ECOLOGY (ECO)

ECO-241 ENVIRONMENTAL SCIENCE (4 Credits)
Studies how ecological principles, philosophy, economics, sociology and politics interact with identifying and solving environmental issues. Topics include: air quality, water quantity and quality, population dynamics, energy sources, types of waste, sustainability, environmental policy and legislation, and pertinent government agencies. Lecture and lab. Course fee applied. This course satisfies the core requirement for lab science.
Prerequisite: None

ECO-242 GEOGRAPHIC INFORMATION SYSTEMS (3 Credits)
This course introduces students to the theory and application of Geographic Information Systems (GIS), and the fundamentals of spatial data management. Students gain practical experience using ArcGIS software for mapping, modelling, and spatial analysis. Prerequisite: BIO-151 or BIO-233.
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ECO-243 NATURAL RESOURCES MGT (3 Credits)
An exploration of the role of natural resource agencies in developing, sustaining and protecting natural resources. Emphasis is placed on the history of natural resource management in Michigan, management philosophies, politics that impact natural resources, species and ecology management, sustainability and carrying capacity.
Prerequisite: None

ECO-301 LAND & WATER RESOURCES - AUSABLE (4 Credits)
Systems-level perspective on land forms and ecosystems. Includes analysis and interpretation of on-site data recorded in the field, remote-sensing data derived from satellite and low-altitude aerial imagery and geographic information systems (GIS). Field trips to and analysis of forests, bogs, marshes, dunes, and rivers. Includes application to policy and land use planning.
Prerequisite: None

ECO-302 LAKE ECOLOGY & MGMT - AUSABLE (4 Credits)
Field study of lakes and streams with applications to planning and management. Includes an introduction to limnology and investigation of representative lakes and streams of the region.
Prerequisite: None

ECO-303 ECOLOGICAL AGRICULTURE - AUSABLE (4 Credits)
Environmental analysis and natural resources in relation to people and policy. The focus is on ethnobotany, ecological agriculture, and land stewardship. It employs a discussion format both in classroom and field settings. Its emphasis is grappling with difficult practical and ethical problems and issues that require deep and persistent thought.
Prerequisite: None

ECO-304 INTERNL DEVELOP & ENVIRON SUS - AUSABLE (4 Credits)
Global Development and Ecological Stewardship: Environmental analysis and natural resources in relation to society and development issues. The focus is on ecological sustainability and sustainable society in the context of the various factors that are bringing environmental degradation and impoverishment of people and cultures. It deals with topics of tropical agriculture, hunger, poverty, international debt, appropriate technology, relief programs, missionary earthkeeping, conservation of wild nature, land tenure, and land stewardship. It employs a discussion format both in classroom and field settings. Its emphasis is grappling with difficult practical and ethical problems and issues that require deep and persistent thought.
Prerequisite: None

ECO-305 AGROECOLOGY (4 Credits)
Study a wide variety of current food production systems through visits with practicing farmers. Evaluate agrosystems in terms of soil quality, energy flow and nutrient cycling, pesticide fate, functional plant, animal, and genetic biodiversity, water use efficiency, energy flow, and population ecology. Learn to recognize, design, and implement sustainable agrosystems. Engage current social and economic food production systems and norms in the context of Christian faith, to steward the natural resources God has entrusted with us more effectively, improving both global environmental health and food security.
Prerequisite: None

ECO-308 ENVIRONMENTAL HEALTH (3 Credits)
Study of the interconnection between the health of people, animals, and their shared environment. This course includes topics such as toxicology, epidemiology, community health, radiation, and environmental justice. These topics are applied at the local, regional, and global scale.
Prerequisite: None

ECO-310 ENVIRONMENTAL LAW & POLICY - AUSABLE (4 Credits)
Analysis of the policy-making process at a local, national, and international scales with examination of environmental policy challenges, including climate change, resource management, and energy development. Students will interact with regional policy-making and land managers in the field to consider linkages between policy and science and ways for science to inform the policy-making process. Environmental ethics, environmental justice, and environmental advocacy will also be considered.
Prerequisite: None

ECO-311 FIELD BOTANY - AUSABLE (4 Credits)
Field identification and ecology of vascular plants as components of natural communities in Michigan. Emphasis is placed upon on-site examination of plants in communities such as bog, dune, forest, marsh, meadow, and swamp. Plants difficult to study under field conditions are brought to the laboratory for microscopic examination and identification. Ecological features such as community stratification and plant zonation along ecological gradients are examined.
Prerequisite: None

ECO-314 ENVIRONMENTAL JUSTICE (3 Credits)
Study of the treatment and involvement of all people in the development and enforcement of environmental laws, regulations, and policies. This course discusses historical, contemporary, and emerging threats to environmental justice.
Prerequisite: None

ECO-318 MARINE BIOLOGY - AUSABLE (4 Credits)
Marine Biology focuses on intertidal life and marine ecology in oceanic and geophysical contexts. Students study the biology of marine plants and animals in the field, specifically trophic dynamic relationships of eel grass communities and the intertidal zone, workings of the island systems of Puget Sound, ecological roles of sea birds and fishes, population and community structure dynamics, exploitation and oceanic microbialization and biogeochemical processes and their linkages with the biosphere. Marine stewardship and effects of human activity on the marine environment are integral to the course.
Prerequisite: None

ECO-321 ANIMAL ECOLOGY - AUSABLE (4 Credits)
Interrelationships between animals and their biotic and physical environments emphasizing behavioral aspects. A field course that centers on the ecology of northern Michigan fauna from a stewardship perspective. Included are individual student projects.
Prerequisite: None

ECO-322 AQUATIC BIOLOGY - AUSABLE (4 Credits)
Ecology, identification, systematics, culture and care of aquatic plants and animals, and adaptations to freshwater environments. Aquatic life is studied in lakes, ponds, bogs, marshes, streams, and in the laboratory. The course assesses human impact on aquatic species and ecosystems, presents procedures for the stewardship of aquatic habitats, and introduces aquatic restoration ecology. Prerequisites: One year of general biology or one semester each of general zoology and general botany.
Prerequisite: None

ECO-323 STREAM ECOLOGY - AUSABLE (4 Credits)
Prerequisite: None

ECO-324 FISH ECOLOGY & MGMT-AUSABLE (4 Credits)
Introduction to the relation of freshwater fish species and their environments in lakes and streams with concurrent examination of techniques and technologies employed to manage populations and species for conservation, recreational use, and commercial harvest. This course will provide understanding of freshwater fish taxonomy and phylogenetic relationships, habitat requirements of major fish species by life stages, stream habitat assessment, population measuring and monitoring, and strategies for management of recreational and commercial species and conservation of threatened and endangered species.
Prerequisite: None

ECO-330 GEOGRAPHIC INFO SYSTEMS/AUSAB (4 Credits)
An introduction to the theory and application of Geographic Information Systems (GIS) for applied social and ecological problem-solving. Through a series of readings, videos, and hands-on exercises covering a variety of environmental themes, issues, and scales, participants will learn the fundamentals of the types of maps, map projections, symbology, classification, analysis, and web mapping applications, and gain skills and confidence to be able to conduct their own field studies, do spatial analysis, and create their own maps and visualizations.
Prerequisite: None

ECO-332 ENVIRONMENTAL CHMSTRY - AUSABLE (4 Credits)
Principles and analysis of chemical movement and distribution both natural and human-induced in natural environments. Sampling and analytical methods are included for water, soil, and air. Work is conducted both on site in natural habitats and the laboratory.
Prerequisite: None

ECO-341 ECOLOGY (4 Credits)
The study of the interrelationships of living organisms, plant or animal, and their environments. These are studied with a view of discovering the principles that govern relationships. A special emphasis on the different ecosystems of Michigan bogs, marshes, streams, and sand dunes, and man's impact on them, will be studied. Lecture and lab. Course fee applied. This course satisfies the core requirement for lab science.
Prerequisite: MAT-151 or MAT-251, EGR-100 or BIO-225 and BIO-233

ECO-342 FIELD BIOLOGY (4 Credits)
First two weeks: Instruction and experience in the use of the tools of the field biologist, trips to different types of ecosystems: forest, field, stream, pond, lake, marsh, and bog. Final week: Travel experience covering points of interest in the Upper Peninsula and Lower Peninsula of Michigan, or the student may elect to work on a field problem in the Grand Rapids area. Course fee applied.
Prerequisite: EGR-100 or BIO-225 and BIO-233

ECO-343 TROPICAL AGRICULTURE -AUSABLE (4 Credits)
An introduction to tropical agriculture for working with resource-poor farmers. Topics include the scientific basis behind successful low cost techniques, a survey of major tropical crops and their requirements, and on-site practical work. Selected issues in Christian missions and in community development, and some urban gardening and small animal techniques are also covered. Taught in a rural, mountainous village in Costa Rica in collaboration with a Christian organization aiding redevelopment after an earthquake, with several trips to different ecosystem regions of Costa Rica.
Prerequisite: None

ECO-345 WILDLIFE ECOLOGY - AUSABLE (4 Credits)
Ecology, conservation and stewardship of wildlife species and their habitats. Includes growth and structure of natural and managed populations, environmental and human social factors affecting wildlife communities and wildlife conservation. The course is set in the context of the historical development of the field from management, to ecology, and to the land ethic of Leopold. Includes management and stewardship of non-game and endangered species, and long-term prospects of wildlife in changing environmental, climatic and social contexts.
Prerequisite: None

ECO-354 ENVIRONMENTAL JUSTICE - AUSABLE (4 Credits)
Systems-level perspective on land forms and ecosystems. Includes analysis and interpretation of on-site data recorded in the field, remote-sensing data derived from satellite and low-altitude aerial imagery and geographic information systems (GIS). Field trips to and analysis of forests, bogs, marshes, dunes, and rivers. Includes application to policy and land use planning. Prerequisite: One year of introductory science.
Prerequisite: None

ECO-355 WATERSHEDS IN GLOBAL DVLPT - AUSABLE (4 Credits)
Principles of watershed ecology. Includes principles and practice of community-based water monitoring and watershed management for developing and developed countries and data access and analysis using an online relational database and data-to-action strategies. Designed for students in science and public policy, including students interested in missions and development and agencies involved in environmental assessment and community development. Prerequisite: One year of general biology.
Prerequisite: None

ECO-358 FIELD TECHNIQUES IN WETLANDS (4 Credits)
A comprehensive overview of wetland ecosystem processes, values, legislation and quantification. Students will learn to evaluate and quantify soils, hydrologic status and vegetation in a variety of wetland ecosystems including bogs, emergent marshes, forested wetlands and wetlands converted for agriculture, and to apply standard tools developed by the US Army Corps of Engineers and Michigan Department of Environmental Quality to assess wetland extent and habitat quality.
Prerequisite: None

ECO-359 MARINE MAMMALS - AUSABLE (4 Credits)
Biology, behavior, ecology, identification and conservation of the marine mammals of the Pacific Rim. This study area covers some major habitats in Puget Sound and the Salish Sea, with attention to the diving physiology, social behavior, and communications of whales and seals. The course aims to develop a stewardship perspective rooted in biological principles and directed at the global conservation of marine mammals and their ecosystems. Special attention is given to their use by cultures of the region in order to understand current issues.
Prerequisite: None

ECO-360 APPLIED BIODIVERSITY GENETICS - AUSABLE (4 Credits)
A field class introducing recent advances in molecular biology techniques, computation and storage for applied ecological work. The ability to utilize these techniques is becoming more and more important to scientists for addressing fundamental questions in biology. This course will expose you to a broad range of techniques and concepts in molecular biology and phylogenetics. Emphasis is placed on the strengths and limitations of each method and its application to a wide range of organisms, including plants, animals and microorganisms. It will provide a foundation for molecular applications to issues of environmental stewardship. Prerequisites: Two years of biology, one year of chemistry.
Prerequisite: None

ECO-361 FIELD BIOLOGY IN SPRING-AUSABLE (4 Credits)
Springtime plants and animals, their field identification, field biology, behavior and landscape context with a focus on spring flora, amphibia, and birds.
Prerequisite: None

ECO-362 ENVIRONMENTAL APPS IN GIS - AUSABLE (4 Credits)
Introduction to the theory and application of spatial analysis for environmental conservation and planning using geographic information systems (GIS) technology in the context of real world conservation problems.
Prerequisite: None

ECO-365 INSECT ECOLOGY = AUSABLE (4 Credits)
Life history, behavior, and ecology of terrestrial and aquatic insects, and their roles in pollination, herbivory, predation, agroecosystems, disease and vector epidemiology, invasion ecology, soil ecology, biodiversity, and freshwater ecology. Practical applications include study of Integrated Pest Management (IPM) approaches to reduce negative impacts of pest species in agricultural, subcultural, and medical settings while preserving biodiversity and ecosystem functionality.
Prerequisite: None

ECO-367 CONSERVATION/DEVELOPMENT OF INDIAN TROP (4 Credits)
Tropical ecology of South India, including an introduction to and comparative analysis of coastal ecosystems, the plains, and montane tropical ecosystems of the Western Ghats including altitudinal zonation. The course will be taught on-site at a variety of ecosystem preserves and national parks. If suitable arrangements can be made, a number of ecosystems will be studied on the Andaman Islands. Topics include tropical ecosystem structure and function, adaptations of flora and fauna, biodiversity surveys, past and present human interactions with the landscape, and autecology of selected plant and animal species. Prerequisites: Upper division standing and at least one ecology course (preferably completed at AuSable).
Prerequisite: None

ECO-368 FOREST ECOLOGY (4 Credits)
This course will focus on how plants interact with the abiotic environment and with other organisms. Field trips will provide opportunity to examine various physiological adaptations and population and community processes; and to introduce research approaches in different contexts. Quantitative skills including data collection, management, and basic analysis will be emphasized.
Prerequisite: None

ECO-371 FOREST MGMT - AUSABLE (4 Credits)
Introduction to site-level, landscape and multi- stakeholder approaches to forest management, including strateies of climate change adaptation and mitigation. Theory, application, and techniques of forest management for specified values and objectives including instrumental (economic/utilitarian and life support such as wood production, habitat and watershed protection and climate moderation) and non-instrumental values (such as aesthetic, moral/spiritual values e.g. recreation). The course will address the evolution of forest management practice and some specific practices, methods and techniques of growing trees and the development and care of forests (silviculture) as applied to natural forests managed for various objectives.
Prerequisite: None

ECO-377 MARINE INVERTEBRATES - AUSABLE (4 Credits)
Prerequisite: None

ECO-385 URBAN ENVIRONMENTAL JUSTICE/AUSABLE (4 Credits)
Introduction to environmental justice theory, practice, and history as a movement that bridges scholarship, action, science and ethics. Grounded in a case study of Chicago, students learn about how urban ecologies are formed around matters of race, class, food politics, health, industry, waste, energy, markets, and history. Through assigned readings, classroom discussion, field visits and research with activists, churches, community organizations, and city officials, students are equipped with skills and framework to conceive of the city, the environment, and justice in relation to a biblical vision of human flourishing in and with natural and built environments.
Prerequisite: None

ECO-390 DIRECTED INDIV STUDY - AUSABLE (1-4 Credits)
Field or laboratory study of a problem selected by the student in consultation with a professor, and presented as a written proposal in advance of the session in which the study is to be conducted. Normally, problems are outgrowths of previous coursework with a given professor at Au Sable. Prerequisite: A study proposal including goals and objectives, methods, protocols for evaluation; to be signed by the professor and program director.
Prerequisite: None

ECO-400 ENVIRONMENTAL BIOLOGY CAPSTONE (3 Credits)
This course investigates the pressing local and global environmental issues and the interdisciplinary strategies necessary to address these issues. Emphasis will be placed upon investigating environmental issues through the Christian environmental stewardship framework.
Prerequisite: None

ECO-442 ADVANCED FIELD STUDIES (1-6 Credits)
A field-oriented course in the study of the relationships of the fauna and flora of special segment of the biosphere such as Northern Ireland, Yellowstone National Park, the Florida peninsula and other locations in the USA and abroad. Students spend most of the time on location experiencing the ecology of the area. Course fee applied. Instructor permission required.
Prerequisite: None

ECO-443 ADVANCED FIELD STUDIES LAB (1 Credit)
The laboratory field-oriented experience taken in conjunction with or after ECO-442. This course is designed to immerse students in a field-oriented experience focusing on the natural history, environmental issues and culture of the region or country studied in ECO-442. Instructor permission required.
Prerequisite: ECO-442 (previously or concurrently)

ECO-471 CONSERVATION BIOLOGY - AUSABLE (4 Credits)
Principles of conservation biology with applications to sustainable human society and biospheric integrity. An integrative approach to biology and society that interrelates population biology, ecological principles, biogeochemical cycles, ecosystem functions, and human society in the context of biospheric degradation. The course develops a stewardship perspective rooted in biological principles and directed at conservation of plant and animal species, biotic communities, ecosystems, and human society. Included are topics of human development, poverty, and economic growth.
Prerequisite: None

ECO-478 ALPINE ECOLOGY - AUSABLE (4 Credits)
Ecology of the mountains of the Pacific Northwest, with particular attention to adaptation of plant and animal life to montane climates and altitudes, and analysis and interpretation of altitudinal zonation of biotic communities with applications to latitudinal biogeography. Also included are topics of physiological responses of organisms to reduced oxygen levels, low temperatures and high altitude radiation regimes. Field work includes on-site studies in the Olympic Mountains of the Olympic Peninsula.
Prerequisite: None

ECO-480 ADVANCED TOPICS: ECOLOGY (1-4 Credits)
Prerequisite: None

ECO-482 RESTORATION ECOLOGY - AUSABLE (4 Credits)
Ecological foundations and techniques for ecosystem and biotic community restoration. This course applies ecological principles and environmental ethics to redeeming and restoring degraded and damaged ecosystems and endangered species. Field studies include analysis of restoration and rehabilitation work with the Kirtland Warbler, an officially designated wild river, coastal dunes, kettlehole bogs, old growth forest, deforested lands, degraded residential and farming sites, and abandoned oil wells. A practical field laboratory is included in which techniques are applied to a specific site.
Prerequisite: None