

**813A. Supervised Individual Study in Nutrition**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 10 credits. HNF 461.

**813B. Supervised Individual Study in Experimental Foods**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 10 credits. Approval of department.

**813C. Supervised Individual Study in Foodservice Management**  
Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 10 credits. Approval of department.  
Special studies in facility management, personnel coordination and tools and methods of operational control.

**816. Applied Human Nutrition**  
Spring. 3(3-0) HNF 462.

**840. Topics in Nutrition (MTC)**  
Fall, Winter, Spring, Summer. 2 to 3 credits. May reenroll for a maximum of 15 credits if different subtitles are taken. HNF 462, PSL 432, BCH 401 or approval of department.  
Advanced studies in nutrition: assessment and surveillance, community, clinical, growth and development, behavior, infectious disease and environment, oral health, obesity, aging, diet.

**841. Nutrition and Obesity**  
Winter of even-numbered years. 2(2-0)  
One undergraduate course in nutrition, biochemistry or physiology.  
Assessment, energy metabolism, and risk factors associated with obesity. Significance of nutrition and other factors for weight control and reduction.

**842. Nutritional Counseling**  
Fall of odd-numbered years. 3(2-3) HNF 470 or approval of department.  
Provision of nutritional counseling for clients. Assessment, planning, implementation and evaluation of nutritional counseling.

**899. Master's Thesis Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**921. Pathology of Nutritional and Metabolic Diseases**  
(HNF 921, LSM 921.) Spring of odd-numbered years. 4(3-2) ANT 420, ANS 525, BCH 452, HNF 462 recommended. Interdepartmental with and administered by the Department of Large Animal Clinical Sciences.  
Development, physiopathology and morphologic pathology of nutritional and metabolic diseases including carbohydrate, protein, fatty acid, vitamin and mineral deficiencies, their experimental induction and their medical or economic significance.

**935. Comparative Nutrition—Lipids and Carbohydrates**  
Winter of odd-numbered years. 4(4-0) BCH 452 and a previous course on principles of nutrition. Interdepartmental with the Department of Animal Science.  
Regulatory aspects of carbohydrate and lipid metabolism as influenced by nutrition in mammals. Emphasis on normal and abnormal physiological states such as obesity, ketosis and diabetes.

**936. Comparative Nutrition—Protein Metabolism and Developmental Biology**  
Winter of even-numbered years. 4(4-0) PSL 811 or approval of department. Interdepartmental with and administered by the Department of Animal Science.

Protein quality assessment, protein status, protein calorie malnutrition, amino acid metabolism, protein turnover, digestion and absorption, hormonal control of protein metabolism, developmental aspects of protein metabolism and growth.

**937. Comparative Nutrition—Minerals**  
Fall of even-numbered years. 3 credits. PSL 811 or approval of department. Interdepartmental with and administered by the Department of Animal Science.

Forms and location in body, metabolic roles, deficiency and toxicity signs, interrelationships, requirements and biological availability of sources.

**938. Comparative Nutrition—Vitamins**  
Spring of odd-numbered years. 4(4-0) BCH 452, BCH 453 or approval of department. Interdepartmental with the Department of Animal Science.

Advanced concepts in function and metabolism of vitamins; mechanism of action at cellular/molecular level. Biosyntheses, deficiencies, toxicity. Modern approaches to isolation and assay. Use of animal models in research.

**999. Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## FOOD SYSTEMS ECONOMICS AND MANAGEMENT

See Agricultural Economics.

## FOREIGN LANGUAGES

See Linguistics and Germanic, Slavic, Asian and African Languages, and Romance and Classical Languages.

## FORESTRY FOR

### College of Agriculture and Natural Resources

In 305 and 430, field trips are scheduled for several consecutive days away from the campus for integrated field experience, primarily in the second half of spring term of the junior year, so that these courses must be taken concurrently. This precludes enrollment in other courses during that term. The approximate cost of these field trips is \$200.

**202. Introduction to Forestry**  
Fall, Spring. 3(3-0)

Forestry in its broadest sense, including: historic development, forest growth, protection and management, products, national and world economy and policy. Emphasis on multiple use concepts. One-day field trip required.

**203. Resource Ecology**  
(IDC 200.) Fall, Winter, Spring, Summer. 3(3-0) Interdepartmental with the departments of Fisheries and Wildlife, Geography, Resource Development, and Zoology. Administered by the Department of Fisheries and Wildlife.

Basic concepts of ecology which are the unifying basis for resource management, conservation policy and the analysis of environmental quality. Extensive use of guest lecturers.

**204. Forest Vegetation**  
Fall, Spring. 4(3-2)

Nomenclature, classification, and identification of important trees, shrubs, and herbaceous plants of forest and field.

**209. Wood and Its Uses**  
Fall. 4(3-2)

Macroscopic and microscopic features of wood, species identification, moisture relations, physical and mechanical properties, growth characteristics, fungi and insect attack, and description of products.

**220. Plants and Their Environment**

Winter. 3(3-0) Interdepartmental with Agriculture and Natural Resources.  
Relationships between plants and fundamental climatic, edaphic, and biotic factors; structure and function of different ecosystems in relation to environmental factors.

**304. Forest Ecology**

Spring. 4(3-3) BOT 205, CSS 210, FOR 204 or BOT 318. Majors: FOR 305, FOR 320, FOR 329 concurrently.  
Structure and function of forest ecosystems. Community dynamics in response to disturbance. Life histories of trees related to environment. Extended field trips required.

**305. Silviculture**

Spring. 4(2-4) FOR 204, CSS 210. Majors: FOR 304, FOR 320, FOR 329 concurrently  
Natural and artificial forest reproduction methods; intermediate stand treatments; nontimber aspects of silviculture; field studies of silvicultural methods. Extended field trips required.

**320. Forest Measurements**

Spring. 4(3-3) MTH 109 or MTH 111, FOR 204. Majors: FOR 304, FOR 305, FOR 329 concurrently.  
Individual tree measurements. Estimation of site quality, stand volume, density, and stocking. Alternative sampling methods; systematic, simple random, and stratified sampling. Plot sampling and point sampling. Extended field trips required.

**329. Timber Harvesting**

(FOR 429.) Spring. 3(2-3) FOR 204, CSS 210. Majors: FOR 304, FOR 305, FOR 320 concurrently.  
Felling, bucking and transport of trees to mill site. Capabilities and limitations of mechanical devices, vehicles, and logging systems related to timber size and terrain. Extended field trips required.

**330. Forest Protection**

Fall. 4(4-0) FOR 304, FOR 305, FOR 320. Interdepartmental with the departments of Botany and Plant Pathology and Entomology.  
Procedures used to detect and respond to pest, fire and environmental problems in a variety of forest types.

## Descriptions — Forestry

### of Courses

#### 409. Terrestrial Hydrology

Winter. 3(2-2) CSS 210, MTH 108, CPS 100, Juniors; or approval of department. Interdepartmental with the departments of Crop and Soil Sciences and Resource Development.

Global hydrologic cycle, balances, and precipitation. Water storage and flows in vegetation, soil and groundwater of forest, wildland, rural and wetland landscapes. Management effects on evapotranspiration, groundwater recharge, and streamflow.

#### 410. Genetics of Woody Plants

Fall. 3(2-2) BOT 205, BOT 301; or approval of department.

Patterns and origins of genetic diversity in woody plants and procedures for genetic improvement of forest and ornamental species including selection, progeny testing, cloning, hybridization, polyploidy, inbreeding, and gene conservation. Field trips required.

#### 411. Tree Physiology

Winter of even-numbered years. 3(3-0) BOT 301.

The fundamental principles of plant physiology with particular reference to the growth and development of woody plants, and consideration of the influence of genetic and environmental factors on physiological processes in trees.

#### 420. Modeling Forest Growth

Winter. 4(3-2) FOR 320, CPS 115 or approval of department.

Individual tree and stand-level growth models. Basic models for individual tree volume. Parameters to estimate growth and yield. Computer models for Lake States species.

#### 424. Forest Soils

Spring. 3(2-3) CSS 210; Juniors or approval of department. Forestry majors: FOR 305, FOR 402, FOR 425, FOR 429 concurrently. Interdepartmental with the Department of Crop and Soil Sciences.

Interrelationships of forest site and the growth of trees. Properties, classification, inventory, productivity and management of forest soils. Effects of silvicultural and forest management practices on the soil.

#### 428. Seminar

Fall. 1(1-0) Seniors.

Current forestry topics.

#### 430. Industrial Timber Utilization Processes

Winter. 3(2-2) FOR 329.

Mechanics and technologies of industrial wood conversion processes, including grading logs and lumber, manufacture of furniture, plywood, particleboard, fiberboard, and paper. Field trips required.

#### 431. Finishing, Preservation and Drying of Wood

Winter. 3(3-0) FOR 309.

Properties, selection, application of decorative and protective coatings, wood preservatives and fire retardants. Air and kiln drying of lumber.

#### 435. Law and Resources

Fall. 3(3-0) R D 417 or GBL 430. Interdepartmental with and administered by the Department of Resource Development.

Legal theories, cases, statutes and constitutional considerations are applied to natural resource utilization. Private and public property interests in natural resources are illustrated through case studies of use conflicts.

#### 446. Range Management

Winter of even-numbered years. 4(4-0) FOR 220 or FOR 304 or approval of department.

The science of range management, with emphasis on range regions, range vegetation management, livestock management practices, range improvements and multiple use values of rangelands.

#### 450. Natural Resource Administration

Spring. 4(4-0) Seniors. Interdepartmental with Agriculture and Natural Resources and the departments of Fisheries and Wildlife, Park and Recreation Resources, and Resource Development.

Concepts and methods of administering wildland properties. The legal, economic and social environment. Benefit-cost analysis of management changes. Unit organization, personnel management and accounting. Presents a systems view of administration.

#### 451. Plant Molecular Genetics

Spring. 4(2-6) CSS 350 or ZOL 441. Interdepartmental with the departments of Crop and Soil Sciences and Horticulture. Administered by the Department of Crop and Soil Sciences.

Principles, concepts, and techniques of plant biotechnology. Recombinant DNA technology, plant molecular biology, transformation, and tissue culture in relation to plant improvement.

#### 454. Forestry in International Development

Fall. 3(3-0)

Assessment of the world's forest resources, forest products industry and trade, and forestry-related environmental and social problems. Emphasis on issues and policy approaches in developing countries.

#### 455. Natural Resource Economics

Fall. 4(3-2) EC 200 or EC 201. Interdepartmental with Agriculture and Natural Resources and the departments of Fisheries and Wildlife, Park and Recreation Resources, and Resource Development.

Basic economic and institutional principles and techniques that govern the production and consumption of renewable natural resources. Natural resource evaluation, project analysis, and distributional considerations.

#### 458. Timber Management

Fall. 4(3-2) FOR 305, FOR 455 or concurrently.

Managing forest lands for timber production and other uses. Compartment examination, silvicultural prescription, yield projection and economic evaluation of timber management programs. Timber sales, harvest scheduling, access roads.

#### 460. Arboriculture

Fall. 3(2-2) Approval of department.

Principles and techniques of species selection, establishment, and cultural practices used in the care and maintenance of shade and ornamental trees. Two-day field trip required.

#### 461. Urban Forestry

Spring. 3(3-0) FOR 460 or approval of department.

Principles of urban forest management: organizational, legal, economic, cultural and environmental. Inventories, utility forestry and commercial arboriculture. Field trips required.

#### 465. Forest and Wood Science Problems

Fall, Winter, Spring, Summer. 1 to 5 credits. Seniors with a 2.80 average, or approval of department.

Special problems course for students qualified for advanced study in some phase of forestry or wood science.

#### 466. Natural Resource Planning

Winter. 3(2-2) FOR 455 or R D 417 or approval of department. Interdepartmental with the departments of Park and Recreation Resources and Resource Development.

Natural resource planning concepts and techniques applicable to area-level and subarea-level planning. Case studies in comprehensive, multiple resource public planning and single resource private planning.

#### 491. Natural Resources and Modern Society

Spring. 3(3-0) Juniors. Interdepartmental with Agriculture and Natural Resources and the Department of Resource Development.

A survey of the social and economic significance of natural resources in modern industrial and urban society. Current problems of natural resources management and use are examined in terms of the society in which they exist.

#### 804. Forest Ecology

Winter. 3(3-0) Approval of department.

Theories, methods of analysis, and discussion of current investigations of energy, nutrients, and biomass dynamics in forest ecosystems.

#### 807. Special Problems

Fall, Winter, Spring, Summer. 2 to 5 credits. May reenroll for credit with a maximum of 10 credits. Approval of department.

Advanced study in administration, biometrics, photogrammetry, dendrology, silviculture, management, economics, ecology, genetics, arboriculture, hydrology, soils, recreation, physiology, policy, entomology, products harvesting, wood preservation, timber mechanics, wood conversion, fire, range management, extension and pathology.

#### 809. Natural Resources Economics

Winter. 3(3-0) Approval of department. Interdepartmental with the Department of Resource Development.

Applications of economic analysis to natural resource problems.

#### 814. Plant Breeding and Genetics Seminar

Winter. 1(1-0) May reenroll for a maximum of 2 credits. Approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Crop and Soil Sciences.

#### 815. Selected Topics in Plant Breeding and Genetics (MTC)

Fall, Winter, Spring, Summer. 2 to 5 credits. May reenroll for a maximum of 12 credits if different topics are taken. Approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Crop and Soil Sciences.

Selected topics in plant breeding including: host-plant resistance, nutrition and quality, computerized records and data analysis, classical literature and strategies for improving field, horticulture and forestry crops.

**816. Special Problems in Plant Breeding and Genetics**

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 8 credits. Approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Horticulture.

Students may conduct research in a laboratory, greenhouse or field-plot on a selected subject or study selected published literature under the supervision of a faculty member.

**817. Plant Breeding Methods**

(FOR 823.) Fall. 3(3-0) STT 422 or concurrently. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Crop and Soil Sciences.

Methods, strategies and practices in organization and operation of plant breeding programs. Emphasis on practical application of classical, modern and futuristic approaches to plant breeding.

**819. Plant Breeding Systems**

(FOR 822.) Winter. 3(3-0) CSS 821, STT 422. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Horticulture.

Breeding systems for improvement of self and cross pollinated and of vegetatively propagated crops. The genetic basis for parent selection.

**821. Genetic Concepts in Plant Breeding**

Fall. 3(3-0) CSS 350 or ZOL 441. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Crop and Soil Sciences.

Genetic structure of plant populations, gene action, inbreeding, outbreeding, heterosis, linkage and recombination, genetic architecture of traits, genetic distance.

**828. Seminar**

Fall. 1(1-0)

Critical study and discussion of advanced forestry topics.

**835. Silviculture**

Fall. 3(3-0) FOR 305 or approval of department.

Biological basis of intensive forest management including seedling production, site evaluation and preparation, plantation establishment, intermediate stand treatments and natural reproduction methods. Field trip optional.

**836. Evolution of Crop Plants**

Fall of even-numbered years. 3(3-0) CSS 821 or approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Horticulture.

Cultural and biological aspects of evolution under domestication; origin and diversity of cultivated plants.

**838. Tissue Culture for Plant Breeding**

Winter of even-numbered years. 3(2-2) BOT 414, CSS 821. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Horticulture.

The application of plant cell, protoplast and tissue culture methodologies and principles to crop improvement.

**840. Recreation Economics**

Spring. 4(4-0) FOR 809 or approval of instructor. Interdepartmental with the departments of Park and Recreation Resources, and Resource Development. Administered by the Department of Park and Recreation Resources.

Applications of economic analysis to recreation resource problems including measurement of demand and supply, valuation of recreation resources, determination of economic impact, economic decision making and policy considerations.

**850. Administering the Public Land Agency**

Spring. 4(4-0) FOR 450 or approval of department.

Case studies of administrative problems in land management agencies. Students are organized as teams and prepare team reports on specified aspects of each case.

**855. The Research Process in Natural Resources**

Fall. 3(3-0) Approval of department. Interdepartmental with and administered by the Department of Resource Development.

Research and decision processes as applied in natural resource investigations. Research organization and applications of research results. Oriented to management, social science, and policy studies. Preparation of project proposals.

**881. Urban Internship**

Fall, Winter, Spring, Summer. 9 credits. Open only to Forestry-Urban Studies Master's students. Approval of department.

Individual experience in approved institutional position related to an urban development policy area.

**899. Master's Thesis Research**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**910. Resource Economics Proseminar**

Spring of odd-numbered years. 3(3-0) May reenroll for a maximum of 9 credits. Approval of department. Interdepartmental with the departments of Agricultural Economics and Resource Development.

A seminar wherein advanced graduate students in the fields of resource economics participate with faculty in the joint conduct of a major research project in resource economics and policy.

**940. Theoretical Population Genetics**

Winter. 4(4-0) MTH 113, STT 422 or approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture.

Discussion of mathematical theories in population genetics and experimental works on natural and laboratory populations.

**941. Quantitative Genetics in Plant Breeding**

Spring of even-numbered years. 4(4-0) STT 423, CSS 817 or approval of department. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture. Administered by the Department of Crop and Soil Sciences.

Calculation and implication of genetic parameters. Linkage. Coancestry and inbreeding. Covariance between relatives. Heritability and selection. Genotype by environment interaction. Emphasis on relationship of quantitative genetics to plant breeding.

**944. Physiological Genetics**

Winter of odd-numbered years. 3(3-0) BOT 413; CSS 821. Interdepartmental with the departments of Crop and Soil Sciences, and Horticulture.

Control of variation in higher plants including adaptive physiology, quantitative genetics, growth correlation, biochemical genetics, hybrid physiology, and genecology.

**960. Simulation Models in Natural Resource Management**

Winter of odd-numbered years. 3(3-0) R D 855 and knowledge of FORTRAN programming or approval of department. Interdepartmental with and administered by the Department of Resource Development.

The role of simulation models in developing management strategies. Applications of computer simulation in natural resources. Modeling of decision systems in natural resources management.

**976. Multivariate Methods in Forestry Research**

Winter. 4(4-0) MTH 334, STT 423.

Application of multivariate techniques such as principal components, canonical analysis, factor analysis, and clustering to problems in forestry research. Case studies drawn from several forestry disciplines.

**999. Doctoral Dissertation Research**

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**FRENCH**

See Romance and Classical Languages.

**GENERAL BUSINESS AND BUSINESS LAW GBL**

**College of Business and Graduate School of Business Administration**

**341. Survey of Business Law**

Fall, Winter, Spring. 4(4-0) Juniors. Not open to students with majors in the College of Business.

Historical development of the law; courts, court procedures and civil remedies, torts, crimes; contracts, agency, sales, negotiable instruments, real and personal property, including bailments and liens. Textbook and lecture rather than case approach.

**345. Business Ethics**

Fall. 4(4-0) Juniors. Interdepartmental with and administered by the Department of Philosophy.

Ethical dimensions of the relationships between a business and employees, consumers, other businesses, society, government, and the law. Readings from philosophical and business sources.

**400H. Honors Work**

Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.

Independent and informal study in law, office administration or business communications.