441. Commodity and Futures Marketing
Spring. 3(3-0)
P: FSM 200, EC 291; STT 200 or STT 201 or STT 315.
R: Not open to freshmen and sophomores.
Supply, demand and prices in commodity markets.
Futures and options and their role in forward pricing.
Agricultural and food markets.

443. Food Industry and Cooperative Marketing
Spring. 3(3-0)
P: FSM 200. R: Not open to freshmen and sophomores.
Multiple firm and cooperative marketing methods.
Organization and operation of cooperatives, marketing orders, trade associations and other forms of group action in the food system.

200. Forests and the Global Environment
Fall. 3(3-0)
Relationships between forests, climatic and edaphic factors, and human influences upon forest resources.
Deforestation, biodiversity, sustainable forest management and timber trade.

304. Wood Technology
Fall. 4(3-2)
P: CEM 141, PHY 231. R: Not open to freshmen and sophomores.
Structure and identification of wood. Physical and mechanical characteristics. Major industrial timber utilization processes including manufacture of lumber, furniture, composites, and paper.

306. Forest Biometry
Spring. 4(3-2)
P: MTH 118, FOR 201, FOR 204. R: Not open to freshmen and sophomores.
Describing location and area of forest resources. Quantification of site, stand, and tree characteristics. Sampling and inventory. Predicting growth and yield.

210. Fundamentals of Soil and Landscape Science
Fall. 3(2-3) Interdepartmental with Crop and Soil Sciences. Administered by Crop and Soil Sciences. P: CEM 141.

211. Urban Trees in Improving the Urban Environment
Spring. 3(3-0)
P: BOT 105, BOT 301, CSS 350.
Applications of plant and genetic principles to improve tree species and to preserve biological diversity in forest ecosystems or human benefit.

202. Forest Field Studies
Summer. 3 credits. Offered only at W.K. Kellogg Biological Station and Manistee National Forest.
P: FOR 204, FOR 305, FOR 404, FOR 406. R: Open only to juniors and seniors in College of Agriculture and Natural Resources.

300. Wood Technology
Fall. 4(3-2)
P: CEM 141, PHY 231. R: Not open to freshmen and sophomores.
Structure and identification of wood. Physical and mechanical characteristics. Major industrial timber utilization processes including manufacture of lumber, furniture, composites, and paper.

400. Forest and Agricultural Ecology
Fall. 4(3-3) Interdepartmental with Crop and Soil Sciences.
P: CSS 219, BOT 105.
Structure and function of ecosystems managed for crop and wood production. Productivity, nutrient cycling, community dynamics as affected by management intensity and natural disturbance. Dynamics of managed versus natural ecosystems.

210. Forest Hydrology
Spring of odd numbered years. 3(2-3) Interdepartmental with Crop and Soil Sciences, and Resource Development.
P: CSS 210, MTH 116; CPS 100 or CPS 130 or CPS 131. R: Not open to freshmen and sophomores.
Science and technology of the hydrologic cycle and water resources in forest, wildland, wetland, and rural watersheds.

210. Forest Hydrology
Spring of odd numbered years. 3(2-3) Interdepartmental with Crop and Soil Sciences, and Resource Development.
P: CSS 210, MTH 116; CPS 100 or CPS 130 or CPS 131. R: Not open to freshmen and sophomores.
Science and technology of the hydrologic cycle and water resources in forest, wildland, wetland, and rural watersheds.

210. Natural Resource Data Analysis
Spring. 3(2-2)
P: CPS 100 or CPS 130 or CPS 131 or approval of department.
Quantitative analysis of natural resource data. Modeling and display of biophysical and socio-economic data related to natural resource systems.

210. Natural Resource Data Analysis
Spring. 3(2-2)
P: CPS 100 or CPS 130 or CPS 131 or approval of department.
Quantitative analysis of natural resource data. Modeling and display of biophysical and socio-economic data related to natural resource systems.

Forestry — Descriptions of Courses

101. Michigan’s Forests
Spring. 3(3-0)
Ecological, social and economic roles of Michigan’s forests in historic and contemporary context. Geographic similarities and differences in forest resources.

201. Tenets of Forestry
Fall. 1(1-0)
R: Open only to Forestry students. Completion of Tier I writing requirement.
History, founding principles, and core concepts of forestry. Stewardship, conservation, professional ethics, and current forestry issues.

202. Introduction to Forestry
Fall. Spring. 3(3-0)
Historical development of forestry. Forest growth, protection, management, and products. Relationship of national and world economy and policy to forestry. Emphasis on multiple uses of forests.

204. Forest Vegetation
Fall. 2(3-2)
Nomenclature, classification, and identification of woody plants. Tree structure as it relates to growth and ecosystem dynamics.

411. Commodity and Futures Marketing
Spring. 3(3-0)
P: FSM 200, EC 291; STT 200 or STT 201 or STT 315.
R: Not open to freshmen and sophomores.
Supply, demand and prices in commodity markets.
Futures and options and their role in forward pricing.
Agricultural and food markets.

413. Food Industry and Cooperative Marketing
Spring. 3(3-0)
P: FSM 200. R: Not open to freshmen and sophomores.
Multiple firm and cooperative marketing methods.
Organization and operation of cooperatives, marketing orders, trade associations and other forms of group action in the food system.

200. Forests and the Global Environment
Fall. 3(3-0)
Relationships between forests, climatic and edaphic factors, and human influences upon forest resources.
Deforestation, biodiversity, sustainable forest management and timber trade.

304. Wood Technology
Fall. 4(3-2)
P: CEM 141, PHY 231. R: Not open to freshmen and sophomores.
Structure and identification of wood. Physical and mechanical characteristics. Major industrial timber utilization processes including manufacture of lumber, furniture, composites, and paper.

306. Forest Biometry
Spring. 4(3-2)
P: MTH 118, FOR 201, FOR 204. R: Not open to freshmen and sophomores.
Describing location and area of forest resources. Quantification of site, stand, and tree characteristics. Sampling and inventory. Predicting growth and yield.

400. Forest and Agricultural Ecology
Fall. 4(3-3) Interdepartmental with Crop and Soil Sciences.
P: CSS 219, BOT 105.
Structure and function of ecosystems managed for crop and wood production. Productivity, nutrient cycling, community dynamics as affected by management intensity and natural disturbance. Dynamics of managed versus natural ecosystems.

406. Silviculture
Spring. 4(3-2)
P: CSS 210, FOR 204. R: Not open to freshmen and sophomores.

498. Forest Management
Spring. 4(3-2)
P: FOR 420. Management of forests for timber production in a multiple-use context. Yield projections, harvest scheduling, management prescriptions, project analysis and administration.

499. Forest Hydrology
Spring of odd numbered years. 3(2-3) Interdepartmental with Crop and Soil Sciences, and Resource Development.
P: CSS 210, MTH 116; CPS 100 or CPS 130 or CPS 131. R: Not open to freshmen and sophomores.
Science and technology of the hydrologic cycle and water resources in forest, wildland, wetland, and rural watersheds.

210. Forest Field Studies
Summer. 3 credits. Offered only at W.K. Kellogg Biological Station and Manistee National Forest.
P: FOR 204, FOR 305, FOR 404, FOR 406. R: Open only to juniors and seniors in College of Agriculture and Natural Resources.

422. Woody Plant Genetics
Fall. 3(2-2)
P: BOT 105, BOT 301, CSS 350.
Applications of plant breeding and genetic principles to improve tree species and to preserve biological diversity in forest ecosystems or human benefit.

490. Law and Resources
Fall. 3(3-0) Interdepartmental with Resource Development and Public Resource Management. Administered by Resource Development.
P: RB 201; EC 291 or GBL 395. R: Not open to freshmen and sophomores.
Legal principles applied to natural resource use. Sovereignty, property rights, land and water use, jurisdiction, public trust doctrine, fish and game law, mineral rights, and eminent domain. Case and statutory law analysis.

441. Plant Breeding and Biotechnology
Plant improvement by genetic manipulation. Genetic variability in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars.

450. Forestry in International Development
Fall. 3(3-0) Interdepartmental with Sociology. P: FOR 404 or FOR 464. R: Open only to seniors and graduate students.
Biophysical, social and economic factors influencing design and implementation of farm, village and community level forestry and agroforestry projects.

451. Cellular and Molecular Principles and Techniques for Plant Sciences
Spring. 4(3-2) Interdepartmental with Crop and Soil Sciences, and Horticulture. Administered by Crop and Soil Sciences. P: CSS 350 or ZOL 341.
Principles, concepts, and techniques of agricultural plant biotechnology. Recombinant DNA technology, plant molecular biology, transformation, cell tissue, and organ culture in relation to plant improvement.

450. Arboriculture
Fall. 3(2-2)
P: BOT 105, FOR 204, or HRT 211. R: Not open to freshmen and sophomores.
Tree selection and planting for fit climatic, space and edaphic conditions. Diagnosing tree abnormalities. Cultural practices used in the care and maintenance of shade and ornamental trees. Field trip required.

461. Urban Forestry
Spring. 3(3-0)
P: FOR 204 or HRT 211. R: Not open to freshmen and sophomores.
Trees in improving the urban environment. Principles of urban forest management: legal, economic, organizational, and cultural. Street tree planning and inventory systems, community forestry and commercial arboriculture. Field trips required.

454. Natural Resource Economics and Social Science
Fall. 3(2-2) Interdepartmental with Park and Recreation Resources, Fisheries and Wildlife, and Resource Development.
P: EC 201 or EC 202. R: Not open to freshmen and sophomores.
456. **Natural Resources Planning and Policy**
Spring, 3(3-0) Interdepartmental with Fisheries and Wildlife, Park and Recreation Resources, and Resource Development.
P: FUR 408, FUR 418, or FW 434 or FW 424, FW 472 or PRR 443 or RD 415 or RD 460. R: Open only to seniors and graduate students in College of Agriculture and Natural Resources. Scientific, environmental, social, and institutional factors affecting planning and policy-making. Focus on ecosystem-based planning and policy issues through development of a multiple-use plan. Case studies.

478. **Post Management II: Biological Components of Management Systems**
Spring, 3(3-0) Interdepartmental with Entomology, Horticulture, Crop and Soil Sciences, and Fisheries and Wildlife. Administered by Entomology. P: ENT 404 or ENT 470 or BOT 408 or CSS 402 or FW 325. Principles of host plant resistance and biological control and their relationship to the design of agroecosystems. Classification of insect biological control agents.

490. **Woody Plant Physiology**

496. **Biotechnology in Agriculture: Applications and Ethical Issues**
Spring of even-numbered years, 3(3-0) Interdepartmental with Horticulture, Philosophy, and Crop and Soil Sciences. Administered by Horticulture. P: BS 111 or BOT 105. R: Not open to freshmen and sophomores. Current and future roles of biotechnology in agriculture: scientific basis, applications. Environmental, social, and ethical concerns.

490. **Independent Study in Forest and Wood Science**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to juniors and seniors. Approval of department. Special problems course for students qualified for advanced study in some phase of forestry or wood science.

801. **Forestry Research**
Fall, 1(0-0). R: Open only to graduate students in Forestry. The philosophy, nature, and procedures of research in forest science.

802. **Research Processes in Natural Resources**
Fall, 3(3-0) Interdepartmental with Resource Development. Administered by Resource Development. Research planning and implementation. Structure of research organizations. Applications of research results.

804. **Forest Ecology**
Spring of even-numbered years. 3(3-0)

809. **Advanced Wood Technology**
Spring of even-numbered years. 3(2-0)
R: Open only to graduate students in College of Agriculture and Natural Resources. Mechanical and physical properties of wood. Sorption, swelling, elasticity, and anisotropy. Composite technology and industry practices.

819. **Advanced Plant Breeding**
Fall, 3(3-0) Interdepartmental with Horticulture, and Crop and Soil Sciences. Administered by Horticulture.
P: CSS 490, STT 422. Genetic expectations resulting from breeding strategies with cross- and self-pollinated crop plants. Germplasm collections, mapping populations, and modifications of reproductive biology useful for crop improvement.

823. **Methods in Genetic Engineering of Plants**
Fall of even-numbered years. 4(0-8) Interdepartmental with Crop and Soil Sciences, and Horticulture. Administered by Crop and Soil Sciences. Bacterial transformation, Plant transformation via Ti-plasmid, protoplast/PEG, and electroporation methods. Detection of foreign gene integration and expression.

824. **Forest Soils**
Fall of odd-numbered years. 3(2-2) Evaluation and inventory of forest soils and landscape ecosystems. Physical, water, biological, and chemical processes. Nutrient cycling, diagnosis, and fertilization. Variability, geography, and landscape ecology.

827. **Techniques in Cytogenetics**
Fall of odd-numbered years. 10(3-0) Interdepartmental with Crop and Soil Sciences, and Horticulture. Administered by Crop and Soil Sciences. Preparation of chromosomes from commercially important plants for cytogenetic analysis.

829. **The Economics of Environmental Resources**
Fall, 3(3-0) Interdepartmental with Agricultural Economics, Resource Development, Park and Recreation Resources, and Economics. Administered by Agricultural Economics. Economic principles related to environmental conflicts and public policy alternatives. Applications to water quality, land use, conservation, development, and global environmental issues.

832. **Environmental and Natural Resource Law**
Fall, 3(3-0) Interdepartmental with Resource Development, Agricultural Economics, Crop and Soil Sciences, and Geography. Administered by Resource Development.
P: RD 430. Origin and development of environmental law. Theories of power, jurisdiction, sovereignty, property interests, pollution, and other bases for legal controls of natural resources. Common law and constitutional limitations on governmental power.

835. **Silviculture**
Fall of even-numbered years. 3(3-0) R: Open only to graduate students in Forestry, Fisheries and Wildlife, Botany and Plant Pathology, and Resource Development. Ecological, genetic, physiological, and societal impacts of silvicultural practices. Current problems in stand management and forest regeneration in temperate and tropical zones.

836. **Plant Evolution and the Origin of Crop Species**
Fall of even-numbered years. 3(3-0) Interdepartmental with Horticulture, and Crop and Soil Sciences. Administered by Horticulture. P: CSS 350. Cultural and biological aspects of the evolution of domestic plants. Origin and diversity of cultivated plants.

837. **Water Law**
Spring, 3(3-0) Interdepartmental with Resource Development and Agricultural Economics. Administered by Resource Development. P: RD 430. Legal principles applicable to surface water and groundwater, private and public water rights, and controls over water resources. Cases, statutes, and administrative procedures.

883. **Land Use Law**

845. **Forest Resources Policy**
Spring of even-numbered years. 3(3-0) Models, processes and analytical methods. Interaction of markets, government, and citizens in policy issue development, formulation, implementation and evaluation.

854. **Agroforestry Systems**
Spring of even-numbered years. 3(3-0) Open only to graduate students majors in Botany and Plant Pathology, Crop and Soil Sciences, Forestry, and Horticulture. Biophysical and ecological aspects of agroecology and agroforestry. Nutrient cycling and the soil, root, tree and crop interface.

866. **Economics of Renewable Resources**
Spring of odd-numbered years, 3(3-0) Interdepartmental with Resource Development. P: ASC 521. Applications of economic theory and analysis to renewable natural resources problems. Focus on renewable resource interactions, including multiple-use forestry and agroforestry.

890. **Special Problems**
Fall, Spring. 1 to 5 credits. A student may earn a maximum of 7 credits in all enrollments for this course. R: Approval of department; application required. Advanced individual study in an area of forestry.

891D. **Selected Topics in Plant Breeding and Genetics**
Fall, Spring, Summer. 1 to 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Horticulture, and Crop and Soil Sciences. Administered by Horticulture. R: Open only to graduate students in Plant Breeding and Genetics or Genetics. Approval of department. Selected topics in plant breeding.

892. **Plant Breeding and Genetics Seminar**
Fall, Spring, Summer. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Horticulture, and Crop and Soil Sciences. Administered by Horticulture. Experience in review, organization, oral presentation, and analysis of research.

899. **Master's Thesis Research**
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 99 credits in all enrollments for this course.