolitan center.

### **5406. FORESTRY WORKSHOP FOR TEACHERS.** (5 cr)

Forest ecosystems and forest management studied in lecture and laboratory sessions conducted in a forest environment. In field exercises, techniques and materials are developed for teaching principles of forestry in indoor and outdoor classrooms. Tours to forest and wildlife research and management units and utilization locations, and discussions of contemporary forestry issues by guest lecturers.



**5408. FORESTRY IN THE URBAN ENVIRONMENT.** (3 cr; prereq student teacher, teacher, or #)  
Study of forest ecosystems and forest management in lecture and laboratory sessions. Field exercises emphasize techniques and materials useful for teaching principles of forestry in indoor and outdoor classrooms; forest areas in the Twin Cities used for field exercises. Special uses and problems of the urban forest. Discussions and presentations by guest lecturers on contemporary forestry issues.

**5412. ADVANCED REMOTE SENSING.** (4 cr; prereq 5262 or #)  
Working knowledge of quantitative remote sensing. Both theoretical basis and practical aspects, including energy-matter interactions, radiation measurements and sensors, and digital image analysis.

**5458. WATER QUALITY MANAGEMENT: ECOSYSTEM APPROACHES.** (4 cr; prereq Chem 3101, Biol 5041 or equiv, or #)  
Anthropogenic influences on aquatic ecosystems. Influences include forest management, point and non-point pollution, and acid rain.

**5500. URBAN FOREST MANAGEMENT.** (3 cr; prereq 5100 or #)  
Discussion and development of basic concepts. Introduction to terminology and principles of urban tree inventory, propagation, and care; management case studies; equipment operation and costs.

**5501. URBAN FOREST ADMINISTRATION.** (3 cr; prereq 5100, 5500, or #)  
Discussion and development of basic concepts: introduction to public relations, program building; staffing and labor relations; effect of legal restraints on ordinances and contracts; budget monitoring.

**5700. COLLOQUIUM IN FOREST BIOLOGY.** (1-2 cr; prereq varies with topic, #)  
Colloquium on specialized topics in forest biology and silviculture.

**For Graduate Students Only**  
(For description, see *Graduate School Bulletin*)

**8100. RESEARCH PROBLEMS: SILVICULTURE**

**8101. RESEARCH PROBLEMS: FOREST-TREE PHYSIOLOGY**

**8102. RESEARCH PROBLEMS: FOREST-TREE GENETICS**

**8103. RESEARCH PROBLEMS: FOREST HYDROLOGY**

**8105. ADVANCED FIELD SILVICULTURE**

**8106. TOPICS IN SILVICULTURE-FOREST SOILS**

**8107. SEMINAR: FOREST RESOURCES**

**8200. RESEARCH PROBLEMS: FOREST MANAGEMENT**

**8201. RESEARCH PROBLEMS: FOREST ECONOMICS**

**8202. RESEARCH PROBLEMS: FOREST BIOMETRY**

**8203. RESEARCH PROBLEMS: FOREST RECREATION**

**8204. RESEARCH PROBLEMS: FOREST POLICY**

**8205. RESEARCH PROBLEMS: REMOTE SENSING**

**8207. ECONOMIC ANALYSIS OF FORESTRY PROJECTS**

**8210. RESEARCH METHODS IN FORESTRY**

**8211. SEMINAR: NATURAL RESOURCE POLICY ISSUES**

**8213. TOPICS IN WILDLAND HYDROLOGY**

## Mathematics (Math)

**1008. TRIGONOMETRY.** (4 cr; prereq plane geometry and 2 yrs high school algebra or #1111, plane geometry, grade of C or better in 0009)  
Analytic trigonometry, identities, equations, properties of trigonometry functions; right and oblique triangles.

**1111. COLLEGE ALGEBRA AND ANALYTICAL GEOMETRY.** (5 cr, \$1201; prereq plane geometry and 2 yrs high school algebra or plane geometry, grade of C or better in 0009)  
Functions, graphs, quadratic equations, progressions, inequalities, complex numbers, theory of equations, permutations and combinations, probability, systems of equations, determinants, graphing of linear and quadratic equations, conics and standard position, logarithms.

**1142. SHORT CALCULUS.** (5 cr; for students requiring minimal amount of calculus; prereq 3<sup>1/2</sup> yrs high school math or grade of C or better in 1111 or 1201)  
Derivatives, integrals, differential equations, maxima and minima, partial differentiation, applications.

**1201. PRE-CALCULUS.** (5 cr, \$1111; for students who need to review high school higher algebra and trigonometry before taking calculus; prereq 4 yrs high school math including trigonometry)  
Inequalities, analytical geometry; complex numbers, binomial theorem, mathematical induction; functions and graphs; trigonometric, exponential, and logarithmic functions.

**1211-1221-1231. CALCULUS I-II-III.** (5 cr per qtr; prereq 4 yrs high school math including trigonometry, or grade of C or better in 1201, or grade of C or better in 1008 and 1111, or equiv; grade of C or better required to continue in sequence)  
Analytical geometry and calculus of functions of one variable, applications, infinite series, and sequences.

## Course Descriptions

**3211. MULTIVARIABLE CALCULUS.** (5 cr; prereq grade of C or better in 1231 or equiv)  
Partial differentiation, chain rule, implicit functions, applications. Multiple integrals in two and three dimensions.

**3221. INTRODUCTION TO LINEAR ALGEBRA AND LINEAR DIFFERENTIAL EQUATIONS.** (5 cr, §3066, §3142, §3511; prereq grade of C or better in 1231 or equiv)

Vectors, systems of linear equations, matrices, determinants, bases, eigenvalues. Linear differential equations and systems with constant coefficients, initial value problem and general solution, variation of parameters for inhomogeneous equations.

### Rhetoric (Rhet)

**1101. WRITING TO INFORM AND PERSUADE.** (4 cr, §Comp 1011; prereq ¶1104)

Relationship of fact finding and clear thinking to informative and persuasive writing. Importance of thesis sentence, evidence, coherence, clarity, and correctness. Relatively short (500-750 words) assignments designed to complement instruction in the Library Laboratory.

**1104. LIBRARY LABORATORY.** (1 cr; S-N only; taught by St. Paul campus library staff)

On-site instruction in information retrieval techniques. Lectures, audiovisual presentations, and problem-solving assignments designed to strengthen skills in using the library.

**1151. WRITING IN YOUR MAJOR.** (4 cr; prereq 1101, 1104, and soph status)

Students investigate and write on subjects related to their majors. The criterion of appropriateness: good writing meets the expectation of readers and the conventions of a particular form. Assignments such as literature review, abstract, fact sheet, instructions, and feature article.

**1222. PUBLIC SPEAKING.** (4 cr; prereq 1101 and 1104)

Practical course in fundamentals of speechmaking. Emphasis on organizing the speech and projecting it to the audience.

**3254. ADVANCED PUBLIC SPEAKING.** (4 cr; prereq 1222)

Training for specific speech situations most likely to be encountered professionally. Emphasis on analysis, design, preparation, and delivery of presentations to provide greater flexibility within a variety of speech environments.

**3266. COMMUNICATION, DISCUSSION IN SMALL GROUP DECISION MAKING.** (4 cr; prereq 1101)

Role of communication techniques in the small group decision-making process. Emphasis on discussion within a variety of decision-making modes such as voluntary groups, business meetings, and conflict groups.

**3562. WRITING IN YOUR PROFESSION.** (4 cr; prereq 1101, 1104, 1151, and jr status)

Projects in professional writing. Relationship between structuring information to meet the needs of particular readers and writing effectively. Assignments such as the feasibility report, proposal, memorandum, letter of application, and résumé.

### Entomology (Ent)

**5050. FOREST ENTOMOLOGY.** (4 cr; prereq any two courses among the forestry, zoological, botanical, biological, and/or agricultural sciences)

Lectures and laboratory concerning ecology and population management of forest insects, with heavy emphasis on tree factors and biological control.

### Plant Pathology (PIPa)

**5050. FOREST PATHOLOGY.** (4 cr; prereq Biol 1103 or equiv)

Diseases of forest and shade trees; wood decay. Symptoms, etiology, and control. Lectures, laboratory, and fieldwork.

### Soil Science (Soil)

**5710. ADVANCED FOREST SOILS.** (3 cr [4 cr with paper]; prereq 1122, FR 5114)

Factors affecting tree growth; estimation, modification, and management effects on site productivity; regeneration.

# Administration and Faculty



# Administration and Faculty

## University Regents

David M. Lebedoff, Minneapolis, Chair  
Mary T. Schertler, St. Paul, Vice Chair  
Wendell R. Anderson, Wayzata  
Charles H. Casey, West Concord  
Willis K. Drake, Edina  
M. Elizabeth Craig, Minnetonka  
Jack P. Grahek, Ely  
Wally Hilke, St. Paul  
Elton A. Kuderer, Fairmont  
Charles F. McGuiggan, Marshall  
Wenda W. Moore, Minneapolis  
David K. Roe, Minneapolis  
Stanley D. Sahlstrom, Crookston

## University Administrators

Kenneth H. Keller, President  
Roger W. Benjamin, Provost and Vice  
President for Academic Affairs  
Stephen S. Dunham, Vice President and  
General Counsel  
Stanley B. Kegler, Vice President for  
Institutional Relations  
David M. Lilly, Vice President for Finance  
and Operations  
Richard J. Sauer, Vice President for  
Agriculture, Forestry, and Home  
Economics  
Neal A. Vanselow, Vice President for  
Health Sciences  
Frank B. Wilderson, Vice President for  
Student Affairs

## College of Forestry Administrators

Richard A. Skok, Ph.D., Dean  
110g Green Hall (612/624-3400)  
Frank H. Kaufert, Ph.D., Dean Emeritus  
Ira R. Adelman, Ph.D., Head  
Department of Fisheries and Wildlife  
204 Hodson Hall (612/624-3600)  
James L. Bowyer, Ph.D., Head  
Department of Forest Products  
209 Kaufert Laboratory (612/624-9219)

Alan R. Ek, Ph.D., Head  
Department of Forest Resources  
110d Green Hall (612/624-3400)  
John V. Bell, M.S., Assistant Dean for  
Student Affairs  
10 Green Hall (612/624-6768)  
A. Scott Reed, Ph.D., Coordinator  
Cloquet Forestry Center  
Cloquet, MN 55720 (218/879-4528)  
Ann E. Mayhew, M.S.  
Assistant to the Dean  
110e Green Hall (612/624-3400)  
Philip J. Splett, M.S., Coordinator  
Career Opportunities  
110j Green Hall (612/624-6247)  
William K. Ganzlin, M.S.  
Student Personnel Worker  
10 Green Hall (612/624-6768)

## College of Forestry Faculty

### Department of Fisheries and Wildlife

*Professor Emeritus*  
L. Daniel Frenzel, Ph.D.  
William H. Marshall, Ph.D.

*Professor*  
Ira R. Adelman, Ph.D., Head  
Gordon W. Gullion, M.A.  
George R. Spangler, Ph.D.  
Thomas F. Waters, Ph.D.

*Associate Professor*  
Yosef Cohen, Ph.D.  
James A. Cooper, Ph.D.  
Peter A. Jordan, Ph.D.

*Associate Professor  
and Extension Specialist*  
James R. Kitts, Ph.D.

*Assistant Professor*  
Francesca J. Cuthbert, Ph.D.  
Anne R. Kapuscinski, Ph.D.  
James L.D. Smith, Ph.D.

### Department of Forest Products

*Professor Emeritus*  
Ralph L. Hossfeld, Ph.D.  
Frank H. Kaufert, Ph.D.

*Professor*

James L. Bowyer, Ph.D., Head<sup>9</sup>  
 Robert W. Erickson, Ph.D.  
 Roland O. Gertjeansen, Ph.D.  
 Lewis T. Hendricks, Ph.D.  
 Robert H. Rouda, Ph.D.

*Associate Professor*

Roger A. Peterson, M.S.  
 Elmer L. Schmidt, Ph.D.

*Assistant Professor*

Bruno M. Franck, Ph.D.  
 Timothy D. Larson, Ph.D.  
 F. Thomas Milton, M.S.  
 Harlan D. Petersen, M.S.  
 Simo Sarkanen, Ph.D.

*Lecturer*

Vernon L. Guyer, Ph.D.

*Research Specialist*

Robert E. Kroll, Ph.D.

*Associate/Assistant Scientist*

David C. Ritter, Ph.D.  
 Philip G. Steklenski, M.S.

**Department of Forest Resources***Professor Emeritus*

Egolfs V. Bakuzis, Ph.D.  
 Alvin R. Hallgren, Ph.D.  
 Henry L. Hansen, Ph.D.  
 Lawrence C. Merriam, Jr., Ph.D.  
 Merle P. Meyer, Ph.D.<sup>9</sup>  
 Marvin E. Smith, B.S.

*Professor*

Alan R. Ek, Ph.D., Head  
 Alvin A. Alm, Ph.D.  
 Marvin E. Bauer, Ph.D.  
 Kenneth N. Brooks, Ph.D.  
 Paul V. Ellefson, Ph.D.  
 David W. French, Ph.D.<sup>1</sup>  
 Hans M. Gregersen, Ph.D.  
 David F. Grigal, Ph.D.<sup>2</sup>  
 Frank D. Irving, Ph.D.  
 Timothy B. Knopp, Ph.D.  
 Herbert M. Kulman, Ph.D.<sup>3</sup>  
 Carl A. Mohn, Ph.D.  
 Dietmar W. Rose, Ph.D.  
 Harold Scholten, Ph.D.  
 Edward I. Sucoff, Ph.D.

*Adjunct Professor*

John J. Ball, Ph.D.<sup>8</sup>  
 Erwin R. Berglund, Ph.D.<sup>7</sup>  
 Judson G. Isebrands, Ph.D.<sup>6</sup>  
 Rolfe A. Leary, Ph.D.<sup>6</sup>  
 David C. Lothner, Ph.D.<sup>6</sup>  
 Allen L. Lundgren, Ph.D.<sup>6</sup>  
 Elon S. Verry, Ph.D.<sup>6</sup>

*Associate Professor*

Robert A. Blanchette, Ph.D.<sup>1</sup>  
 Thomas E. Burk, Ph.D.  
 Gerald W. Johnson, Ph.D.<sup>5</sup>  
 Vilis Kurmis, Ph.D.  
 James A. Perry, Ph.D.  
 Ford C. Runge, Ph.D.<sup>4</sup>

*Assistant Professor*

Sean C. Ahearn, Ph.D.  
 Melvin J. Baughman, Ph.D.  
 Charles R. Blinn, Ph.D.  
 Glenn R. Furnier, Ph.D.  
 Howard M. Hoganson, Ph.D.  
 Theodore D. Graham-Tomasi, Ph.D.<sup>4</sup>  
 A. Scott Reed, Ph.D.

*Instructor*

Philip J. Splett, M.S.  
 Carl E. Vogt, B.S.

*Research Associate*

Clifford E. Ahlgren, M.S.  
 Isabel F. Ahlgren, Ph.D.  
 David W. Lime, Ph.D.

*Research Fellow*

Marna C. Butler-Fasteland, M.S.  
 Robert A. Stine, M.S.

<sup>1</sup>Associate member from Department of Plant Pathology

<sup>2</sup>Associate member from Department of Soil Science

<sup>3</sup>Associate member from Department of Entomology

<sup>4</sup>Associate member from Department of Agricultural and Applied Economics

<sup>5</sup>Associate member from Department of Civil and Mineral Engineering

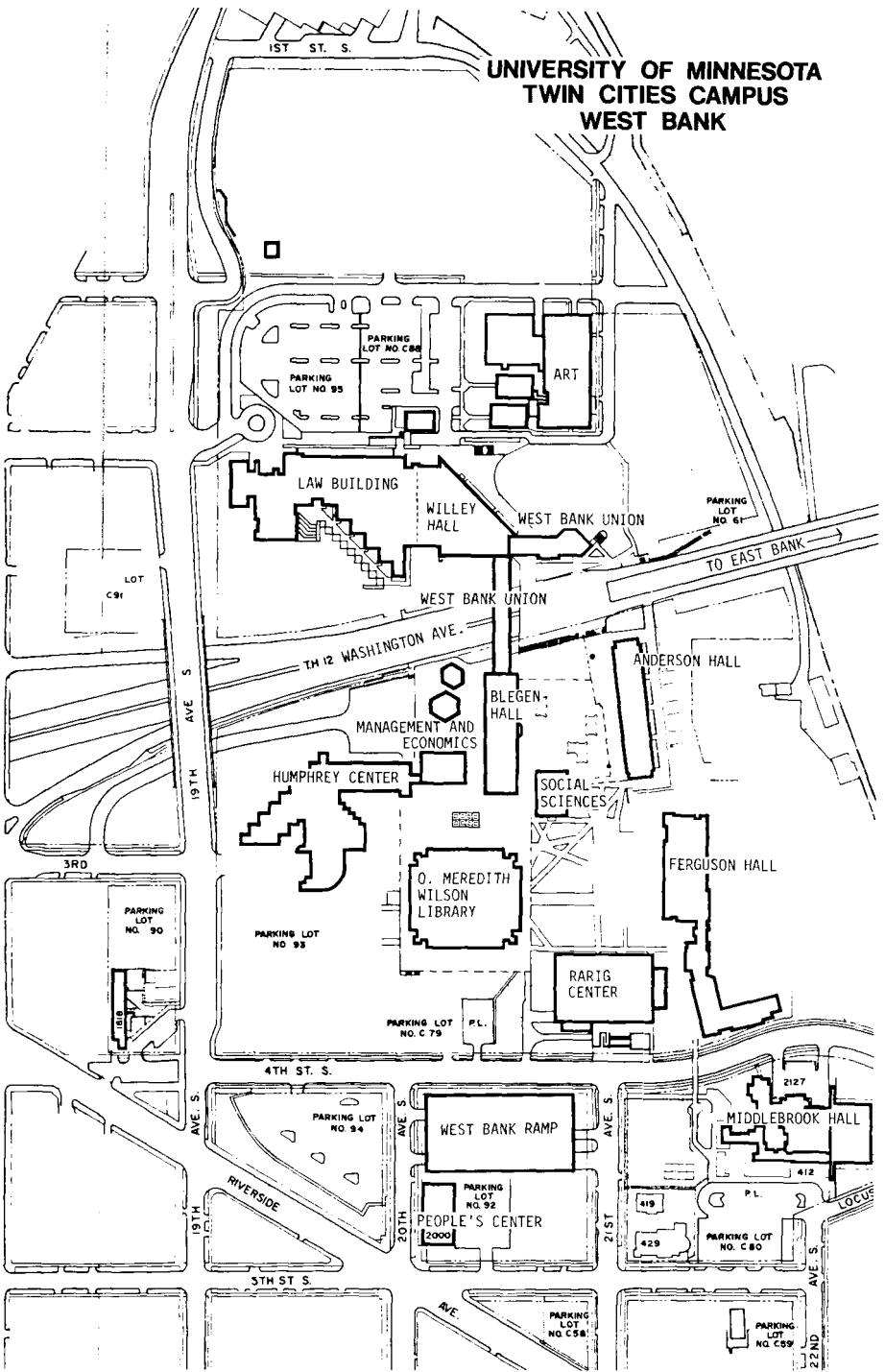
<sup>6</sup>Associate member from North Central Forest Experiment Station, U.S. Forest Service

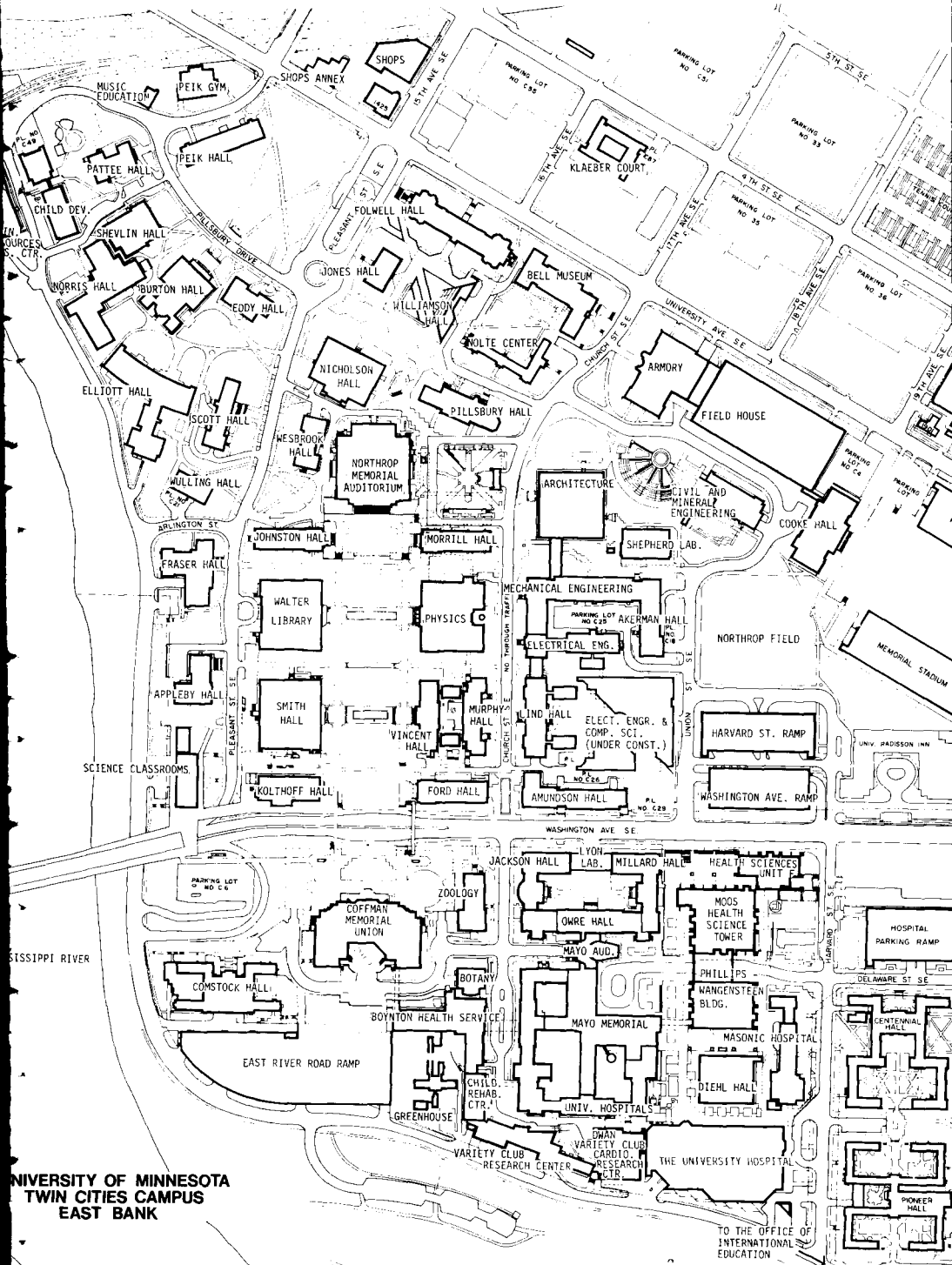
<sup>7</sup>Associate member from Minnesota Department of Natural Resources

<sup>8</sup>Associate member from University of Minnesota Technical College at Waseca

<sup>9</sup>Recipient of the Horace T. Morse-Amoco Foundation Award for Outstanding Contributions to Undergraduate Education

UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
WEST BANK

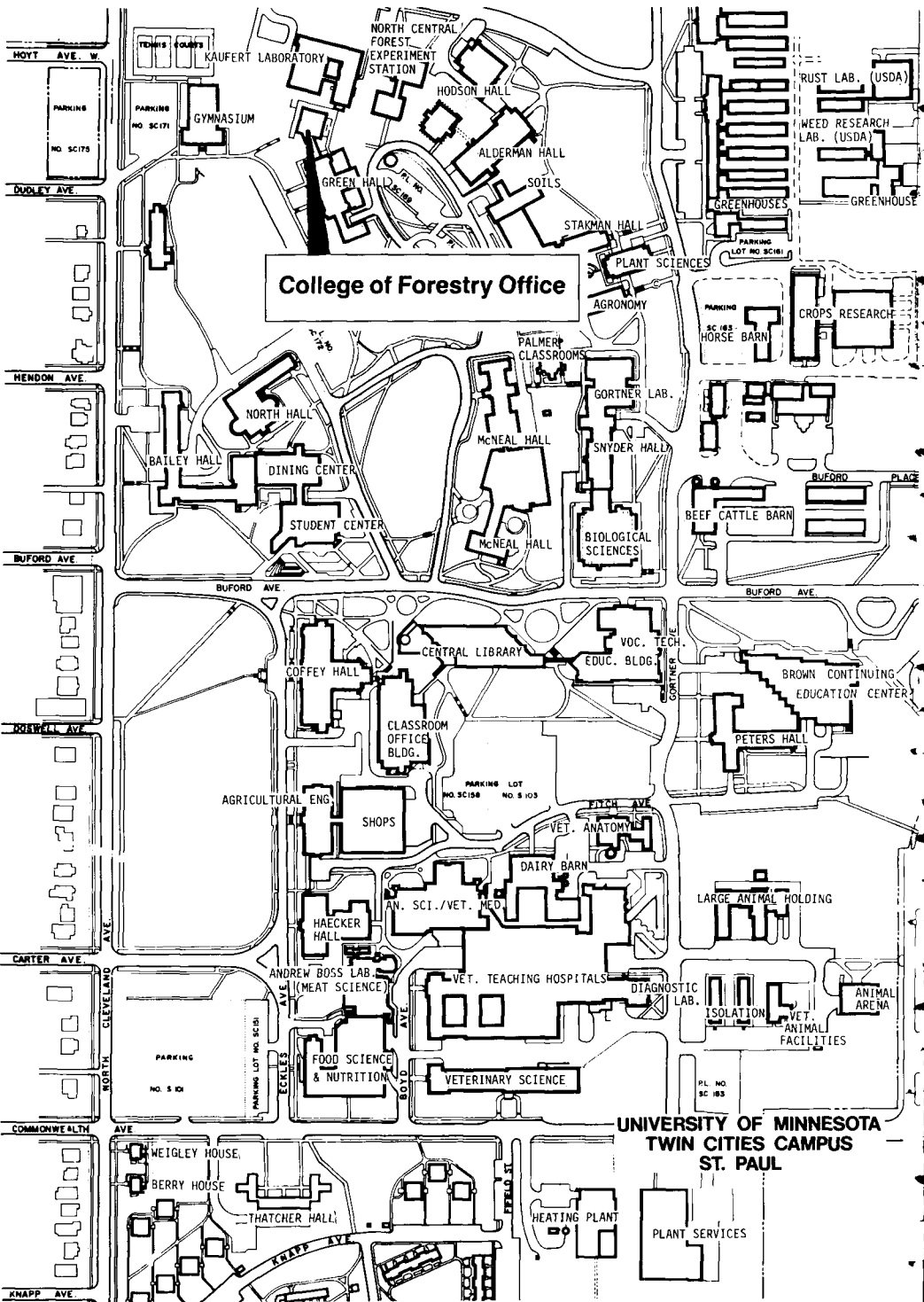




**UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
EAST BANK**

TO THE OFFICE OF  
INTERNATIONAL  
EDUCATION

**College of Forestry Office**



**UNIVERSITY OF MINNESOTA  
TWIN CITIES CAMPUS  
ST. PAUL**



# Index



# Index

- Academic Policies 12  
Accreditation 6  
Administration 7, 41  
Admission 7  
    Adult Special 8  
    Advanced Standing 8  
    Freshman 7  
Adult Special Students 8  
Advanced Standing 8  
Adviser 12  
Areas of Emphasis,  
    Forest Resources 22  
Attendance 12  
Auditing 12  
  
Baccalaureate Programs 11  
Bulletins 2  
  
Class Attendance 12  
Class Standing 12  
CLEP 15  
Cloquet Session 6, 16  
Clubs 10  
Composition  
    and Communication  
    Requirement 15  
Cooperative Education Program,  
    Forest Products 16  
Course Descriptions 31  
Course Numbering and Symbols 32  
Credit Load 12  
Curricula 12  
  
Dean's Letter 3  
Degrees Offered 7  
  
Entomology 40  
Extra Credit 12  
  
Facilities 4, 6  
Faculty 41  
Federal Forestry 28  
Financial Aid 8  
Fisheries and Wildlife 17  
Fisheries and Wildlife Minor 18  
Forest Harvesting 24  
Forest Hydrology 22  
Forest Products 18  
Forest Resources 21  
Forest Resources Minor 25  
Forest Soils 23  
  
Governance 10  
Grading 13  
Graduate Degrees 7  
Graduation Requirements 14  
  
Honor System 13  
Honors, Graduation with 14  
  
Independent Study 12  
Industrial Forest Management 23  
Itasca Session 6, 16  
  
Law Enforcement 28  
Liberal Education Requirements 15  
  
Management and Administration 23  
Marketing 18  
Mathematics 39  
Minnesota-Idaho Student Exchange 16  
Mission 6  
  
Natural Science 26  
  
Options, Recreation  
    Resource Management 28  
  
Paper Science and Engineering 20  
Placement Services 4  
Plant Pathology 40  
Policy Waivers 14  
Probation 13  
Production Management 19  
Progress 13  
  
Quality Credits 14  
  
Records, Access to 2  
Recreation Resource Management 27  
Recreation Site Management 29  
Registration 12  
Renewable Resource Science 26  
Repeating Courses 12  
Resource Measurements and  
    Information Systems 24  
Rhetoric 40  
  
St. Paul Campus Board of Colleges 10  
Satisfactory Progress 13  
Scholarships and Awards 8  
Silviculture/Forest Biology 25  
Social and Managerial Sciences 27  
Soil Science 40  
Special Examinations for Credit 14  
Student Activities 10  
Student Center Board of Governors 10  
Student-Faculty Board 10  
Student Scholastic Standing  
    Committees 10  
Suspension 13  
Symbols 32  
  
Transfer of Credit 8  
  
Urban Forestry 29  
  
Waivers, Policy 14  
Wildlife 17  
Wood Science 21

University of Minnesota Bulletin  
(USPS 651-720)  
Student Support Services  
110 Williamson Hall  
231 Pillsbury Drive S.E.  
Minneapolis, MN 55455

Second-Class  
U.S. Postage  
Paid  
Minneapolis, MN

02236

6

UNIVERSITY ARCHIVES  
10 WALTER LIBRARY  
MPLS, EAST BANK