Ranked as one of the premier forestry and natural resources schools in the world, the College of Forestry at Oregon State University provides graduates with an understanding of the complexity of forests and the economic and social systems that depend upon them. Our students learn to work with nature to keep land healthy for future generations; to know the science, technology, and business associated with managing and using forests; and to work effectively with others in a culturally diverse, global society.

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College of Forestry (CoF)
The OSU College of Forestry has educated students for over 100 years. We offer undergraduate and graduate degrees that prepare students for a variety of careers in the public and private sectors. Our programs feature world-class faculty and modern facilities. We provide remarkable access to local forests, private industries, government agencies, international travel, and research through paid internships and mentored work experiences. Our students graduate with the necessary knowledge and skills for fulfilling careers.

Degrees and Accreditations
Bachelor of Science (BS) and Honors Bachelor of Science (HBS) Degrees and (campus offered):
- Forestry (Corvallis)
- Forest Engineering (Corvallis)
- Forest/Civil Engineering Double Degree (Corvallis)
- Natural Resources (Corvallis, Cascades, Ecampus)
- Renewable Materials (Corvallis)
- Tourism, Recreation & Adventure Leadership (Corvallis, Cascades)

BS degrees in Forestry, Forest Engineering, and Forest-Civil Engineering are accredited by the Society of American Foresters (SAF). In addition, the BS degree in Forest Engineering and the BS double degree in Forest-Civil Engineering are accredited by the Engineering Accreditation Commission of ABET (https://www.abet.org/). The BS degree in Renewable Materials is accredited by the Society of Wood Science and Technology (SWST).

Graduate Degrees including Master of Forestry (MF), Masters of Natural Resources (MNR), Master of Science (MS), and Doctor of Philosophy (Ph.D.):
- Forest Ecosystems & Society (MF, MS, Ph.D.) Corvallis campus
- Natural Resources (MNR) Ecampus
- Sustainable Forest Management (MF, MS, Ph.D.) Corvallis campus
- Wood Science & Engineering (MS, Ph.D.) Corvallis campus

Master of Arts in Interdisciplinary Studies (MAIS) is available in each department.

Graduate Certificates:
- Forests & Climate Change (Ecampus)
- Sustainable Natural Resources (Ecampus)
- Urban Forestry (Ecampus)

Double Degrees
Undergraduates with majors in the College of Forestry also can earn secondary degrees in education, innovation management, or sustainability. See the College of Education, College of Business, or College of Agricultural Sciences sections of this catalog for more information.

High School Preparation
Students planning to study at Oregon State University should include the following subjects in their high school programs: English, 4 years; mathematics, 3 years; science, 3 years (to include at least one year each of two different sciences—biology, chemistry, physics, etc.); social studies, 3 years; and foreign language, 2 years.

Transfer Students
Because of the technical and professional nature of the college’s curricula, the college reserves the right to determine whether courses taken at another institution satisfy the college's curricular requirements. In general, equivalent college-level courses successfully completed at a regionally accredited college or university are accepted.

Advising
The College of Forestry is committed to helping students succeed. Students are required to meet with an advisor each term. Advisors are valuable sources of information about degree programs, mentoring, and other special opportunities in line with students’ interests. The Student Services team is available to help with university rules and regulations, job placement, exchange programs, and referrals to cross-campus programs and services. Students are encouraged to take an active role in their program planning, and to use their time at OSU to develop themselves both academically and professionally.

The college and the OSU Career Development Center provide up-to-date information for both seasonal and permanent work and offer a full array of career services to prepare undergraduates and graduates for jobs.
Education Facilities

The George W. Peavy Forest Science Center and Richardson Hall contain modern classrooms, laboratories, computing, and study facilities. The FERN Center offers students access to educational materials, computers, and group study space. The A.A. “Red” Emmerson Advanced Wood Products Laboratory features 15,000 square-feet of structural testing space and a 2,500 square-foot advanced wood products manufacturing area.

Classes use the nearby college forests for field instruction and research projects. In addition to the 11,500 acres in the McDonald-Dunn Forests, the college manages other forests in Oregon for education and research.

Students benefit from the college’s relationships with public and private programs and facilities. Field trips to forests, wood processing, and manufacturing operations, recreation facilities, and research sites enable students to observe contemporary problems and practices.

Corvallis is one of the largest forestry and wood science research centers in the world. An innovative research program is conducted by the college through its Forest Research Laboratory and by the campus-based Forest Sciences Laboratory of the U.S. Forest Service. These organizations offer state-of-the-art facilities for educational and employment opportunities for students.

The Forest Products Collection contains approximately 2,500 species of wood, primarily from North and South America, Southeast Asia, and Africa, while the grounds around the college are planted with an extensive collection of Pacific Northwest trees and shrubs.

Student Activities

Students participate in social and academic activities related to forestry and natural resources, forest products, sports logging, and more. Clubs and student chapters of several professional societies are active in the college, as well as Xi Sigma Pi, a national honor society. These clubs offer students the chance to develop friendships, leadership and team-building skills. Students may also gain academic and professional experience abroad through the college’s Office of International Programs.

Scholarships

The College of Forestry offers over $500,000 in undergraduate scholarships annually. Many scholarships are merit based, and awards range from between $1,000 and $10,000 per year. Online applications (http://studentservices.forestry.oregonstate.edu/sre/scholarships/) are available in late fall, and are due February 15 of each year.

Graduate students are commonly supported with teaching and research assistantships, as well as fellowships with awards totaling over $300,000 per year. More information is available on the College of Forestry website (http://www.forestry.oregonstate.edu/graduate-programs/funding/).

Scholarships and fellowships are awarded each spring for the following academic year.

Academic Requirements

To earn a bachelor of science degree, a student must complete at least 180 quarter credits of university-level courses for the Forestry; Natural Resources; Renewable Materials; and Tourism, Recreation, and Adventure Leadership programs. At least 192 quarter credits of university-level courses are required for the BS in Forest Engineering, and 242 credits are required for the double degree in Forest Engineering and Civil Engineering. These curricula include:

- Written and oral communications, 12–13 credits including a senior writing intensive course.
- OSU Baccalaureate Core curriculum.
- Completion of an approved departmental curriculum.
- Minimum grades:
  - Forestry majors must earn grades of C or better in all courses (or approved substitutions) required for the major and option. No major or option courses may be taken with S/U grading.
  - Forest Engineering majors must earn grades of C or better in all courses (or approved substitutions) required for the major. No major courses may be taken with S/U grading.
  - Forest-Civil Engineering majors must earn grades of C or better in all courses (or approved substitutions) required for the major. No major courses may be taken with S/U grading.
  - Natural Resources majors must achieve passing grades in all major courses, and a minimum GPA of 2.25 in the option. Natural Resources majors can take up to two S/U graded courses in their major or option.
  - Renewable Materials majors must achieve grades of C or high in all COF courses (prefix: FE, FES, FOR, NR, TRAL, or WSE) for the major or option. No major or option courses may be taken with S/U grading.
  - Tourism, Recreation & Adventure Leadership majors must earn grades of C or high in all COF courses (prefix: FE, FES, FOR, NR, TRAL, or WSE) for the major or option. No major or option courses may be taken with S/U grading.
  - Approved work experience as noted below.

Professional and Personal Requirements

Those majoring in Forest Engineering, Forest Engineering-Civil Engineering, Forestry, Renewable Materials, and Tourism, Recreation & Adventure Leadership must complete six months of satisfactory employment in an area related to their major.

Students are personally responsible for fulfilling all curricular requirements in proper sequence. Work performance and personal conduct are thoroughly appraised by the college. Since the professions of forestry and natural resources are highly regarded for their ethical and academic standards, students are responsible for observing the Professional Code of Conduct of the college in its entirety. Departure from these ethical requirements may result in dismissal from the college.

Forest Engineering (FE)

**FE 101, INTRODUCTION TO FOREST ENGINEERING, 2 Credits**

Introduction to the forest engineering discipline. Discussion of critical issues, available resources, career opportunities and professional opportunities. Overview of field instruments and analytical approaches.
FE 102, FOREST ENGINEERING PROBLEM SOLVING AND TECHNOLOGY, 3 Credits
A technology applications course designed to introduce students to formulating and implementing computational solutions to engineering analysis and design problems in a digital environment. Students will learn to evaluate engineering problems, formulate one or more solution techniques or algorithms, and code the solution using spreadsheet and/or programming software. Professionalism in completing and presenting laboratory exercises is emphasized. Laboratory examples draw from a variety of engineering topics. This course may be substituted for CE 102, Civil Engineering I: Problem Solving and Technology.
Equivalent to: FE 215
Recommended: Calculus

FE 206, ENGINEERING FOREST BIKING TRAILS, 2 Credits
Students will design trails that mitigate impact on the environment and other trail users, while still providing a fun experience for mountain bike riders. Topics include site classification, trail safety, water management, digital terrain models, and commercial road design software. This course will emphasize field and design work.

FE 208, FOREST SURVEYING, 4 Credits
Introduction to theory and practice of surveying methods and measurements as applied to the specifics of forestry problems and their solutions. This is the first of a four-course sequence (FE 208, 209, 310, 311). Together with FE 257 it is designed to prepare students for the Fundamentals of Land Surveying exam, which is necessary to become a professional land surveyor.
Prerequisite: MTH 112 with C or better or MTH 241 with C or better or MTH 251 with C or better or MTH 251H with C or better or MTH 252 with C or better or MTH 252H with C or better
Equivalent to: FE 308
Available via Ecampus

FE 209, FOREST PHOTOGRAMMETRY AND REMOTE SENSING, 4 Credits
Management and conservation of natural resources with the fundamentals of spatial data acquisition from airborne and spaceborne sensors. Introduction to theory of spectral reflectance properties of vegetation, the principles of photographic analysis and aerial photo-interpretation and new advances such as LIDAR.
Prerequisite: MTH 112 with C or better or MTH 241 with C or better or MTH 251 with C or better or MTH 251H with C or better or MTH 252 with C or better or MTH 252H with C or better
Equivalent to: FE 309

FE 257, GIS AND FOREST ENGINEERING APPLICATIONS, 3 Credits
An introduction to the appropriate use and potential applications of geographic information systems (GIS) and related technologies (GPS and remote sensing) in forest management and operational planning and problem solving. Students are presented with lectures and exercises that cover a wide range of GIS and GIS-related topics and issues including spatial database creation, structure, analysis, and modeling. Lec/lab.
Equivalent to: FE 357
Available via Ecampus

FE 307, JUNIOR SEMINAR, 1 Credit
College is the time to develop the skills necessary for the transition between academics and career. In conjunction with the expertise already available on campus, this course will guide students through career planning, exploration, placement, and employer expectations. CROSSLISTED as FE 307/FOR 307.
Equivalent to: FOR 307

FE 310, FOREST ROUTE SURVEYING, 4 Credits
Route surveying and site surveying applied to forestry problems. Use of surveying equipment; traversing; computations; leveling; horizontal, vertical, compound, reverse and spiral curves; earthwork; construction staking as applied to new road and existing road P-line survey. Includes rapid survey techniques. Lec/lab.
Prerequisite: (FE 208 with C or better or FE 308 with C or better) or CE 361 with C or better or CEM 263 with C or better

FE 312, FORESTRY FIELD SCHOOL, 2 Credits
A hands-on experience in the major aspects of forestry, including regeneration surveys, silviculture, cruising, recreation, forest disturbances, logging site and mill visits, east and west of the Cascades Range. CROSSLISTED as FE 312/FOR 312.
Equivalent to: FOR 312

FE 315, SOIL ENGINEERING, 4 Credits
Prerequisite: ENGR 213 (may be taken concurrently) with D- or better
Recommended: CE 311 or CEM 311 or FE 330

FE 316, SOIL MECHANICS, 4 Credits
Soil strength and soil mechanics theories applied to analysis of slope stability, retaining structures, foundations, and pavements. Lec/lab.
Prerequisite: FE 315 (may be taken concurrently) with C- or better or CE 372 (may be taken concurrently) with D- or better

FE 330, FOREST ENGINEERING FLUID MECHANICS AND HYDRAULICS, 3 Credits
Fluid properties, pressure, fluid statics, continuity, energy equation, single and series pipe flow, open channel hydraulics, peakflow estimates for culvert design, stream crossing design. Lec/lab.
Prerequisite: ENGR 213 (may be taken concurrently) with D- or better and FE 102 (may be taken concurrently) [C-]
Equivalent to: FE 431

FE 370, HARVESTING OPERATIONS, 4 Credits
Timber harvesting and transport methods from the forest to the mill. Technical feasibility, economic, and environmental relationships in forestry operations. Junior standing in forestry required. For non-forest engineering students.
Prerequisite: PH 201 with C or better or PH 211 with C or better
FE 371, HARVESTING PROCESS ENGINEERING, 4 Credits
Timber harvesting equipment and systems. Harvesting process evaluation and decisions aided by forest engineering analysis. Lec/lab.
Prerequisite: ENGR 211 with C or better and FE 102 [C]
Recommended: Concurrent enrollment in FE 208 and FE 357

FE 403, THESIS, 1-16 Credits
PREREQ: Departmental approval required.
This course is repeatable for 16 credits.

FE 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FE 406, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

FE 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

FE 415, FOREST ROAD ENGINEERING, 3 Credits
Location, surveying, design, cost estimation, and construction practices for forest roads. Lecture on principles, and laboratory field practice in locating, surveying, designing, and cost estimating.
Prerequisite: FE 310 with C- or better

FE 416, FOREST ROAD SYSTEM MANAGEMENT, 4 Credits
Structural characteristics of bridges, load rating, structural design of culverts, aggregate testing and evaluation, environmental assessment of forest road systems, road maintenance cycles and management.
Prerequisite: (ENGR 211 with D- or better or ENGR 211H with D- or better) and (ENGR 213 [D-] or ENGR 213H [D-]) and FE 316 [C-] and FE 415 [C-]

FE 423, UNMANNED AIRCRAFT SYSTEM REMOTE SENSING, 3 Credits
Unmanned Aircraft System (UAS) Geomatics presents techniques in UAS design and applications for remote sensing measurements of both natural and constructed landscapes.
Prerequisite: FE 309 with C or better or GEOG 480 with C or better or GEOG 481 with C or better or GEO 444 with C or better or GEO 466 with C or better

FE 430, WATERSHED PROCESSES, 4 Credits
Effects of land use practices on the hydrology (interception, infiltration, evapotranspiration, subsurface flow and surface runoff, water yields, and peak flows) of forested watersheds. Surface erosion, mass soil movements, stream temperatures, nutrient levels and effects of management activities upon riparian systems; forest practice rules. Lec/lab.

FE 434, FOREST WATERSHED MANAGEMENT, 4 Credits
Physical hydrology, erosion processes, streams, and riparian areas of forested ecosystems. The material can be widely applied, but is applicable primarily to the humid, temperate rainforests of the Pacific Northwest.
Prerequisite: (CH 121 with C or better or CH 201 with C or better or CH 231 with C or better) and (SOIL 205 [C] or CSS 305 [C] or CSS 205 [C]) and (MTH 241 [C] or MTH 251 [C] or MTH 251H [C])

FE 436, FOREST DISTURBANCE HYDROLOGY, 3 Credits
Impacts of forest disturbance, including timber harvest, wildfire, insect outbreaks, and low frequency storms and floods on watershed hydrology and streams.
Prerequisite: FE 434 with C or better
Equivalent to: FE 435

FE 440, FOREST OPERATIONS ANALYSIS, 4 Credits
Identification and measurement of production components in harvesting systems. Methods analysis, productivity improvement and engineering economics. Report writing skills emphasized. Lec/lab.
Prerequisite: FE 102 with C- or better and (FE 370 [C-] or FE 371 [C-])
Recommended: Basic statistics

FE 444, FOREST REMOTE SENSING AND PHOTOGRAMMETRY, 4 Credits
Introduction to spectral reflectance, photogrammetry, image analysis, and point clouds. Fundamentals of data acquisition with passive and active sensors installed on airborne and spaceborne platforms. Radar and lidar in forestry. Lec/lab.
Prerequisite: FE 257 with C or better and (MTH 112 [C] or MTH 241 [C] or MTH 251 [C] or MTH 251H [C] or MTH 252 [C] or MTH 252H [C]) and (PH 201 [C] or PH 211 [C])

FE 456, *INTERNATIONAL FORESTRY, 3 Credits
An introduction to the biological, physical, and sociological factors that shape the world's forests and the activities used to manage those forests. What influence these factors have on forest policies, practices, and outcomes. CROSSLISTED as FE 456/FOR 456. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: FOR 456
Recommended: Introductory course in biology.

FE 457, TECHNIQUES FOR FOREST RESOURCE ANALYSIS, 4 Credits
Use of linear programming, nonlinear programming, dynamic programming, and simulation to solve complex forest management problems, with emphasis on intertemporal multiple-use scheduling. Forestry transportation problems, multiple-use allocation, and investment analysis. Field trips required. CROSSLISTED as FE 457/FOR 457 and FE 557/FOR 557.
Prerequisite: FOR 329 with C or better and FOR 441 [C] and FOR 443 [C]
Equivalent to: FOR 457
FE 459, FOREST MANAGEMENT PLANNING AND DESIGN I, 4 Credits
Integration of environmental, economic, and social aspects of forestry in management planning. Development of strategic and tactical plans using diverse data types and sources. Senior capstone class projects. Lec/lab. CROSSLISTED as FE 459/FOR 459.
Prerequisite: FE 457 with C or better or FOR 457 with C or better
Equivalent to: FOR 459

FE 460, FOREST OPERATIONS REGULATIONS AND POLICY ISSUES, 3 Credits
Reviews regulations and other policies that affect timber harvesting and other forest practices, particularly policies that address concerns of environment, safety, employment and transportation. Discusses how such rules and other policies evolve, including the role of public perceptions, forestry professionals and other key policy players. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC

FE 469, FOREST MANAGEMENT PLANNING AND DESIGN II, 4 Credits
A team-based, project-centric course for integrated timber harvest planning. Establish tactical and operational planning goals and constraints, identify feasible harvesting and transportation systems, and design harvest units to meet objectives and constraints. Lec/lab. CROSSLISTED as FE 469/FOR 469.
Prerequisite: FE 459 with C or better or FOR 459 with C or better
Equivalent to: FOR 469

FE 470, LOGGING MECHANICS, 4 Credits
Relationship of torque, power, and thrust to the operation of cable and ground-based harvesting systems. On-highway and off-highway heavy truck performance.
Prerequisite: (ENGR 211 with D- or better or ENGR 211H with D- or better) and ENGR 213 [D-] and FE 371 [C-]

FE 471, HARVESTING MANAGEMENT, 3 Credits
Verification of harvesting assessment plans and operational planning/field layout. Practical logging skills related to harvest planning, operations monitoring, and designing worker training programs. Lec/lab.
Recommended: FE 371 and FE 470

FE 472, MECHANIZED HARVESTING AND SIMULATION, 2 Credits
Study of harvesters, forwarders, and processing of timber for maximizing stand value. The use of a harvesting simulator will provide for a hands-on approach to learning.
Recommended: FOR 321

FE 479, SLOPE AND EMBANKMENT DESIGN, 3 Credits
A comprehensive overview of evaluating stability and performance for natural and engineered slopes. Design aspects include construction of road embankments, slope remediation techniques and application of geosynthetics for slope stabilization, slope and wall construction, and drainage. CROSSLISTED as CE 479/FE 479 and CE 579/FE 579.
Prerequisite: CE 373 with C or better or FE 316 with C or better
Equivalent to: CE 479

FE 480, FOREST ENGINEERING PRACTICE AND PROFESSIONALISM, 1 Credit
Personal and professional skills, attributes, and issues in forest engineering practice. Includes topics such as ethics, land stewardship, media relations and risk management.

FE 499, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 8 credits.

FE 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

FE 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

FE 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FE 506, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

FE 507, SEMINAR, 1-16 Credits
Subject matter as required by graduate programs. This course is repeatable for 16 credits.

FE 515, FOREST ROAD ENGINEERING, 3 Credits
Location, surveying, design, cost estimation, and construction practices for forest roads. Lecture on principles, and laboratory field practice in locating, surveying, designing, and cost estimating.
Recommended: Basic surveying

FE 516, FOREST ROAD SYSTEM MANAGEMENT, 4 Credits
Structural characteristics of bridges, load rating, structural design of culverts, aggregate testing and evaluation, environmental assessment of forest road systems, road maintenance cycles and management.
Recommended: FE 415 or FE 515
FE 523, UNMANNED AIRCRAFT SYSTEM REMOTE SENSING, 3 Credits
Unmanned Aircraft System (UAS) Geomatics presents techniques in UAS design and applications for remote sensing measurements of both natural and constructed landscapes.
Prerequisite: GEOG 580 with C or better or GEOG 581 with C or better or GEO 544 with C or better or GEO 566 with C or better or OC 678 with C or better

FE 530, WATERSHED PROCESSES, 4 Credits
Effects of land use practices on the physical hydrology (interception, infiltration, evapotranspiration, subsurface flow and surface runoff, water yields, and peak flows) of forested watersheds. Surface erosion, mass soil movements, stream temperatures, nutrient levels and effects of management activities upon riparian systems; forest practice rules. Lec/lab.

FE 532, FOREST HYDROLOGY, 4 Credits
Physical hydrology, erosion processes, and attributes of stream ecosystems for forested watersheds. Material can be widely applied, but is applicable primarily to the humid, temperate rainforests of the Pacific Northwest. Lec/rec.
Recommended: BEE 512 or introductory hydrology course

FE 536, FOREST DISTURBANCE HYDROLOGY, 3 Credits
Impacts of forest disturbance, including timber harvest, wildfire, insect outbreaks, and low frequency storms and floods on watershed hydrology and streams.
Recommended: FE 434

FE 540, FOREST OPERATIONS ANALYSIS, 4 Credits
Identification and measurement of production components in harvesting systems. Methods analysis, productivity improvement and engineering economics. Report writing skills emphasized. Lec/lab.
Recommended: FE 102 and (FE 370 or FE 371) and basic statistics.

FE 544, FOREST REMOTE SENSING AND PHOTOGRAMMETRY, 4 Credits
Introduction to spectral reflectance, photogrammetry, image analysis, and point clouds. Fundamentals of data acquisition with passive and active sensors installed on airborne and spaceborne platforms. Radar and lidar in forestry. Lec/lab.
Recommended: FE 257 and (MTH 112 or MTH 241 or MTH 251 or MTH 251H or MTH 252 or MTH 252H)

FE 545, SEDIMENT TRANSPORT, 4 Credits
Principles of sediment erosion, transportation and deposition in rivers, reservoirs, and estuaries; measurement, analysis, and computational techniques. Offered even years in winter term. CROSSLISTED as BEE 545/FE 545.
Equivalent to: BEE 545
Recommended: CE 313 or FE 330

FE 552, FOREST TRANSPORTATION SYSTEMS, 4 Credits
Analysis of interactions between harvesting and road systems. Advanced topics in road and landing spacing, determination of road standards, analysis of logging road networks, transfer and sort yard facility location. Simultaneous resource scheduling and transportation planning.
Recommended: FE 102 and (FE 440 or FE 540)

FE 555, FOREST SUPPLY CHAIN MGMT, 3 Credits
Develop and implement operational planning and logistics scheduling systems to manage a forestry supply chain for typical forest organizations in the Pacific Northwest. Once developed, these supply chain plans will be implemented using simulation software that will allow students to view the results of their forest operations plans.
Recommended: (CS 151 or FE 102) and FE 357 and FOR 457

FE 557, TECHNIQUES FOR FOREST RESOURCE ANALYSIS, 4 Credits
Use of linear programming, nonlinear programming, dynamic programming, and simulation to solve complex forest management problems, with emphasis on intertemporal multiple-use scheduling. Forestry transportation problems, multiple-use allocation, and investment analysis. Field trips required. CROSSLISTED as FE 457/FOR 457 and FE 557/FOR 557.
Equivalent to: FOR 557
Recommended: FOR 329 and FOR 441 and FOR 443

FE 560, FOREST OPERATIONS REGULATIONS AND POLICY ISSUES, 3 Credits
Reviews regulations and other policies that affect timber harvesting and other forest practices, particularly policies that address concerns of environment, safety, employment and transportation. Discusses how such rules and other policies evolve, including the role of public perceptions, forestry professionals and other key policy players.

FE 570, LOGGING MECHANICS, 4 Credits
Relationship of torque, power, and thrust to the operation of cable and ground-based harvesting systems. On-highway and off-highway heavy truck performance.
Recommended: ENGR 211 and ENGR 213 and FE 371

FE 571, HARVESTING MANAGEMENT, 3 Credits
Verification of harvesting assessment plans and operational planning/field layout. Practical logging skills related to harvest planning, operations monitoring, and designing worker training programs.
Recommended: FE 371 and FE 470
FE 579, SLOPE AND EMBANKMENT DESIGN, 3 Credits
A comprehensive overview of evaluating stability and performance for natural and engineered slopes. Design aspects include construction of road embankments, slope remediation techniques and application of geosynthetics for slope stabilization, slope and wall construction, and drainage. CROSSLISTED as CE 479/FE 479 and CE 579/FE 579.
Equivalent to: CE 579
Recommended: CE 373 or FE 316

FE 599, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

FE 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

FE 603, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

FE 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FE 606, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

FE 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

FE 640, SPECIAL TOPICS IN FOREST ENGINEERING, 1-3 Credits
Recent advances in logging engineering, forest engineering, and forest operations. Content will vary with instructor. May be retaken for credit.
This course is repeatable for 99 credits.

FES 240, *FOREST BIOLOGY, 4 Credits
Structure, function, development and biology of forest vegetation and their relationships to forestry and natural resource applications. Field trips required. Lec/lab/rec. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science
Equivalent to: FES 240H, FOR 240
Available via Ecampus

FES 240H, *FOREST BIOLOGY, 4 Credits
Structure, function, development and biology of forest vegetation and their relationships to forestry and natural resource applications. Field trips required. Lec/lab/rec. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science; HNRS – Honors Course
Designator
Equivalent to: FES 240

FES 241, DENDROLOGY, 3 Credits
Learn to identify the principal forest trees of North America, and the principal trees and shrubs of the Pacific Northwest. Also learn about forested regions of the world. Lec/lab/rec.
Equivalent to: FES 141
Available via Ecampus

FES 242, FOREST PLANTS OF THE PACIFIC NORTHWEST, 3 Credits
Field course on the identification and ecology of forest trees, shrubs, and herbs of the Pacific Northwest. Overnight camping required. Students should be prepared to hike 3-5 miles per day.

FES 341, FOREST ECOLOGY, 3 Credits
Basic physiological characteristics of trees, succession, climax, and related concepts. Vegetation classification. Stand structure, diversity, competition, growth, soils-forests interactions, biomass and nutrient distribution, energy relations, nutrient element dynamics, ecology of disturbances.
Equivalent to: FOR 341
Available via Ecampus

FES 342, FOREST TYPES OF THE NORTHWEST, 3 Credits
Forest trees in nature are aggregated into stable or transitory associations known as forest cover types. Knowledge of forest cover types, their species composition and ecology, is applicable to the fields of forestry, fire management, wildlife management, and forest ecology.
Equivalent to: FOR 342

FES 343, FORESTS OF THE EASTERN UNITED STATES, 3 Credits
Major Southeast US forest types will be visited and morphological, geographic, ecological and economic characteristics of important forest tree species examined.
Prerequisite: FES 141 with C or better or FES 241 with C or better
This course is repeatable for 3 credits.
FES 350, URBAN FORESTRY, 3 Credits
Introduction to principles and practices of planting and managing trees as a system of urban environment; understanding the economic, environmental, social aspects of urban forests, and an overview of contemporary land use issues and societal perspectives between people and plants. CROSSTLISTED as FES 350/HORT 350.
Equivalent to: FOR 350
Recommended: Foundational forestry and horticulture courses
Available via Ecampus

FES 355, MANAGEMENT FOR MULTIPLE RESOURCE VALUES, 3 Credits
Management of a variety of resource attributes in multiple use context, including considerations for recreation, fish, wildlife, aesthetics, watersheds, and forest products.
Equivalent to: FOR 355
Available via Ecampus

FES 365, *ISSUES IN NATURAL RESOURCES CONSERVATION, 3 Credits
Background of major current issues in natural resources conservation with emphasis on forests, soils, and water and potential sustainable carrying capacity. Focus on evaluating facts and opinions related to issues. Basics of terrestrial and aquatic ecology, recent and current issues of soil, water, and forest use and management. (Bacc Core Course) Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: FOR 365
Available via Ecampus

FES 399, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

FES 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: FS 401
This course is repeatable for 16 credits.

FES 403, THESIS, 1-16 Credits
Equivalent to: FS 403
This course is repeatable for 16 credits.

FES 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: FS 405
This course is repeatable for 16 credits.

FES 406, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

FES 407, SEMINAR, 1-16 Credits
Some sections graded A-F. This course is repeatable for a maximum of 16 credits.
This course is repeatable for 16 credits.

FES 410, INTERNSHIP, 1-16 Credits
Full-time supervised professional experience emphasizing functional proficiency under joint sponsorship of university and agency personnel. Graded P/N.
This course is repeatable for 16 credits.

FES 412, FOREST ENTOMOLOGY, 3 Credits
Role of insects in natural and managed forests. Recognition of important forest insect pest groups and species, prediction of forest insect responses to environmental changes, and management strategies and treatments to protect forest resource values.
Prerequisite: BI 204 with C or better or BI 211 with C or better or BI 211H with C or better or BI 212 with C or better or BI 212H with C or better or BI 221 with C or better or BI 221H with C or better

FES 422, RESEARCH METHODS IN SOCIAL SCIENCE, 4 Credits
An introduction to research methods applied to social science issues and problems. Emphasis is on the nature of the research process, how to conduct research, and how to interpret and disseminate research results. Lec/lab.
Prerequisite: ST 201 with D- or better or ST 351 with D- or better or ST 351H with D- or better
Equivalent to: TOL 422
Available via Ecampus

FES 430, FOREST AS CLASSROOM, 4 Credits
Investigates instructional methods used to teach K-12 students about natural resources. Reveals how forest exploration can be used as a means to teach others about science, ecology, mathematics, social science, and history. Provides an opportunity for future teachers, naturalists, interpreters, and scientists to improve their teaching and communication skills.
Available via Ecampus

FES 433, PLANNING AGROFORESTRY PROJECTS, 2 Credits
Helps forestry and other natural resource students understand various agroforestry concepts, systems and technologies and practices worldwide. Lays the groundwork for students to identify different systems, characterize socio-economic conditions and plan sustainable agroforestry systems. Class activities examine how biological, economic, and social factors influence agroforestry farming decisions.
Prerequisite: BOT 341 with D- or better

FES 435, *GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK, 3 Credits
A multidisciplinary course that examines the scientific, social, political, economic, environmental, and ethical controversies surrounding agricultural and natural resource biotechnologies. Lec/rec. CROSSTLISTED as FES 435/TOX 435 and FES 535/MCB 535/TOX 535. (Bacc Core Course) Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: FES 435H, TOX 435, TOX 435H
Recommended: One quarter each of biology and chemistry
Available via Ecampus
FES 440, WILDLAND FIRE ECOLOGY, 3 Credits
Fire histories and ecology of major forest, rangeland, and wetland ecosystems. Includes fire interactions with physical and biotic components of ecosystems, role of fire in ecological processes, and utilization in natural resource management.
Equivalent to: FOR 446
Recommended: Junior or senior standing, with coursework in ecology and natural resource management
Available via Ecampus

FES 444, ECOLOGICAL ASPECTS OF PARK MANAGEMENT, 3 Credits
Ecological principles applied to the management of park recreation uses. The relationship between biological and physical science information and recreation management decisions is explored.
Equivalent to: TOL 444
Recommended: An ecology course and completion or concurrent enrollment in FES 251 or FOR 251

FES 445, ECOLOGICAL RESTORATION, 4 Credits
Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSLISTED as FES 445/FW 445 and FES 545/FW 545.
Equivalent to: FOR 445, FW 445
Recommended: BI 370 or BI 370H
Available via Ecampus

FES 447, ARBORICULTURE, 4 Credits
The principles and practices of arboriculture, the art and science of selecting, planting, establishing and maintaining trees in urban, suburban, commercial and residential landscapes. CROSSLISTED as FES 447/HORT 447 and FES 547/HORT 547.
Equivalent to: FOR 447, HORT 447
Recommended: (FES 141 or FES 241 or HORT 226 or HORT 228) and (FOR 111 or HORT 112)
Available via Ecampus

FES 450X, LARGE CARNIVORES IN ECOLOGY, 1 Credit
Exploration of interesting effects of large carnivores on other animals and the structure and function of ecosystems. Featured carnivores include gray wolves, grizzly bears, cougars, lions, and others. Investigation of the global conservation status and trends of large carnivores and their prey.

FES 452, BIODIVERSITY CONSERVATION IN MANAGED FORESTS, 3 Credits
Designed for students in forestry, wildlife, fisheries and related fields. Introduces the concepts of, and approaches to, managing forest stands, landscapes and regions to achieve desired habitat conditions for indicator species and conservation of biological diversity. CROSSLISTED as FES 452/FW 452.
Equivalent to: FS 453, FW 452
Recommended: FES 240 or FES 341 or BI 370
Available via Ecampus

FES 454, MANAGING AT THE WILDLAND-URBAN INTERFACE, 3 Credits
Course targets fire-prone communities where resource professionals need to work cooperatively with local and federal agencies and citizens to gain acceptance for fire management programs and build joint responsibility for fuel reduction activities.
Equivalent to: FOR 454
Recommended: FOR 111 for non-Ecampus students

FES 455, URBAN FOREST PLANNING, POLICY AND MANAGEMENT, 4 Credits
Examination of planning, policy, and management strategies used in the stewardship of urban natural resources. Fundamentals for developing effective programs to maximize the economic, environmental, and social values and benefits of urban forest landscapes. CROSSLISTED as FES 455/HORT 455 and FES 555/HORT 555.
Prerequisite: FES 350 with C- or better or HORT 350 with C- or better
Equivalent to: FOR 455, HORT 455
Available via Ecampus

FES 477, *AGROFORESTRY, 3 Credits
Theory and worldwide practice of multiple-crop low input sustainable systems involving concurrent production of tree and agricultural products. Biological, economic, social, and political factors that underlie the application of agroforestry technology. CROSSLISTED as FES 477/ NR 477 and FES 577/RNG 577. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues; CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: FS 477, NR 477
Recommended: Introductory course in biology.

FES 485, *CONSENSUS AND NATURAL RESOURCES, 3 Credits
Students will use a working group approach. They will select a natural resource topic, study the team process and interaction as a method of learning, explore the issue using systems practice, and strive for consensus on solutions to their issue. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: FS 485
Available via Ecampus

FES 486, *PUBLIC LANDS POLICY AND MANAGEMENT, 3 Credits
Examines public lands policy and management in the Western U.S. Overview of historical and current federal land management agency laws, regulations, and policies. Highlights political, legal, economic, ecological, and social context of public land management decisions. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: Sophomore standing
Available via Ecampus

FES 499, SELECTED TOPICS IN FOREST SCIENCE, 0-16 Credits
In-depth studies of specific topics within a field of specialization. Examples include biotechnology in forestry, mycorrhizal ecology, tree improvement, landscape ecology, global climatic change in relation to forestry, advanced silviculture prescriptions, agroforestry, and others.
This course is repeatable for 16 credits.
FES 500, MARKET TOOLS FOR MANAGING GREENHOUSE GAS EMISSIONS, 3 Credits
Examines the use of market-based approaches to managing greenhouse gas emissions; the role of forestry and natural resource management in mitigating greenhouse gas emissions; and the design of carbon and offset markets in the context of broader climate change policies. CROSSLISTED as FES 500/MNR 500.
Equivalent to: MNR 500
Recommended: MTH 111

FES 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: FS 501
This course is repeatable for 16 credits.

FES 503, THESIS, 1-16 Credits
Equivalent to: FS 503
This course is repeatable for 999 credits.

FES 505, READING AND CONFERENCE, 1-16 Credits
Some sections graded P/N.
Equivalent to: FS 505
This course is repeatable for 16 credits.
Available via Ecampus

FES 506, PROJECTS, 1-16 Credits
Equivalent to: FS 506
This course is repeatable for 16 credits.
Available via Ecampus

FES 507, SEMINAR, 1-16 Credits
Some sections graded A-F.
Equivalent to: FS 507
This course is repeatable for 16 credits.

FES 508, WORKSHOP, 1-16 Credits
Equivalent to: FS 508
This course is repeatable for 16 credits.

FES 511, COMMUNITIES AND NATURAL RESOURCES, 5 Credits
Provides students from diverse backgrounds with interdisciplinary, experiential learning exposure to contemporary community and natural resource issues in rural Oregon. Social science concepts are employed to critically appraise current conditions and future prospects for rural, natural resource-dependent communities.
Equivalent to: FS 511
This course is repeatable for 15 credits.

FES 512, FOREST ENTOMOLOGY, 3 Credits
Role of insects in natural and managed forests. Recognition of important forest insect pest groups and species, prediction of forest insect responses to environmental changes, and management strategies and treatments to protect forest resource values.
Recommended: BI 204 or BI 211 or BI 211H or BI 212 or BI 212H or equivalent.

FES 520, POSING RESEARCH QUESTIONS, 3 Credits
Acquaints beginning graduate students in the natural resources to the scientific method and formation of good researchable questions. The course consists of lectures, readings and discussions. Concepts in the course are reinforced and amplified by discipline-specific companion modules. Students prepare and orally present a researchable question in their area of interest that is critiqued by the class and instructors.
Equivalent to: FS 520

FES 521, NATURAL RESOURCE RESEARCH PLANNING, 3 Credits
Research planning and study plan development, investigative procedures, the principles and ethics of natural resource science, principles and practices in scientific communication.
Equivalent to: FS 521

FES 522, RESEARCH METHODS SOCIAL SCIENCE, 4 Credits
An introduction to research methods applied to social science issues and problems. Emphasis is on the nature of the research process, how to conduct research, and how to interpret and disseminate research results.
Lec/lab
Equivalent to: FOR 522, MNR 522
Recommended: Recent statistics course

FES 523, QUANTITATIVE ANALYSIS IN SOCIAL SCIENCE, 4 Credits
Application and interpretation of statistical approaches to human dimensions of natural resources, recreation, and other social sciences. Emphasis is on an applied approach focusing on understanding data, selecting appropriate statistics for theoretical and managerial problems, using statistical software for analyses, and interpreting findings.
Recommended: (FES 522 or FOR 522) and ST 511

FES 524, NATURAL RESOURCES DATA ANALYSIS, 4 Credits
Hands-on experience in applied statistical modeling and data analysis for natural resources. Emphasis is on understanding of statistical models and the application and actual implementation of statistical analysis techniques, use of statistical software for analyses (e.g., R), and interpretation of findings. Students analyze data from their own research for final projects.
Prerequisite: ST 511 with B or better and ST 512 [B]

FES 525, INTERDISCIPLINARY APPROACHES TO SOCIO-ECOLOGICAL PROBLEMS, 3 Credits
Inter-, multi- and transdisciplinary approaches to socio-ecological problems, including terminology, assumptions, and analytical frameworks of different scientific fields. How disciplines have been integrated to approach specific case studies. Teams apply concepts, tools, and approaches in a final integrated analysis, resulting in proposed actions or policies.
FES 526, EFFECTIVE COMMUNICATION & PRESENTATION SKILLS FOR SCIENTISTS, 1 Credit
Provides an overview of communication principles and effective scientific communication skills for producing a seminar on proposed research presented to fellow scientists. Students evaluate strengths and weaknesses of communication styles; develop their ability to provide fair, timely feedback; and apply communication principles to evaluate strengths and weaknesses of presentations and proposed research. This course is repeatable for 3 credits.

FES 527, FOREST CARBON ANALYSIS FOR ASSESSMENTS AND POLICY AGREEMENTS, 3 Credits
Role of forests in mitigating greenhouse gas emissions. International GHG policies and recommendations for monitoring emissions and forest carbon. Measurement, modeling, and projections of forest ecosystem carbon. Evaluation of policies for reducing GHG emissions and increasing forest carbon stores.
Prerequisite: FES 536 with C or better
Recommended: MNR 538 or MNR 550

FES 530, FOREST AS CLASSROOM, 4 Credits
Investigates instructional methods used to teach K-12 students about natural resources. Reveals how forest exploration can be used as a means to teach others about science, ecology, mathematics, social science, and history. Provides an opportunity for future teachers, naturalists, interpreters, and scientists to improve their teaching and communication skills.
Available via Ecampus

FES 533, PLANNING AGROFORESTRY PROJECTS, 2 Credits
Helps forestry and other natural resource students understand various agroforestry concepts, systems and technologies and practices worldwide. Lays the groundwork for students to identify different systems, characterize socio-economic conditions and plan sustainable agroforestry systems. Class activities examine how biological, economic, and social factors influence agroforestry farming decisions.
Recommended: BOT 341 and/or equivalent course in ecology.

FES 535, GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK, 3 Credits
A multidisciplinary course that examines the scientific, social, political, economic, environmental, and ethical controversies surrounding agricultural and natural resource biotechnologies. Lec/rec. CROSSLISTED as FES 435/TOX 435 and FES 535/MCB 535/TOX 535.
Equivalent to: BI 535, FS 535, MCB 535, TOX 535
Recommended: One quarter each of biology and chemistry
Available via Ecampus

FES 536, CARBON SEQUESTRATION IN FORESTS, 2 Credits
Examines processes controlling the sequestration of carbon in the forest system including the forest itself and wood products. Also examines how forests can be managed to sequester carbon as well as the important economic, policy, and other constraints. Lectures, readings, discussion, simulation models, and home work will be used to cover the material.
Recommended: Undergraduate-level biology or ecology.

FES 537, BELOWGROUND ECOSYSTEMS, 3 Credits
Physical and biological components and their interactions in different soil ecosystems with description and examination of the relationships between producers and decomposers in the soil.
Recommended: Undergraduate biology or ecology courses

FES 538, VALUATION OF NON-MARKET RESOURCES, 3 Credits
Focuses on the theory and methods for estimating the economic value of non-market resources (e.g. clean air and water, biodiversity, nature-based recreation, etc.). Blends the theory and econometrics of non-market valuation through hands-on applications of methods with real datasets. The valuation of non-market resources is a burgeoning field within applied economics and should continue to grow in both importance and applications.
Recommended: AREC 512 or ECON 512

FES 540, WILDLAND FIRE ECOLOGY, 3 Credits
Fire histories and ecology of major forest, rangeland, and wetland ecosystems. Includes fire interactions with physical and biotic components of ecosystems, role of fire in ecological processes, and utilization in natural resource management.
Recommended: Coursework in ecology and natural resource management

FES 542, WILDLIFE LANDSCAPE ECOLOGY, 3 Credits
Explores the interaction between spatial pattern and scale and ecological processes with particular emphasis on biodiversity in forests. The focus is on theory, methods and conservation applications in landscape ecology.
Recommended: Undergraduate courses in ecology and concurrent enrollment in ST 511

FES 543, ADVANCED SILVICULTURE, 3 Credits
The scientific basis of forest regeneration and silvicultural practices and prescriptions in immature and mature stands. Field trips are required.
Lec/lab.
Equivalent to: FS 543
Recommended: FOR 442 and FOR 443
FES 545, ECOLOGICAL RESTORATION, 4 Credits
Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSTILLED as FES 445/FW 445 and FES 545/FW 545.
Equivalent to: FOR 545, FW 545
Recommended: BI 370 or BI 370H
Available via Ecampus

FES 546, ADVANCED FOREST COMMUNITY ECOLOGY, 4 Credits
Fundamental concepts of community including disturbance, diversity and succession. Strong emphasis on field skills and data interpretation. Saturday field trip required. Lec/lab.

FES 547, ARBORICULTURE, 4 Credits
The principles and practices of arboriculture, the art and science of selecting, planting, establishing and maintaining trees in urban, suburban, commercial and residential landscapes. CROSSTILLED as FES 447/HORT 447 and FES 547/HORT 547.
Equivalent to: HORT 547
Recommended: (FES 141 or FES 241 or HORT 226 or HORT 228) and (FOR 111 or HORT 112)
Available via Ecampus

FES 548, INVASIVE PLANTS: BIOLOGY, ECOLOGY AND MANAGEMENT, 3 Credits
Concepts of plant physiology, genetics and population dynamics are used to understand how plant invasions occur and some communities continue to exist. Management implications are explored.
Equivalent to: FS 548

FES 550, TROPHIC CASCADES, 2-3 Credits
Theory and empirical analysis of terrestrial carnivore effects on plants and ecosystems as mediated through herbivores. Emphasis on large carnivores, frequency/strength of trophic cascades, implications for ecosystem function, management, and restoration. Lectures, current literature, discussions, field exercise, term paper, and student presentations. CROSSTILLED as FES 550/FW 550.
Equivalent to: FOR 547, FW 547, FW 550
This course is repeatable for 3 credits.

FES 552, FOREST WILDLIFE HABITAT MANAGEMENT, 4 Credits
Management of terrestrial vertebrates in forest ecosystems. Effects on silvicultural practices and landscape pattern on habitats and populations. CROSSTILLED as FES 552/FW 552.
Equivalent to: FW 552
Recommended: FOR 341 or equivalent course in ecology.
Available via Ecampus

FES 554, MANAGING AT THE WILDLAND-URBAN INTERFACE, 3 Credits
Course targets fire-prone communities where resource professionals need to work cooperatively with local and federal agencies and citizens to gain acceptance for fire management programs and build joint responsibility for fuel reduction activities.
Equivalent to: FOR 554
Recommended: FOR 111 for non-Ecampus students

FES 555, URBAN FOREST PLANNING, POLICY AND MANAGEMENT, 4 Credits
Examination of planning, policy, and management strategies used in the stewardship of urban natural resources. Fundamentals for developing effective programs to maximize the economic, environmental, and social values and benefits of urban forest landscapes. CROSSTILLED as FES 455/HORT 455 and FES 555/HORT 555.
Equivalent to: FOR 555, HORT 555
Recommended: FES 350 or HORT 350
Available via Ecampus

FES 558, CONCEPTS OF FOREST RECREATION PLANNING AND MANAGEMENT, 3 Credits
Examines research that forms the conceptual basis for tools, techniques, and approaches used in recreation planning and management.
Equivalent to: FOR 558

FES 560, GREEN INFRASTRUCTURE, 4 Credits
Explores the relationship between the natural and built environments in cities and examines how planning for and managing green infrastructure assets (such as urban tree canopy, watersheds, and natural areas) increases economic health, community livability and ecological resilience in cities.

FES 561, PHYSIOLOGY OF WOODY PLANTS, 3 Credits
The structure, growth and physiological processes of trees and shrubs.
Equivalent to: FS 561
Recommended: ((CH 231 or CH 231H) and (CH 232 or CH 232H) and (CH 233 or CH 233H)) and CH 331 and CH 332 and BOT 331

FES 565, URBAN FORESTRY LEADERSHIP, 2 Credits
Examines the application of leadership theories and principles to the decision-making, policy creation, and effective administration of urban forestry programs in the public, private, and non-profit sectors. Taught via Ecampus only.
Available via Ecampus

FES 577, AGROFORESTRY, 3 Credits
Theory and worldwide practice of multiple-crop low input sustainable systems involving concurrent production of tree and agricultural products. Biological, economic, social, and political factors that underlie the application of agroforestry technology. CROSSTILLED as FES 477/NR 477 and FES 577/RNG 577.
Equivalent to: FS 577, NR 577, RNG 577
Recommended: Introductory course in biology.
FES 580, WRITING SCIENTIFIC MANUSCRIPTS, 1 Credit
Discussion of parts of a scientific manuscript and the submission, review, and publication process. Brief presentations and discussion of examples provided by the instructor and students. Students write their own manuscripts and work in teams to provide feedback on manuscript components.

FES 585, CONSENSUS AND NATURAL RESOURCES, 3 Credits
Students will use a working group approach. They will select a natural resource topic, study the team process and interaction as a method of learning, explore the issue using systems practice, and strive for consensus on solutions to their issue.
Equivalent to: FS 585
Available via Ecampus

FES 586, PUBLIC LANDS POLICY AND MANAGEMENT, 3 Credits
Examines public lands policy and management in the Western U.S. Overview of historical and current federal land management agency laws, regulations, and policies. Highlights political, legal, economic, ecological, and social context of public land management decisions.
Available via Ecampus

FES 599, SELECTED TOPICS IN FOREST SCIENCE, 0-16 Credits
In-depth studies of specific topics within a field of specialization. Examples include biotechnology in forestry, mycorrhizal ecology, tree improvement, landscape ecology, global climatic change in relation to forestry, advanced silviculture prescriptions, agroforestry, and others. This course is repeatable for 16 credits.
Available via Ecampus

FES 600, GLOBAL CHANGE ECOLOGY: IMPACTS, MITIGATION, AND ADAPTATION, 3 Credits
An interdisciplinary discourse on what is known about global change and dynamics of the earth system, including principles of climate, influences on ecosystem functioning and connectivity needed to understand responses of the earth system to human activities.
Equivalent to: FS 600

FES 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: FS 601
This course is repeatable for 16 credits.

FES 603, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

FES 605, READING AND CONFERENCE, 1-16 Credits
Equivalent to: FS 605
This course is repeatable for 16 credits.

FES 606, PROJECTS, 1-16 Credits
Equivalent to: FS 606
This course is repeatable for 16 credits.

FES 629, TEACHING PRACTICUM IN FOREST SCIENCE, 1 Credit
Preparation of graduate students in forest science and related disciplines for their first teaching experiences. Using concepts and information introduced in the class, students will develop the curriculum for one credit of college-level instruction (or an equivalent approved by the instructor) in a topic of their choice.
Equivalent to: FS 629

FES 646, FOREST ECOSYSTEMS ANALYSIS AND APPLICATION, 4 Credits
The structure and function of forests and associated streams in natural and managed landscapes; application of ecosystem analysis to policy management decisions; roles of models; scaling from individual processes to ecosystems, landscapes, and beyond. Required classroom discussions, field trip.
Equivalent to: FS 646
Recommended: College-level ecology/biology, chemistry, and math; familiarity with Excel.

FES 699, SELECTED TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

Forestry (FOR)

FOR 111, INTRODUCTION TO FORESTRY, 3 Credits
Forest resources in the world; forests and human well-being; where and how forests grow; environmental and human values; products, characteristics, and uses; basic elements of use, planning and management. Interpretation of forestry literature; professional origins in the U.S. Field trips required.
Equivalent to: F 111
Available via Ecampus

FOR 112, COMPUTING APPLICATIONS IN FORESTRY, 3 Credits
An overview of computing applications used in all aspects of forestry work, but largely focused on development of intermediate and advanced spreadsheet skills using Microsoft Excel (e.g., complex formulas and functions, charting, and pivot tables). Additionally, the course rounds out essential skills in document formatting and presentation development.

FOR 199, SPECIAL STUDIES, 1-16 Credits
This course is repeatable for 16 credits.

FOR 206, *FOREST SOILS LABORATORY FOR SOIL 205, 1 Credit
Laboratory exercise and field trips designed to develop student competency in soil processes, description, analysis, and assessment with a particular emphasis on the role of soils in managed and unmanaged forest ecosystems. (Bacc Core Course if taken with SOIL 205)
Attributes: CPBS – Core, Pers, Biological Science; CPPS – Core, Pers, Physical Science
Corequisites: SOIL 205
FOR 208, FOREST SOILS RECITATION, 1 Credit
Readings, exercises, discussions designed to develop student competency in forest soil processes, description, analysis, and assessment. A particular emphasis will be placed on the role of soils in managed and unmanaged forest ecosystems.
Recommended: An introductory soils course.
Available via Ecampus

FOR 307, JUNIOR SEMINAR, 1 Credit
College is the time to develop the skills necessary for the transition between academics and career. In conjunction with the expertise already available on campus, this course will guide students through career planning, exploration, placement, and employer expectations.
CROSSLISTED as FE 307/FOR 307.
Equivalent to: FE 307

FOR 312, FORESTRY FIELD SCHOOL, 2 Credits
A hands-on experience in the major aspects of forestry, including regeneration surveys, silviculture, cruising, recreation, forest disturbances, logging site and mill visits, east and west of the Cascades Range. CROSSLISTED as FE 312/FOR 312.
Equivalent to: FE 312

FOR 321, FOREST MENSURATION, 5 Credits
Encompasses methods used to measure tree, stand and forest-level attributes, and sample and analyze forest resources data. Provides information that support forest management decisions at the stand and forest levels. Focuses mainly on quantitative analysis of forest vegetation. Uses considerable time and effort on measuring other forest resources (e.g., wildlife habitat and riparian zones).
Prerequisite: (FOR 141 with C or better or FES 141 with C or better or FOR 241 with C or better or FES 241 with C or better) and FE 208 [C] and (MTH 241 [C] or MTH 245 [C] or MTH 251 [C] or MTH 251H [C]) and (ST 201 [C] or ST 314 [C] or ST 314H [C] or ST 351 [C] or ST 351H [C])

FOR 322, FOREST MODELS, 3 Credits
Introduction to static and dynamic forest models: defining what they are, how they might be used, and, in general terms, how they are developed.
Prerequisite: FOR 321 with C- or better and MTH 241 [D-] and (ST 201 [D-] or ST 351 [D-])
Equivalent to: F 322

FOR 329, FOREST RESOURCE ECONOMICS I, 4 Credits
Forest products markets, appraisal, rotation, thinning, uneven-aged management and forest regulation. Economics of timber management and harvest scheduling.
Prerequisite: ST 201 with D- or better or ST 351 with D- or better
Equivalent to: FOR 331

FOR 330, FOREST RESOURCE ECONOMICS II, 4 Credits
Basic arithmetic of interest and capital budgeting. Basic wood products markets. Forest resource markets and market failures. Nonmarket valuation and multiple-use forestry. Impacts of forest management and policy decisions on forest resource use. Lec/lab.
Prerequisite: (AEC 250 with C or better or (ECON 201 with C or better or ECON 201H with C or better)) and (MTH 241 [C] or MTH 245 [C] or (MTH 251 [C] or MTH 251H [C]))
Equivalent to: FOR 430

FOR 346, TOPICS IN WILDLAND FIRE, 3 Credits
An interdisciplinary survey of concepts relating to fire science, ecology, management, and policy. Includes case studies of several representative ecosystems, ranging from west- and eastside forests of the Pacific Northwest to shrub steppe ecosystems of the Intermountain West and chaparral ecosystems of southern California. Distance and campus-based delivery using videos, website, and discussion.
Equivalent to: FW 346, RNG 346
Recommended: Coursework in forest biology or ecology (eg. FOR 240 or FES 240 or FES 341)
Available via Ecampus

FOR 399, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

FOR 399H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
This course is repeatable for 16 credits.

FOR 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

FOR 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

FOR 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FOR 406, PROJECTS, 1-16 Credits
Section 4: Integrated Projects, Graded.
This course is repeatable for 16 credits.

FOR 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

FOR 408, WORKSHOP, 1-3 Credits
This course is repeatable for 16 credits.
FOR 410, INTERNSHIP, 1-16 Credits
Full-time supervised professional experience emphasizing functional proficiency under joint sponsorship of university and agency personnel. Graded P/N.
Equivalent to: FRR 410
This course is repeatable for 16 credits.

FOR 413, FOREST PATHOLOGY, 3 Credits
Effects of diseases on forest ecosystems. Recognition of important groups, prediction of pathogen responses to environmental changes, and management strategies for protection of forest resources. Field trips.
Lec/lab. CROSSTLISTED as BOT 413/FOR 413
Prerequisite: BI 204 with C or better or BI 212 with C or better or BI 212H with C or better or BI 213 with C or better or BI 213H with C or better or BI 221 with C or better or BI 221H with C or better
Equivalent to: BOT 413

FOR 417, ADVANCED FOREST SOILS, 4 Credits
Synthesize current information on fundamental properties and processes of forest soils with emphasis on applications to silviculture, soil conservation, and sustainable management of forested ecosystems. Lec/lab.
Prerequisite: SOIL 205 with C- or better and ((CH 231 with C- or better or CH 231H with C- or better) and (CH 261 [C-] or CH 261H [C-]) or CH 201 [C-]) and (MTH 241 [C-] or MTH 251 [C-] or MTH 251H [C-] or MTH 252 [C-] or MTH 252H [C-])
Equivalent to: FOR 417X

FOR 431, ECONOMICS AND POLICY OF FOREST WILDLAND FIRE, 3 Credits
General overview of the history of fire and the interaction of people with fire on forested landscapes. Forest fire policy history and current issues in the U.S. Basic legal concepts relevant to forest fire policy. An economic framework for understanding spatial externalities, decision-making under certainty, institutional economics, and incentives.
Prerequisite: AEC 351 with C or better or AEC 352 with C or better or FOR 330 with C or better or ECON 352 with C or better
Available via Ecampus

FOR 436, WILDLAND FIRE SCIENCE AND MANAGEMENT, 4 Credits
Principles and applications of fire as a natural resource management tool; the role of fire in conservation management, restoration, and preservation of ecosystems. Covers basic techniques and current research used to describe fire behavior and spread, fuels and fuel manipulation, and fire effects on the biota. Focus will be on fire as a natural process in ecosystem dynamics. Lec/lab.
Prerequisite: BI 431 with C or better or and FOR 431 [C] and FOR 433 [C]
Equivalent to: FW 436, RNG 436
Available via Ecampus

FOR 441, SILVICULTURE PRINCIPLES, 4 Credits
Nursery operation, vegetation management, herbivores, fire, seeding and planting techniques. Introduction to principles and techniques involving vegetation control, thinning, fertilizing, and harvesting. Environmental considerations related to forest stand treatments. Lec/lab.
Prerequisite: (FES 240 with C or better or FOR 240 with C or better) and (FES 141 [C] or FES 241 [C])

FOR 442, SILVICULTURE REFORESTATION, 4 Credits
Silvicultural principles and practices needed to successfully regenerate forestlands in North America. Topics include artificial and natural regeneration, genetic improvement, seed orchards, forest tree nurseries, site preparation, seedling quality and handling, vegetation management, animal damage protection, early stand management, and ecological and ecophysiological considerations. Emphasis is placed on regeneration methods applied to plantations in western Oregon. Field trips required.
Prerequisite: SOIL 205 with C or better and (FES 240 [C] or FES 240H [C] or FOR 240 [C])
Corequisites: FOR 443

FOR 443, SILVICULTURAL PRACTICES, 4 Credits
Manipulation of forest stand structure and dynamics to meet various resource management objectives. Covers key concepts and practices associated with vegetation control, thinning, fertilization, even-aged and uneven-aged regeneration systems including social and environmental considerations associated with treatments. Two-day field trip required.
Lec/lab.
Prerequisite: (FES 240 with C or better or FES 240H with C or better or FOR 240 with C or better) and FOR 321 [C]
Corequisites: FOR 442

FOR 456, *INTERNATIONAL FORESTRY, 3 Credits
An introduction to the biological, physical, and sociological factors that shape the world's forests and the activities used to manage those forests. What influence these factors have on forest policies, practices, and outcomes. CROSSTLISTED as FE 456/FOR 456. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: FE 456
Recommended: Introductory course in biology.

FOR 457, TECHNIQUES FOR FOREST RESOURCE ANALYSIS, 4 Credits
Use of linear programming, nonlinear programming, dynamic programming, and simulation to solve complex forest management problems, with emphasis on intertemporal multiple-use scheduling. Forestry transportation problems, multiple-use allocation, and investment analysis. Field trips required. CROSSTLISTED as FE 457/FOR 457 and FE 557/FOR 557.
Prerequisite: FOR 329 with C or better and FOR 441 [C] and FOR 443 [C]
Equivalent to: FE 457

FOR 459, FOREST MANAGEMENT PLANNING AND DESIGN I, 4 Credits
Integration of environmental, economic, and social aspects of forestry in management planning. Development of strategic and tactical plans using diverse data types and sources. Senior capstone class projects. Lec/lab.
CROSSTLISTED as FE 459/FOR 459.
Prerequisite: FE 457 with C or better or FOR 457 with C or better
Equivalent to: FE 459
FOR 460, ^FOREST POLICY, 4 Credits
Policy formulation and analysis for forest resources. Consideration of policy affecting land management approaches to planning, management, and social and economic development. Major forestry policy areas covered include outdoor recreation, range, timber, wilderness, and wildlife and fish. Lec/lab. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC

FOR 462, NATURAL RESOURCE POLICY AND LAW, 3 Credits
First of two offerings designed to provide an introduction to current environmental and natural resource law issues and disputes for students who will have to meet, consult, and work with lawyers throughout their professional career. Focus is on mechanisms governing resource allocation within the constraints of private property rights. Emphasis is placed on the federal Endangered Species Act and its relation to water allocation and public trust doctrines. Students will also gain a broad understanding of regulatory.

FOR 469, FOREST MANAGEMENT PLANNING AND DESIGN II, 4 Credits
A team-based, project-centric course for integrated timber harvest planning. Establish tactical and operational planning goals and constraints, identify feasible harvesting and transportation systems, and design harvest units to meet objectives and constraints. Lec/lab. CROSSLISTED as FE 469/FOR 469.
Prerequisite: FE 459 with C or better or FOR 459 with C or better
Equivalent to: FE 469

FOR 499, SPECIAL TOPICS, 0-16 Credits
Topics of current importance in forest resources issues, education, policies, economics, management, business, social values, silviculture, and biometrics. Topics will change from term to term. May be repeated with different topics for credit. Section 8: Social aspects of natural resource management (3 credits) graded.
This course is repeatable for 16 credits.
Available via Ecampus

FOR 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: F 501
This course is repeatable for 16 credits.

FOR 503, THESIS, 1-16 Credits
Equivalent to: F 503
This course is repeatable for 999 credits.

FOR 505, READING AND CONFERENCE, 1-16 Credits
Equivalent to: F 505, FRR 505
This course is repeatable for 16 credits.

FOR 506, PROJECTS, 1-16 Credits
Equivalent to: F 506
This course is repeatable for 16 credits.

FOR 507, SEMINAR, 1-16 Credits
Equivalent to: F 507, FRR 507
This course is repeatable for 16 credits.

FOR 508, WORKSHOP, 1-3 Credits
This course is repeatable for 16 credits.

FOR 510, INTERNSHIP, 1-9 Credits
This course is repeatable for 16 credits.

FOR 513, FOREST PATHOLOGY, 3 Credits
Effects of diseases on forest ecosystems. Recognition of important groups, prediction of pathogen responses to environmental changes, and management strategies for protection of forest resources. Field trips. Lec/lab. CROSSLISTED as BOT 513/FOR 513.
Equivalent to: BOT 513
Recommended: BI 204 or BI 212 or BI 212H or BI 213 or BI 213H

FOR 517, ADVANCED FOREST SOILS, 4 Credits
Synthesize current information on fundamental properties and processes of forest soils with emphasis on applications to silviculture, soil conservation, and sustainable management of forested ecosystems. Lec/lab.
Recommended: SOIL 205 and (((CH 231 or CH 231H) and (CH 261 or CH 261H)) or CH 201) and (MTH 241 or MTH 251 or MTH 251H or MTH 252 or MTH 252H) all with a minimum grade of C-

FOR 518, MANAGING FOREST NUTRITION, 3 Credits
Synthesize current information on nutrient limitations of forest productivity, long-term forest productivity, and mitigating and managing forest nutrition with emphasis on forests of the Pacific Northwest.

FOR 520, GEOSPATIAL FOREST ANALYSIS, 3 Credits
Prerequisite: FE 444 with C or better or GEOG 480 with C or better

FOR 524, FOREST BIOMETRICS, 3 Credits
Advanced topics in forest biometrics, including measurement of forest structure and dynamics, application of sampling theory and methods, and statistical techniques for interpreting forestry data.
Equivalent to: F 524
Recommended: FOR 322 and ST 511

FOR 525, FOREST MODELING, 3 Credits
Examination of regression techniques and assumptions used to develop static and dynamic equations of tree and stand attributes.
Prerequisite: ST 552 with C or better
Equivalent to: F 525

FOR 528, PROFESSIONAL COMMUNICATION AND ETHICS, 2 Credits
Conventions of written and oral communication in forestry and related disciplines including basic narrative development. Exploration of environmental, professional, and research ethics, and the role they play in effective communication with multiple stakeholders.
FOR 531, ECONOMICS AND POLICY OF FOREST WILDLAND FIRE, 3 Credits
General overview of the history of fire and the interaction of people with fire on forested landscapes. Forest fire policy history and current issues in the U.S. Basic legal concepts relevant to forest fire policy. An economic framework for understanding spatial externalities, decision-making under certainty, institutional economics, and incentives.
Recommended: FOR 330 or AEC 351 or AEC 352 or ECON 352
Available via Ecampus

FOR 534, ECONOMICS OF THE FOREST RESOURCE, 3 Credits
Topics include optimal stand and forest management for timber production, economics of ecosystem services (e.g. recreation, biodiversity, carbon sequestration, water quality and regulation), non-market valuation methods, management under risk and uncertainty, discounting, intergenerational equity, sustainability, international trade and other global issues.
Recommended: FOR 330 and FOR 331

FOR 536, WILDLAND FIRE SCIENCE AND MANAGEMENT, 4 Credits
Principles and applications of fire as a natural resource management tool; the role of fire in conservation management, restoration, and preservation of ecosystems. Covers basic techniques and current research used to describe fire behavior and spread, fuels and fuel manipulation, and fire effects on the biota. Focus will be on fire as a natural process in ecosystem dynamics. Lec/lab.
Equivalent to: FW 536, RNG 536

FOR 542, INTERNATIONAL INTENSIVE SILVICULTURE, 2 Credits
Operational and ecological aspects of intensive silvicultural management of planted forests around the world. Guest speakers in different countries will describe the type of silvicultural management that is carried out in the speaker's country from species and genetic selection, to harvest and rotation length, including site preparation and planting techniques. Emphasis on comparing silvicultural practices in each country to the management of plantations in western Oregon.

FOR 543, SILVICULTURAL PRACTICES, 5 Credits
Manipulation of immature and mature forest stands for various resource management objectives. Principles and techniques involving vegetation control, thinning, fertilizing, and harvesting. Environmental considerations related to stand treatments. Two-day field trips required.
Recommended: (FOR 240 or FES 240) and FOR 321 and concurrent enrollment in FOR 429

FOR 549, SILVICULTURAL INFLUENCES ON FOREST ECOSYSTEM DYNAMICS, 3 Credits
Fundamental biological and ecological principles for the design and implementation of silvicultural regimes that achieve a wide diversity of forest ecosystem management objectives.
Recommended: Undergraduate course in silviculture and in forest mensuration.

FOR 550, SUSTAINABLE FOREST MANAGEMENT, 3 Credits
Sustainable forestry as part of the global sustainability movement. History of sustainability and its influence on decision-making in forest management. Current dimensions of sustainability: forest certification, climate change, role of environmental ethics, biodiversity conservation, maintenance of long-term site productivity, conservation of soil and water resources, roles of social institutions, and links to concerns for social justice.

FOR 557, TECHNIQUES FOR FOREST RESOURCE ANALYSIS, 4 Credits
Use of linear programming, nonlinear programming, dynamic programming, and simulation to solve complex forest management problems, with emphasis on intertemporal multiple-use scheduling. Forestry transportation problems, multiple-use allocation, and investment analysis. Field trips required. CROSSTLED as FE 457/FOR 457 and FE 557/FOR 557.
Equivalent to: FE 557
Recommended: FOR 329 and FOR 441 and FOR 443

FOR 561, FOREST POLICY ANALYSIS, 3 Credits
Basic elements of forest policy problems, including resource allocation and efficiency, distribution, and interpersonal equity, taxation, regulation, and control, and planning and uncertainty. Emphasis on policy and analysis and its uses in policy decision.

FOR 562, NATURAL RESOURCE POLICY AND LAW, 3 Credits
First of two offerings designed to provide an introduction to current environmental and natural resource law issues and disputes for students who will have to meet, consult, and work with lawyers throughout their professional career. Focus is on mechanisms governing resource allocation within the constraints of private property rights. Emphasis is placed on the federal Endangered Species Act and its relation to water allocation and public trust doctrines. Students will also gain a broad understanding of regulatory

FOR 563, ENVIRONMENTAL POLICY AND LAW INTERACTIONS, 3 Credits
Second of two offerings designed to provide an introduction to current environmental and natural resource law issues and disputes for students who will have to meet, consult, and work with lawyers throughout their professional career. Focus is on the arena of regulatory environmental laws. Environmental torts, regulation of point and non-point source pollution under the federal Clean Water Act, wetlands protection, and laws governing agricultural and forest practices will be examined as examples of regulatory frameworks for achieving resource protection. Students will be exposed to the basic framework of federal laws regulating air and hazardous waste pollutants.
FOR 599, SPECIAL TOPICS, 1-16 Credits
Topics of current importance in forest resources issues, education, policies, economics, management, business, social values, silviculture, and biometrics. Topics will change from term to term. May be repeated with different topics for credit. Section 8: Social aspects of natural resource management (3 credits) graded.
This course is repeatable for 16 credits.
Available via Ecampus

FOR 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: F 601
This course is repeatable for 16 credits.

FOR 603, THESIS, 1-16 Credits
Equivalent to: F 603
This course is repeatable for 999 credits.

FOR 605, READING AND CONFERENCE, 1-16 Credits
Equivalent to: F 605
This course is repeatable for 16 credits.

FOR 606, PROJECTS, 1-16 Credits
Equivalent to: F 606
This course is repeatable for 16 credits.

FOR 607, SEMINAR, 1-16 Credits
Equivalent to: F 607
This course is repeatable for 16 credits.

FOR 699, SPECIAL TOPICS, 1-16 Credits
Topics of current importance in forest resources issues, education, policies, economics, management, business, social values, silviculture, and biometrics. Topics will change from term to term. May be repeated with different topics for credit.
This course is repeatable for 16 credits.

FOR 808, WORKSHOP, 1-9 Credits
This course is repeatable for 16 credits.

Master of Natural Resources (MNR)

MNR 500, MARKET TOOLS FOR MANAGING GREENHOUSE GAS EMISSIONS, 3 Credits
Examines the use of market-based approaches to managing greenhouse gas emissions; the role of forestry and natural resource management in mitigating greenhouse gas emissions; and the design of carbon and offset markets in the context of broader climate change policies. CROSSLISTED as FES 500/MNR 500.
Equivalent to: FES 500
Recommended: MTH 111

MNR 511, INTRODUCTION TO SUSTAINABLE NATURAL RESOURCES, 3 Credits
Overview of economic, environmental, social, cultural, ethical, and policy considerations of sustainable natural resource management. International collaborative efforts to address global natural resource issues. Key policy drivers, key stressors, balancing competing interests. Introductory course required for all Master of Natural Resources students; open to other graduate students. Taught via Ecampus only.
Recommended: Undergraduate biology or ecology course
Available via Ecampus

MNR 519, DIVERSITY, EQUITY AND INCLUSION IN NATURAL RESOURCE MGMT, 3 Credits
Explores practical approaches to operationalizing diversity, equity and inclusion (DEI) principles in natural resource management organizational settings, programs and outdoor settings. Examines case studies on topics such as accessibility to recreational places, implicit bias and cultural competency in public communications, and how enhancing workplace diversity increases social capital. Introduces DEI analysis through a research project in their local area.
Available via Ecampus

MNR 522, RESEARCH METHODS SOCIAL SCIENCE, 4 Credits
An introduction to research methods applied to social science issues and problems. Emphasis is on the nature of the research process, how to conduct research, and how to interpret and disseminate research results. Lec/lab.
Equivalent to: FES 522
Recommended: Upper-division or graduate level statistics

MNR 530, TROPICAL FOREST ECOLOGY AND MANAGEMENT: A GLOBAL PERSPECTIVE, 3 Credits
Study of tropical forest ecology and the common ecological patterns found within tropical forests. The threats and challenges that tropical forests face in the 21st century and the issues of human use and their impacts. Developing strategies for sustainable management and restoration approaches to alleviate pressure on remaining tropical forests. Taught via Ecampus only.

MNR 538, ADAPTING FORESTS TO CLIMATE CHANGE, 3 Credits
Climate change is expected to have profound effects on forests. Society can respond by managing in forests in ways that can help mitigate climate change or help forests adapt. Nonetheless, changes in climate and forest responses are uncertain, making management and policy decisions difficult and controversial. We will investigate the effects of climate change on forests, focusing on potential forest management and policy responses.
Available via Ecampus
MNR 550, CLIMATE CHANGE IMPACTS ON FOREST ECOSYSTEMS, 3 Credits

Forest management responses to climate change rely on understanding the mechanisms of interaction between forests and climate, as well as the capacity to evaluate impacts of future climate scenarios on forests. Considers effects of rising CO2 and changing climate at the level of ecophysiological processes, changes in species distribution, changes in disturbance regimes, and ecosystem-level impacts mediated by the water, carbon, and nitrogen cycles. Modeling approaches include statistically-based bioclimatic envelopes, and dynamic global vegetation models that treat ecosystem processes and changes in biome distribution.

Recommended: Basic ecology course
Available via Ecampus

MNR 560, DEVELOPING THE MNR CAPSTONE PROPOSAL, 3 Credits

Applies content from across the MNR degree in developing a capstone project. Explores the types of capstone projects and methodologies. Identifies and evaluates the data needed to address natural resource problems or topics. Develops outlines for students’ individualized MNR capstone projects.
Prerequisite: MNR 511 with C or better
Available via Ecampus

MNR 561, MNR CAPSTONE PROJECT, 1-6 Credits

Students work with their major advisor on the completion of their capstone project at the end of the MNR degree program. Students incorporate knowledge gained from coursework to address a natural resource problem within interconnected ecological, economic and social contexts.
Prerequisite: MNR 560 with C or better or SNR 506 with P or better
This course is repeatable for 12 credits.
Available via Ecampus

Natural Resources (NR)
NR 003, UNDERGRADUATE RESEARCH, 0 Credits

Engage in research activities appropriate to the discipline; and through the research experience, acquire skills, techniques, and knowledge relevant to the field of study. In consultation with a faculty mentor, engage in research activity, and make and execute a plan for a project.

NR 201, MANAGING NATURAL RESOURCES FOR THE FUTURE, 3 Credits

Overview of the complexities involved in managing natural resources of the Pacific Northwest. Exposure to major natural resource issues of the region. Development of critical thinking skills useful in seeking solutions.
Available via Ecampus

NR 202, NATURAL RESOURCE PROBLEMS AND SOLUTIONS, 3 Credits

Exploration of the multiple components (ecological, social, political, ethical) of selected natural resource problems. Uses case studies to illustrate how social and biophysical characteristics of environmental problems influence the methods used to try to solve these problems and their potential for success.
Recommended: NR 201
Available via Ecampus

NR 312, CRITICAL THINKING FOR NATURAL RESOURCE CHALLENGES, 3 Credits

Provides an introduction to critical thinking as it applies to issues and problems in natural resources. Attention is given to formal argument analysis, fallacies of argumentation, and critical scientific and philosophical concepts.
Recommended: Sophomore standing

NR 325, SCIENTIFIC METHODS FOR ANALYZING NATURAL RESOURCE PROBLEMS, 3 Credits

Approaches to disciplinary and interdisciplinary problem analysis in natural resources. Introduces systems thinking and the benefits and limitations of different tools used to integrate information from multiple disciplines and stakeholders. Applications of alternative analysis tools are illustrated through selected forest-related case studies. Lec/lab.
Prerequisite: MTH 111 with C- or better or Math Placement - ALEKS with a score of 060
Recommended: NR 201 and (ST 201 or ST 351)

NR 351, WHEN SCIENCE ESCAPES THE LAB: SCIENCE AND RESOURCE MANAGEMENT, 3 Credits

Role of science in solving natural resource problems. Selecting the "best available science." How science is portrayed, filtered, and used by the media and interests groups to affect policy and management. Analysis of case studies on use of science in natural resource decision making.
(Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: Sophomore standing and NR 312

NR 380, NATURE IN STORYTELLING OVER THE CENTURIES, 3 Credits

Examines the historic tendency across cultures to mythologize elements of the natural world, resulting in celebrated myths, fables, and stories. The course examines nature-based folklore from past centuries, uncovering early perceptions of landscapes, creatures, and plants held by societies and cultures. Focus then shifts to exploration of how elements of the natural world have been portrayed in contemporary film, television, and advertising, revealing how perceptions of nature have evolved over the past century. Connections between contemporary popular culture and old-world myths, fables, and stories will thus be revealed.
Available via Ecampus

NR 399, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 16 credits.
NR 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

NR 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

NR 405, READING AND CONFERENCE, 1-9 Credits
This course is repeatable for 18 credits.

NR 406, PROJECTS, 1-9 Credits
This course is repeatable for 16 credits.
Available via Ecampus

NR 407, SEMINAR, 1-9 Credits
This course is repeatable for 18 credits.

NR 410, INTERNSHIP, 1-6 Credits
This course is repeatable for 12 credits.
Available via Ecampus

NR 455, NATURAL RESOURCE DECISION MAKING, 4 Credits
Students will participate on collaborative planning teams that effectively engage stakeholders in the decision making process, and offer sound natural resource decisions that are supported by multiple interests.
Prerequisite: FES 485 with D- or better and (BI 371 [D-] or BI 373 [D-] or ENSC 479 [D-] or FE 460 [D-] or FES 486 [D-] or FOR 460 [D-] or FW 435 [D-] or FW 439 [D-] or FW 454 [D-] or FW 497 [D-] or GEOG 323 [D-] or HORT 318 [D-] or SOIL 395 [D-] or WR 462 [D-])
Available via Ecampus

NR 477, AGROFORESTRY, 3 Credits
Theory and worldwide practice of multiple-crop low input sustainable systems involving concurrent production of tree and agricultural products. Biological, economic, social, and political factors that underlie the application of agroforestry technology. CROSSLISTED as FES 477/ NR 477 and FES 577/RNG 577. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues; CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: FES 477, FS 477, RNG 477
Recommended: Introductory course in biology.

NR 499, SPECIAL TOPICS, 1-16 Credits
This is a hybrid course when offered by Ecampus.
Equivalent to: NR 499H
This course is repeatable for 16 credits.
Available via Ecampus

NR 499H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: NR 499
This course is repeatable for 16 credits.

Sustainable Natural Resources (SNR)

SNR 506, INDEPENDENT PROJECT IN NATURAL RESOURCE SUSTAINABILITY, 2 Credits
Students identify, pose, frame, and analyze the various components of an important natural resource sustainability problem within their country, region, or organization and, at the end of term, present a workplan for its resolution. Oral and written reports are expected. Graded P/N.
Prerequisite: SNR 511 with C or better
Available via Ecampus

SNR 511, SUSTAINABLE NATURAL RESOURCE DEVELOPMENT, 1 Credit
Using readings, class discussions, and field trips, we introduce the program sessions and pedagogical methods, familiarize students with basic working definitions of sustainability, and build capacity to work as group on a common project.
Available via Ecampus

SNR 520, SOCIAL ASPECTS OF SUSTAINABLE NATURAL RESOURCES, 3 Credits
Using readings, personal experiences, and class discussions, students explore five principles of socially sustainable natural resource management, and review the role they play in creating natural resource-based sustainable communities.
Recommended: SNR 511
Available via Ecampus

SNR 521, ECONOMICS OF SUSTAINABLE NATURAL RESOURCE MANAGEMENT, 3 Credits
Focuses on the sources of market failure, the means of correcting market failure, and the real-world examples of making progress toward sustainable resource use by means of market mechanisms.
Recommended: SNR 511
Available via Ecampus

SNR 522, BASIC BELIEFS AND ETHICS IN NATURAL RESOURCES, 3 Credits
Examines basic philosophies and ethical systems in American forestry, including Pinchot’s agricultural/utilitarian approach and Leopold’s biotic/ecological model, compares them to contemporary public attitudes and considers their implications for sustainability.
Available via Ecampus

SNR 530, ECOLOGICAL PRINCIPLES OF SUSTAINABLE NATURAL RESOURCES, 3 Credits
Focus on ecological sustainability and ecological concepts and principles, with examples drawn from forests and arid lands. Exploration of global ecosystems, ecological processes and services, factors that create and maintain diversity, ecosystem health and integrity. Principles for sustainable natural resource management and use.
Recommended: SNR 511 and a basic ecology course
Available via Ecampus
SNR 531, SUSTAINABLE SILVICULTURE AND FOREST CERTIFICATION, 3 Credits

Strategies for sustainable silviculture, and measuring and verifying environmental performance (including certification systems) are examined using classroom lectures, case studies, and field exercises. Part of the 18-credit Sustainable Natural Resources (SNR) Graduate Certificate; also open to other graduate students.

Recommended: SNR 511 and at least two years' experience working in a natural resources-related field

SNR 532, PLANNING AGROFORESTRY PROJECTS, 2 Credits

Develop basic understanding and appreciation of agroforestry concepts, systems, technologies and practices as used and applied in tropical and temperate zones of the world.

Recommended: SNR 530 (or equivalent ecology course) and SNR 511

Available via Ecampus

SNR 533, NONTIMBER FOREST PRODUCTS: AN INTERDISCIPLINARY INTRODUCTION, 3 Credits

Interdisciplinary introduction to the culture, history, economy, ecology, policy and management of nontimber forest products (NTFP), e.g., wild foods, medicines, floral greens, craft material and landscaping species. Includes domestic public and private forest and international case studies.

Available via Ecampus

SNR 534, REDUCED IMPACT TIMBER HARVEST, 2 Credits

Explores planning, implementation, monitoring, and evaluation of reduced impact timber harvesting. Part of the 18-credit Sustainable Natural Resources (SNR) Graduate Certificate; also open to other graduate students.

Recommended: SNR 511 and at least two years' experience working in a natural resources-related field

SNR 535, SUSTAINABLE MANAGEMENT OF AQUATIC AND RIPARIAN RESOURCES, 3 Credits

Explores integrated strategies for sustainable management of watersheds, estuaries, coastal zones, and aquatic resources. Special emphasis given to links between land uses and aquatic environments. Part of the 18-credit Sustainable Natural Resources (SNR) Graduate Certificate; also open to other graduate students.

Recommended: SNR 511

SNR 808, WORKSHOP, 1-4 Credits

Describes the policies, practices, and market mechanisms that enhance ecological, economic, and social sustainability of natural resource production and natural ecosystems. Sustainable natural resource management attempts to meet the needs of the present without compromising the future of people or the ecosystems on which they depend.

This course is repeatable for 4 credits.

Tourism and Outdoor Leadership (TRAL)

TRAL 110, INTRODUCTION TO WHITE WATER KAYAKING, 2 Credits

Students will learn fundamentals of white water kayaking in sheltered & moving water based on the internationally recognized British Canoe (BC) and American Canoe Association (ACA) teaching and skills certification systems. Emphasis is on activity and basic skills.

TRAL 111, INTRODUCTION TO CANOEING, 2 Credits

Students will learn fundamentals of canoeing in sheltered & moving water based on the internationally recognized British Canoe (BC) and American Canoe Association (ACA) teaching and skills certification systems. Emphasis is on activity and basic skills.

TRAL 115, OUTDOOR LIVING SKILLS, 2 Credits

Educates and introduces students on how to travel safely in the backcountry through proper preparation, risk awareness, Leave No Trace ethics, terrain recognition, navigation, and camp craft. Classroom and field (lab) experience. Includes one mandatory weekend overnight outing. CROSSLISTED as PAC 115/TRAL 115.

Corequisites: TRAL 118

Equivalent to: PAC 115

This course is repeatable for 4 credits.

TRAL 118, LABORATORY FOR OUTDOOR LIVING SKILLS, 1 Credit

Practical field application of concepts learned in PAC 115/TRAL 115, Outdoor Living Skills. Field (lab) experience includes one mandatory weekend overnight. Introduces how to travel safely in the backcountry through proper preparation, risk awareness, Leave No Trace ethics, terrain recognition, navigation, and camp craft. CROSSLISTED as PAC 118/TRAL 118.

Corequisites: TRAL 115

Equivalent to: PAC 118

This course is repeatable for 2 credits.

TRAL 130, INTRODUCTION TO OUTDOOR AND ADVENTURE PROFESSIONS, 3 Credits

Outdoor and adventure professions will be explored. Introduces students to practical and conceptual aspects of land and water trips in outdoor tourism, adventure, and educational settings. Innovative people and products will be examined in the context of outdoor and adventure professions and their impact, past, present, and future.

Equivalent to: TOL 130
TRAL 132, *FOUNDATIONS AND HISTORY OF OUTDOOR AND ADVENTURE PROFESSIONS, 3 Credits
History, evolution, and theoretical underpinning of outdoor and adventure professions as an important and evolving feature of Western culture within the United States and beyond. Influential ideas, paradigm shifts, events, and developments that have led to professionalism, institutionalization, dissemination, and impact on other subject areas and professions. Impact of other cultures on current state of the professions. (Bacc Core Course)
Attributes: CPWC – Core, Pers, West Culture
Equivalent to: TOL 132

TRAL 173, INTERMEDIATE ROCK CLIMBING, 2 Credits
Introduces variety of basic skills, gear and systems that will allow them to safely participate in a single pitch rock climbing environment based on internationally recognized American Mountain Guides Association (AMGA) teaching and skills certification systems. Presents students with various technical skills that will serve as a foundation for future land-based outdoor disciplines. Students will be introduced to gear, such as software (ropes, webbing, harnesses) and hardware (carabiners, friction devices); skills, such as knots, belaying, rappelling, lead climbing; and systems such as anchors and basic rescue techniques. CROSSTRAILISTED as PAC 173/TRAL 173.
Equivalent to: PAC 173
This course is repeatable for 10 credits.

TRAL 215, GROUP FACILITATION, 4 Credits
Introduces facilitation, leadership, and management of groups. Group facilitation theory, techniques, and models for use in a variety of environments and with different populations. Prominent personality types and how to effectively facilitate these. Determining needs, utilizing appropriate techniques, sequencing, and processing to meet specific determined needs of groups.

TRAL 217, INTERMEDIATE ROCK, 2 Credits
 Begins by affirming rock site management foundational skills such as proper equipment, knots, belay techniques, rappelling, and basic climbing anchor systems. Then focuses on building upon those foundational skills by covering more complex anchor systems, belay techniques, vertical rescue, releasable rappels, and movement through various rock specific terrains.
Recommended: TRAL 172 or similar training and equivalent skill level

TRAL 218, ROCK SITE MANAGEMENT, 2 Credits
 Begins by affirming Intermediate Rock foundational skills such as proper equipment, knots, belay & lead climbing techniques, movement, rappelling, and basic climbing anchor systems based on internationally recognized American Mountain Guides Association (AMGA) teaching and skills certification systems. Class will then focus on building upon those foundational skills by covering more complex anchor systems, belay techniques, vertical rescue, releasable rappels and movement through various rock specific terrains.
Prerequisite: TRAL 173 with C or better or PAC 173 with C or better

TRAL 251, RECREATION RESOURCE MANAGEMENT, 4 Credits
Overview of recreation resource management including study of land and water resources used for outdoor recreation. The planning and management of natural and cultural resources for long-term resource productivity, with a focus on rural and wildlife areas of the forest, range and coast.
Equivalent to: FES 251
Available via Ecampus

TRAL 260, INTERMEDIATE PADDLESPORT, 2 Credits
Learn how to successfully paddle as a competent group member within moving water & whitewater environments up to class III. This course will emphasize that the student has a holistic approach to river running, can be an effective group member during river rescues, can contribute to the safety, group skills and leadership of a river descent and showcase the knowledge required of an intermediate whitewater paddler based on internationally recognized British Canoe (BC) and American Canoe Association (ACA) teaching and skills certification systems. Uses a variety of diverse whitewater specific kayaks and canoes.
Prerequisite: (TRAL 110 with C or better or PAC 110 with C or better) and (TRAL 111 [C] or PAC 111 [C])

TRAL 270, PRE-INTERNSHIP SEMINAR, 1 Credit
Exploration of career goals, internship opportunities, and the variety of practice areas in the tourism, recreation, and adventure leadership (TRAL) professions. Student preparation in planning, obtaining, and completing TRAL internships. The course is designed to assist undergraduate majors in TRAL prepare for the required internship. Graded P/N.
Equivalent to: TOL 270

TRAL 280, OUTDOOR LEADERSHIP FUNDAMENTALS, 3 Credits
A week-long outdoor expedition focusing on water-based and land-based skills while developing a comprehensive understanding of expedition behavior. Students will meet in the classroom to prepare for the week-long field expedition covering various topics such as risk management, expedition planning, navigation, water safety and other topics. The expedition will expose students to extended travel in the backcountry while further developing technical and interpersonal skills.
Prerequisite: (TRAL 110 with C or better or PAC 110 with C or better) and (TRAL 111 [C] or PAC 111 [C]) and TRAL 115 [C] and TRAL 118 [C] and TRAL 173 [C]

TRAL 299, SPECIAL TOPICS, 0-16 Credits
Topics of current importance in tourism, recreation, and/or adventure leadership education. Topics will change from term to term. May be repeated with different topics for credit.
This course is repeatable for 16 credits.

TRAL 309, CERTIFICATION PRACTICUM, 2 Credits
Allows students the opportunity to acquire nationally or internationally recognized certification in one or more disciplines. Will provide an avenue for students to acquire professional faculty guidance and mentoring so they are more able to attain a certification.
This course is repeatable for 6 credits.
TRAL 351, OUTDOOR RECREATION MANAGEMENT ON PUBLIC LANDS, 3 Credits
Explores current issues and problems in outdoor recreation management on public lands and approaches to address these. Emphasis on day-to-day, field-based management of recreation resources, rather than broad-scale planning.
Prerequisite: TRAL 251 with C- or better or FES 251 with C- or better
Equivalent to: FES 351

TRAL 352, WILDERNESS MANAGEMENT, 3 Credits
Wilderness as land use concept. Wilderness history, preservation, planning and management. Wilderness in the context of other land uses.
Equivalent to: FES 352
Available via Ecampus

TRAL 353, NATURE, ECO, AND ADVENTURE TOURISM, 4 Credits
Examines natural resource-based tourism issues in both domestic and international contexts, with examples from around the world. Explores distinctions between nature-based tourism and other forms of tourism (e.g., traditional mass tourism, adventure tourism, ecotourism), positive and negative impacts of natural resource-based tourism (e.g., social, cultural, economic, environmental), and other related issues such as marketing, accreditation and certification, poverty and pro-poor tourism, and sustainable design.
Equivalent to: FES 353

TRAL 354, COMMUNITIES, NATURAL AREAS, AND SUSTAINABLE TOURISM, 3 Credits
Introduces students to macro-level community and regional issues associated with tourism in natural areas. Explores positive and negative community impacts associated with tourism, traditional government-based tourism management and policies; community-based tourism management, and partnerships and stakeholder collaboration. Domestic and international examples are used to illustrate concepts and principles.
Equivalent to: FES 354

TRAL 357, *PARKS AND PROTECTED AREAS MANAGEMENT, 3 Credits
Provides a broad yet comprehensive understanding of the theories, problems, and techniques of managing parks, wild and scenic rivers, wilderness, and other protected areas. Covers the evolution of policies and recent issues in management of these protected areas, in the United States and around the world. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: FES 357

TRAL 350, DESIGN AND MANAGEMENT OF OUTDOOR EXPERIENCES, 4 Credits
Introduction to pedagogical, administrative, and organizational knowledge, skills, and dispositions for effective design and management of effective short and extended duration outdoor experiences in wilderness-like areas. Covers personnel logistics, site planning, itinerary planning, educational and skills progression, communication with volunteers and program contacts, budgets.
Prerequisite: TRAL 280 with C or better or TOL 375 with C or better
Equivalent to: TOL 370
Recommended: Junior standing

TRAL 372, ETHICS AND ADVENTURE LEADERSHIP, 3 Credits
Examines ethical issues and situations inherent in adventure leadership and other experiential education settings. Leading adventure programs entails judgment-laden decisions that are made every hour of every day concerning participants, leaders, and programs. Students will become familiar with predominant ethical theories and apply these theories to practical situations with a view to assessing the values that influence their decisions and subsequent actions. Students will better understand how their decisions influence their professional work and those of others within the context of adventure leadership.
Equivalent to: TOL 372
Recommended: TOL 375 or TRAL 375 or other writing intensive course

TRAL 373, WILDERNESS AND ADVENTURE EDUCATION, 4 Credits
Rationale for and methods used in the application of wilderness and outdoor adventure education programs in education, recreation, corporate and human service settings. Covers historical and contemporary philosophies and practices in adventure education, with a primary emphasis on outdoor adventure education. Explores the educational, social, and ethical consequences of outdoor adventure education programs. Also explores the role of wilderness in the context of the United States and differing views of what constitutes wilderness from an international perspective.
Equivalent to: TOL 373
Recommended: TRAL 375 or TOL 375

TRAL 374, OUTDOOR ADVENTURE EDUCATION, 3 Credits
Rationale for and methods used in the application of outdoor adventure education programs in education, recreation, corporate and human service settings. Historical and contemporary philosophies and practices in outdoor adventure education. Explores the educational, social, and ethical consequences of outdoor adventure education programs. Examines outdoor adventure education in the context of the United States and differing paradigms informing the practice in other cultures internationally. Presents current research in outdoor adventure education.
Prerequisite: TRAL 130 with C or better and TRAL 132 [C] and TRAL 215 [C]
**TRAL 375, EXPERIENTIAL EDUCATION, 4 Credits**
Theory, techniques, and practice of experiential education. Students will define learning objectives, design curriculum, develop teaching materials, and effectively teach a variety of audiences. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Equivalent to: TOL 375

**TRAL 377, EXPEDITIONS I WATER, 5 Credits**
A field-based course that develops the knowledge, skills, and dispositions needed to safely and effectively lead, and participate in, an extended water-based expedition of one week or longer. Technical skill emphasis is on whitewater kayaks and/or rafts and/or canoes with an additional focus on swift water rescue skills.
Prerequisite: TRAL 370 with C or better and TRAL 260 [C]
Corequisites: TRAL 379
Equivalent to: TOL 377

**TRAL 378, TOURISM AND RECREATION DATA ANALYSIS, 3 Credits**
Introduces students to descriptive and inferential statistics. The focus is on 1) applying relevant statistical analyses to tourism and recreation data and 2) interpreting results.
Equivalent to: TOL 378
Recommended: MTH 111

**TRAL 379, EXPEDITIONS II-LAND, 10 Credits**
This is a field-based course that develops the knowledge, skills, and dispositions needed to safely and effectively lead and participate in an extended backcountry expedition of three weeks or longer. Emphasis is on mountaineering skills in a backcountry context.
Prerequisite: TRAL 370 with C or better
Corequisites: TRAL 377
Equivalent to: TOL 379

**TRAL 399, SPECIAL TOPICS, 0-16 Credits**
Topics of current importance in tourism, recreation, and/or adventure leadership education. Topics will change from term to term. May be repeated with different topics for credit.
This course is repeatable for 16 credits.

**TRAL 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits**
Equivalent to: TOL 401
This course is repeatable for 16 credits.

**TRAL 406, PROJECTS, 1-16 Credits**
Equivalent to: TOL 406
This course is repeatable for 16 credits.

**TRAL 410, INTERNSHIP, 1-16 Credits**
Full-time supervised professional experience emphasizing functional proficiency under joint sponsorship of university and agency personnel. Graded P/N.
Equivalent to: TOL 410
This course is repeatable for 16 credits.
Recommended: FES 251 and FES 351 and FES 356 and FOR 391 and FOR 407

**TRAL 432, ECONOMICS OF RECREATION AND TOURISM, 3 Credits**
Applications of economic theory, concepts, and methods to outdoor recreation and nature-based tourism resources, projects, and plans. Key topics include analyses of economic impacts, benefits and costs, demand and supply, and non-market valuation (e.g., revealed, stated, and benefit transfer methods).
Equivalent to: FES 432
Recommended: (AEC 350, ECON 201 or 201H) and (ST 202 or 202H)

**TRAL 456, PLANNING FOR SUSTAINABLE RECREATION, 4 Credits**
Concepts related to the creation and design of outdoor recreation plans. Techniques for collecting data pertaining to visitor experiences and preferences. Recreation planning at several levels, both for public and private lands, with emphasis on larger scale site planning where recreation is integrated with other resource uses. Lec/lab.
Prerequisite: TRAL 251 with C or better or FES 251 with C or better
Equivalent to: FES 456

**TRAL 457, PLANNING FOR SUSTAINABLE TOURISM, 4 Credits**
Examines relationships among tourists, tourism developments, and the planning of tourist attractions and services. Focuses on planning tourist resources and programs within a geographic region, as well as at both the destination and site levels. Planning tools and design concepts are reviewed, analyzed, and applied. Lec/lab.
Prerequisite: TRAL 251 with C or better or FES 251 with C or better
Equivalent to: FES 457

**TRAL 474, ENTREPRENEURSHIP IN TOURISM, RECREATION, AND ADVENTURE LEADERSHIP, 3 Credits**
Creation and management of tourism and outdoor leadership businesses. Covers principles of running a successful business and includes special considerations for operations on public lands (e.g., concessionaires).
Equivalent to: TOL 474
Recommended: BA 101
TRAL 476, RISK MANAGEMENT IN TOURISM, RECREATION, AND ADVENTURE LEADERSHIP, 3 Credits
Risk management in tourism and outdoor leadership from an operational perspective. Focuses on risk in tourism and outdoor education programs as a contributing factor for learning, growth, and satisfaction of client motivations. Covers the nature of accidents in outdoor settings, addresses the practitioner’s perspective of risk in the field, and describes theories and methods of implementing risk management. Covers the ethics of utilizing risk and potentially dangerous activities as a basis for enhancing client education and experience.
Equivalent to: TOL 476

TRAL 477, ADVENTURE THERAPY, 3 Credits
Provides students with an overview of adventure therapy, including its history, theory, current status and future trends. Includes program design, ethical issues, and best practices in the field.
Equivalent to: TOL 477

TRAL 478, LEGAL ISSUES IN TOURISM, RECREATION, AND ADVENTURE LEADERSHIP, 3 Credits
Covers the legal dimensions of tourism and outdoor leadership activities. Students will learn about the civil and criminal judicial system from a tourism and outdoor leadership perspective. They will learn to apply risk management methodologies and instruments, such as contracts, insurance, waivers and releases to address legal liability. The basic principles of intentional and negligent torts will be discussed, with an emphasis on practical applications. Also covers employment issues and general business law, including business structure and the use of entities as liability shields.
Prerequisite: TRAL 375 with C- or better or TOL 375 with C- or better
Equivalent to: TOL 478

TRAL 479, *NATURE AND THE HUMAN EXPERIENCE, 3 Credits
Examines the human experience with (and within) nature from biological, psychological, spiritual, and international/cultural perspectives. Identifies opportunities for fostering the human-nature connection to achieve organizational goals and individual and societal health. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: TOL 479
Recommended: TOL 375 or other equivalent WIC course.

TRAL 493, ENVIRONMENTAL INTERPRETATION, 4 Credits
Interpretation of natural and cultural features in parks, museums, and similar settings. Emphasis on learning and applying effective communication techniques in the development of brochures, exhibits, talks, museums, and visitor centers.
Equivalent to: FES 493
Available via Ecampus

TRAL 499, SPECIAL TOPICS, 1-16 Credits
Topics of current importance in forest resources issues, education, policies, economics, management, business, social values, silviculture, and biometrics. Topics will change from term to term. May be repeated with different topics for credit. Section 8: Social aspects of natural resource management (3 credits) graded.
Equivalent to: TOL 499
This course is repeatable for 16 credits.
Available via Ecampus

TRAL 593, ENVIRONMENTAL INTERPRETATION, 4 Credits
Interpretation of natural and cultural features in parks, museums, and similar settings. Emphasis on learning and applying effective communication techniques in the development of brochures, exhibits, talks, museums, and visitor centers.
Equivalent to: FES 593
Available via Ecampus

Wood Science & Engineering (WSE)
WSE 111, RENEWABLE MATERIALS FOR A GREEN PLANET, 2 Credits
Renewable materials are an integral part of modern lifestyles, and current societal trends point to increased use of renewable materials. This course provides an overview of renewable materials and their current applications in society. As an overview course, it covers a breadth of renewable material uses and exposes students to life-cycle thinking.

WSE 210, RENEWABLE MATERIALS TECHNOLOGY AND UTILIZATION, 4 Credits
Characteristics and uses of renewable fiber products including wood, bamboo and grasses; manufacturing processes; effect of tree growth and harvesting on renewable products manufacturing and properties. Wood identification. Lec/lab.
Equivalent to: FP 210

WSE 211, WOODTURNING WITH SCIENCE I, 4 Credits
An introduction to scientific woodturning. Students will get a grounding in tools, lathes, sharpening, and set-up, and then will transition into turning basic forms (spindle and bowl). Particular relevance will be placed upon grain orientation, wood moisture content, wood anatomy, wood chemistry, wood species and extractive effects, and how all of these attributed affect both form and function. Class instruction will be entirely studio based. CROSSLISTED as ART 211/WSE 211.
Equivalent to: ART 211
This course is repeatable for 8 credits.

WSE 225, DEVELOPMENTS OF BUILDING DESIGN WITH RENEWABLE MATERIALS, 3 Credits
Introduction to architectural design, considering the different building requirements and the solutions available, with a focus on wood-based products and other ligno-cellulosic materials.
WSE 250, CAD: COMPUTER AIDED DESIGN, 3 Credits
Provides students with the tools and techniques to design and render products, furniture, and structures using Solidworks, as well as create technical drawings that facilitate communication between designers, engineers, and clients. The techniques developed during this course are applicable to a wide variety of industrial CAD and product design industries worldwide. Lec/lab/studio.
Available via Ecampus

WSE 266, *INDUSTRIAL HEMP, 3 Credits
Introduction to the botany, biology and agronomy of the hemp plant, and the origins, historical contexts and implications of contemporary legal and social issues surrounding its use for food, fiber, and building products. Taught via Ecampus only. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst; CPWC – Core, Pers, West Culture
Available via Ecampus

WSE 299, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

WSE 320, ANATOMY OF RENEWABLE MATERIALS, 3 Credits
Examination of macroscopic and microscopic anatomy of renewable (plant based) materials commonly used by society. Learning activities including lecture and the hands-on study of the various plant materials and their components with naked-eye, hand lens, and microscopic examination. Lec/lab.

WSE 321, CHEMISTRY OF RENEWABLE MATERIALS, 3 Credits
Chemical structures and chemical properties of renewable plant-based materials will be taught at molecular levels. Chemical compositions of different renewable materials will be covered. Chemical and biochemical modifications and applications or renewable materials will be discussed in detail. Lec/lab.
Prerequisite: CH 122 with D- or better or CH 202 with D- or better or CH 232 with D- or better or CH 232H with D- or better

WSE 322, PHYSICAL AND MECHANICAL PROPERTIES OF RENEWABLE MATERIALS, 4 Credits
Introduction to thermodynamics and mechanics of plant fibers, solid wood and bio-based composites: hygroscopicity, heat and mass transport; statics, elasticity and strength of materials; mechanical properties.
Prerequisite: WSE 321 with C- or better

WSE 324, RENEWABLE MATERIALS LABORATORY, 3 Credits
Integrates the knowledge gained in the core science courses (WSE 321 and WSE 322) to help students obtain a deeper understanding of how chemistry, physics, and anatomy affect renewable material properties. The course uses renewable fiber materials such as hardwoods, softwoods, natural fibers, bamboo, composite wood products (e.g. OSB, plywood, MDF, etc.) and fiber-based products (e.g. wood-plastic composites, natural fiber composites, straw panels, paper, etc.) to examine the intricate relationships between fundamental properties and performance. Lec/lab.
Prerequisite: WSE 321 with C- or better and WSE 322 [C-]

WSE 350, WOODWORKING FOR ART AND DESIGN, 3 Credits
Acquaints students with the fundamentals of making art and design objects with wood.

WSE 351, ADVANCED CAD: COMPUTER AIDED DESIGN, 3 Credits
Develop advanced techniques using industry standard CAD software as it relates to wood based product, furniture, and structural design. Build upon the skills acquired during WSE 250 CAD: COMPUTER AIDED DESIGN and learn advanced Solidworks techniques. Introduction to Rhinoceros 3D software and various parametric plugins. Lec/studio.
Prerequisite: WSE 250 with C- or better

WSE 352, CAM FOR THE CNC ROUTER AND LASER ENGRAVER, 3 Credits
Process G-code using CAM software for CNC routing operations, as well as create raster and vector drawings for laser cutting/engraving applications. Each student will work through the design process researching and conceptualizing ideas, 3D modeling designs, developing working prototypes, and fabricating a final product. Lec/lab/studio.
Prerequisite: WSE 350 with C- or better
Recommended: Introductory level CAD course or demonstrated proficiency in industry standard CAD software

WSE 385, *EVALUATING SUSTAINABILITY THROUGH LIFE CYCLE ANALYSIS, 3 Credits
With increased focus on sustainability, it has become important to quantify a sustainability metric of a material, process, or a system. To that end an understanding of life cycle analysis (LCA) is needed that can be used to determine a sustainability metric. This Ecampus course presents the use of LCA to gain insights on the environmental and social impacts of the choices we make. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Available via Ecampus
WSE 392, *BAMBOOLOOZA: THE FASCINATING WORLD OF BAMBOO, 3 Credits
An exploration of the world of bamboo and its application to renewable products. This course provides an in-depth understanding of a renewable material bamboo from its native form to processed products. Additionally, this course discusses the utilization and perception of bamboo in different societies of the world. Taught via Ecampus only. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society Available via Ecampus

WSE 399, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

WSE 401, RESEARCH, 1-16 Credits
Equivalent to: FP 401
This course is repeatable for 16 credits.

WSE 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

WSE 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: FP 405
This course is repeatable for 16 credits.

WSE 406, PROJECTS, 1-16 Credits
Equivalent to: FP 406
This course is repeatable for 16 credits.

WSE 413, WOODTURNING WITH SCIENCE II, 4 Credits
An in-depth look at how character in wood (figure, spalting, knots, etc.) affects machinability and output in both functional and aesthetic turning. Students will work with a wide range of spalted wood types and figure across numerous species while working on advanced turning forms. Particular emphasis will be placed upon how figure affects grain orientation, how spalting affects density and stability, and how the challenges with character wood can be overcome without specialty tools. Class instruction will be entirely studio based. CROSSLISTED as ART 413/WSE 413.
Prerequisite: WSE 210 with C- or better and WSE 211 [C-]

WSE 414, WSE ART AND DESIGN CAPSTONE, 8 Credits
Brings together the basic collaborative design elements and technical background of each student in the creation of collaborative design projects with the intention of giving students real-world, problem-based design experience.
This course is repeatable for 16 credits.

WSE 425, TIMBER TECTONICS IN THE DIGITAL AGE, 4 Credits
An exploration of the advances in design, construction and fabrication of timber buildings. Includes experimentation with both physical and digital models and a final project, in collaboration with UO Architecture students. Lec/lab/studio.
Recommended: Junior standing and knowledge of CAD

WSE 430, FUNDAMENTALS OF ENGINEERING MECHANICS, 4 Credits
An introduction to fundamentals of engineering mechanics for RM students selecting Science and Engineering option. While in most aspects the course follows standard introductory mechanics courses for engineers, special attention is paid to elasticity and strength in cellular and anisotropic materials like solid wood and bio-based composites. The overall objective of this course is to provide fundamental knowledge and practical skills in the area of engineering mechanics and mechanical principles behind some of the most important methods of characterization, processing, and utilization of renewable biomaterials; commonly used today, emerging and future. Lec/lab.
Prerequisite: MTH 254 with D- or better and WSE 324 [B-]

WSE 444, STRAND-BASED COMPOSITES MANUFACTURE, 1 Credit
The strand-based composites manufacturing process uses the results of research projects and the instructor's mill experience. All aspects of the process from wood procurement through pressing are discussed. This course will be valuable to those interested in a manufacturing career. Available via Ecampus

WSE 450, ENTREPRENEURIAL PRODUCT DEVELOPMENT I, 3 Credits
Provides an entrepreneurial experience in product development, in which students design, produce, market, and sell a product in a business setting. Working as a team, students will design a product using renewable materials and are expected to perform and understand manufacturing techniques and processes to produce the product in limited quantities.
Prerequisite: WSE 250 with C- or better and WSE 455 [C-]

WSE 451, ENTREPRENEURIAL PRODUCT DEVELOPMENT II, 3 Credits
Provides an entrepreneurial experience in product development, in which students design, produce, market, and sell a product in a business setting. Working as a team, students will design a product using renewable materials and are expected to perform and understand manufacturing techniques and processes to produce the product in limited quantities. Lab/studio.
Prerequisite: WSE 250 with C- or better and WSE 450 [C-] and WSE 455 [C-]

WSE 453, ^FOREST PRODUCTS BUSINESS, 3 Credits
Provides students with the skills necessary to operate effectively in the global forest products industry. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: ECON 201 and ECON 202
WSE 455, INDUSTRIAL MARKETING IN THE FOREST SECTOR, 3 Credits
Marketing relies heavily on effective communication, so this course concentrates on written and oral communication. The course will arm students with the skills necessary to apply basic concepts of marketing of forest products. Application will be highlighted through examples and industry speakers relating course work to the day-to-day work in business.
Equivalent to: FP 455

WSE 458, DESIGN OF WOOD STRUCTURES, 3 Credits
Study of basic wood properties and design considerations. Design of wood connectors, beams, columns, and beam columns. Introduction to plywood and glue laminated members. Design of structural diaphragms and shear walls. Taught via Ecampus only.
Prerequisite: CE 381 with C or better
Equivalent to: CE 484
Available via Ecampus

WSE 461, BIO-BASED PRODUCTS MANUFACTURING, 4 Credits
First of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include the major processing steps for the conversion of raw materials such as wood, bamboo, hemp, and cereal straws into products.
Prerequisite: WSE 210 with C- or better and WSE 321 [C-] and WSE 324 [C-]

WSE 462, ADVANCED MANUFACTURING 1, 4 Credits
Second of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include process design elements, quality control, and approaches to continuous process improvement.
Prerequisite: WSE 461 with C- or better

WSE 463, ADVANCED MANUFACTURING 2, 4 Credits
Third of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include process control, optimization, automation, and contemporary topics such as Big Data and the Internet of Things and the potential impacts of the trends on manufacturing enterprises.
Prerequisite: WSE 462 with C- or better

WSE 465, RENEWABLE MATERIALS MANUFACTURING EXPERIENCE, 2 Credits
Learning about and visiting a number of renewable materials industrial and commercial operations representing all parts of the renewable materials value chain. The class will meet daily for one 5-day week immediately prior to the start of fall term. During the week, the students and at least one instructor will meet daily. Lectures will precede visits to industrial plants, mills and sites. At the end of the day, an instructor will participate in a debriefing session, reiterating what was learned during the day. Students will then submit a report on the day’s activities. The class includes daily travel and overnight stays.
This course is repeatable for 4 credits.

WSE 470, *FORESTS, WOOD, AND CIVILIZATION, 3 Credits
Multidisciplinary examination of issues related to the roles of forests, trees, and wood in civilization, as providers of commodities, ecosystem services, and spiritual and artistic inspiration. Issues include global supply and demand, wood ownership and political power, and perceptions and uses of forest resources in different societies. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: WSE 470H

WSE 471, RENEWABLE MATERIALS IN BUILDING CONSTRUCTION, 3 Credits
Building construction is a major application of renewable materials, primarily wood. This course explores material selection options, applications, and performance characteristics. Residential construction is emphasized, but non-residential construction applications will also be discussed. Concepts and interpretation of life cycle assessment are introduced.

WSE 473, BIOENERGY AND ENVIRONMENTAL IMPACT, 3 Credits
Explores world’s use of woody biomass fuels, their potential to contribute to our region’s energy supply, and conversion technologies such a direct combustion, pyrolysis, and thermochemical modification. Also examines emissions and other environmental impacts of utilizing renewable materials to generate energy and manufacture products.
Prerequisite: ((MTH 111 with D- or better or MTH 112 with D- or better or MTH 231 with D- or better or MTH 241 with D- or better or MTH 245 with D- or better or MTH 251 with D- or better or MTH 251H with D- or better) and (CH 122 [D-] or CH 222 [D-] or CH 232 [D-] or CH 232H [D-]))

WSE 499, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 99 credits.

WSE 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: FP 501
This course is repeatable for 16 credits.

WSE 503, THESIS, 1-16 Credits
Equivalent to: FP 503
This course is repeatable for 999 credits.
WSE 505, READING AND CONFERENCE, 1-16 Credits
Equivalent to: FP 505
This course is repeatable for 16 credits.

WSE 506, PROJECTS, 1-16 Credits
Equivalent to: FP 506
This course is repeatable for 16 credits.

WSE 507, SEMINAR, 1 Credit
Section 1: Beginning Seminar. Section 2: Seminar. Graded P/N.
Equivalent to: FP 507
This course is repeatable for 99 credits.

WSE 513, WOODTURNING WITH SCIENCE II, 4 Credits
An in-depth look at how character in wood (figure, spalting, knots, etc.) affects machinability and output in both functional and aesthetic turning. Students will work with a wide range of spalted wood types and figure across numerous species while working on advanced turning forms. Particular emphasis will be placed upon how figure affects grain orientation, how spalting affects density and stability, and how the challenges with character wood can be overcome without specialty tools. Class instruction will be entirely studio based.
This course is repeatable for 12 credits.
Recommended: WSE 210 and WSE 211

WSE 514, WSE MASTER OF DESIGN CAPSTONE, 3 Credits
Focuses on preparing MDes students for displaying and marketing their work in competitive studio settings. Become familiar with finding a venue, advertising, designing a space, tracking lighting, hanging or displaying work, administering a show opening, and publicizing work using an artist/designer statement, as well as producing a catalog. Assessment will be via a three party critique of work, composed of one artist, one designer, and one scientist. Assessment will relate to the student’s ability to defend critique, put together a cohesive show, and create an appropriate body of work.
Prerequisite: WSE 522 with C or better

WSE 516, INTRODUCTION TO SCULPTURAL WOODTURNING, 4 Credits
The development of studio/sculptural woodturning has a unique history, and involves a cluster of specialized skills. This course blends historic woodturning practices with modern approaches and aesthetics to bring an understanding of wood science into this very specialized field of woodturning.
Prerequisite: WSE 513 with B or better and WSE 514 [B]
This course is repeatable for 12 credits.

WSE 520, THE GLOBAL CONTEXT OF THE FOREST SECTOR, 3 Credits
Provides a broad knowledge base of business and marketing practices in the global forest industry. Includes a module on research ethics that fulfills OSU Graduate School requirements.

WSE 521, WOOD SCIENCE I, 4 Credits
A comprehensive overview and integration of wood anatomy, wood physics, wood chemistry and wood mechanics; global contemporary issues impacting the wood and fiber sector; integration of basic wood sciences to understand the complex relationships between environment and wood material properties, and the influence of both on the use of wood-based materials.

WSE 522, WOOD SCIENCE II, 4 Credits
Continuation of the comprehensive overview and integration of wood and fiber anatomy, physics, chemistry, and mechanics; integration of basic wood science to understand relationships with wood and fiber properties and their impact on final use. Focus on biological, chemical and physical degradation of wood; adhesion; and physical and engineering properties of wood. Lec/lab.

WSE 525, TIMBER TECTONICS IN THE DIGITAL AGE, 4 Credits
An exploration of the advances in design, construction and fabrication of timber buildings. Includes experimentation with both physical and digital models and a final project, in collaboration with UO Architecture students. Lec/lab/studio.
Recommended: Knowledge of CAD

WSE 526, STRUCTURAL HEALTH ASSESSMENT/MONITORING OF TIMBER BUILDINGS, 3 Credits
Holistic approaches for the evaluation of the performance of timber systems and structures in a building. Learn about the tools available to experts for different analysis purposes, and to understand how data acquired from different techniques can be analyzed and used to inform building management and maintenance, fabrication and construction practices, and future design.

WSE 530, POLYMER COMPOSITES, 3 Credits
A comprehensive survey of the material and mechanical properties of polymer-based composite materials including failure mechanisms, interfacial and nanoscale effects, and transport and thermal properties.
Recommended: CHE 545 and multivariable calculus

WSE 535, POLYMER SYNTHESIS AND STRUCTURE, 3 Credits
A comprehensive overview of various synthetic methods for various synthetic polymers; structures of various synthetic and natural polymers.
Recommended: 3 credits of undergraduate organic chemistry or CH 331 or CH 334

WSE 553, FOREST PRODUCTS BUSINESS, 3 Credits
Provides students with the skills necessary to operate effectively in the global forest products industry.
Recommended: ECON 201 and ECON 202
WSE 555, INDUSTRIAL MARKETING IN THE FOREST SECTOR, 3 Credits
Marketing relies heavily on effective communication, so this course concentrates on written and oral communication. The course will arm students with the skills necessary to apply basic concepts of marketing of forest products. Application will be highlighted through examples and industry speakers relating coursework to the day-to-day work in business.
Equivalent to: FP 555

WSE 558, WOOD DESIGN, 4 Credits
Study of basic wood properties and design considerations. Design and behavior of wood connectors, beams, columns and beam columns. Introduction to plywood and glued laminated members. Analysis and design of structural diaphragms and shear walls. Lec/lab. CROSSLISTED as CE 584/WSE 558.
Equivalent to: CE 584
Recommended: CE 383 or CE 481 with minimum grade of C

WSE 561, BIO-BASED PRODUCTS MANUFACTURING, 4 Credits
First of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include the major processing steps for the conversion of raw materials such as wood, bamboo, hemp, and cereal straws into products.
Recommended: WSE 210 and WSE 321 and WSE 324

WSE 562, ADVANCED MANUFACTURING 1, 4 Credits
Second of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include process design elements, quality control, and approaches to continuous process improvement.
Recommended: WSE 461

WSE 563, ADVANCED MANUFACTURING 2, 4 Credits
Third of a 3-term series exploring technologies and management practices associated with manufacturing products from wood and other renewable materials. Subjects covered include process control, optimization, automation, and contemporary topics such as Big Data and the Internet of Things and the potential impacts of the trends on manufacturing enterprises.
Recommended: WSE 462

WSE 571, RENEWABLE MATERIALS IN BUILDING CONSTRUCTION, 3 Credits
Building construction is a major application of renewable materials, primarily wood. This course explores material selection options, applications, and performance characteristics. Residential construction is emphasized, but non-residential construction applications will also be discussed. Concepts and interpretation of life cycle assessment are introduced.

WSE 573, BIOENERGY AND ENVIRONMENTAL IMPACT, 3 Credits
Explores world’s use of woody biomass fuels, their potential to contribute to our region’s energy supply, and conversion technologies such as direct combustion, pyrolysis, and thermochemical modification. Also examines emissions and other environmental impacts of utilizing renewable materials to generate energy and manufacture products.
Recommended: (MTH 111 or MTH 112 or MTH 231 or MTH 241 or MTH 245 or MTH 251 or MTH 251H) and (CH 122 or CH 222)

WSE 592, ADVANCED WOOD DESIGN, 4 Credits
Recommended: Understanding of basic concepts in mechanics and timber design

WSE 599, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 99 credits.

WSE 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: FP 601
This course is repeatable for 16 credits.

WSE 603, THESIS, 1-16 Credits
Equivalent to: FP 603
This course is repeatable for 999 credits.

WSE 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

WSE 606, PROJECTS, 1-16 Credits
Equivalent to: FP 606
This course is repeatable for 16 credits.

WSE 607, SEMINAR, 1 Credit
Section 1: Beginning Seminar. Section 2: Graduate Seminar.
Equivalent to: FP 607
This course is repeatable for 99 credits.

WSE 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.