



College of Forestry

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Green Hall is located at 1530 North Cleveland Avenue, St. Paul, Minnesota 55108.

The Kaufert Laboratory of Forest Products and Wood Science is located at 2004 Folwell Avenue, St. Paul, Minnesota 55108.

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This biennial bulletin focuses on the undergraduate offerings of the College of Forestry, based on the St. Paul campus of the University of Minnesota.

OTHER SOURCES OF INFORMATION

Office of Student Services (10 Green Hall, 612/373-0842)—Questions about College of Forestry programs and procedures may be directed to this office.

Class Schedule—This quarterly publication lists University day school courses complete with hours, rooms, instructors, prerequisites, registration instructions, fees, maps, final exam schedules, grading definitions, and other pertinent information.

Official Daily Bulletin Column—Published in the Twin Cities campus newspaper, the *Minnesota Daily*, and posted on bulletin boards, this column keeps abreast of course changes, study opportunities, meetings, and activities.

Other Bulletins—*The General Information Bulletin* provides an overview of University policies. Evening and summer courses are featured in the *Continuing Education and Extension Classes Bulletin* and *Summer Session Bulletin*, respectively. Separate bulletins are also published for the Lake Itasca Biology Session, College of Agriculture, College of Liberal Arts, Institute of Technology, College of Biological Sciences, School of Management, Graduate School, and other University units. Most bulletins are available through the Office of Admissions and Records, 130 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, Minnesota 55108 (612/373-0703).

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, creed, color, sex, national origin, or handicap. 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, and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be directed to Lillian H. Williams, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, 100 Church Street S.E., University of Minnesota, Minneapolis, Minnesota 55455, (612) 373-7969, or to the Director of the Office of Civil Rights, Department of Education, Washington, D.C. 20202, or to the Director of the Office of Federal Contract Compliance Programs, Department of Labor, Washington, D.C. 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 attendance, college and class, major, adviser, and degrees earned—is considered public or directory information. To prevent release of such information outside the University while in attendance at the University, a student must notify the records office on his or her 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 information booth in Williamson Hall, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Coordinator of Student Support Services, 260E Williamson Hall, (612) 373-2106.



LETTER FROM THE DEAN

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

Forests play important roles in the lives of people worldwide. From their basic use as a source of firewood for heating and cooking to their use as wilderness for physical challenges and psychological rewards, forests and their multiple resources touch on the economic, social, and cultural well-being of each of us. If you would like to help make the most of our forest resources now and in the future, I am sure you will find this bulletin presents some 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, and graduates have played leadership roles in forest 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 and cultural resource.

Richard A. Skok

Richard A. Skok
Dean, College of Forestry

College of Forestry

I. GENERAL INFORMATION

Mission

The College of Forestry seeks to increase the economic, social, and environmental benefits of one of our most important renewable natural resources, forests. It is engaged in undergraduate and graduate education in forestry and forest products; basic and applied research; and extension, continuing education, and public service activities.

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.

Facilities

The College of Forestry is based in two adjacent buildings—Green Hall and the Kaufert Laboratory of Forest Products and Wood Science—on the St. Paul branch of the Twin Cities campus. Green Hall houses the Dean's Office, Office of Student Services, Forest Resources Department, Forestry Library, and Remote Sensing Laboratory. 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. Also on the St. Paul campus, next to Green Hall and Kaufert Laboratory, 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. The state park, Minnesota's largest, 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. Forest Resources, Forest Science, and Urban Forestry majors spend a 3½-week summer term at the station studying botany, ecology, 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 and some Forest Science seniors spend their fall quarter at the center taking 18 credits of field-oriented instruction in forest inventory, silviculture, engineering and harvesting, forest soils, hydrology, recreation planning, and wildlife. Students interact with representatives of local industries and nearby state and federal forestry agencies. The center has housing, dining, classroom, laboratory, and library facilities.

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 offered 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 five major programs: Forest Products, Forest Resources, Forest Science, Recreation Resource Management, or Urban Forestry. Curricular requirements are fully explained in Section II of this bulletin. The degree may be earned with the honors "with distinction" or "with high distinction."

Graduate Degrees—The master of science (M.S.), the doctor of philosophy (Ph.D.), 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 college's Director of Graduate Studies, 110B Green Hall, 373-0833, or the *Graduate School Bulletin*. Interested students should apply for admission through the Graduate School, 306 Johnston Hall, 101 Pleasant Street S.E., Minneapolis, Minnesota 55455 (373-2973).

Administration

The undergraduate curricula of the College of Forestry are organized within two academic departments—Forest Products (203 Kaufert Lab) and Forest Resources (110 Green Hall), which also offers the Forest 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 several faculty members, which is responsible for interpreting and administering faculty policies and requirements regarding admission, transfer of credit, curricula, academic standards, student credit loads, and other academic matters.

The college's Office of Student Services, 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 and Records, 130 Coffey Hall, 1420 Eckles Avenue, St. Paul, Minnesota 55108 (373-0707). A \$15 nonrefundable application (credentials examination) 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 Testing (ACT) program 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:

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

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, Continuing Education and Extension, or adult special enrollment may also be eligible for transfer to the College of Forestry.

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

Field Session Fees

The following costs for the field training sessions at Itasca and Cloquet are based on the latest figures available at the time of publication. All fees are subject to review and revision, with yearly increases almost inevitable. (The annual *General Information Bulletin* contains residence regulations and the most current and complete breakdown of tuition and fees charged for the academic year.)

<i>Itasca Session</i>	<i>Cost per 3½-week Summer Term (1982)</i>
Resident and Nonresident Tuition	\$159.00
Student Services Fee	15.00

In addition, a nominal fee is assessed for cabin rental. Meals are provided through a student cooperative on the basis of actual cost plus 5 percent of gross operating expenses for use of dining hall facilities, breakage, and other miscellaneous items.

<i>Cloquet Session</i>	<i>Cost per Fall Quarter (1981)</i>
Resident Tuition	\$ 397.00
Nonresident Tuition	1,085.00
Health Fee	35.00

In addition, a nominal fee is assessed for use of dormitories. Meals are provided at cost through a student cooperative.

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, Minnesota 55455, 376-2424; or 199 Coffey Hall, 1420 Eckles Avenue, St. Paul, Minnesota 55108, 376-2572). Application forms are available from either of these Student Financial Aid offices and from most Minnesota high school guidance offices. Applications should be forwarded to the American College Testing (ACT) Program by March 1 for priority consideration. 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. Those available to incoming freshmen and/or transfer students (indicated by an asterisk) are normally awarded the spring before the academic year of their use. Contact the college's Office of Student Services 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.

General Information

- 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 \$400 award annually.
- Andersen Corporation Scholarships**—Sponsored by Andersen Corporation, Bayport, Minnesota. For Forest Products juniors and seniors in the marketing and production management specializations on the basis of academic achievement and professional promise. Three \$1,000 awards annually.
- R. M. Brown Scholarship**—Sponsored by donations to the College of Forestry. For a Forest Resources or Forest Science senior with a special interest in mensuration or statistics. One \$200 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. Three \$200 awards annually.
- Caleb Dorr Scholarships**—Sponsored by the Caleb D. Dorr Fund. For the forestry student in each class with the highest grade point average. Four \$300 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. \$100 each.
- Forest Products Marketing Scholarship**—Sponsored by the Forest Industry Fraternity of Minneapolis and St. Paul. For a deserving and promising Forest Products junior or senior entering the marketing specialization. One \$500 award annually.
- Robert L. Goudy Memorial Scholarships**—Sponsored by Mr. and Mrs. F. X. Corbett, Georgetown, Colorado. For outstanding 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 forestry 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 on the basis of outstanding academic ability and strong desire to pursue careers in natural resource management. Three \$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.
- 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. Two \$1,000 awards annually.
- 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.
- Pulp and Paper Scholarships**—Sponsored by Sunds Defibrator, Inc.; Beloit Corporation; Blandin Paper Company; H. B. Fuller Company; Minnesota Section, Technical Association of the Pulp and Paper Industry; North Central Division, Paper Industry Management Association; Pollatch Foundation for Higher Education; St. Regis Paper Company; and Nalco Chemical Company. For Forest Products juniors and seniors in the pulp and paper specialization on the basis of academic performance and professional promise. \$1,000 to \$1,500 each.
- 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. 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. \$300 each.
- 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 \$150 award annually.

Placement Services

The College of Forestry helps students locate summer jobs in forestry and forest products as well as permanent employment following graduation. Placement services for students of the Forest Resources Department are provided by the career opportunities coordinator in 8F Green Hall. Students in the Forest Products pulp and paper specialization receive assistance in 102 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.

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 in 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, Recreation Resource Management Club, and Forest Products Club-Forest Products Research 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*.





II. BACCALAUREATE PROGRAMS

Five Major Curricula

The College of Forestry offers five major curricula leading to the bachelor of science (B.S.) degree: (1) Forest Products (with specializations in marketing, production management, pulp and paper, and wood science and technology); (2) Forest Resources; (3) Forest Science (with specializations in natural science and social and managerial sciences); (4) Recreation Resource Management; and (5) Urban Forestry. Because the first year of course work 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 of Student Services. All other students are assigned a faculty adviser within their curriculum.

Credit Load—The typical work 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 attained at least a B average the previous quarter and permission from the departmental 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.

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 a course, with the instructor's approval. The extra work is mutually agreed to and conducted independently of class. Contact the Office of Student Services for more information.

Independent Study—Students may register to take regularly offered courses through independent study, without attending class, with the instructor's approval. Contact the Office of Student Services 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, in University-approved cocurricular activities, and (d) approval of the absence by the departmental 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.

Baccalaureate Programs

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

Forest Resources juniors and seniors may sign their own quarterly course enrollment request form. 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 of Student Services for instructions and forms.

During the first three days 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 three days, the approval of both the adviser and the instructor is needed in order 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 departmental 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 N (no credit) will be reported.

If a student withdraws from the college in mid quarter, all classes should be officially cancelled. Cancellation within the first six weeks entitles the student to a refund prorated according to the number of weeks classes were attended. Students may be entitled to a full refund, even after classes have started, if they obtain written certification from each instructor that they never attended class.

Grading—Two grading options, A-B-C-D-N 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 percent of the residence credits presented for the baccalaureate degree may be in courses in which a grade of S was received.
2. Required courses must be taken under the A-N option. Prerequisites for required courses and courses in the major must also be taken A-N unless an exception is made.

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

Honor System—Under an honor system they adopted on the St. Paul campus, students accept responsibility for the supervision of student conduct 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 of Student Services.

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 departmental Student Scholastic Standing Committee. The following chart details conditions under which these actions will be taken.

CONDITIONS FOR PROBATION AND SUSPENSION

<i>Student Classification</i>	<i>Probation</i>	<i>Suspension</i>
	Cumulative GPA is below	Cumulative GPA after first two quarters in college is below
Freshman	1.90	1.60
Sophomore	2.00	1.90
Upper Division	2.00	1.90
	(or)	(or)
	Any combination of three D and N grades in any one quarter	Two consecutive quarters of probation
		(or)
		Any combination of four D and N grades in three consecutive quarters

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

The Itasca session for Forest Resources and Forest 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 departmental 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 departmental Student Scholastic Standing Committee for a final decision. Contact the Office of Student Services 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 nine credits in physical education may be applied toward the degree. No more than nine credits in music may be applied as elective credits toward the degree, with no more than six of these in Mus 1430 or concert band.
2. Achieve a grade point average of 2.00 or higher with no more than five credits of D in required forestry courses and five credits of D in other required courses.
3. Satisfy Council on Liberal Education (CLE) requirements (see below).
4. Satisfy residence and other general University requirements for graduation.

Baccalaureate Programs

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 one-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 are those which 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.

CLE 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 course work in each of four categories established by the University's Council on Liberal Education (CLE). The number of credits required in each category and a partial list of courses that fulfill CLE requirements follow. Students in doubt about the use of specific courses should consult the Office of Student Services or the *College of Liberal Arts Bulletin*.

All College of Forestry students must take Rhet 1101, 1102, 1222, and 3551 or 3562. Students who pass an English proficiency examination, administered by the Rhetoric Department, may be exempted from Rhet 1101 and/or 1102. Students with above average writing skills may also take exemption examinations, administered once each quarter by the Rhetoric Department, for Rhet 3551 and/or 3562. Note that advanced composition courses taken at other institutions can be used to satisfy the Rhet 3551 or 3562 requirement.

The College of Forestry accepts College Level Examination Program (CLEP) scores at the 75th percentile or higher for exemption from up to eight credits in category IV and, in special cases by petition, in category III. No more than six credits in any one discipline (e.g., economics, psychology) may be counted toward category III requirements.

I. Communication, Language, Symbolic Systems—26 credits

- A. English and Foreign Language Communication Skills
Comp 1011, 1012, 1013, 1027
Rhet 1101-1102, 1222, 1506, 3254, 3266, 3551, 3562
Spch 1101, 1102, 3605
- B. Linguistics, Logic, and Philosophic Analysis
Clas 1048, 3048
Ling—all courses except 1005, 3970, 5970
Phil 1001, 1005, 3631, 5105, 5201
- C. Mathematics
Math—all courses except 0009, 1005-1006, 5005-5006, 5090, 5703
Stat 1051, 3081, 3091, 5021

II. Physical and Biological Sciences—25 credits

- A. 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

- B. The Biological Universe
 - Biol 1009, 1103, 1105, 1106, 1107
 - Bot 1009, 1012
 - EBB 3004
 - Ent 1005
 - GCB 3022
 - Phsl 1002

III. The Individual and Society—8 credits

- A. Analysis of Human Behavior and Institutions
 - Afro 1025, 3055, 3061-3062, 3072, 3075-3076, 3091-3092, 3098, 5401
 - AgEc 1020, 1030
 - Anth 1102
 - Econ 1001-1002, 1004-1005, 3001-3002
 - FR 1201
 - FSoS 1001, 1025
 - Geog 1301, 1401
 - Pol 1001, 1025, 1026, 1027, 1031, 1051
 - Psy 1001, 1004-1005
 - Rhet 5165
 - Soc 1001, 1002, 3101
 - Spch 3401
 - SSci 3402
- B. Development of Civilization: Historical and Philosophical Studies
 - Afro 1015, 1025, 1036, 1441, 1442, 3081-3082
 - Clas 1001, 1002, 1003, 1004, 1005, 1006, 1042, 3071, 3072, 3073
 - Fren 3501, 3502
 - Hist—all courses through 1954
 - Ital 3501, 3502
 - Jour 5601
 - Phil 1002, 3001, 3002, 3003, 3004
 - Pol 1041
 - Rhet 1310, 1311, 3375
 - Russ 3501, 3502, 3503
 - Span 3501, 3502

IV. Literary and Artistic Expression—8 credits

- A. Literature
 - Engl—all literature courses
 - Foreign languages—all literature courses
 - Rhet—all literature and humanities courses
- B. 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, Forest Science, and Urban Forestry 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, attained a minimum cumulative grade point average of 2.00, and 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).

It is the responsibility of students to supply the College of Forestry with a complete transcript of all course work and an application by July 15 before the start of the Itasca session they wish to attend.

Cloquet Session—Students in Forest Resources and in the natural science specialization of Forest 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

Baccalaureate Programs

point average of 2.00 at the end of the preceding quarter and completed the Itasca Forestry Session and FR 1100, 3220, 5100, 5114, 5200, 5212, and 5223. In addition, Forest Resources students must have completed AgET 1400, FR 3103, 5215, 5232, and FW 3052.

Forest Products

This curriculum is for students interested in careers in the development, production, marketing, and utilization of the thousands of products which flow from forests—from 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. The four specializations are similar enough that students completing one can seek employment in another.

Marketing—This specialization is for students interested in the sales, distribution, and market development 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, course work 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, work in urban renewal programs, technical sales, product promotion, and specialized marketing research.

FRESHMAN YEAR—41-45 required credits

Acct 1024—Principles of Financial Accounting I (3)
Acct 1025—Principles of Financial Accounting II (3)
Acct 3001—Managerial Accounting (4)
Biol 1009—General Biology (5)
Chem 1001—Chemical Principles and Covalent Systems (5)
Chem 1002—Chemical Principles and Covalent Systems (5)
Econ 1001—Principles of Macroeconomics (4)
Econ 1002—Principles of Microeconomics (4)
Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)
Rhet 1101—Communication I (4)
Rhet 1102—Communication II (4)
Electives and CLE requirements

SOPHOMORE YEAR—42 required credits

ForP 1301—Wood as a Raw Material (4)
ForP 1303—Wood Structure and Identification (2)
FR 1100—Dendrology (4)
Math 1142—Short Calculus (5)
Mktg 3000—Principles of Marketing (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 1222—Public Speaking (4)
Stat 3091—Probability and Statistics (4)
Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (152-156 credits), CLE requirements in category IV (8 credits), and electives (28-32 credits).

JUNIOR YEAR—35 required credits

BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)
CSci 3103—Introduction to Programming Languages and Problem Solving (3)
CSci 3131—FORTRAN Laboratory (2)
ForP 3300—Wood Industry Tours (2)
ForP 3303—Forest Products Marketing (3)
ForP 5300—Wood-Fluid Relationships (3)
ForP 5301—Mechanical Properties (3)
ForP 5303—Wood Deterioration (3)
Mktg 3010—Buyer Behavior and Marketing Analysis (4)
Psy 5751—Psychology of Advertising (4)
QA 3055—Introduction to Management Sciences (4)
Electives and CLE requirements

SENIOR YEAR—34 required credits

ForP 5304—Wood Drying and Preservation Processes (4)
ForP 5306—Manufacturing Processes (3)¹
ForP 5307—Wood-Base Panel Technology (4)
ForP 5331—Senior Seminar (2)¹
ForP 5355—Mechanics and Structural Design With Wood Products (4)
ForP 5356—Advanced Forest Products Marketing (3)
FR 5264—Quantitative Techniques in Forest Management (3)
FR 5265—Forest Policy Issues (3)
Mktg 3020—Marketing Operations Management (4)
Rhet 3562—Scientific and Technical Writing (4)¹
Electives and CLE requirements

¹Two credits of Rhet 3562 are to be taken with ForP 5306 and 2 credits with ForP 5331, for a total of 4 Rhet 3562 credits. Students taking ForP 5306 and ForP 5331 in the same quarter should register for Rhet 3562Y (4 credits). Students taking ForP 5306 and ForP 5331 in different quarters should register for Rhet 3562X (2 credits) concurrently with each ForP course.

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—37-41 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)
- Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)
- Math 1142—Short Calculus (5)
- Rhet 1101—Communication I (4)
- Rhet 1102—Communication II (4)
- Electives and CLE requirements

SOPHOMORE YEAR—33 required credits

- 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 1222—Public Speaking (4)
- Stat 3091—Probability and Statistics (4)
- Electives and CLE requirements

JUNIOR YEAR—42 required credits

- CSci 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3131—FORTRAN Laboratory (2)
- ForP 3300—Wood Industry Tours (2)

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (156-160 credits), CLE requirements in category IV (8 credits), and electives (24-28 credits).

- ForP 3303—Forest Products Marketing (3)
- ForP 5300—Wood-Fluid Relationships (3)
- ForP 5301—Mechanical Properties (3)
- ForP 5303—Wood Deterioration (3)
- ForP 5355—Mechanics and Structural Design with Wood Products (4)
- FR 5265—Forest Policy Issues (3)
- IEOR 5000—Introduction to Industrial Engineering Analysis (4)
- IEOR 5030—Quality Control and Reliability (4)
- IR 3007—Collective Bargaining Negotiations and Modern Labor Relations (4)
- OM 3000—Introduction to Operations Management (4)
- Electives and CLE requirements

SENIOR YEAR—44 required credits

- ForP 5304—Wood Drying and Preservation Processes (4)
- ForP 5305—Pulp and Paper Technology (4)
- ForP 5306—Manufacturing Processes (3)¹
- ForP 5307—Wood-Base Panel Technology (4)
- ForP 5331—Senior Seminar (2)¹
- IEOR 5010—Introduction to Work Analysis (4)
- IEOR 5020—Engineering Cost Accounting, Analysis and Control (4)
- IEOR 5040—Introduction to Operations Research (4)
- IEOR 5311—Management for Engineers (3)
- IEOR 5361—Inventory and Production Control (4)
- IR 3002—Industrial Relations Systems: Labor Markets and the Management of Human Resources (4)
- Rhet 3562—Scientific and Technical Writing (4)¹
- Electives and CLE requirements

¹Two credits of Rhet 3562 are to be taken with ForP 5306 and 2 credits with ForP 5331, for a total of 4 Rhet 3562 credits. Students taking ForP 5306 and ForP 5331 in the same quarter should register for Rhet 3562Y (4 credits). Students taking ForP 5306 and ForP 5331 in different quarters should register for Rhet 3562X (2 credits) concurrently with each ForP course.

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Pulp and Paper—This specialization provides in-depth training in mathematics, physics, chemistry, and wood science and technology. It also includes specialized pulp and paper and related engineering courses on the technology of wood pulp production and the manufacture of paper and other fiber products. Graduates find careers in process engineering, technical services, industrial sales, and research.

FRESHMAN YEAR—42 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)
Math 1211—Calculus I (5)
Math 1221—Calculus II (5)
Math 1231—Calculus III (5)
Rhet 1101—Communication I (4)
Rhet 1102—Communication II (4)
Electives and CLE requirements

SOPHOMORE YEAR—38 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)
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)
Electives and CLE requirements

JUNIOR YEAR—40 required credits

CE 3400—Fluid Mechanics (4)
CSci 3103—Introduction to Programming Languages and Problem Solving (3)
CSci 3131—FORTRAN Laboratory (2)
ForP 3300—Wood Industry Tours (2)
ForP 5300—Wood-Fluid Relationships (3)
ForP 5301—Mechanical Properties (3)
ForP 5302—Wood Chemistry (3)
ForP 5305—Pulp and Paper Technology (4)
ForP 5310—Pulp and Paper Process Laboratory (3)
ME 3301—Thermodynamics (4)
Rhet 1222—Public Speaking (4)
Stat 5021—Statistical Analysis I (5)
Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (158 credits). CLE requirements in categories III and IV (12 credits), and electives (22 credits).

SENIOR YEAR—38 required credits

AgEn 5070—Automatic Control and Instrumentation (4)
Chem 5520—Elementary Physical Chemistry (3)
ForP 5306—Manufacturing Processes (3)¹
ForP 5312—Pulp and Paper Process Calculations (4)
ForP 5313—Pulp and Paper Process Operations (5)
ForP 5315—Paper Engineering Laboratory (2)
ForP 5316—Coated Product Development (2)
ForP 5331—Senior Seminar (2)¹
ForP 5359—Surface and Colloid Chemistry of Papermaking (3)
ForP 5361—Adhesion and Adhesives (3)
FR 5265—Forest Policy Issues (3)
Rhet 3562—Scientific and Technical Writing (4)¹
Electives and CLE requirements

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)
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)

¹Two credits of Rhet 3562 are to be taken with ForP 5306 and 2 credits with ForP 5331, for a total of 4 Rhet 3562 credits. Students taking ForP 5306 and ForP 5331 in the same quarter should register for Rhet 3562Y (4 credits). Students taking ForP 5306 and ForP 5331 in different quarters should register for Rhet 3562X (2 credits) concurrently with each ForP course.

Wood Science and Technology—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—47 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)
 Math 1211—Calculus I (5)
 Math 1221—Calculus II (5)
 Math 1231—Calculus III (5)
 Rhet 1101—Communication I (4)
 Rhet 1102—Communication II (4)
 Electives and CLE requirements

SOPHOMORE YEAR—42 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)
 Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (160 credits), CLE requirements in categories III and IV (11 credits), and electives (21 credits).

JUNIOR YEAR—40 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 5301—Mechanical Properties (3)
 ForP 5302—Wood Chemistry (3)
 ForP 5303—Wood Deterioration (3)
 Rhet 1222—Public Speaking (4)
 Stat 5021—Statistical Analysis I (5)
 Electives and CLE requirements

SENIOR YEAR—31 required credits

ForP 5304—Wood Drying and Preservation Processes (4)
 ForP 5305—Pulp and Paper Technology (4)
 ForP 5306—Manufacturing Processes (3)¹
 ForP 5307—Wood-Base Panel Technology (4)
 ForP 5331—Senior Seminar (2)¹
 ForP 5355—Mechanics and Structural Design With Wood Products (4)
 ForP 5361—Adhesion and Adhesives (3)
 FR 5265—Forest Policy Issues (3)
 Rhet 3562—Scientific and Technical Writing (4)¹
 Electives and CLE requirements

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 in this curriculum take a core of required courses, including the Itasca and Cloquet sessions. In addition, students must complete a minimum of 20 credits in an area of emphasis, such as silviculture, forest management, management and administration, measurement and information systems, quantitative forest management, hydrology, remote sensing, forest soils, and wood utilization. Recommended course lists for available areas of emphasis may be obtained from the Office of Student Services. New areas of emphasis are currently being developed. A student may also submit a proposal for an individual area of specialization, including an explanation of its professional relevance and the courses to be completed, to the faculty for their review and approval.

¹Two credits of Rhet 3562 are to be taken with ForP 5306 and 2 credits with ForP 5331, for a total of 4 Rhet 3562 credits. Students taking ForP 5306 and ForP 5331 in the same quarter should register for Rhet 3562Y (4 credits). Students taking ForP 5306 and ForP 5331 in different quarters should register for Rhet 3562X (2 credits) concurrently with each ForP course.

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FRESHMAN YEAR—48-55 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)
Geo 1001—Physical Geology (5)
IND 1600—Drafting (3) (Students with a C or better in high school mechanical drawing are exempt)
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—Communication I (4)
Rhet 1102—Communication II (4)
Electives and CLE requirements

SOPHOMORE YEAR—26 required credits

AgEc 1020—Principles of Macroeconomics (5)
AgEc 1030—Principles of Microeconomics (4)
CSci 3101—A FORTRAN Introduction to Computer Programming (4)
(or) CSci 3102—Introduction to PASCAL Programming (4)
ForP 1301—Wood as a Raw Material (4)
Rhet 1222—Public Speaking (4)
Stat 3081—Experimental Techniques and Statistical Inference (5)
(or) Stat 5021—Statistical Analysis I (5)
FR 1100—Dendrology and AgET 1400—Surveying if recommended by adviser
Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (143-150 credits), CLE requirements in categories III and IV (11 credits), and electives and credits to satisfy area of emphasis (31-38 credits).

Forest Science

This curriculum resembles Forest Resources but gives students a more in-depth basic science background and more opportunity for individuality in course selection. It is excellent preparation for graduate study and subsequent employment in forestry research, teaching, or related fields. Graduates may pursue forest management or similar careers without advanced degree work, but may not be qualified for some professional forestry positions.

Only students with a demonstrated potential for academic excellence should consider this curriculum. Forest Science students are expected to maintain a minimum grade point average of 3.00.

Specializations in natural science and in social and managerial sciences are offered.

¹Must be completed in conjunction with Rhet 3562X.

ITASCA SESSION—6 required credits

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

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

JUNIOR YEAR—38 required credits

AgET 1400—Surveying (4)
FR 1100—Dendrology (4)
FR 3103—Meteorology and Climatology for Resource Managers (2)
FR 3220—Beginning Forest Soils (2)
FR 5100—Silviculture (3)
FR 5114—Forest Hydrology (3)
FR 5200—Aerial Photo Interpretation (3)
FR 5212—Natural Resources Inventory (3)¹
FR 5215—Forest Fire Management (2)
FR 5223—Timber Management Planning (3)
FR 5232—Management of Recreational Lands (3)
FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
Rhet 3562X—Scientific and Technical Writing (2)
Electives and CLE requirements

SENIOR YEAR—25 required credits

Fall Quarter—Cloquet Session
FR 5101—Field Silviculture I (4)
FR 5104—Field Silviculture II (1)
FR 5115—Forest Hydrology, Field Applications (2)
FR 5126—Field Forest Soils (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 (1)
Winter and Spring Quarters—On Campus
FR 5222—Forest Policy and Economics (5)¹
Rhet 3562X—Scientific and Technical Writing (2)
Electives and CLE requirements

Natural Science

FRESHMAN YEAR—48-52 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)
- Geo 1001—Physical Geology (5)
- Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)
- Math 1211—Calculus I (5)
- Math 1221—Calculus II (5)
- Math 1231—Calculus III (5)
- Rhet 1101—Communication I (4)
- Rhet 1102—Communication II (4)
- Electives and CLE requirements

SOPHOMORE YEAR—40 required credits

- AgEc 1020—Principles of Macroeconomics (5)
- 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 3103—Introduction to Programming Languages and Problem Solving (3)
- CSci 3131—FORTRAN Laboratory (2)
- 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 CLE 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—Important Forest Plants (2)
- FR 3101—Field Forest Ecology (3)
- FR 3201—Field Forest Measurements (1)

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (165-171 credits), CLE requirements in categories III and IV (11 credits), and electives (10-16 credits).

JUNIOR YEAR—28 required credits

- FR 1100—Dendrology (4)
- FR 3220—Beginning Forest Soils (2)
- FR 5100—Silviculture (3)
- FR 5114—Forest Hydrology (3)
- FR 5200—Aerial Photo Interpretation (3)
- FR 5212—Natural Resources Inventory (3)¹
- FR 5223—Timber Management Planning (3)
- Rhet 3562X—Scientific and Technical Writing (2)
- Stat 5021—Statistical Analysis I (5)
- Electives and CLE requirements

SENIOR YEAR—43-45 required credits

Fall Quarter—Cloquet Session

- FR 5101—Field Silviculture I (4)
- FR 5104—Field Silviculture II (1)
- FR 5115—Forest Hydrology, Field Applications (2)
- FR 5126—Field Forest Soils (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 (1)

Winter and Spring Quarters—On Campus

- FR 5222—Forest Policy and Economics (5)¹
- Rhet 3562X—Scientific and Technical Writing (2)

Select three of the following:

1. Ent 5050—Forest Entomology (4)
2. PIPa 5050—Forest Pathology (4)
3. FR 3103—Meteorology and Climatology for Resource Managers (2)
 - (and) FR 5215—Forest Fire Management (2)
4. FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
5. FR 5232—Management of Recreational Lands (3)

Select two of the following:

1. FR 5401—Senior Topics (4)
2. PIPh 3131—Survey of Plant Physiology (4)
 - (or) FR 3114—Tree Physiology (3)
 - (and) FR 3115—Tree Physiology Laboratory (1)
 - (or) GCB 3022—Genetics (4)
3. Soil 5232—Soil Physics (4)
 - (or) Soil 5520—Soil Development and Classification (3)
 - (or) Soil 5710—Advanced Forest Soils (3)

Electives and CLE requirements

¹Must be completed in conjunction with Rhet 3562X.

Baccalaureate Programs

Social and Managerial Sciences

FRESHMAN YEAR—43-47 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)
Math 1008—Trigonometry (4) (Students with a C or better in high school trigonometry are exempt)
Math 1211—Calculus I (5)
Math 1221—Calculus II (5)
Math 1231—Calculus III (5)
Rhet 1101—Communication I (4)
Rhet 1102—Communication II (4)
Electives and CLE requirements

SOPHOMORE YEAR—34 or 35 required credits

- AgEc 1020—Principles of Macroeconomics (5)
AgEc 1030—Principles of Microeconomics (4)
CSci 3103—Introduction to Programming Languages and Problem Solving (3)
CSci 3131—FORTRAN Laboratory (2)
ForP 1301—Wood as a Raw Material (4)
FR 1100—Dendrology (4)
FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
Phys 1001—The Physical World (4)
Phys 1005—Physics Laboratory (1)
(or) Math 3142—Introduction to Linear Algebra (4)
Rhet 1222—Public Speaking (4)
Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (136-142 credits), CLE requirements in categories III and IV (10 credits), and electives (40-46 credits).

ITASCA SESSION—6 required credits

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

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

JUNIOR YEAR—32 or 33 required credits

- FR 3220—Beginning Forest Soils (2)
FR 5100—Silviculture (3)
FR 5114—Forest Hydrology (3)
FR 5200—Aerial Photo Interpretation (3)
FR 5212—Natural Resources Inventory (3)¹
FR 5223—Timber Management Planning (3)
Rhet 3562X—Scientific and Technical Writing (2)
Stat 5021—Statistical Analysis I (5)
Stat 5022—Statistical Analysis II (5)
Stat 5302—Applied Regression Analysis (4)
(or) FR 5253—Forest Biometry (3)
Electives and CLE requirements

SENIOR YEAR—21 required credits

- FR 5222—Forest Policy and Economics (5)¹
FR 5232—Management of Recreational Lands (3)
FR 5264—Quantitative Techniques in Forest Management (3)
FR 5401—Senior Topics (4)
PIPa 5050—Forest Pathology (4)
(or) Ent 5050—Forest Entomology (4)
Rhet 3562X—Scientific and Technical Writing (2)
Electives and CLE requirements

¹Must be completed in conjunction with Rhet 3562X.

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 not included.

FRESHMAN YEAR—50-57 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)
 IND 1600—Drafting (3) (Students with a C or better in high school mechanical drawing are exempt)
 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—Communication I (4)
 Rhet 1102—Communication II (4)
 Soil 1122—Introductory Soil Science (4)
 Electives and CLE requirements

SOPHOMORE YEAR—43-48 required credits

AgEc 1020—Principles of Macroeconomics (5)
 AgEc 1030—Principles of Microeconomics (4)
 EBB 3004—Fundamentals of Ecology (4)
 FR 1100—Dendrology (4)
 LA 1024—Landscape Theory (4)
 (or) LA 1001—Environmental Design: Man and Environment (4)
 Math 1142—Short Calculus (5)
 (or) Math 1211—Calculus I (5)
 Phys 1001—The Physical World (4)
 (and) Phys 1005—Physics Laboratory (1) (Students who have completed high school physics are exempt, but must first see their adviser)
 Pol 1041—Contemporary Political Ideologies (4)
 (or) Pol 1031—Selected Problems in American Public Policy (4)
 Psy 1001—General Psychology (5)
 Rhet 1222—Public Speaking (4)
 Soc 1001—Introduction to Sociology (4)
 Electives and CLE requirements

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (158-171 credits), CLE requirements (8 credits), and electives (13-26 credits).

JUNIOR YEAR—38 required credits

AgEc 3610—Community Resource Development (4)
 (or) AgEc 5620—Regional Economic Analysis (4)
 AgET 3410—Hydrology, Water Control (4)
 FR 5232—Management of Recreational Lands (3)
 FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
 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 3551—Professional Writing (4)
 (or) Rhet 3562—Scientific and Technical Writing (4)
 Stat 3081—Experimental Techniques and Statistical Inference (5)
 (or) Stat 5021—Statistical Analysis I (5)
 (or) Soc 3801—Sociological Methods I: Descriptive Statistics (5)
 Electives and CLE requirements

SENIOR YEAR—27 or 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)
 RCD 5099—Interdisciplinary Seminar I (4)
 RCD 5100—Interdisciplinary Seminar II (4)
 Soc 5401—Social Organizations (5)
 (or) Soc 5651—Rural Social Institutions (4)
 (or) Jour 5501—Communication and Public Opinion I (4)
 Electives and CLE requirements

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—43-47 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)
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 (3)
Rhet 1101—Communication I (4)
Rhet 1102—Communication II (4)
Electives and CLE requirements

SOPHOMORE YEAR—40 required credits

AgEc 1020—Principles of Macroeconomics (5)
AgEc 1250—Principles of Accounting (5)
BLaw 3058—Introduction to Law, and the Law of Contracts and Agency (4)
CSci 3101—A FORTRAN Introduction to Computer Programming (4)
(or) CSci 3102—Introduction to PASCAL Programming (4)
Hort 1021—Woody Plant Materials (5)
LA 1024—Landscape Theory (4)
Rhet 1222—Public Speaking (4)
Soil 1122—Introductory Soil Science (4)
Stat 3081—Experimental Techniques and Statistical Inference (5)
(or) Stat 5021—Statistical Analysis I (5)
Electives and CLE 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—Important Forest Plants (2)
FR 3101—Field Forest Ecology (3)
FR 3201—Field Forest Measurements (1)

TOTAL GRADUATION REQUIREMENTS—192 credits

Required courses listed above (170-174 credits), CLE requirements in categories III and IV (11 credits), and electives (7-11 credits).

JUNIOR YEAR—43 required credits

ForP 1301—Wood as a Raw Material (4)
FR 1100—Dendrology (4)
FR 3103—Meteorology and Climatology for Resource Managers (2)
FR 3114—Tree Physiology (3)
FR 5100—Silviculture (3)
FR 5200—Aerial Photo Interpretation (3)
FR 5212—Natural Resources Inventory (3)¹
FW 3052—Introduction to Fisheries and Wildlife Biology and Management (4)
Hort 1100—Biology of Horticultural Production (4)
Hort 1036—Plant Propagation (4)
Hort 3076—Arboriculture (3)
PIPa 5050—Forest Pathology (4)
Rhet 3562X—Scientific and Technical Writing (2)

SENIOR YEAR—38 required credits

Ent 5050—Forest Entomology (4)
FR 5114—Forest Hydrology (3)
FR 5222—Forest Policy and Economics (5)¹
FR 5232—Management of Recreational Lands (3)
FR 5xxx—Urban Forest Management (3)
FR 5xxx—Urban Forest Administration (3)
Hort 5046—Nursery Management and Production I (3)
Hort 5048—Nursery Management and Production II (4)
IR 3010—Human Relations, Applied Organization Theory (4)
(or) IR 3002—Industrial Relations Systems: Labor Markets, the Management of Human Resources (4)
(or) Jour 5549—Public Relations (4)
PA 5521—Strategy, Tactics in Project Planning (4)
Rhet 3562X—Scientific and Technical Writing (2)
Electives and CLE requirements

¹Must be completed in conjunction with Rhet 3562X.



III. 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 in lieu of page footnotes:

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

† Concurrent registration is allowed (or required) in the course listed after the paragraph mark.

Consent of the instructor is required prior to registration.

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

Forest Products (ForP)

- 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.** (1 cr, 2 cr with project; S-N only; prereq #)
Discussions, guest talks, audiovisual programs, and in-class exercises on people management, planning and organization, meetings and group problem solving, technology transfer and introduction of change into organizations, mass media and publicity campaigns, time management, and career planning and development. Written project for an additional credit optional.
- 1301. WOOD AS A RAW MATERIAL.** (4 cr)
The physical and chemical nature of solid wood and wood fibers 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 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)
Visits to a number of firms involved with various facets of the forest products industry.
- 3303. FOREST PRODUCTS MARKETING.** (3 cr; prereq Mktg 3000)
Historical and current considerations of forest products marketing at the manufacturing, wholesale, and retail levels. Lectures, guest speakers, and field trips.
- 3310. WOOD-FRAME BUILDING SYSTEMS AND MATERIALS.** (4 cr; prereq AgET 1015, Phys 1001 or equiv)
Development and principles of manufactured housing systems. Wood-frame construction technology. Strength and other properties of wood and wood-based materials as related to design. Material and design optimization. Insulation materials and heat loss.
- 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.
- 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.** (3 cr; prereq Chem 3302)
Chemical composition, reactions, and analyses of wood, wood components, and derivatives.
- 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, 5302 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. Field trip optional.
- 5306. MANUFACTURING PROCESSES.** (3 cr; prereq 1301 or #, 3300 recommended)
Manufacture of wood-based products from a systems point of view. Input requirements, machinery selection, methods of economic comparison. Technology related to lumber manufacture.
- 5307. WOOD-BASE PANEL TECHNOLOGY.** (4 cr; prereq 5300, 5301 or #)
Design, manufacture, properties, and applications of plywood, particleboard, fiberboard, and composite panels. Adhesives and their application in the panel industry. Lecture, laboratory, and research project.
- 5310. PULP AND PAPER PROCESS LABORATORY.** (3 cr; prereq 5305 or 5305s)
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 #)
Chemical and physical process calculations; steady and unsteady state material and energy balances applied to pulping and papermaking processes.
- 5313. PULP AND PAPER PROCESS OPERATIONS.** (5 cr; prereq CE 3400 or #)
Application of the principles of momentum, heat, and mass transfer to unit operations in the pulp and paper industry: fluid transport, filtration, sheet forming, sedimentation, heat exchange, evaporation, gas absorption and stripping, distillation, leaching, extraction, crystallization, humidification, and drying.
- 5315. PAPER ENGINEERING LABORATORY.** (2 cr; prereq 5312 or #)
Experiments designed to illustrate and apply the principles of momentum, heat, and mass transfer using the pilot-plant paper machine and coater.
- 5316. COATED PRODUCT DEVELOPMENT.** (2 cr; prereq 5310 or #)
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. SENIOR SEMINAR.** (2 cr; prereq sr; A-N grading only)
Current developments in forest products.
- 5350. WOODY TISSUE MICROTECHNIQUE.** (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. ADVANCED WOOD CHEMISTRY.** (2 cr; prereq 5302, Chem 3100, Chem 3101 or equiv; offered when feasible)
Laboratory problems in the analysis of wood constituents and in the techniques of their isolation and purification.
- 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 #)
Lectures and case studies on retail, wholesale, manufacturer, and market analysis research concerning the forest products business.
- 5359. SURFACE AND COLLOID CHEMISTRY OF PAPERMAKING.** (3 cr; prereq Chem 5520 or #)
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 of these woods; relation of these properties to favored uses for the woods.
- 5361. ADHESION AND ADHESIVES.** (3 cr; prereq 5359, Chem 3302, Chem 5520 or #)
Introduction to adhesion. Physico-chemical interactions at adhesive-adherend interface. Polymer adsorption. Polymer structure and adhesive utility. Wood as adherend. Adhesive-wood interface. Shelf-life of resins. Curing. Adhesive cohesion and performance. Adhesives from renewable resources.
- 5401. SENIOR TOPICS.** (Cr ar; prereq sr)
Independent study in a field of interest to a forestry major planned with the student's adviser.

Course Descriptions

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *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

8305. INFLUENCE OF CULTURAL/GENETIC PRACTICES ON THE STRUCTURE AND UTILIZATION OF WOODY FIBROUS MATERIALS

8306. SEMINAR: FOREST PRODUCTS

Forest Resources (FR)

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.

1101. INTRODUCTION TO AIR AND WATER QUALITY. (4 cr)

Air and water quality problems. Basic processes that govern the accretion, depletion, and cycles of specific types and sources of pollution. Methods of pollution abatement and influence of political, social, and economic pressures on the maintenance of a "quality environment."

1102. LEADERSHIP AND MANAGEMENT SKILLS FOR COLLEGE OF FORESTRY STUDENTS. (1 cr, 2 cr with project; prereq #: S-N only)

Discussions, guest talks, audiovisual programs, and in-class exercises on people management, planning and organization, meetings and group problem solving, technology transfer and introduction of change into organizations, mass media and publicity campaigns, time management, and career planning and development. Written project for an additional credit optional.

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 ♯1100)

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. IMPORTANT FOREST PLANTS. (2 cr; prereq Biol 1103; given at Itasca)

Identification of forest plants as related to forest types.

3101. FIELD FOREST ECOLOGY. (3 cr; prereq Chem 1001 or Chem 1004; given at Itasca)

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

3103. METEOROLOGY AND CLIMATOLOGY FOR 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.

3114. TREE PHYSIOLOGY. (3 cr; prereq Chem 1001 or Chem 1004, 10 cr of biology)

The growth, development, and functions of forest and shade trees. Lecture only.

3115. TREE PHYSIOLOGY LABORATORY. (1 cr; prereq 3114 or ♯3114)

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

- 3201. FIELD FOREST MEASUREMENTS.** (1 cr; prereq Math 1008 or #; given at Itasca)
Introduction to land survey, tree and stand measurement, and basic forest sampling techniques.
- 3220. BEGINNING FOREST SOILS.** (2 cr; prereq Itasca session, Geo 1001)
Basic soil properties and relationships to tree growth; soil development and classification.
- 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.
- 5100. SILVICULTURE.** (3 cr; prereq Itasca session, 1100)
Introduction to silvics, forest regeneration and site preparation techniques, intermediate silvicultural practices, and silvicultural systems.
- 5101. FIELD SILVICULTURE I.** (4 cr; prereq 5100; 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.
- 5102. REGIONAL SILVICULTURE.** (3 cr; prereq 5100 or #)
Forest regions of the United States emphasizing silvical, historical, geographic, economic, and other determinants of silvicultural practices.
- 5103. ADVANCED FOREST TREE BIOLOGY.** (3 cr; prereq #)
Current applications and research in forest tree biology.
- 5104. FIELD SILVICULTURE II.** (1 cr; prereq 5100; given at Cloquet)
Application of even-age and all-age silvicultural systems to hardwood stands. Lectures, field trips, and exercises.
- 5105. INTENSIVE SILVICULTURE.** (3 cr; prereq sr in forestry)
Principles and techniques underlying silvicultural systems aimed at high productivity. Current practices in various forest regions of the United States and the world. Lectures and guest speakers.
- 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 or #; 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.
- 5126. FIELD FOREST SOILS.** (2 cr; prereq 3220, 5114; given at Cloquet)
Field examination of forest soils and their relationship to site productivity and forest management.
- 5150. FOREST ECOLOGY SEMINAR.** (3 cr; prereq sr, 3101, 5100 or #)
Survey of classical concepts and contemporary developments in ecology as related to forestry. Discussion group format.
- 5152. FOREST GENETICS.** (3 cr; prereq #)
Genetic variation of forest-tree species and underlying principles; application of plant breeding principles to forestry.
- 5153. ADVANCED FOREST HYDROLOGY.** (4 cr; prereq 3220, 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.
- 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 1030 or equivalent computer programming course with FORTRAN or BASIC language, Math 1142 or Math 1211, Stat 3081 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 #)
Field exercises in prescribed burn planning and execution.

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- 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 3220, 5200, 5212; 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.
- 5222. FOREST POLICY AND ECONOMICS.** (5 cr or cr ar, §5265; prereq AgEc 1030 or #)
Forest resource supply and consumption relationships, United States and world; legal and political factors; basic economic analysis of forestry activities (production, consumption, and investments).
- 5223. TIMBER MANAGEMENT PLANNING.** (3 cr; prereq 5212, 5222 or #)
Introduction to fundamentals of forest planning, including sustained yield, measurement of growing stock, regulation models, and development of timber management plans. Modern harvest scheduling and planning models.
- 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.
- 5232. MANAGEMENT OF RECREATIONAL LANDS.** (3 cr; prereq jr in forestry or #)
Recreational use of the forest and associated land and water. Policy problems arising from recreational demands.
- 5233. PRINCIPLES OF OUTDOOR RECREATION DESIGN AND PLANNING.** (4 cr; prereq 5232 or #)
(Same as LA 5010) For advanced students associated with design, management, and planning of recreational facilities. Planning and design principles related to recreational land use and development; parks, campsites, water areas, highways, summer and winter recreational facilities.
- 5236. FOREST RECREATION PLANNING.** (1 cr; prereq 5232; given at Cloquet)
Recreation area and site planning, examples and managerial concerns. Fieldwork and presentation.
- 5248. HARVESTING AND ENGINEERING.** (3 cr; prereq AgET 1400; 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.
- 5253. FOREST BIOMETRY.** (3 cr; prereq 5212, Stat 5022 or #)
Topics in forest measurements, sampling, inventory, and the modeling and analysis of forest growth and change.
- 5257. RECREATION LAND POLICY.** (3 cr; prereq 5232 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 5232, RRM major or grad student or #)
Development of environmental framework for understanding recreation behavior. Contributions of several disciplines, current cultural trends, management implications.
- 5260. ADMINISTRATIVE PROCESSES FOR NATURAL RESOURCE MANAGERS.** (3 cr; prereq sr or #)
Development of U.S. forestry and resource management organizations. Staffing, direction, organization, planning, budgeting, and related administrative practices.
- 5261. ADVANCED FOREST POLICY AND ECONOMICS.** (3 cr; prereq 5222 or #)
Advanced topics concerning the quantitative techniques for analyzing forestry policy and economic activities; economic analysis of forestry projects; analyses of political and legal processes in forestry; review of literature on forest policy and economics; case studies.
- 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, multispectral, 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, 5222, 5223 or #)
Forestry applications of quantitative techniques in allocation and other decision-making problems. Mathematical programming, simulation, and other techniques.
- 5265. FOREST POLICY ISSUES.** (3 cr, §5222)
Processes by which forestry issues evolve and are resolved; systematic analysis of issues (defining issues, assessing special interest group concerns, defining objectives and alternatives); analysis of selected forestry issues such as sustained yield, clear-cutting, forest practice regulation, multiple and dominant use, and energy conservation.
- 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.
- 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.

FOR GRADUATE STUDENTS ONLY

(For course descriptions, see the *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
- 8108. FOUNDATIONS OF RENEWABLE RESOURCES RESEARCH
- 8200. RESEARCH PROBLEMS: FOREST MANAGEMENT
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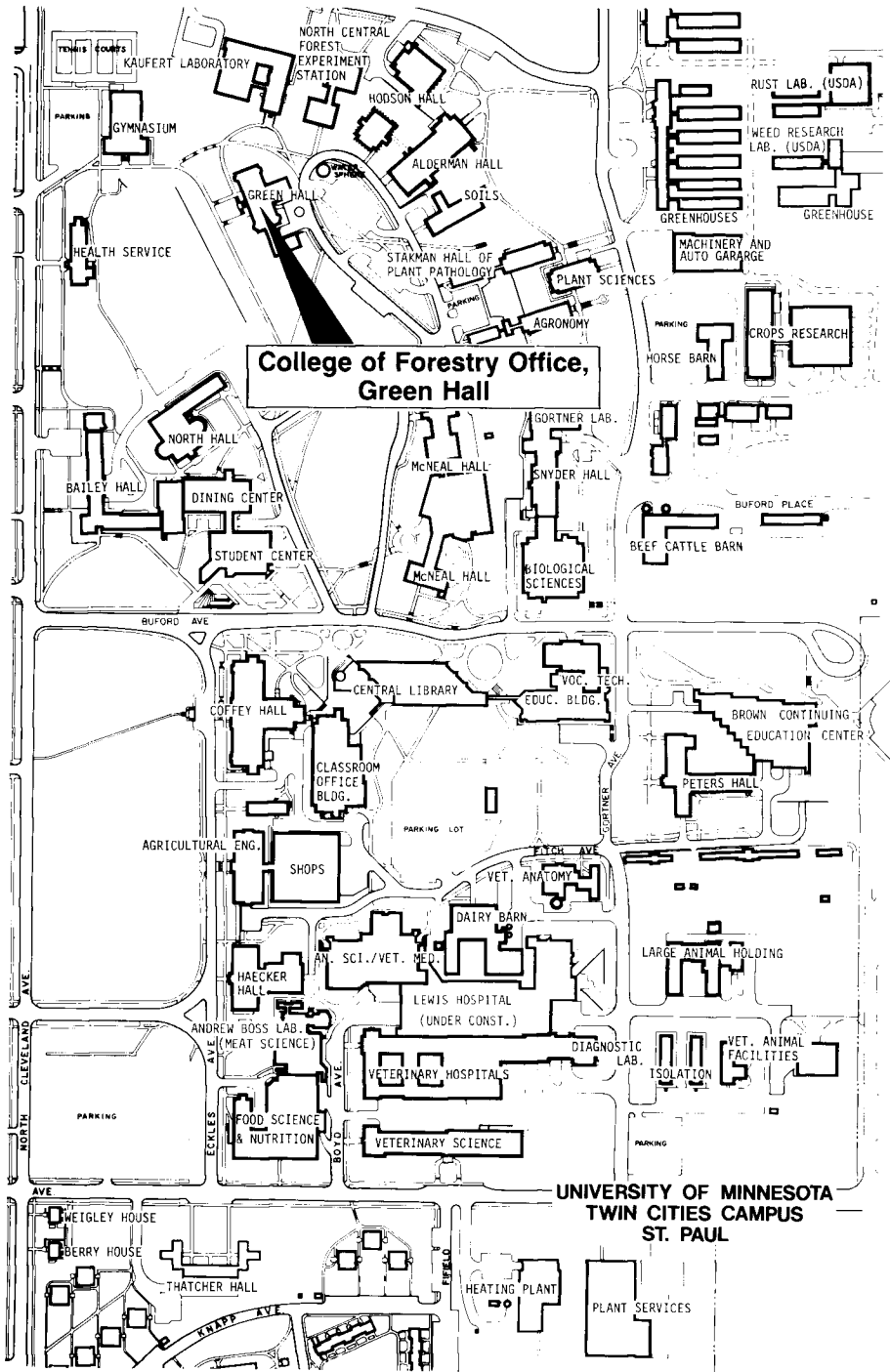
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**College of Forestry Office,
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