Course Number	Title	Academic Level	Sustainability category	School/College	Description
UP 614	Collaborative Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	Conflict and disagreement are inevitable parts of the urban planning process.Â This course provides students the opportunity to learn skills and techniques of collaborative planning, the practice of engaging diverse people and groups to resolve disputes and come to agreements.Â Topics covered will include interest-based negotiation, stakeholder analysis, facilitation, mediation, the consensus building approach to multiparty negotiation, and the design of urban planning processes.Â Special attention will be paid to race, gender, and cultural diversity, as well as the role of power and expert knowledge.Â Students will explore these topics through in-class exercises and simulations, case analysis, readings, and discussion.
ENGR 521	Clean Tech Entrepreneurship	Graduate	Includes Sustainability	Engineering	The course teaches the students how to screen venture opportunities in various cleantech domains. Venture assessments are approached through strategic, financial and market screens, and consider the impact of policy and regulatory constraints on the business opportunity.
ARCH 585	Advanced Building Technology	Graduate	Includes Sustainability	Arch. and U.P. (Taubman)	The objective of this course is to explore state-of-the-art building and environmental technologies. Recent advancements in building technology promoting intelligence and automation are reviewed and explorations of a new generation of buildings and building technologies are pursued. The main topics of the course are: 1. Direction of technological advancements. 2. Building automation and intelligent building technologies. 3. Advanced lighting, daylighting, heating, ventilating, and air-conditioning systems. 4. Prototype buildings of the future
URP 524	Program Evaluation for Urban Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman)	This course provides an overview of the theories, issues and practice of program evaluation as it relates to urban planning and policy making. Using a combination of case studies and hands-on projects the student develops an understanding of the purpose of program evaluation, the evaluation process, the role of protgram evaluation in urban planning and policy making, and critical issues and limitations of evaluation. Students are introduced to techniques for selecting best evaluation approaches and appropriate methods; collecting, analyzing, and interpreting data; and developing recommendations.
UP 529	Scenario Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman)	This course provides a hands-on introduction to the theory and practice of public sector urban scenario planning. This planning method integrates creativity and analysis to construct multiple possible futures for urban places, with the aim of improving decisions by challenging assumptions and encouraging learning. The course combines seminar discussions of key readings and cases with a series of hands-on assignments to construct urban scenarios for a site in Southeast Michigan. Special emphasis is placed on the range of computer models used by professionals, and how diverse stakeholders can be engaged in the scenario planning process.
ARCH 531	Networked Cities	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	This course examines architecture's emerging relationship with the design of interactivity, interfaces, and information infrastructures. Working mainly in seminar format, in response to short weekly readings, participants debate issues in the past, present, and future of technology-laden places. Biweekly lectures explore how places have generally emerged at crossovers between infrastructures. Biweekly storyboard projects interpret architecture and the city in terms of interaction design. A final project invites a situational design proposition. Emphasis is on how computing now pervades the physical world, however, and not on dematerialization. This course attempts to take apart popular misconceptions of cyberspace, and to reassert the value of embodied architecture in a digital economy.
ARCH 527	Building Systems	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	This course focuses on the analysis of building costs, the integration of structural and mechanical systems, the development of material assemblies, and the synthesis of building components and systems at the outset of the design process. This comprehensive approach to the design process will be supported by case study examples that identify integration strategies with regard to life safety codes, building services, and construction technologies.
ARCH 707	Physical Pursuits MS	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	This technique-based course covers topics related to material properties, behavior, performance, tooling, and manufacturing techniques. Â The course will focus, in part, on physical explorations in working processes related to the development of material assemblies, assessment of their behavior and effects, and their potential applications.
ARCH 564	Advanced Materials Structures	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture, Arch. and U.P. (Taubman)	This course introduces the application and design of alternative materials such as glass, fabrics, aluminum, metal alloys, fiber composites and laminates that are used structurally in architectural construction. Comparisons are made by studying their application through transfer technology in the automotive, aerospace, biomechanical and other related industries. Their properties and structural behavior are explored qualitatively through digital design and material stress analysis and applications are studies through prototyping and laboratory testing.
UP 519	Theories of Urban Design	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture, Arch. and U.P. (Taubman), Arch. and U.P. (Taubman) Â» Urban and Regional Planning	The seminar is designed as a critical and collective inquiry into theories of urban design in order to develop an in-depth, interdisciplinary approach toward a more meaningful urban design for the future. Through a series of readings, discussions, case studies, presentations, and research work, students focus on deficiencies and opportunities in current urban design approaches, and formulate their own perspectives and strategies of urban form intervention, based on a critical understanding of the fundamental nature of cities versus the nature of thinking in the field of urban design.
CEE 574	Materials Seclection for Sustainable Design	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture, Engineering Â» Civil & Environmental Eng.	Integrated study of materials properties, performance, and economic and environmental cost, as related to engineering and architectural design. Topics include material properties and selection, materials database, processing and design, ecological considerations, and optimization. Examples will be drawn from cementitious materials and ceramics, metals, ploymers and composites.

URP 507	Fund of Planning Practice	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Students are introduced to planning practice by generating a complete master plan during the course of the semester. Â The class teaches techniques associated with problem identification, assessment of issues, and formulation and articulation of final recommendations. Â There is an emphasis on strong written, graphic, and oral communication skills as a basis of critiquing class performance.
URP 502	U.S. Planning Institutions and Law	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course provides a general overview of the legal aspects of urban and regional planning, including institutional structures, sources of and limits on legal authority, and traditional and evolving approaches to land use and development control. Â The principle focus of the course will be on the relationships between planning as a public policy-making process and the laws that authorize, implement, and constrain planning initiatives.
UP 540	Planning Theory	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This is a course in the theoretical foundations of planning. This course will stress basic tools that will help you to invent new solutions to new problems in the real world. We will use case studies of urban regions across the US for class discussion to both bring theory to life and allow us to test established planning theory against real urban problems. We will cover the historical foundations of planning, the classical theoretical paradigms of planning, an examination of the major roles played by practicing planners, and finally the application of those theories and roles to the case study and to larger problems of environmental limits, economic globalization, and increasing social disparity.
URP 570	Global and Comparative Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Course designed to emphasize the theories that underlie planning interventions in countries that are newly industrialized or industrializing. Countries such as India, Jamaica, Malaysia, Guatemala, China, Thailand, Tanzania, Hong Kong, Venezuela, and Egypt, varying in size and historical antecedent, will be used for drawing illustrative case studies. The demographic, technological, and ideological changes that have resulted in unprecedented population growth and migration during the development decades will be reviewed. Responses to migration, housing scarcity, need for physical and social infrastructure, for jobs and amenities will be studied.
UP 671	Public Policy & Transportation	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course examines surface transportation from a broad public policy perspective, with a special focus on its institutional and urban components. With shifting political priorities, central government's role in transportation has changed significantly in the past decade. Concurrently, the mandates placed upon the transportation planning profession have changed and incorporate enhanced attention to air quality and other non-mobility concerns such as promoting broader public participation, preserving the environment, and ensuring social equity. The course investigates this changing landscape for transportation planning and its implications for the relationships between federal, state, regional, and local authorities.
UP 537	Housing Policy and Economics	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	The objective of this class is to provide students with an understanding of policy and planning in housing, and the role of regulation in housing development, delivery, and choice. The course will address the economic, political, legal, and social forces that shape the house stock and its use by owner-occupiers and tenants. We will examine the policies and programs that are currently in place, and their effect on the quality and affordability of housing. The first part of the course will provide a broad conceptual understanding of the basic economics of housing supply and demand, including the economic and financial aspects of housing delivery, the legal and administrative framework in which housing is developed, and the way households make housing choices and adjust their housing consumptions. The second part of the class will focus on housing policy and planning to examine how affordable housing is delivered by both government and non-profit actors in the national, local, and community levels. The final part of the class will examine a variety of issues such as the links between housing and neighborhood transition, housing and transportation, and housing and local public finance.
URP 551	Physical Planning Workshop	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course provides an overview of basic theory, principles and skills involved in planning for the physical environment. The course is taught primarily in a studio format in which the students learn by undertaking real or applied problems. The objective of the course is to provide students with a basic understanding of physical and land use planning, and to provide them with the rudimentary skills, including graphic communication skills, necessary for producing a physical plan.
URP 521	Intermediate Geographic Information Systems	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course builds on UP 406 and covers additional GIS and related technologies. The objectives of the course are to provide spatial information and analysis capabilities for urban planners and those in related disciplines. The course will cover advanced principles and concepts of GIS, theory and tools of spatial analysis with a focused exposure to GIS applications.
URP 541	Urban Land Use Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course will provide a broad overview of major land use planning issues from the perspective of the professional planner. Students will learn the fundamentals about the planning and development process including how to: review site plans, develop master plans, revise development standards, write staff reports and inspect development sites. Important planning tools and techniques will be applied to sustainable land use practices such as natural features protection, infill development, brownfield mitigation, neo-traditional development and urban waterfront redevelopment. Speakers and field trips will provide first hand glimpse of the major land use issues that planners deal with everyday. This course will be helpful to anyone interested in working as a public or private sector planner.
URP 590	Integrative Real Estate Seminar	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	A survey seminar regarding the various progressive approaches to real estate development, including downtown revitalization, conservation development, New Urbanism, etc. It will also review the history of conventional development, progressive project financing, and public policy such as smart growth and regionalism.

UP 574	Comp Urban Policy	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	The purpose of this course is to familiarize students with current debates dealing with urban planning theory and practice both domestically and internationally. The themes considered in the course include the built environment and architectural design of cities, modernist city-building and postmodern urbanism, the entrepreneurial city and privatized urbanism, and the politics of place.
UP 515	Liquid Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Liquid Planning --- This course will study the urbanized hydrology of the Great Lakes Watershed Basin through different disciplinary lenses. Â Students will work in multidisciplinary teams to examine the implications of storm water management practices, and will produce design documents, three-dimensional studies, and short report documenting the integration of diverse design processes.
URP 540	Land Use Planning & Development Management	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Land use is one of the essential dimensions of planning. While criticisms over past practices abound, land use planning remains a critical arena for discussion and innovation. Moreover, while many associate land use planning with development; it also plays a significant role in rethinking land management in cities with declining populations and correspondingly growing regions of vacant land. Understanding how different land use controls work and the reasons for their creation can help decode our existing landscapes and provide insight for further policy and design implementation. This course will provide students with an overview of the techniques, process, strategies, and potential tradeoffs of different land use planning approaches.
URP 505	Planning Methods Qualitative Focus	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course introduces students to some of the methods and techniques used in planning practice and urban research. We will cover computer applications for data analysis, including some computer lab time scheduled periodically through the semester. Analytic approaches include research design, multivariate regression, population forecasting, survey research, case study research, evaluation, and graphic data presentation. The emphasis is on methods in the context of planning and urban policy research, and matching the method to the problem. The course will focus especially on qualitative planning methods.
UP 650	Advanced Urban Theory	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	This is an intensive reading seminar on contemporary conceptual challenges in planning and urban development, with an emphasis on urban intellectual history and critical social theory.Â It is intended for both doctoral students and master's students interested in deepening their understanding of ideas in planning, urban theory, and urban history.Â Themes may include: the rise of the 20th Century planning thought in its broader social context; urban political economy; modernism and the failure of social engineering; postmodernism and the privatization of public space; suburbanization, regionalism and new urbanism; the impact of technological innovation on cities; networks and the information city; globalization and the persistence of the local; utopianism; and competing visions of the market and the state.
UP 523	Regional Planning	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	This introductory course examines regional planning and analysis. Regionalism represents a distinctive view of metropolitan development, an alternative conception of community, and an institutional response to environment, economic and social challenges. We examine such debates a sustainability, metropolitan sprawl, city-suburb inequality, and the role of state and federal policy.
UP 522	State&Local Land Mgt	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	State and Local Land Management --- State government has always been the primary source of the legal authorities used for the public management of private land use and development. Most states have traditionally delegated many of those authorities to their local governments. Since the 1970's, however, -suburban sprawl- has increasingly prompted states either to take some of those authorities back or to demand more and better management by their local governments. This course explores the successes and failures of state-level attempts to reform local land use planning and development management efforts.
UP 521	The Social Life of Public Spaces	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	This course examines the social life of parks, sidewalks, subways, plazas, malls, and other shared spaces. The course will focus on the aesthetic, legal, and social considerations that designers and city officials should consider when they try to use regulation and design to promote the health and vitality of public spaces. An eclectic array of classic and contemporary readings from sociology, urban planning and design, law, and related fields will be reviewed.
UD 712	Territories and Constituencies	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban Design	This core studio introduces a series of design approaches to study complex metropolitan regions and the network of agents in their transformation. Students develop fundamental skills to integrate multi-scalar design strategies and experiment with advanced representation methods, such as GIS, digital video and other technologies. The studio includes field trips to select cities to engage with local practitioners, designers, and policymakers.
UD 715	Integrative City Cultures Seminar	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban Design	Humanities seminar that engages humanities-related scholarship and creative work on issues related to contemporary urbanization, urbanization in specific contexts (post-industrial, megacities), and/or in different geographical locations (Western, non-Western, continent-specific, etc.). Â Participants will engage textual and visual materials, and writing as a form of communication. Â The course seeks to combine contemporary humanities scholarship with problems and challenges of the contemporary city.
UD 718	Theories and Methods in Urban Design	Graduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban Design	This seminar explores contemporary theories of urbanism as a lens for understanding urban design practice.Â Cities are both participants in, and resultants of, systems of economy and power.Â As such, they evince design relationships between their public and the prevailing economic and political systems.Â Drawing from architecture, planning, urban design, cultural theory, geography, sociology, political science, and ecology, the course presents the interdisciplinary cross-section of theories of urbanization that will be used to examine the methods that have been and are being used to design cities today, globally.

MO 501	Human Behavior & Organization	Graduate	Includes Sustainability	Business (Ross)	The purpose of this course is to improve your effectiveness as a manager by introducing you to frameworks for understanding organizational processes and by giving you experience in applying these frameworks. The field of management and organizations is at the intersection of several social science disciplines and focuses on applying their insights to solving organizational problems and building organizational competencies. Topics include improving decision making, building networks, negotiation, power and politics, organization design, motivation and compensation systems, and leading (and surviving) organizational change.
TO 601	Information Systems	Graduate	Includes Sustainability	Business (Ross)	An introduction to information systems for managers. Â Topics discussed include the kinds of information systems that support individual, group and corporate goals, with an emphasis not only on the hardware/software but also the managerial concerns with the design and implementation of information technology.
TO 552	Operations Management	Graduate	Includes Sustainability	Business (Ross)	All value in society is generated by transforming one set of things into other, different things. Without such transformations, there would be no wealth creation and no rationale for business. Operations management is the design and management of those transformation processes. In this course, we will provide a framework for systematically examining and understanding operation management issues. We will also expose you to a few of the most important tools and practices that are useful in managing manufacturing and service production systems.
MO 603	Navigating Change: Skiills & Strategies for Consultants & Managers	Graduate	Includes Sustainability	Business (Ross)	What makes change agents effective? What practices, capabilities, and approaches enable organizations to transform themselves appropriately? This course addresses these questions with focus on change leadership tools and approaches. We study successful and unsuccessful change, explore factors that shape the outcomes of change agents' efforts, and review students' experiences with organizational change from a variety of perspectives. We help prepare leaders to diagnose and implement successful change both when they are in charge and when they must work through others.
TO 620	Global Supply Chain Management	Graduate	Includes Sustainability	Business (Ross)	Supply chain is the central nervous system of the global economy. Supply chain consists of all activities involved in fulfilling a customer request. Effective management of supply chain entails management of material, information and financial flows. Supply chain is perhaps the only discipline and business function in an organization that cuts across functional boundaries. Globalization of economy has heightened the strategic importance and of supply chain management and created new opportunities for using supply chain strategy and planning as a competitive tool. Inter- and intra-firm coordination issues are becoming critical for effective management of the supply chain. Depending on the industry sector, supply chain related costs account for 20-25% of a typical firm's total cost. On the revenue side, the supply chain decisions have a direct impact on the market penetration and customer service. Specific learning goals for this course are:Â -- Develop a general manager?s perspective on key issues in designing and managing end-to-end global supply chains.Â -- Know that effective management of end-to-end supply chain entails management of material, information and financial flows.Â -- Develop an understanding of key drivers of supply chain performance and their inter-relationships with business strategy and other functions within the company such as marketing, manufacturing, accounting, and finance.Â -- Develop the ability to design and formulate integrated supply chain strategy, so that all components are not only internally synchronized but also tuned to fit corporate strategy, competitive realities and market needs.Â -- Develop an in depth understanding of elements of supply chain designs for efficiency, responsiveness, and variety.Â -- Understand the importance of intra-firm coordination strategies and the knowledge of how to execute on such strategies.Â -- Understand dynamics of flows across firm boundaries, reasons for lack of synchronization, and managerial actions to improve overall supply chain performance.Â -- Understand the importance risk management in the extended global supply chain; learn the key elements of a robust risk management system and develop execution plans.
MO 593	Human Behavior & Organization	Graduate	Includes Sustainability	Business (Ross)	The purpose of this course is to improve your effectiveness as a manager by introducing you to frameworks for understanding organizational processes and by giving you experience in applying these frameworks. The field of management and organizations is at the intersection of several social science disciplines and focuses on applying their insights to solving organizational problems and building organizational competencies. Topics include improving decision making, building networks, negotiation, power and politics, organization design, motivation and compensation systems, and leading (and surviving) organizational change.
STRATEGY 594	Corporate Strategy II	Graduate	Includes Sustainability	Business (Ross)	This course builds upon the first year corporate strategy core course. Â It deals with more complex corporate and multi-business situations, including diversified firms, inter-firm alliances, business acquisitions and global competition.

BE 555	Non-Market Strategy: Shaping the Rules of the Game	Graduate	Includes Sustainability	Business (Ross)	Most business courses teach you how to play the game of business within the rules. Â This course is about the rules themselves, their creation and their enforcement. Â While a firm's competitive advantage is created in large part through developing exploiting difficult-to-imitate capabilities and resources in the market environment, the non-market environment in which the firm operates also presents important risks and opportunities for business leaders. Â Many barriers to imitation derive from legal rules or public policies that favor certain capabilities over others. Â These policies are not exogenously given. Â They are instead the outcome of competition between businesses and other groups within public institutions. Â In many industries, corporate activity in the policymaking and judicial process is a key element in creating or maintaining a company's competitive advantage. Â This course has four main goals: Â 1) Create awareness of the broad range of ways in which the non-market environment - especially government policy - affects business. Â 2) Give an understanding of the process through which business and other groups create and change the rules of the game. Â 3) Gain a mastery of a set of conceptual tools and frameworks for developing and implementing non-market strategies. Â 4) Provide opportunities to practice formulating integrated strategies that function skillfully in the non-market arena.
BA 612	Business Strategies for the Base of the Pyramid	Graduate	Includes Sustainability	Business (Ross)	The condition of the world's poor is the subject of growing attention. Global poverty is increasingly seen as an unacceptable outcome of the current economic system, and there is interest in exploring new market-based approaches to poverty alleviation. The emerging base of the pyramid (BoP) perspective aligns business-oriented incentives for growth, innovation, and profits with the development community's efforts to create a more inclusive capitalism. In fact, the relationship between profits and poverty alleviation in pursuit of mutual value creation is a central component of the BoP perspective. To explore these issues, this course integrates concepts of strategy, international business, non-profit management, and poverty alleviation to stimulate the leadership skills and competitive imagination needed to design BoP ventures. Through combination of cases, readings, lectures, videos, and outside guests, class session will engage students in discussions aimed at: 1) identifying the opportunities associated with a new perspective on serving BoP markets; and 2) developing the strategies, business models, and partnerships required to productively explore those opportunities.
MKT 614	Social Marketing	Graduate	Includes Sustainability	Business (Ross)	Explores social marketing and consumer culture from managerial and ethical perspectives. The overall thrust of the course will be on using marketing methods to benefit the public interest. Topics will include: social marketing such as anti-smoking campaigns; corporate social responsibility and cause related marketing; marketing in nonprofit organizations; green marketing; economic and sociological perspectives on consumer culture; the psychology of happiness and how personal well-being is influenced by wealth, consumption, and materialism; and public policy concerns related to marketing and advertising.
MO 672	Leading Non-Profit Organizations	Graduate	Includes Sustainability	Business (Ross)	This is a course intended to give students a broad overview of the leadership challenges of the non-profit sector. The course content is designed for students who not only plan to lead non-profit organizations, but who may also serve as volunteers or on non-profit boards. The core framework for this course will focus on non-profit leaders as capacity builders. This includes the leadership capability to create a mission centered non-profit organization aligned with its strategies, skills, organizational culture and a supporting infrastructure. In addition, we explore the leader as external agent building capacity through advocacy, working with businesses and collaborating with other non-profit organizations.
ES 644	Introduction to Microfinance	Graduate	Includes Sustainability	Business (Ross)	Â This live broadcast of a 7-week seminar speaker series hosted by the Haas School of Business University of California explores why and how microfinance operations have grown to proved financial services to poor and low-income people on a sustainable basis.Â The class brings together advice and best practices from successful practitioners and institutions around the world as well as new technology startups targeting the industry.Â This course will provide students with an excellent introduction to microfinance as an important development effort in the war against poverty, and it will also serve as an excellent forum to learn about current challenges and debates in the world of microfinance.Â This course represents a unique partnering with the Haas School of Business.Â A 2-hour webcast will be followed by an additional hour of discussion led by Ross faculty.
TO 624	Strategic Sourcing	Graduate	Includes Sustainability	Business (Ross)	Strategic sourcing is the cross-functional process of critically analyzing how the organization can most effectively secure outside goods and services. This process is rooted in gaining a deep understanding of the overall value chain for the good of service of interest, and the business case behind a mutually beneficial and sustainable relationship between the buyer and supplier(s). This course teaches: analytical tools such as spend analyses (what is bought where?) and cost modeling (what drives cost?) to inform business case development: how to negotiate with suppliers using market-based (competitive bid) or multi-party (negotiation) mechanisms; and ways of structuring relationships and contracts to track results, drive sustainable performance, and mitigate risk.
TO 623	Information Technology Strategy in Supply Chain and Logistics	Graduate	Includes Sustainability	Business (Ross)	Digital technologies have permeated every aspect of modern business. Â The capacity to execute any business model rests heavily on the approach taken by firms in organizing their information architecture. Â This course will explore the role of information architecture on Supply Chain and Logistics functions. Â We will discuss the dominant technologies traditionally used in planning, forecasting, scheduling and managing supply chains. Â We will then explore the emerging new technologies such as SOA (Service Oriented Architecture) that enable firms to innovate in their business models through dynamic engagement with their supply partners in evolving global supply networks. Â Class discussions and case studies will include technology and business process choices in new product development, design, MRP, ERP, distribution and logistics.

MO 637	Social Intrapreneurship: Â Leading Social Innovation in Organizations	Graduate	Includes Sustainability	Business (Ross)	Getting a major initiative to succeed in big organizations is much like leading a social movement. Â It takes being able to read the opportunity structure and thinking like an entrepreneur as one's career develops; mapping the social system to locate allies inside and outside the organization; mobilizing a team using available technologies; and framing the initiative in a way that motivates decision makers and makes the business case. The course draws on the latest advances in social research, network analysis, and information technology to provide a toolkit for leading social innovation within organizations. Â We first lay out a framework for how effective social movements change organizations. Â This framework includes four parts: reading the opportunity structure to recognize when the time is right for an innovation; mapping the social terrain to locate allies and supporters; mobilizing allies into a team; and framing the case effectively as a business proposition. Â The second session breaks down the process of recognizing opportunities, drawing on the experience of a successful intrapreneur who built a major social initiative at IBM. Â The third and fourth sessions are training in the tools of social network analysis and their application as a way to visualize and quantify the social terrain. Â Here we will see how to use public information to map out power structures inside and beyond the organization. Â The fifth session highlights newly available tools for mobilization that have underlain actions from whimsical "flash mobs" to political protests in the wake of contested elections. Â The sixth session lays out the rules for making the case for change to decision makers, from how to frame it to how to demonstrate its business value. Â In the second half of the course, we go through several cases of successful and unsuccessful social innovation in organizations. Â Innovations can be of several types: products (selling goods and services whose value extends beyond profit), practices (making how we do it more sustainable), people (making the workplace more just and rewarding), and public (building the community beyond). Â We end with live practice in making a compelling and brief pitch for your innovation to a client board.
WMBA 604	Leadership Development: Self Awareness, Skills & Strategies	Graduate	Includes Sustainability	Business (Ross)	This course offers an extensive journey into the nature of leadership in organizations, with an emphasis on self-understanding and learning. It offers both a theoretical and practical understanding of leadership. At the end of this course, students should have a better conceptual sense of leadership, important insights into themselves as leaders, an enhanced ability to understand and map the context in which leadership is to be exerted, and practical ideas about how to work that context in order to lead change. The course will use cases, experimental exercises, role-plays, videos, and self-assessment exercises to stimulate student learning.
BL 557	Legal and Ethical Environment	Graduate	Includes Sustainability	Business (Ross)	Legal and Ethical Environment of Business --- This course focuses on the role of law in positive leadership and organizational success. The course has two main goals: (1) to develop legally and ethically savvy leaders who are able to achieve career success by understanding the legal aspects of their business responsibilities and (2) to show how organizations can achieve competitive advantage by reducing legal risk and using the law to create economic value, while also encouraging responsible conduct.More specifically, the course offers an examination of legal and ethical issues that every businessperson should understand to make sound business decisions in a global environment. It provides an overview of the legal system, the nature and uses of law, ethical decision-making frameworks, contract law, torts and the law of product liability, criminal law, the regulatory environment, intellectual property, and employment law.
BL 536	Ethics of Corporate Management	Graduate	Includes Sustainability	Business (Ross), Environment and Sustainability	This course draws upon classical moral theory as well as the most up-to-date contemporary business ethics thinking.Â Dilemmas faced by executives are the primary basis of the discussion.Â It also examines corporate compliance systems designed in accordance with the Federal Sentencing Guidelines.
EDUC 524	Inquiry on Educational Issues	Graduate	Includes Sustainability	Education	This course provides on orientation to educational inquiry appropriate for a range of education stakeholders. In interdisciplinary work groups students investigate a specific contemporary educational policy/practice issue as it plays out in real-world contexts, conduct a guided inquiry into the issue, and design a response to the issue.
MECHENG 577	Materials in Design	Graduate	Includes Sustainability	Engineering	Use of Materials and their Selection in Design --- Material properties, including physical, mechanical, thermal, electrical, economic, corrosion and environmental properties.Â Interaction of function, shape, choice of materials, processing, economics and environmental Impact in design.Â Methodology for materials selection and optimization, including performance indices, multiple constraints and multiple objectives, Introduction to analysis of environmental impact of materials selection.
AEROSP 530	Gas-Turbine Propulsion	Graduate	Includes Sustainability	Engineering Â» Aerospace Engineering	Advanced analysis of turbojet engines: effect of altitude parameters an engine performance; off-design equilibrium running of a turbojet engine; dynamics of engine considered as a quasi-static system; fluid mechanics of a rotating axial blade row; centrifugal compressors; transonic flow problems.
AEROSP 633	Advanced Combustion	Graduate	Includes Sustainability	Engineering Â» Aerospace Engineering	Thermodynamics of gas mixtures, chemical kinetics, conservation equations for multi-component reacting gas mixtures, deflagration and detonation waves. Â Nozzle flows and boundary layers with reaction and diffusion.
CHE 517	Biopharmaceutical Engineering	Graduate	Includes Sustainability	Engineering Â» Chemical Engineering	This course covers fundamental concepts essential for the discovery, development, manufacturing, formulation and characterization of biopharmaceuticals. Topics include basic immunology, antibody, discovery and engineering, emerging therapeutic modalities, vaccines, product quality and analytics, biosimilars, cell culture, purification and formulation.
CEE 521	Flow Open Channels	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Conservation laws for transient flow in open channels; shallow-water approximation; the method of characteristics; simple waves and hydraulic jumps; non-reflective boundary conditions; dam-break analysis; overland flow; prediction and mitigation of flood waves.

CEE 542	Soil and Site Improvement	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Analysis of geotechnical problems affecting site use including weak, compressible soil; high shrink-swell potential; and liquefiable soils. Stabilization techniques including compaction, earth reinforcement, admixture stabilization, deep mixing, grouting, precompression, thermal and electrokinetic stabilization and vibro-compaction.
CEE 511	Dynamics of Structures	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Dynamic equilibrium of structures. Response of a single degree of freedom system to dynamic excitation: free vibration, harmonic loads, pulses and earthquakes. Response spectra. Response of multi-degree-of-freedom systems. Seismic behavior of buildings and the basis of seismic building codes.
CEE 520	Hydrological Models	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Key elements of land-surface hydrology. Water in the atmosphere; dry adiabatic and pseudoadiabatic processes. Vapor turbulent transfer. Heat fluxes and surface energy budgets. Mass transfer and energy budget methods for estimating evapotranspiration. Soil physical properties; water flow in unsaturated soils; infiltration. Snow hydrology. Runoff generation. Probabilistic approaches to describing spatial variability.
CEE 547	Soil Engineering & Pavement Systems	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Soil Engineering & Pavement Systems- Soils engineering as applied to the design, construction and rehabilitation of pavement systems. The design, evaluation and rehabilitation of rigid, flexible and composite pavements.
CEE 611	Earthquake Engineering	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	This course is to serve as an introduction to the field of earthquake engineering, specifically the seismic behavior and design of structures. Â Topics include: Â tectonic theory; engineering characterization of earthquakes; probabilistic hazard analysis; structural modeling and analysis; response of structures during earthquakes; performance-based design; seismic detailing considerations; selected advanced topics.
CEE 682	Special Problems in Environmental Engineering	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Special problems designed to develop perspective and depth of comprehension in selected areas of sanitary, environmental or water resources engineering.
CEE 582	Environmental Microbiology	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Discussion of basic microbial metabolic processes, thermodynamics of growth and energy generation, and genetic and metabolic diversity. Emphasis is placed on the application of these concepts to biogeochemical cycling, subsurface microbiology, wastewater microbiology, pollutant degradation, and microbial ecology.
CEE 540	Advanced Soil Mechanics	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Deformation and strength of soils; total and effective stress; drained and undrained behavior. Constitutive description: elastic-plastic, hardening/softening, Cam clay model, critical states. Stress paths, and testing of soils. Modeling of reinforced soil: multi-component model and homogenization approach; fiber-reinforced soil. Theorems of limit analysis; applications in stability assessment.
CEE 624	Restoration Fundamentals and Practice in Aquatic Systems	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	The topics to be covered in the lectures are Sediment transport, Fluid mechanics/bluff body flows - Hydraulics, Geomorphology, Dimensional analysis, Field measurement techniques - Particle Image Velocimetry, Acoustic Doppler Velocimetry, flow and wave gauges. Biological overview: fishes, macrobenthos, plants. Current restoration techniques in a variety of environments.
CEE 573	Data Analysis in Civil and Environmental Engineering	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Data Analysis in Civil and Environmental Engineering -- Course topics address practical problems of analysis of manipulation and monitoring datasets in environmental sciences and engineering: Â hypothesis testing, uncertainty, linear, regressions, data of high dimension, and time domain and frequency domain analysis of series. Â Examples are drawn from the fields of environmental and civil engineering and surface and subsurface hydrology.
CEE 563	Air Quality Engineering Fundamentals	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Fundamental engineering principles for preventing or reducing air pollutant emissions. Combustion modifications to prevent pollutant formation. Gas adsorption and absorption processes, including carbon capture and sequestration. Particle filtration processes. Emissions and control of metals and air toxins. Indoor air pollutants and their control. Selected case studies. Economics and cost estimation.
CEE 527	Coastal Hydraulics	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Engineering	General description of wave systems including spectral representation; solutions to oscillatory wave equation; wave breaking; harbor resonance; wave shoaling, refraction, and diffraction; wave forecasting; selection of design wave conditions; forces on coastal structures; shoreline erosion processes.
CEE 693	Environmental Molecular Biology	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Engineering	Principles and techniques of molecular biology with an emphasis on genetic analysis of enzymatic systems capable of pollutant degradation: Genetic systems and gene probing in unusual prokaryotes: Use of molecular biological techniques for the enumeration and characterization of natural microbial communities: Biochemistry and kinetics of enzymatic systems. Lectures and laboratory.
EAS 557	Industrial Ecology	Graduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Environment and Sustainability	Analysis of material and energy flows in industrial and ecological systems to enhance eco-efficiency and sustainability in meeting human needs. Methods: life cycle assessment quantifies energy, wastes and emissions for materials production, manufacturing, product use, and recovery/disposition; life cycle design integrates environmental, performance, economic, and policy/regulatory objectives. This interdisciplinary course also includes a series of industrial/municipal site assessments (one-credit optional).
SPACE 501	Climate, Atmospheres, and Space Sciences Seminar	Graduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Seminars in Climate, Atmospheres and Space Sciences --- Current Research efforts will be presented by graduate students and faculty dealing with all phases of the Climate, Atmospheric and Space Sciences.
SPACE 532	Radiative Transfer	Graduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Physical processes, mathematical representation and numerical modeling of radiative transfer through atmospheres. Rayleigh and Mie scattering. Gaseous absorption and emission lines and line broadening. Numerical considerations and approximations. Applications include radiative energy balance and global climate, satellite remote sensing of atmospheres, and propagation through ionized media.

CLIMATE 585	Introduction to Remote Sensing and Inversion Theory	Graduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Introduction to active (radar and lidar) and passive (thermal emission) visible, infrared and microwave remote sensing. Â Fundamentals of electromagnetic emission, absorption and scattering. Â Sensor performance characteristics. Â Mathematical methods of inversion of integral transforms and ill-conditioned systems of equations commonly encountered in remote sensing.
CLIMATE 588	Regional Scale Climate	Graduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Regional scale climate processes are introduced along with the tools needed for their analysis, including downscaling techniques. The course integrates lectures, assigned journal papers, and hands-on data analysis. In a course project, students will apply the analytical tools to a subject chosen by the student.
AUTO 566	Modeling, Analysis, and Control of Hybrid Electric Vehicles	Graduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Modeling, analysis and control of vehicles with electrified propulsion systems, including electric vehicles, hybrid vehicles, plug-in and fuel cell vehicles. Introduction of the concepts and terminology, the state-of-the-art development, energy conversion and storage options, modeling, analysis, system integration and basic principles of vehicle controls.
NAVARCH 552	Offshore Eng II	Graduate	Includes Sustainability	Engineering Â» Naval Arch. & Marine Eng.	Offshore Engineering II --- Design and analysis requirements of offshore engineering structures. Hydrodynamic loads on offshore platforms. Wave theories applied in offshore engineering. Marine riser mechanics: dynamics and structural stability. Mooring dynamic: nonlinear stability and design.
EAS 588	Site Engineering	Graduate	Includes Sustainability	Environment and Sustainability	Site engineering is the process by which landscape architecture design concepts are translated into the working drawings necessary to build the product. The major goal of this course is to introduce the basic methods to make this translation possible.
NRE 532	Natural Resource Conflict Management	Graduate	Includes Sustainability	Environment and Sustainability	This course builds an understanding of the causes, dynamics and consequences of natural resource and environmental conflicts as well as the range of possible procedural interventions that can be used to manage these conflicts. The course emphasizes the practical application of dispute resolution theories to the environmental and natural resource context. Case materials for the course are drawn from current conflicts in situations including public lands management, air and water pollution regulation, solid and hazardous waste facility siting, wildlife and endangered species management, and community planning.
EAS 538	Natural Resources Statistics	Graduate	Includes Sustainability	Environment and Sustainability	Basic concepts of biometrics and its applicaiton to natural resource prolem solving to include descriptive statistics, probability, underlying distributions, sampling distributions, estimation, hypothesis testing, goodness-of-it procedures, contingency tables, sampling, simple linear correlation and regression, one-way analysis of variance, and nonparametric statistics.
NRE 562	Environmental Policy, Politics & Organizations	Graduate	Includes Sustainability	Environment and Sustainability	Examines processes of resource policy formation and administration, and the behavior of government institutions as they shape natural resource policies and management programs. Develops an analytic ability to disaggregate complex political and management situations, assess the feasibility of resource policy changes, and build strategy to get such changes adopted and implemented. Cases explore situations at the federal, state, and local levels.
NRE 570	Microeconomics With Natural Resource Applications	Graduate	Includes Sustainability	Environment and Sustainability	Develops the tools of microeconomics at an intermediate level. Supplementary materials highlight relevance of course concepts to natural resource and environmental issues. Emphasis is on skill development for natural resource policy analysis. Applications include oil cartels, forestry, common property fisheries, valuation of recreational sites, irreversible development projects, and below-cost timber sales.
EAS 787	Met Studio	Graduate	Includes Sustainability	Environment and Sustainability	Metropolitan Studio This landscape architecture studio focuses on master planning and design for park and recreation areas, using a combination of formats-lecture, readings, and studio work.
EAS 590	Landscape Ecology Design	Graduate	Includes Sustainability	Environment and Sustainability	This course draws from landscape ecology, conservation biology, and aesthetics to design supportive environments for human experience and to protect habitats for other species.
NRE 691	Plants and their Use in the Designed Landscape	Graduate	Includes Sustainability	Environment and Sustainability	This course will focus on the art and science of using plants in the landscape. Building on previous knowledge from NRE 437, Woody Plants, this course will expand the plant palette of ornamental plans and focus on the cultural and design issues of using plants in the landscape.
NRE 586	Visualizing the Environment	Graduate	Includes Sustainability	Environment and Sustainability	The objectives of this course are to understand the various 2-dimensional communication techniques used to represent 3-dimensional design ideas and the development of heightened visual perception related to representing the natural and built environment on paper.
EAS 587	Landscape as Environmental Media	Graduate	Includes Sustainability	Environment and Sustainability	Provides 1st year students with a strong foundation in design fundamentals: strategies for spatial layout, form generation, appropriate media representation and translation of concepts into three-dimensional space. The second half of the term focuses on design process and the creation of landscape interventions in response to cultural and ecological context.
NRE 540	GIS and Natural Resource Applications	Graduate	Includes Sustainability	Environment and Sustainability	This course is intended to give students the ability to plan, design, and execute a GIS project for natural resources management. Students will learn the potentials and limitations of geographic analyses. They will learn how to build geographic databases, analyze data spatially, and produce output that succinctly summarizes their results.
EAS 531	Principles of GIS	Graduate	Includes Sustainability	Environment and Sustainability	Principles of Geographic Information Systems --- This class will provide a firm understanding to the issues that affect the use of geographic information systems (GIS) for application, research, and planning in natural resources. Students will learn to conceptualize and implement geographic data management and analysis for research and application.

NRE 580	Environmental Integrated Assessment	Graduate	Includes Sustainability	Environment and Sustainability	This course provides students with a set of frameworks for integrating knowledge from natural and social sciences in support of environmental management and policy development. Through lectures, case studies, and discussions, students will learn how these frameworks are used to guide, implement, and analyze environmental policies. The course is designed as interdisciplinary and-while it will include information at moderate depth in the areas of the case studies-the focus is on how disciplinary information is integrated for policy contexts.
NRE 534	GIS & Landscape Mod	Graduate	Includes Sustainability	Environment and Sustainability	The goal of this class is to explore various approaches to modeling landscape pattern and change. The course will necessarily move between social and ecological processes and applications of the models, always with a geographical focus. During the course we will read about different modeling approaches, discuss applications of models and work on 5-6 exercies. We will explore GIS suitability models through a number of statistical and computational approaches.
NRE 509	Ecology: Science of Context and Interaction	Graduate	Includes Sustainability	Environment and Sustainability	The natural science core course provides a broad foundational treatment of concepts and processes that operate in ecological systems. It covers interactions among water, soils, the atmosphere, and basic life processes (respiration and photosynthesis) in terrestrial and aquatic ecosystems, including the principles of energy flow and the cycling of matter. It covers ecological principles such as population growth and regulation, trophic interactions, ecological networks, and community change. It covers evolution and natural selection. The course draws examples from some of the dominant habitats on earth, including rivers, lakes, wetlands, forests, deserts, and agricultural systems.
NRE 510	Environmental Decision Making and Governance	Graduate	Includes Sustainability	Environment and Sustainability	Focuses on the social, political and economic processes that shape human interactions with natural systems, that create environmental problems, and that resolve or manage those problems. The course draws broadly on research and scholarship from economics, ethics, political science, policy analysis, history, psychology, sociology, anthropology, management, and law.
NRE 503	Imprints and Archetypes: History and Theory of Landscape Design	Graduate	Includes Sustainability	Environment and Sustainability	Imprints and Archetypes: Â History and Theory of Landscape Design --- This course examines landscape history through a series of ten spatial typologies that span from Neolithic times into today, revealing the central ways that human beings idealize, sanctify, manipulate, exploit and express themselves through the changing medium of their environment.
NRE 520	Fluvial Ecosystems	Graduate	Includes Sustainability	Environment and Sustainability	This course introduces key concepts pertinent to understanding rivers and stream ecosystems and their management in the face of multiple human stressors acting at local through landscape scales. Physical, chemical and biological aspects are integrated into a holistic understanding of the processes that maintain the variety and variability of fluvial ecosystems. Using the watershed as a framework, the impacts of human activities are described and possible management and restoration actions are explored. Management issues including threats to river health, evaluation methods, management and restoration are covered in depth. Appropriate both for students interested in conducting research in fluvial ecosystems and for those interested in management of rivers and their watersheds. Need not be taken concurrently with NRE 521.
NRE 536	Environmental Mediation	Graduate	Includes Sustainability	Environment and Sustainability	Module on Environmental Mediation --- This course is an intensive 20-hour module that develops a student's skills in mediation as they can be applied to the resolution of environmental and other public disputes. It will help a student to: assess the appropriateness of a mediation strategy; understand the group dynamics and incentives that make mediation challenging; design a negotiation process for multiparty disputes; carry out a mediation strategy both at the negotiating table and between meetings; and deal with difficult mediation challenges that occur in process design and management.
NRE 555	Climate and Development: Impacts, Mitigation and Adaptation in Less Developed Countries	Graduate	Includes Sustainability	Environment and Sustainability	Broadly understood, scholarship on climate change and development remains in its infancy. Whereas there has been an extensive attention paid to both issues through the years, only recently they have come together both as a field of inquiry and practice. Historically development policies emphasized centrally sponsored programs of change and large-scale projects to foment economic growth. Scholarship in the human dimensions of climate change have mostly focused on anthropogenic drives and mitigation and only more recently has started to explore impacts and adaptation more seriously. This class seeks to bring these two themes together by focusing on how development and climate change intersect both in policy design and implementation as well as a new focus of research and production of knowledge. The course is organized around themes interspersing climate change and development. Part 1 is a historical look on development theory and practice and the emergence of climate change as a critical stressor to be taken into account for future policy making. Part 2 focuses on potential impacts of climate change in less developed countries. Part 3 explores response options with an emphasis on adaptation, resource management, to the emergence of global institutions for environmental governance.
EAS 541	Remote Sensing of Environment	Graduate	Includes Sustainability	Environment and Sustainability	Remote sensing, including air photos and satellite imagery is one of the most useful and important spatial data sources in both GIS and environmental sciences defined broadly. In this course, students will learn the theory, sensors, analysis methods, and applications of remote sensing. Lectures provide a comprehensive introduction to remote sensing, and labs present opportunity for hands-on analysis experience using ERDAS Imagine and ArcGIS software and imagery.

NRE 523	Ecological Risk Assessment	Graduate	Includes Sustainability	Environment and Sustainability	This course introduces the ecological risk assessments (ERAs), describing the process recommended by the U.S. Environmental Protection Agency (EPA) and other hazard assessment methods.Â A wide range of assessments exist dealing with chemical-specific criteria development to the remediation of small to mega-sites exceeding $1billion in costs. Common shortfalls often made when conducting ERAs, such as failing to adequately link stressor exposures to biological effects will be discussed.Â Case study examples will demonstrate the state-of-the-practice and new approaches that decrease uncertainty associated with the ERA process.Â The important linkage of ERA issues to decision-making in the risk management process will be emphasized, with real-world, high visibility case studies discussed by national experts. The primary objectives of the course are to build competency in assessing stressors in ecosystems and thereby become more effective in dealing with real-world issues commonly encountered.Â This bridges process, science and practice throughout the ERA process. This should result in the ability to recognize quality ERAs and identify ways to strengthen the linkage between an accurate ERA and management options. Â We will describe the state-of-the-practice including its limitations, realities and ways to improve ERAs along with remediation efforts in freshwaters and marine near-coastal areas.
EAS 553	Diverse Farming Systems	Graduate	Includes Sustainability	Environment and Sustainability	In this interdisciplinary course, we will critically explore an intersecting literature on agroecology, biodiversity, ecosystem services, diversified farming systems, agroforestry, and farmer's livelihoods. The first part of the course will focus on the application of ecological theory to the study of diverse farming systems including intercropping and agroforestry. The second part will emphasize biodiversity both in terms of how agricultural landscapes affect biodiversity and how biodiversity contributes to the sustainability, productivity and resilience of agroecosystems and farming communities. The last part of the course will cover some of the most salient social issues in diverse farming systems, such as tree and land tenure and gender issues as well as the social rural movements that promote diverse farming systems and agroecology.
NRE 577	Political Ecology, Environmental Security, and Conflict	Graduate	Includes Sustainability	Environment and Sustainability	This course uses a geographical political ecology lens to interrogate conflicts (broadly defined) between people and institutions over natural resources, in both developed and developing world contexts. Â The course will first review the literature on political ecology as an explanatory framework by tracing out its intellectual genealogy and outlining some of the current approaches and perspectives utilized in this subfield. Â Next, we will critique traditional approaches to the study of natural resources related conflicts. Â The remainder of the course will rely on theoretical and empirical studies, which help to unveil the complexities associated with conflict environments. Â Seven specific themes will be addressed in two parts. Â The first part concentrates on political ecological approaches to the study of environmental commodities and (violent) conflict and encompasses: (1) population, resource scarcity and green security, and (2) conflict commodities and extractive natural resources (oil, diamonds, forests, and water). Â The second part of the course probes deeper into the social and political aspects of environmental conflicts and specifically examines: Â (3) gender and the environment; (4) land, culture and identity; (5) climate change; (6) food security, and; (7) conflicts between people and protected areas.
EAS 610	Advanced LCA Methods & Tools	Graduate	Includes Sustainability	Environment and Sustainability	Advanced LCA Methods and Tools --- This course is intended for students who have taken (or are enrolled in) Industrial Ecology and wish to expand their life cycle assessment (LCA) skills set. The course covers advanced LCA methods and key software tools used to conduct LCA studies including SimaPro and GaBi. Â Examples of the skills that will be covered include advanced impact assessment methods, consequential vs. attributional LCA, allocation rules, and transportation fuel and vehicle technology modeling using the new GREET.net program. The course will also cover tools for generating and characterizing results such as uncertainty analysis using RiskSim Monte Carlo simulation software and sensitivity/scenario analyses using Excel "What-If Analysis" tools. At the end of the semester a final project will allow students to demonstrate these advanced LCA methods/tools.
NRE 578	Urban Stormwater: Science, Design, and Management	Graduate	Includes Sustainability	Environment and Sustainability	Urban runoff is a pervasive environmental problem that degrades water quality, aquatic communities, habitat and property values, and recreational uses. The course describes the major aspects of this problem defining the sources, characterizing the environmental impacts, and characterizing approaches to addressing those impacts by design and management.Â Working in interdisciplinary teams, students also develop and select appropriate management alternatives based on real-world examples.
EDUC 581	Advanced Environmental Education	Graduate	Includes Sustainability	Environment and Sustainability, Education	The goal of this course is to provide graduate students from variety of backgrounds (e.g. education, environmental science / studies, natural resource management, other) with the knowledge and skills to lead and manage environmental education programs. To achieve this goal, students will learn about theories, methods, and resources for effective environmental education as well as gain essential grant writing and program evaluation skills. After completion of this course, students will be able to: -- develop, implement, and evaluate environmental education programs, -- use instructional methods appropriate for environmental education, -- write a competitive environmental education grant proposal, and -- identify leading environmental education organizations and resources. As part of this course, students also have the option to become certified in Project Learning Tree, Project Wet or Project WILD, three of the most frequently used environmental education curricula in the country.
EECS 532	Microwave Remote Sensing I: Radiometry	Graduate	Includes Sustainability	Graduate Studies (Rackham)	Radiative transfer theory: Â blackbody radiation; microwave radiometry; atmospheric propagation and emission; radiometer receivers; surface and volume scattering and emission; applications to meteorology, oceanography, and hydrology.

HISTORY 557	Latin America: The Colonial Period	Graduate	Includes Sustainability	Graduate Studies (Rackham)	This course examines Latin America from the initial encounters between Europeans and Native Americans to the early nineteenth century wars of independence. It focuses on interactions among Native Americans, Africans, and Europeans, tracing the evolution of a range of multiethnic, colonial societies in the Americas. Thus we will study the indigenous background to conquest as well as the nature of the settler communities, and the development of plantation slavery as well as village life. We will analyze overlapping structures of class, race, gender, and ethnicity in a colonial context and examine the complex processes by which identities were assigned and assumed. Finally, we will ask what permitted the survival of these colonial structures for over three hundred years, and what factors eventually led to the collapse of the colonial system.
SW 823	Comparative Cross-National Analyses of Social Services Systems	Graduate	Includes Sustainability	Graduate Studies (Rackham), Social Work	Newly developed methodologies for cross-national comparative research, from political science, sociology, and economics are used to analyze the social services systems in other industrialized and developing countries with reference to the U.S. systems. Â Attention will be given to the application of this knowledge to effecting changes in the U.S. social services system. Â Particular social service sectors will be chosen to illustrate in depth and relevance of cross-national analysis. Â Students will become knowledgeable about and able to use at least one model of cross-national comparative analyses, understand and critique the U.S. system of social welfare with reference to alternative systems in other countries, and use and select research methods of comparative analysis.
LAW 695	International Trade Law	Graduate	Includes Sustainability	Law	This course is a comprehensive introduction to the legal framework for U.S. and international regulation of international trade in goods. The course will include: a brief introduction to the economics of trade; an examination of the World Trade Organization (WTO), the General Agreement on Tariffs and Trade (GATT), and related instruments; and an analysis of U.S. laws providing relief from "unfairly" traded imports, including the antidumping and countervailing duty laws, and of other U.S. laws providing for the restriction of imports, such as the "escape clause."
LAW 735	Land Use Planning & Control	Graduate	Includes Sustainability	Law	This course will introduce students to the legal and planning concepts that form our system of land use control and regulation.Â We will explore the principal methods by which local governments control owners? use of their land, with a special emphasis on zoning, planning, eminent domain, constitutional issues and the evolving theories about the conflict between property ownership and social responsibility.Â Through the use of in-class exercises, students will gain a deeper appreciation of the legal issues confronting land owners, developers, municipalities, special interest groups and other participants in the land use arena.
LAW 761	Water Law	Graduate	Includes Sustainability	Law	The course in Water Law examines in depth the laws and methods by which the use of water, both surface water and groundwater, is allocated in the United States. It is quintessentially a class about water quantity in which water quality plays a limiting role. The text for the class will be Legal Control of Water Resources by Joseph Sax, Barton Thompson, John Leshy, and Robert Abrams, 4th ed., 2006. Topics of study will include: riparianism, prior appropriation, the five distinct doctrines that states apply to groundwater use, public rights in water, allocation of waters of shared basins, and federal water rights, and international water management. In the examination of the law in each of those areas, themes that relate water law to larger issues of development and economic policy will be considered. Roughly two-thirds of the material will have more direct and immediate applicability to the Western, more arid part of the nation. Even so, the East is becoming ever more "water-constrained" and faces increasing need for laws that better allocate the water resource.
LAW 894	Good Life/Government	Graduate	Includes Sustainability	Law	What Makes a Good Life? and What Should Government Do About It? What sort of activities and projects and relationships make up a valuable human life, a life worthy of choice by a reflective person with reasonable opportunities? How does one put together and organize such a life? And, on the political side, what is the appropriate role of government in facilitating or encouraging such lives? Is the standard contemporary liberal view that government should be neutral between competing "conceptions of the good" correct? The seminar will read no legal materials and it will eschew all questions of legal doctrine. On the other hand, the sort of issues we will discuss are central to major legal problems, ranging from what mix of uses to allow in national parks to the issue of assisted suicide. We will explore some such issues along the way. The issues for the seminar are also issues each of us confronts in trying to shape a satisfactory life in (or out of) the law.
LAW 930	Environmental Law Clinic	Graduate	Includes Sustainability	Law	The clinic offers hands-on lawyering experience in cases drawn from the judicial, administrative, and legislative docket of the National Wildlife Federation's Great Lakes Natural Resource Center in Ann Arbor. The Center's resident attorneys supervise students. Students work on a wide range of natural resources and conservation issues, and participate in some of the most significant environmental legal work in the United States. Students may visit officials, draft testimony on proposed legislation, write an appellate brief, participate in rule-making, or help negotiate a settlement. The clinic is a three-credit-hour offering that students may elect for one or two semesters, for a maximum of six hours. Courses in administrative and environmental law are not prerequisites, but are recommended.

LAW 602	International Investment Law	Graduate	Includes Sustainability	Law	Foreign investment has long been recognized as one of the pillars of the global economy, and is now a focus on significant public attention as many states -- especially in Latin America, Eastern Europe, and the former Soviet Union -- view it as the key to rescuing their economies. This course will examine the international community's regulation of foreign investment, focussing upon the norms that have emerged over the past seventy years to govern this process. The class will primarily address investment abroad, in both developed and developing nations, although attention will also be given to restrictions on foreign investment in the United States. It will consider the protections required by international investors, e.g., those concerning establishment of new enterprises, transfers of profits, fair treatment, and expropriation. We will also discuss the increased focus on responsibilities of investors in the areas of human rights and environmental and labor standards. Resolution of investment disputes will also be covered. The course is designed both to shed light on the process of foreign investment as well as to demonstrate the relevance of international law to transnational business transactions. Completion of Transnational Law or an equivalent course in international law prior to taking this course is highly recommended but not required.
LAW 791	Environmental Crimes	Graduate	Includes Sustainability	Law	In the last two decades, federal prosecutors have brought more criminal cases against corporations for environmental crimes than for any other form of white collar crime, and criminal enforcement has become an integral part of pollution prevention efforts in the United States. This course considers the criminal provisions of federal environmental laws, including the Resource Conservation and Recovery Act, the Clean Water Act, and the Clean Air Act, and their application in selected precedent-setting prosecutions. We focus on the legal and policy issues raised by prosecution of corporations and their officers and employees, including the role of criminal enforcement in a complex statutory and regulatory scheme, the coordination of parallel criminal, civil, and administrative proceedings, and controversies surrounding the government's strategies, including obtaining corporate waiver of attorney-client privilege and work product doctrine. Although not required, students may find it helpful if they have already taken one of the introductory environmental law survey courses and/or criminal procedure.
LAW 842	Environ Litg in Supreme Court	Graduate	Includes Sustainability	Law	When Chief Justice Roberts and Justice Alito took their seats on the Supreme Court, environmentalists predicted that the newly configured Court would restrict--and possibly even eviscerate--environmental laws.Â The Roberts Court's first significant environmental decision in the combined cases of Rapanos v. United States and Carabell v. Army Corps of Engineers revealed sharp divisions among the Justices.Â The stakes rose when the Court chose to hear five environmental cases during the 2006-2007 term, and five more in the 2008-2009 term.Â Most recently, the composition of the Court changed yet again when Justice Sotomayor was sworn in on August 8, 2009. This seminar will closely examine five environmental cases decided by the Roberts Court during the last four years:Â Rapanos v. United States (wetlands), Environmental Defense v. Duke Energy Corp. (power plant emissions), Massachusetts v. EPA (global warming), Entergy v. Riverkeeper (cost-benefit analysis), and Burlington Northern v. United States (Superfund liability).Â For each case, materials will include the Circuit Court opinion, selected portions of the parties' briefs in the Supreme Court, the oral argument transcript, and the Court's final decision.Â Through careful study of these cases, we will seek to understand not only the legal import of the decisions but also the direction of the Court under Chief Justice Roberts.
LAW 628	Environmental Dispute Resolution	Graduate	Includes Sustainability	Law	Environmental Dispute Resolution ("EDR") is designed to acquaint the student with the process of negotiating and mediating environmental disputes and to develop both the skills of negotiating as well as an understanding of what is necessary for a successful resolution of such disputes. EDR is different from most other negotiations because it typically involves multiple parties who have an interest in the outcome and because it requires the utilization of scientific information from which scientific predictions may be at least challenging or impossible to make. We will explore the complexities of EDR by discussing observations of leaders in the field, by studying actual negotiated and mediated cases and discussing why or why not these disputes were successfully resolved. By using the lessons learned from these cases as a framework, we will begin to negotiate environmental disputes arising from simulated fact patterns. We will discuss the effectiveness of negotiation techniques and address the nuances that arise from power imbalance and commonly occurring political implications. We will evaluate whether resolution by compromise necessarily achieves environmental justice and we will discuss ethical issues that arise in EDR negotiations. The course will conclude with a Term Paper based upon your role in preparing for and experience in negotiating a resolution of a case simulation.
LAW 634	Water Wars/Great Lakes	Graduate	Includes Sustainability	Law	In this class, we will learn and experience national, state, and international natural resource law through the lens of this unique region. The public trust doctrine, water law, the Clean Water Act and other environmental laws, and even maritime law are all being simultaneously litigated and rewritten in this period of seismic shifts in Great Lakes law. The class will cover these and other topics through lectures by and discussions with the leaders in the Great Lakes region who right now are remaking Great Lakes law and policy.

LAW 405	Environmental Law Practicum	Graduate	Includes Sustainability	Law	Environmental law is like a Russian nesting doll:Â inside the outer body of federal and state statutes is an entire body of federal and state administrative regulations and procedures, and inside that are federal and state guidance documents, cleanup criteria, risk standards, and inter-agency Memoranda of Understanding.Â Keep opening to see the body of state and federal environmental administrative decisions, and at last is the individual agency representative, armed with powerful discretion.Â The environmental law practitioner must open up the nesting doll to see all these components in order to effectively handle cases and counsel clients.Â In this course students will gain an understanding of all these parts, and apply them to issues and fact patterns based on actual cases.Â Students will review and evaluate administrative orders, permit applications and denials, and other agency action scenarios.Â Students will visit sites of actual agency action, prepare research memoranda, and evaluate client options.Â Students will learn how to work with environmental professionals and consultants in order to process and apply technical and scientific standards to a case.Â The class will culminate in a mock contested case hearing based on an actual dispute, for which the students will develop case theories, practice witness preparation, strategize on the use of exhibits, dispositive motions, conduct direct and cross examinations, make and respond to evidence objections, and prepare written closing arguments including proposed findings of fact and conclusions of law.Â Throughout the semester we will obtain insights from guest speakers from agencies, the legislature, interest groups, and environmental consultants and scientists.Â Students will also gain an understanding of the changing regulatory landscape by analyzing and discussing current legislative and administrative initiatives at both the state and federal levels, and important case law developments involving agency action, discretion and enforcement.
LAW 519	UN & Other International Organizations	Graduate	Includes Sustainability	Law	International organizations play an increasingly wide-ranging and consequential role in creating, interpreting, and securing compliance with international obligations.Â This course will address the legal issues arising from the creation and operation of international organizations, as well as the concerns and challenges that the actions of such organizations present, both on the international plane and in national courts.Â Topics covered will include the United Nations Security Council's role in sanctions and peacekeeping, the dispute settlement procedures at the World Trade Organization, and "technocratic" regulation by the International Civil Aviation Organization.Â This course complements and does not overlap with courses and seminars such as International Human Rights and International Trade.
LAW 534	Energy Law: Regulation of Electricity	Graduate	Includes Sustainability	Law	This course will focus on the regulation of electricity production and distribution in the United States. Students will examine the traditional economic regulation of electric utility monopolies and the more recent move to competitive markets in the industry. The course will also cover a number of the major sources of government regulation of environmental, land use, and public safety issues associated with the electricity industry. Students will examine recent trends to promote energy efficiency and clean energy in the United States. Throughout the course, students will learn about the complex interaction between federal and state laws governing the electricity industry.
LAW 943	India Externship	Graduate	Includes Sustainability	Law	A semester-long externship opportunity with Alternative Law Forum (ALF) in Bangalore, India. Integrating alternative lawyering with critical research, alternative dispute resolution, pedagogic interventions, and more generally maintaining sustained legal interventions in various social issues, ALF engages with cutting-edge issues in intellectual property, gender and sexuality law, media and culture, labor, environmental, and land rights law, as well as the constitution in general. Second- and third- year law students will work side-by-side with top-notch Indian lawyers on pressing legal matters and policy issues.
LAW 692	International Law Fundamentals	Graduate	Includes Sustainability	Law	This class will introduce students to the fundamental processes, structures, and regimes of international law. Â We will explore how international law is made through treaties, custom, and other processes; the rules by which it allows various actors (e.g., states, NGOs, international organizations, and corporations) to participate in international affairs; basic rules on how states can apply their laws beyond their borders; rules governing common areas like the oceans; the core of human rights law; and rules regulating a state's use of force. Â Each topic will be discussed through examination of a real ongoing or recent incident, controversy, or conflict. Â Students will be encouraged to think about how law can be made, enforced, and interpreted in an environment lacking a single legislature, executive, or judiciary. Â Like transnational law, this course will prove highly useful to preparing students for more specialized courses in international law.
Law 666	Climate Change and the Law	Graduate	Includes Sustainability	Law	The Legal Response to a Rapidly Warming PlanetEvidence of human induced climate change and its seriousness is mounting. Â Last year was the warmest on record, Arctic sea ice is melting at an accelerating rate, sea levels are rising faster than any time in the past 2800 years, and a storm in Fiji this year may have been the most powerful ever recorded. Â Much of the legal focus on climate change has been on the international negotiations in Paris, which last year achieved an historic agreement to reduce emissions of greenhouse gases. Â However, while the Paris Agreement set ambitious goals and provides a framework for national reporting and finance, much of the action will necessarily be within national and sub-national legal frameworks. Â This course will draw on recent developments and consider legal issues such as the status of EPA's proposed Clean Power Plan; Exxon's liability for misleading investors about climate change; and implications of the Climate Change Task Force established by the Financial Stability Board.
LAW 733	Detroit Litigation Advocacy Workshop	Graduate	Includes Sustainability	Law	The Detroit Litigation Advocacy Workshop ("D LAW") is a research-oriented course that provides students a unique opportunity to help shape the City of Detroit's public-interest litigation program. Each student will be responsible for researching litigation options available to the City on one or more specified topics (for example, consumer protection; environmental justice; housing; nuisance abatement). The final product will be a "white paper" laying out, in detail, how the City might use litigation to tackle problems in those areas. These white papers will be used by the Detroit Mayor's Office when formulating litigation strategies -- and will serve as a cornerstone for future collaborations between the City of Detroit and the Law School.

LAW 682	International Environment Law & Policy	Graduate	Includes Sustainability	Law	This course examines how society manages --and sometimes fails to manage--environmental issues that fall beyond the authority or capability of a single national government. Topics covered in the course will include: *The nature of international environmental issues: context and concepts *Theoretical perspectives and approaches to international environmental problem solving *International environmental lawmaking and general principles *Compliance and dispute resolution *Norms of international invironmental protection, including regulatory mechanisms for: climate change; biological diversity and biosafety; the marine environment (living resources and pollution); the polar regions; and hazardous substances and transboundary movement *The relationship between international environmental law and other legal regimes.
AAS 596	History of Environmental Thought and Activism	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies, Literature, Science, & Arts	Introduction to techniques of risk benefit analysis as applied to water resource and environmental engineering. Techniques of multi-objective water resource planning, the engineering-political interfaces, and political bargaining and decision making are also discussed.
ANTHRCUL 625	Anthropological Approaches to Property and Property Rights	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Property is a topic of great current importance. This course introduces anthropological conceptions of property and covers several timely issues, such as privatization, intellectual and cultural property, the commons, and property in body parts.
ANTHRCUL 673	Language Ideologies	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Â "Language Ideologies" are conceptualizations about the language, speakers, and discourse practices people encounter in their social world.Â The study of language ideologies draws together questions about language, culture, social positioning, and politics.Â This course explores such questions theoretically and through a wide range of ethnographic, historical, and linguistic case materials.
ANTHRCUL 539	Consumption	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	This course is designed to provide an overview of some of the most salient issues for understanding consumption in anthropological research today.Â Once a marginalized topic in anthropology, the study of "consumption" per se makes little sense in a world where it is difficult to conceive of an anthropological topic that can avoid engagement with commodified material cultures and related economies, networks, cultural meanings and social organizations.Â The study of "consumption" today carries on under various rubrics, from studies of material culture and commercial media, to commodity chain analyses and biopolitics.Â The readings to be discussed will provide both theoretical grounding in basic issues and questions, as well as forays into more recent developments.Â Topics to be covered include:Â morality, commodity, gift, body, shopping, provisioning, sacrifice, class, brand, image, media, value, materiality.
ANTHRCUL 628	Bio-Art International: Biotechnology, Genetics, and Contemporary Art	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	An exploration of art forms produced from using biotechnology and/or genetic engineering to create, manipulate, and/or transform living things. Â These new art forms cross and confuse the boundaries between "the artificial" and "the natural," and provoke complex ethical questions.
ANTHRCUL 541	Environmental Anthropology	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	This class examines anthropological approaches to contemporary environmental problems. We will consider what it means to live in a world in which competing ideas about nature are in dialogue with each other. We will study the way that the world is transformed by the accelerated circulation of persons, things, and ideas through globalization. We will also learn about the institutions and forces that increasingly mediate anthropogenic impacts on the environment, including the relationship between corporations and their critics, states and their legal systems, the media, and nongovernmental organizations (NGOs) focused on environmental issues.
ANTHRCUL 548	Theory & Practice in Medical Anthropology	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts	This seminar examines the theoretical foundations of medical anthropology as well as particular studies which represent subfield interests in cultural concepts of health and illness; local and global aspects of reproduction health; the social construction of knowledge and politics of science; ethno-medicine and healing; and perceptions of environment and health.
CMPLXSYS 530	Computer Modeling of Complex Systems	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Complex Systems	The purpose of this course is to introduce students to the basic concepts, tools and issues which arise when using computers to model complex (adaptive) systems (CAS). The emphasis will be on agent-based, bottom-up computer models. (We will only briefly look at other approaches.) The bulk of the course will involve "learning by example", i.e., students will: read, discuss, evaluate a number of models from a variety of disciplines. Modify and run experiments with exisiting models. Design, implement, run, write-up results from their own models. The course will cover all aspects of the modeling process itself, from model design through implementation to analyzing, documenting and communicating results. The emphasis in CMPLXSYS 530 is on "Exploratory Models" of more generic complex (adaptive) systems and/or phenomena (vs. "predictive" models for specific situations).
CMPLXSYS 501	An Introduction to Complex Systems	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Complex Systems	This course covers a broad range of fundamental topics relevant to the study of complex systems. The course work involves weekly readings focus on "classics" in the complex systems literature, in order to give students a broad, general understanding for the variety of work that falls under the rubric of complex systems. Topics to be covered will include evolutionary systems, self-organized criticality, measures of complexity, approaches to modeling complex adaptive systems, and emergence. Authors to be covered include Holland, Axelrod, Kaufmann, Bak, and Gell-Mann. Grading will be based on the participation in the discussions and on two or three term papers.

MATH 550	Introduction to Adaptive Systems	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Complex Systems, Literature, Science, & Arts Â» Mathematics	Introduction to Adaptive Systems:Â Sustainability has become a key issue in research and teaching at The University of Michigan.Â Math 550/CSC 510 will present a systems-based and in-depth examination of the mathematical foundations behind the sustainability of renewable (fish, forests, fauna) and nonrenewable (oil, gas, coal) resources. Since change, resilience to change, evolution, optimality, and trade-offs are central issues in sustainability, focal topics of this course will be the theory and applications of dynamical systems, optimal control theory and game theory. Our systems approach to sustainability will include quite a bit of ecology and economics. Students will use Excel spreadsheets for more complex computations.
EARTH 532	Sem in Climate, Tectonics & Surface Processes	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This seminar discusses the coupling and interactions between climate, tectonics, and Earth surface processes. This interdisciplinary seminar integrates concepts and readings from the fields of paleoclimate, neotectonics, tectonic geomorphology, lithosperic geodynamics, and process geomorphology. Emphasis is placed on learning how to critically analyze various methods, data sets, and arguments presented in the literature. Participants are expected to read and actively discuss current scientific papers.
EARTH 523	Microbial Community Omics	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course will focus on emerging "omics" approaches (genomics, transcriptomics, proteomics) to studying microorganisms and their interactions with various environments.Â It will cover both conceptual and analytical aspects of microbial genome science through lecture and laboratory exercises.Â Lab exercises will focus on utilization of high-performance computing to analyze real datasets.
EARTH 929	Investigations	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	Investigations in Geology and Mineralogy
EEB 498	the Ecology of Agroecosystems	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Analysis of ecological principles as they apply to agricultural ecosystems, emphasizing theoretical aspects but also covering empirical results of critical experiments. While the emphasis is on principles, practical applicability is also explored where appropriate. Physical, biological, and social forces are integrated as necessary. Designed as preparation for active research in agroecosystem ecology.
NRE 436	Woody Plants: Biology & Identification	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability	Woody Plants is an intensive field- and lecture-based learning experience, in which you will learn to identify 160 trees, shrub and vine species that are important in Michigan environments. You will learn about their taxonomy, distribution, habitat associations, and biogeographic history and how to identify them in their leafless winter condition.
NRE 415	Behavioral Ecology & Conservation Biology	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts, Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability	Environments shape the behavior and life histories of animals, and animals' behaviors and life histories affect how we can act successfully to conserve and manage wildlife species. How can we use this knowledge? Because environments pose constraints, in any given environment, behaviors have 'better' (more effective, less costly) and 'worse' impacts on an organism's survival and reproduction. Understanding this complex problem requires that we generate testable hypotheses to understand the functional significance of the behaviors we see. We must consider hypotheses in at least six basic areas: the basics of selection, how the basics play out in different environments, how environments shape life history, life history strategies-mating effort, life history strategies-parental effort, and how life histories affect what conservation strategies will work.
ECON 662	Environmental Economics	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Economics, Literature, Science, & Arts, Environment and Sustainability	Environmental Economics
NRE 668	Advanced Natural Resources Economics	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Economics, Literature, Science, & Arts, Environment and Sustainability	Description of the literature on the pricing of natural resources (agricultural goods, renewable and nonrenewable resources and durables) over time. The first half of the course considers resources which are privately owned; the second half considers resources that are common property. To provide a point of reference, the behavior of resource markets in the absence of government intervention is studied first. There is then an extensive treatment of the dynamic effects on market equilibria of widespread government policies (unanticipated, partially anticipated or fully anticipated). Policies analyzed include: bufferstocks used to affect prices (ceilings, floors, bands, and pegs); bans, embargoes, price controls and whatever else is timely or of interest to participants. To simplify the mathematics, discrete-time methods are used predominately. The Kuhn-Tucker theorem is utilized when studying competitive equilibrium under certainty. Dynamic-programming is used to study single-agent (planning or monopoly) problems under uncertainty (with or without learning). Multi-stage game theory is used to investigate dynamic common-property problems. A working understanding of these methods is developed during the course.
HISTART 680	Bio-Art International: Â Biotechnology, Genetics, and Contemporary Art	Graduate	Includes Sustainability	Literature, Science, & Arts Â» History of Art	An Exploration of art forms produced from using biotechnology and/or genetic engineering to create, manipulate, and/or transform living things. Â These new art forms cross-confuse the boundaries between "the artificial" and "the natural," and provoke complex ethnical questions.
SOC 861	Research Workshop in Social Movements and Political Protests	Graduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	Workshops are designed to give students experience in writing, presenting, and commenting on research papers that are being prepared for publication in the area of social inequality. Some workshops also include faculty presenters and some cover special topics related to professional socialization.
PUBHLTH 554	Introduction to Globalization and Health	Graduate	Includes Sustainability	Public Health	The course addresses the diverse health impacts of economic, environmental, and cultural globalization.Â Well-being is affected by the transnational movement of people, technologies, capital, commodities, toxins, pathogens, ideologies and treatments, and changing global power relations and actions of international organizations.Â These topics are explored through lectures and discussion of readings.

PUBHLTH 610	Introduction to Public Health	Graduate	Includes Sustainability	Public Health	This course is intended to serve as an introduction to the major issues of public health in the United States, although issues of global health will be considered as well.Â We will examine environmental, social and ethic determinants of public health, and how they may be altered.
EHS 500	Principles of Environmental Health Sciences	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course provides a broad overview of some of the most important and current challenges to human health from environmental and occupational risk factors while teaching the basic knowledge the basic knowledge and multi-disciplinary skills used to assess, control, and prevent them. We will address specific threats, such as outdoor and indoor air pollution, toxic metals, pesticides, radiation and occupational stressors; analyze impacts on specific diseases and injuries, such as cardiovascular disease, asthma, cancer, musculoskeletal injuries and impaired child development; and introduce emerging threats, such as the hormone-mimicking potential of plastic chemicals and the impact of global climate change on heat-related mortality and shifting patterns of infectious disease. Emphasis will also be given to understanding the worsening environmental health impacts of industrialization on developing countries, the effects of globalization, such as the growing movement of hazardous industries, products, and wastes across borders, and the rise of the environmental justice movement.
EHS 652	Evaluation of Chemical Hazards	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Covers the concepts and techniques related to the evaluation of occupational exposures to gases, vapors, and aerosols. Emphasis on operating mechanisms and practical aspects of industrial hygiene air-monitoring equipment, characterizing exposure distributions, and developing sampling strategies. Lectures, laboratory exercises, demonstrations, problems, technical reports, and reading. Primarily for students in occupational health and safety.
EHS 582	Principles of Community Air Pollution	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Discussion of economic, nuisance, and health aspects, emphasizing sources, causes, effects, control measures, and the organization and administration of community control programs.
EHS 654	Control of Exposures to Airborne Contaminants	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Discussion of the principles of controlling airborne contaminants in working and living environments. It deals with general environmental and local exhaust ventilation for indoor spaces, filtration and emission control for the ambient environment, and personal respiratory protection. Specific topics include: basic properties of air and aerodynamics, and behavior of airborne contaminants; general dilution and local exhaust ventilation concepts, methods and design; fan performance and selection; air cleaning equipment; ventilation testing, OSHA and EPA standards, indoor air quality, and others.
EHS 550	Introduction to Occupational and Environmental Health	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Discussion of the basic concepts of occupational and environmental hygiene; recognition and evaluation of chemical, physical and biological hazards; the human environment; control hierarchies, strategies and technologies; personal protection, criteria and standards; the international dimension; and ethical issues. The course provides basic underpinnings of the nature of theory and practice in occupational and environmental hygiene, and thus provides a structural framework for thinking about the field, identifying linkages between disciplines and specialties, and providing a platform for more advanced study in the individual areas listed.
EHS 576	Microbiology in Environmental Health	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course is basic knowledge about microbes in the environment and its impact on public health. Topics will include: introduction to microbiology; growth and control of microbes in the environments; characterization and identification of microbes in the environment; biofirms and its control; transmission and persistence of health-related microbes in various environments such as water, air, food, indoor and industrial nettings; microbial transformation of organic and metal contaminants; spread of antibiotics resistance in the environment.
NUTR 547	Food Science	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	An examination of food composition and the chemical and physical changes that result from food processing, preparation and cooking. Discussion of foods as complex systems containing a wide variety of chemicals including nutrients, phytochemicals, functional ingredients, natural or transferred toxins and additives. Discussion of changes in chemicals with different types of food preservation. Consideration of health risks associated with dietary exposure to selected nutrients and other chemicals. Exploration of the role of sensory analysis related to food acceptance. Overview of important regulations related to the content of food products.
EHS 616	Introduction to Toxicologic Pathology	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course will provide an introduction to the histologic damage produced by chemical toxicants. A combination of lectures, student-led discussions and slide-reading sessions will be used in integrate concepts of toxicological mechanism, physiology and pathologic outcome. Emphasis will be placed on molecular methods and mechanisms used for the diagnosis and investigative toxicological pathology. The pathology associated with chemicals that damage the major organ systems of humans and mammals will be discussed.
EHS 504	Genes and the Environment	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Genes and the Environment - In past years disease causation frequently was thought of as a "dichotomy" between genes ("nature") and the environment ("nurture"). More recently this view has been replaced with a more holistic perspective that emphasizes the importance of interactions between genes and environment and/or occupational exposures. The focus of this course will be on interactions between genes and specific environmental and/or occupations exposures. The course will consist of detailed evaluation of specific examples of gene-exposure interactions (e.g., beryllium-related lung disease, peripheral neurotoxicity from organophosphate pesticides, bladder cancer and amine exposure), the underlying science of such examples, medical consequences, potential policy and social implications of current and future scientific knowledge, and review of current and pending legislation that address these issues.

EHS 657	Advanced Exposure Assessment	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	The course will introduce classical, contemporary, and cutting-edge approaches to the estimation of human exposure to environmental and occupational agents as it relates to epidemiology studies as well as risk science, regulatory compliance, exposure source/route apportionment, and susceptibility factors. Qualitative and quantitative methods in exposure science will be covered, including surrogate measures, exposure modeling, and biological markers of exposure, in addition to statistical concepts such as exposure measurement error and efficient study design.
EHS 672	Life cycle assessment: Human Health and Environmental Impacts	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course describes how consumption and products affect environmental risks and impacts on human health and on ecosystems. Based on a life cycle approach, this course will first provide an overview of the impacts generated by consumers and by the students themselves. How to carry out Life Cycle Assessment (LCA) of products and services will then be presented. For the Life Cycle Impact Assessment phase, a special focus will be given to the characterization of comparative risks of toxics and substances on human health and ecosystems. This leads to discussion of the potentials and limitations of LCA compared to other assessment tools such as risk assessment and environmental impact assessment. Practical cases studies will be taken from multiple consumption domains, from agriculture and food production up to electronic services.
EHS 801	Research and Communication in the Environmental Health Science	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	The course will cover research and communication skills essential to graduate school success and a professional career in the environmental health sciences. EHS 801 will consist of lectures, discussion sessions, journal clubs, homework assignments, group activities, and several presentations. Guest lecturers will include Departmental Faculty and University communication specialists. Students will be strongly encouraged to integrate their own dissertation aims into all aspects of the seminar.
NUTR 660	Environmental Epigenetics and Public Health	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course examines the principles and applications of genomics and epigenomics as they relate to human nutrition, environmental exposures and disease etiology. Course lectures will address gene transcription, epigenetic mechanisms, gene-environment interactions, and environmental epigenomics. Case studies will evaluate these processes using both animal and human examples drawn from the primary literature. Students will also be introduced to current laboratory methods and emerging technologies for examining genomics and epigenomics.
EHS 601	Exposure Science and Health	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course will convey the basic concepts of occupational and environmental exposure science: the fundamental and practical aspects of assessing and controlling exposures to hazardous agents, broadly defined, encountered in occupational, residential, and ambient environments. The course is designed to provide the knowledge and skills necessary to assess exposure, and understand how upstream processes create risks for health.
EHS 602	Environmental Health Policy	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	EHS 602 complements EHS 601 (Foundations of Environmental Health Services) and provides a foundational understanding of how a science and evidence-based approach to public health translates into decisions and actions through environmental health policy in the public and private sector.
EHS 655	Human Exposure Analysis	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Students taking this course will learn how to conduct statistical analysis of human exposure, and will apply these skills to a dataset containing exposure and health outcome data. Â They will also develop skills for understanding, interpreting, and communicating exposure information and for identifying and communicating evidence-based risk management recommendations.
EHS 683	Air Pollution and Global Health	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	Clean air is considered to be basic requirement of human health and well-being.Â However, air pollution continues to pose a significant threat to health worldwide.Â This course covers air pollutants, their characterization, ambient concentrations, effects on human health and the environment, and international policy-making, guidelines, and governance.
EHS 603	Occupational and Environmental Disease	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences	This course will focus on selected topics in occupational and environmental disease, including an understanding of causation and assessing the scientific literature. The goal will be to cover major toxins/exposures and also key organ systems and/or disease categories, reviewing conditions of historical significance as well as current relevance, all within the concepts and contexts of occupational and environmental epidemiology. Major health effects and disease categories to be covered include: lung diseases related to asbestos and other pneumoconiotic dusts; immunologic lung diseases such as asthma and hypersensitivity pneumonitis; illness caused by organic solvents and persistent organics; pesticide related diseases; occupational skin disease; occupational hearing loss; occupational infectious diseases; illness caused by metals such as lead, mercury, arsenic, and cadmium; environmental and occupational carcinogens; health effects of ionizing radiation including radon; health issues related to outdoor air pollution and indoor air quality including building related illness and mold; health effects of shift work and the built environment; issues of reproductive health; disparities in occupational and environmental health; and other selected topics.
EAS 517	Conservation Biology	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Environment and Sustainability	The world is in the midst of a period of environmental change that is unprecedented in the history of human life. This course examines the causes and consequences of one of the most prominent forms of change in the modern era - loss of biological diversity and its impacts on the ecological functions performed by natural ecosystems. Unlike many Conservation Biology courses, this class will make no false assumption that biodiversity has inherent value, or is universally 'good' for society. Rather, the goals of the class are simply to (i) detail the scientific evidence for why Earth's biological resources are being depleted, (ii) outline how these changes are likely to impact ecosystems and the services they provide to humanity, (iii) describe the social and economic trade-offs we are likely to face as a result of biodiversity loss, and (iv) study the current and emerging management strategies that are used to curb changes in our planet's biological resources.

EHS 572	Environmental Impact Assessment	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Environment and Sustainability	A comprehensive framework for predicting and evaluating environmental impacts is presented. The course emphasized the theory, application, integration and evaluation of models simulating transport and fate of contaminants in air surface and ground water, and soil. Case studies and computer exercises are used to demonstrate contemporary exposure and health risk assessment problems.
EHS 588	Environmental Law	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Environment and Sustainability, Literature, Science, & Arts Â» Program in the Environment	Introduces students to environmental law and the impact of the legal process on decisions that affect the environment. Topics include common law tort actions, toxic tort actions, statutory controls of pollution and other environmentally harmful activities. Additional areas include administrative agency structure and performance, constitutional rights to environmental quality and more.
CHEM 574	Environmental Chemistry	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Literature, Science, & Arts Â» Chemistry	Environmental chemistry of the atmosphere, hydrosphere, geosphere and soils. Review of physical and chemical hazards and sources, distribution, transformations, routes to man of environmental contaminants. Human exposure assessment procedures and applications in health risk analysis programs.
EHS 506	Principles of Toxicology	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health	Principles underlying the chemical, physiological and anatomical basis of toxicity. Dose-response relationships, toxicokinetics and biotransformation, mechanisms of cellular injury and death, organ system toxicity, developmental toxicology, genoteoxicity and toxicogenomics, and chemical carcinogenesis. Principles will be illustrated where appropriate with specific examples of toxicity from environments and pharmaceutical agents.
EHS 653	Environmental Sampling and Analysis Laboratory	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health	Laboratory and lecture course on equipment, instrumentation, methodologies, and strategies for measuring environmental chemical and biological contaminants. A primary emphasis is placed on air monitoring for human exposure assessment in the workplace and general environment. Dermal, surface, soil, and water contamination measurements are also covered. Lectures, laboratories, and demonstrations. Primarily for students in environmental health sciences and with interests in occupational and ambient-environment exposure assessments for regulatory compliance and epidemiologic risk estimation.
EHS 501	Occupational Environmental Disease	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health	Selected topics in the diagnosis, treatment and prevention of environmental and occupational disease, including coverage of toxins, exposures, organ systems, and disease. Lectures and case studies address exposures to solvents, radon, lead and other metals, asbestos and other pneumoconiotic dusts, outdoor air pollution, indoor air quality, and noise. Major health effects and disease categories covered include cancer, respiratory disease, and reproductive health.
EHS 508	Principles of Risk Assessment	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health	This course is designed to provide the knowledge and skills necessary to understand risk assessment methods. Students will understand to use the limitations of risk assessment in establishing exposure standards, acceptable concentrations, and the environmental criteria for hazardous substances that present a risk of carcinogenic or other health effects and the suitability of risk assessment for such purposes. The basic approaches to environmental risk assessment will be emphasized, including methods for identifying health effects, modeling of health effects, and derivation of risk estimates. Methods for dealing with uncertainties as well as limitations and criticisms of risk assessment methods will be discussed. Specific examples of risk assessments will be analyzed and critiqued.
EHS 625	Environment and the Immune Response	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health	Environmental and occupational exposures to pollutants and toxicants in air, water, and food, whether synthetic or natural, influence human by interacting with the hosts immune system. These exposures can either initiate or exacerbate human disease. The course will consist of detailed evaluations of papers, chosen by the students, that explore the impact of environmental and occupational exposures in immunesuppression, autoimmunity, or hypersensitivity.
EHS 608	Environmental Epidemiology	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health Â» Epidemiology	This course will serve as an introduction to topics in environmental epidemiology, covering major areas of current inquiry in this field. It will convey the basic tools required to critically read the literature and to develop appropriate study designs in light of intended applications. The class meeting will include lectures and student-led discussions. This course will review epidemiologic methods used in evaluating the health effects of physical, biological and chemical agents in the environment and the available evidence in the health effects of such exposures. We will also consider policy and public health applications of the scientific evidence. Topics include lectures of methodology and major environmental exposures, discussions based on review and critiques of current literature, and presentations by outside experts on specific environmental epidemiology issues of current interest. After taking this course, students should have a better understanding of the scope, limitations, applications and future of environmental epidemiology.
EPID 675	Data Analysis for Environmental Epidemiology	Graduate	Includes Sustainability	Public Health Â» Environmental Health Sciences, Public Health Â» Epidemiology	This course will introduce non-parametric smoothing methods, such as splines, locally weighted ploynomial regression (LOESS) and generalized additive models (GAM), and focus on continuous environmental exposure variables. It will also deal with analysis of correlated data, including longitudinal analysis and time-series analysis that are widely used in environmental epidemiology.
EPID 605	Infectious Disease Epidemiology	Graduate	Includes Sustainability	Public Health Â» Epidemiology	Introduction to disease and transmission characteristics, and the descriptive epidemiology of infectious agents. This course will help students to understand the theoretical basis of pathogen transmission and what factors determine patterns of disease occurrence. Students will learn how to apply this understanding to disease prevention and control.
EPID 543	Epidemiology of Viral Diseases	Graduate	Includes Sustainability	Public Health Â» Epidemiology	The nature of viruses including replication, transmission, pathogenesis, pathology, antigenic relationships and preventive measures.

EPID 582	Molecular Epidemiology	Graduate	Includes Sustainability	Public Health Â» Epidemiology	The rapid development in molecular techniques since the early 1980s has enhanced the ability of epidemiologists to define and measure both exposures and outcomes. In this course, we will explore the impact of these measures on the design, conduct and analysis of epidemiologic studies by examining successful and unsuccessful applications of these new measurement tools. We will also discuss the ethical issues arising from an enhanced ability to identify individuals with early stage of disease, increased susceptibility or to measure very low levels of exposure in the environment, and sensitize students to the potential conflicts in research ethics arising from collaborative research projects.
EPID 621	Cancer Epidemiology	Graduate	Includes Sustainability	Public Health Â» Epidemiology	This course serves as a basic introduction to the field of cancer epidemiology. The course applied the principles developed in the introductory epidemiology courses to the study of cancer. The course commences with a descriptive account of cancer vocabulary; multistage model of carcinogenesis; and pathologic and biologic basis of cancer. The course topics also include magnitude of the cancer problem; trends in cancer frequency, incidence, burden, mortality, survival and international cancer epidemiology. The concepts of the role of smoking, radiation, lifestyles, nutrition, and other exposures are reviewed. The descriptive epidemiology, natural history, and pathologic and biologic characteristics of selected common cancers, as well as factors related to their etiology are also discussed. The course format consists of a series of lectures by three faculty members and directed readings from the current literature. Students are required to analyze and present assigned papers of a given cancer.
EPID 506	Health of Nations: Introduction to International Health	Graduate	Includes Sustainability	Public Health Â» Epidemiology	This course presents an overview of mortality and disease occurrence in terms of geographic, cultural, nutritional and environmental factors. Reviews health indicators such as infant mortality and economic factors associated with development. Discusses health problems of developing countries and describes programs and organizations involved in addressing them. This course is required for students in the International Health track in Epidemiology but can also be taken by non International Health students.
EPID 783	Methods in Community-Based Participatory Research for Health	Graduate	Includes Sustainability	Public Health Â» Epidemiology	There is increasing recognition and support for more comprehensive and participatory approaches to research and interventions in order to address the complex set of determinants associated with public health problems that affect populations generally, as well as those factors associated with racial and ethnic disparities in health more specifically. Â Community-based participatory research (CBPR) is one such partnership approach that equitably involves all partners in all aspects of the research and intervention process, aimed at both increasing knowledge and understanding and linking the knowledge gained with interventions and policy change to enhance the health and quality of life of community members. Â This course will provide an introduction to some of the core principles, concepts and methods involved in using a CBPR approach. Â Organized along the phases of CBPR, this course will focus on describing and understanding partnership, formation, maintenance and evaluation; the use of quantitative and qualitative methods (e.g., survey, focus group interview, observational checklist) for the purposes of community assessment, examining basic research questions, and developing and evaluating interventions; and feedback, interpretation, dissemination and application of research results. The course will examine the rationale for, benefits of the challenges associated with using a community-academic partnership approach to research and interventions.
EPID 822	Malaria and Other Important Vector-borne Diseases	Graduate	Includes Sustainability	Public Health Â» Epidemiology	Infectious agents transmitted by anthropod vectors produce an enormous disease burden worldwide, especially in underdeveloped countries. Malaria alone kills more than on million people each year, mostly children, and results in 42 million DALYs lost. This course is designed to investigate the epidemiology of malaria and other important vector-borne diseases that principally affect poor people living in tropical countries. The complex interactions influencing transmission dynamics, including immunologic, ecologic, economic and social factors are explored. Options for treatment, prevention and control involving vectors, parasites and human behavior are examined. Analysis also considers the role of other infections, including HIV, as altering transmission and disease.
EPID 618	Global Social Epidemiology	Graduate	Includes Sustainability	Public Health Â» Epidemiology	Social epidemiology course with a focus on global population and health trends, health equity, and the social determinants of health in a global context.
EPID 703	Infectious Disease	Graduate	Includes Sustainability	Public Health Â» Epidemiology, Public Health	This course will focus on current topics and new concepts in infectious disease epidemiology. We will discuss factors and issues of diseases most currently prevalent in the world, their status, epidemiology, and methods of control and prevention and barriers to their successful applications. The diseases to be discussed include but are not limited to: diarrheal diseases, HIV/AIDS, tuberculosis, vaccine preventable diseases, influenza, emerging infections, West Nile virus, hemorrhagic fevers, zoonoses, hospital infections including multiple resistant staphylococcus and antibiotic resistance of other organisms.
EPID 755	Emerging & Re-Emer Infectious Diseases	Graduate	Includes Sustainability	Public Health Â» Epidemiology, Public Health	Emerging and re-emerging infectious diseases continue to represent a major worldwide public health problem. Naturally occurring and bioterrorist introduced agents can result in disease and death. Societal, technological and environmental factors have a significant effect on infectious diseases facilitating the emergence of new diseases and the re-emergence of old ones. Recent occurrences that underscore the public health concerns include viral infections, such as HIV, SARS, NIPAH virus, dengue, SLE, West Nile virus and bacterial infections, such as Helicobacter pylori, E. coli 0157: H7, and antibiotic resistant organisms including tubercle bacilli, staphylococci, streptococci, and gram negative rods. The role of infectious agents as causative factors of malignancies will be reviewed. We will discuss the general factors that have influenced the occurrence of these diseases and the programs promoted by the Centers for Disease Control and Prevention, the World Health Organization, and other professional organizations, to combat these infectious diseases. The major emerging and re-emerging infections will be discussed emphasizing their identification, epidemiology, recommended control and prevention measures, and their current unresolved problems. We will also discuss the threat of bioterrorism in reintroducing an infectious agent.

HBEHED 690	Environmental Health Promotion	Graduate	Includes Sustainability	Public Health Â» Health Behavior & Education	This class applied health education principles towards understanding and intervening on different environmental hazards. The course will review various kinds of environmental issues, including biochemical toxins, physical hazards, and psychosocial stressors. Students will learn about select datasouces from which they may obtain environmental health information. The course will examine the literature on risk perception, risk communication, ethics, and environmental health education and explore how health educators can use resource and conceptual tools to help ameliorate environmental concerns. This course will also examine case studies from individual communities as focal points for discussion. Based on these case studies, students will explore whether extant theories and approaches can help protect vulnerable populations, insure environmental justice, and reduce health disparities.
HBEHED 617	Global Public Health	Graduate	Includes Sustainability	Public Health Â» Health Behavior & Education	In this course, we discuss globalization and health, major actors/organizations in global health, global health inequities, and "hot topics" in global health. This course is designed to help students critically think about how to apply key concepts and skills in health behavior and health education to understanding global health issues.
NBEHED 626	Introduction to Geographic Information Systems and Health Behaviors	Graduate	Includes Sustainability	Public Health Â» Health Behavior & Education	GIS offer useful tools for collecting, mapping and analyzing health data. The course focuses on how to use GIS to understand the geography of health, health behaviors, and health disparities. Students will learn to use ESRI's ArcGIS for introductory data management, mapping and geographic data analysis.
HBEHED 603	Population Change: Gender, Family and Fertility in Africa and Asia	Graduate	Includes Sustainability	Public Health Â» Health Behavior & Education, Public Health	This seminar will review causes and consequences of recent demographic change in Africa and Asia, highlighting emerging trends in gender, family formation and fertility. An exploration of general global and regional trends will be followed by in-depth case-study of five countries: India, China, Burkina Faso, South Africa and Zimbabwe. In each case we will reflect on the relative contributions of demographic pressure, population policies and programs, the international women's movement, and the continuing AIDS epidemic, to the observed trends in sexual behavior, gender norms, marriage, and fertility.
HBEHED 550	The Challenge of HIV/AIDS: Strengthening Health Systems in Resource-Poor Settings	Graduate	Includes Sustainability	Public Health Â» Health Behavior & Education, Public Health	Over 40 million people are currently infected with HIV, with the majority of these living in the poorest countries. While new drugs and social interventions in the North are preventing mother-to-child HIV transmission, and have substantially reduced AIDS-related morbidity and mortality, similar interventions are making limited headway in resource- poor settings, especially those most severely affected by HIV/AIDS. Failure is in part due to funding, but more often a consequence of the underlying weakness of health systems. This course will address the operational and social challenges of implementing HIV prevention and care where health and education systems are weak, and political structures fragile. We will critically evaluate a wide range of health and behavioral interventions that have failed or succeeded in sub-Saharan Africa and South Asia, and explore why things work, and attempt to identify models of best practice for diverse settings. We will review emerging opportunities posed by the Global Fund and the Millennium Development Goals to use HIV-related donations to leverage improvements in the overall health sector in poor countries.
HMP 653	Law & Public Health	Graduate	Includes Sustainability	Public Health Â» Health Management & Policy	The purpose of this course is to examine the legal context of the relationship the individual and the community, and to understand public health regulation in the context of a market-driven system. The goals of the course are for students to understand generally: constitutional authority and limits on governmental intervention in public health (i.e., individual rights vs. society's rights); the function of the interactions between courts, legislatures, and regulators; how law will affect students as strategic thinkers in public health positions; how to recognize legal result and communicate with attorneys; and the process of public health regulation and potential legal barriers to public health intervention strategies. Specific topics will vary, but will usually include; the nature and scope of public health authority; constitutional constraints on public health initiatives; tobacco control; youth violence; injury prevention; the spread of communicable disease; and regulating environmental risk.
HMP 626	Race, Ethnicity, Culture and Policy	Graduate	Includes Sustainability	Public Health Â» Health Management & Policy	"Managing and Maximizing Difference and Diversity in Healthcare," examines the confluence of socio-demographic diversity in the workforce and the population, the under representation of women and minorities in healthcare leadership and professional positions, and persistent racial and ethnic disparities in health and healthcare. Â Students will use organizational behavior and organization theory as frameworks for examining relationships between diversity and disparities in healthcare quality. Â Conceptually, we will begin by exploring many kinds of "difference" that influence an organization's performance including individual, functional, demographic and ideological differences. Â We will also review the benefits and risks of difference, giving focused attention to issues of power, conflict, culture and stereotypes. Â From a practical standpoint, students will conduct self-evaluations, analyze cases, participate in exercises and complete assignments that build competencies for managing diversity. Â At the end of the course, students will have a repertoire of concrete steps to manage and maximize difference at multiple levels including organizational policies and infrastructure; management & leadership; within and across groups; and one's own minority status. Â This course is highly interactive and designed to promote growth and learning through personal reflection and interpersonal interactions, as well as from traditional didactic methods.

HMP 624	Health Policy Challenges in Developing Countries	Graduate	Includes Sustainability	Public Health Â» Health Management & Policy	This course examines the state of public health systems in developing countries in sub-Saharan Africa, Latin America, and parts of Asia in the context of global initiatives to dramatically improve health outcomes. The course will cover recent trends in health outcomes, the structure, history and performance of developing country health systems, the international players in health (including the UN and other multilateral and bilateral organizations), key constraints to improving health care delivery, and potential ways forward. This course focuses on international and national health policy as it pertains to developing countries but also deals with questions of health management and implementation of complex systems. There are wide, and in some instances growing, global disparities in health status. In some countries in southern sub-Saharan Africa, for example, the AIDS epidemic has cut 20 years from average life expectancy over the past decade while the developed world has enjoyed a boom of new health discoveries and advances. AIDS and a resurgence in malaria and TB have added to the tremendous strain on fragile health systems, which have already been ravaged by years of underfunding. Government-run health systems in developing countries, whose main role is to deliver a modest package of essential interventions for largely preventable and/or treatable conditions, are on the verge of collapse.
HMP 627	Population Dynamics and Policy	Graduate	Includes Sustainability	Public Health Â» Health Management & Policy	Examine the interrelationship between core population issues, public policy and health policy. A rigorous treatment of core population topics useful to designing effective policies. A broad array of population topics including population health and life expectancy, population aging, immigration, population and climate change, low fertility, and health disparities are covered.
HMP 617	US Food Policy and Public Health	Graduate	Includes Sustainability	Public Health Â» Health Management & Policy	This course uses the social ecological framework as a vehicle to explore the different factors that influence the way we eat. We will examine different policy and public health approaches to address problems stemming from the modern US food system within the context of the social/cultural factors that surround food.
NUTR 631	Vitamins & Minerals	Graduate	Includes Sustainability	Public Health Â» Nutritional Sciences	This course provides an in-depth introduction to vitamin and mineral metabolism with particular emphasis on factors that influence nutrient bioavailability, regulation of nutrient homeostasis, and biological function. Other topics include the health effects of inadequate and excessive micronutrient intakes, nutrient requirements across life stages, role of micronutrients in environmental exposures, and controversies/support for nutrient supplementation/fortification programs. The course will consist of lectures on the major metabolic topics for each micronutrient and discussions on nutrient-related health concerns from the current literature.
NUTR 585	Food Service Mgmt	Graduate	Includes Sustainability	Public Health Â» Nutritional Sciences	This course examines the principles of food systems management, defing and applying management theories and functions in food and nutrition settings. Human, material and facility management will be discussed. Students gain an understanding of the tools available for managing effective and efficient food and nutrition organizations. Purchasing and inventory techniques will be examined. Using the foodservice systems model as a guide, it shows students how to transform the human, material, facility and operational inputs of the system into outputs of meals, customer satisfaction, employee satisfaction and financial accountability. This course will cover cost control, methods that are specific to managing food service operations, including food waste and theft.
NUTR 657	Nutrition, the Environment, and Cancer	Graduate	Includes Sustainability	Public Health Â» Nutritional Sciences	Â A large amount of research indicates that dietary and environment factors impact the development and recurrence of various types of cancer. This course will survey both classic and emerging literature relevant to this topic in a structured discussion and journal club format.
PUBPOL 735	Professional Development	Graduate	Includes Sustainability	Public Policy (Ford)	Pathways to Professional Success --- Researchers have found that a person?s IQ and classroom performance is at best a moderate predictor of long term success. This seminar will help you learn skills (beyond analytical skills) that will help you achieve the professional goals that you desire; self-awareness, developing sustainable and ethical power and influence, managing organizational politics; managing your relationships with bosses, peers, and direct reports, effective networking, creating high performing teams; and achieving work/life balance.
PUBPOL 580	Values, Ethics and Political Advocacy	Graduate	Includes Sustainability	Public Policy (Ford)	Makes students sensitive to and articulate about the ways in which moral and political values come into play in the American policy process, particularly as they affect non-elected public officials who work in a world shaped by politics. Topics covered include the tensions between ethics and politics, an introduction to various moral theories that figure in contemporary policy debates, a consideration of the principal values that animate American politics, and issues and dilemmas in professional ethics. The course addresses issues that affect international as well as U.S. policy and politics.
PUBPOL 587	Public Management	Graduate	Includes Sustainability	Public Policy (Ford)	Introduction to what public managers do and to help provide the students with perspectives and opportunities for practice that will help them become effective public managers. Includes topics such as the motivation of employees, the distribution of tasks and authority, the negotiation of support and services, and the representation of a public organization or public policy to a variety of audiences
PUBPOL 674	Economic and Social Policies in a Selected Emerging Market Economy	Graduate	Includes Sustainability	Public Policy (Ford)	This seven-week, course is open to any graduate student focuses on the evolution of a given country's economic, political and social institutions and policies, beginning with the historical origins of the country. Students will examine why the country embarked on the development strategies in different periods and what the consequences of those strategies were. The course will progress to the current period and examine the pressing policy issues facing the country today and how the leaders are dealing with those problems given the internal and external constraints. The interests of the students will help shape which current policies will be examined more closely in the last part of the course. Grades will be based on one 10-page policy paper and a final exam.

PUBPOL 686	State and Local Policy Analysis: Â Focus on Development Policy	Graduate	Includes Sustainability	Public Policy (Ford)	The purpose of this course is to expose students to various perspectives on state and local policy through the lens of one especially topical policy area: development policy. Â The course will expose students to several theoretical perspectives on development policy, including economic, legal, political, sociological, environmental, and planning perspectives. Â These perspectives will provide students with the analytic tools to complete the course's main project, which will be a group research project on a topic currently being considered by policy makers in the Ann Arbor area.
PUBPOL 671	Policy and Management in the Nonprofit Sector	Graduate	Includes Sustainability	Public Policy (Ford)	This course provides a survey of policy and management issues in the nonprofit sector in the US. It focuses on how nonprofit organizations differ from governments and private firms and the implications of these differences for public policy and management. Assignments include theoretical readings, case studies and readings on contemporary events in the nonprofit sector. Among the topics covered are the nature and variety of nonprofit organizations, governance and accountability, ethics, financing and economic decision-making, and performance measurement.
PUBPOL 754	Research Seminar in Science, Tech and Public Policy	Graduate	Includes Sustainability	Public Policy (Ford)	Introduces students to topical issues in science and technology policy. Those currently in the science policymaking arena as well as experts in applied science policy research will be invited to campus to participate as seminar speakers. By interacting with those active in science policy circles, it is hoped that students will gain a real appreciation for the processes and underpinnings of current national science policy.
PUBPOL 756	Local Government, Opportunity for Activism	Graduate	Includes Sustainability	Public Policy (Ford)	What goes on in city government is in many ways more important to our lives than what happens in Washington. This course goes beyond the structure and theory of municipal government to look at how things really happen at the local level. It will explore the underlying dynamics of the city/suburb conflict, sprawl vs. density and how these issues influence local economies and state legislatures. There will be a focus on the interaction of citizen activists and elected officials in effecting change. Topics will include running for office, environmental and affordable housing campaigns and activist-generated ballot initiatives. Both past and present campaigns will be examined, including case studies of both successful and failed initiatives. Students will explore the unfolding Greenbelt and Greenway programs, and how these proposals may impact sprawl and affordable housing. Guest speakers will include elected officials and activists from past and present campaigns for social and environmental change.
PUBPOL 650	Introduction to Science and Technology Policy Analysis	Graduate	Includes Sustainability	Public Policy (Ford)	As it exposes students to the landscape of science and technology policymaking in the US and abroad, this course introduces theories and methodologies for science and technology policy analysis, with literature drawn from a range of disciplines, including political science, economics, sociology, and history. Students will learn how science and technology policy is made, with specific attention to the roles of government agencies, expert advisory committees, private industry, the courts, and the public. They will also gain tools for science and technology policy analysis, including research funding allocation methods, science and technology assessment, innovation theory, and cost-benefit analysis. The course will also explore how national and international contexts shape science and technology policymaking.
PUBPOL 510	The Politics of Public Policy	Graduate	Includes Sustainability	Public Policy (Ford)	Policy analysis is a profession that brings systematic thinking and social scientific evidence to bear on substantive problems, but policymakers seldom defer to expert judgments. Many see policy analysis as material to be deployed selectively and strategically in political battles fought on other terms. To be effective, policy specialists must understand the political environments in which they operate, including the participants who shape policy within particular domains; the ways in which they perceive problems and solutions; the interests and ideologies likely to govern their actions; the strategies they use; and the institutional arrangements and processes that shape their behavior and constrain their decisions. The goal of the core politics course is to help you approach such matters more critically and strategically, especially as you take on new jobs in an upwardly mobile career. Every section of the course emphasizes a different level of governance: International politics, comparative politic, or national/subnational politics. For more information, students should consult the descriptions for the individual sections available at fordschool.umich.edu.
SW 611	Social Change Theories	Graduate	Includes Sustainability	Social Work	This course will review theories and research from the social sciences on social change, focusing especially at the societal level. Theories of social conflict, interest groups, and social movements, and such processes as consciousness-raising will be covered. Dynamics of the diffusion of innovations in society will also be addressed. Examples will be drawn from areas of practice in which social workers are involved, such as mental health and chemical dependency, child and family welfare, civil rights, health care, and consumer protection.
SW 671	Social Policy Development & Enactment	Graduate	Includes Sustainability	Social Work	This course will review the overall design of human service systems, how to plan for and design such systems, how to develop the legislative mandates and regulations that operationalize these designs, and how to facilitate their formal enactment. Students will learn the analytic skills associated with the development of policies that give specification to human service systems, as well as the more interactional skills associated with facilitating the enactment of these policies.

SW 657	Multicultural, Multilingual Organizing	Graduate	Includes Sustainability	Social Work	This course will examine multicultural, multilingual organizing as a process of promoting intergroup relations and social development at the community level. Included will be content on efforts by diverse groups (inclusive of the following dimensions: ability, age, class, color, culture, ethnicity, family structure, gender (including gender identity and gender expression), marital status, national origin, race, religion or spirituality, sex, and sexual orientation, as well community of residence) to maintain their identities while also interacting and cooperating across cultural boundaries. Students will apply existing practice to multicultural situations and develop emergent skills for the future. This course will examine concepts and techniques of multicultural, multilingual organizing. Relevant strategies and tactics that promote positive intergroup relations and pluralism at the community level will be analyzed (e.g., interethnic planning and multigroup coalition-building). Students will be prepared for the roles that social workers can expect to serve in building a racially, ethnically, and religiously heterogeneous society.
SW 663	Grantgetting, Contracting, & Fund Raising	Graduate	Includes Sustainability	Social Work	Human service organizations secure resources through a variety of venues, including fees, grants, contracts, gifts, bequests, in-kind (non-cash) contributions, and investments. Instruction will be provided in assessing an agency's resource mix and how to repackage or expand its revenue streams. Skill development will be emphasized in areas such as grant seeking, proposal writing, presentations, service contracting, campaign planning, campaign management, donor development, direct solicitation of gifts, and planning of fundraising events. This course will also address consumer and third-party fee setting and collection, outsourcing, income investment, and creation of for-profit subsidiaries.
SW 400	Social Problems & Social Work Today	Graduate	Includes Sustainability	Social Work	This course is considered an advanced, undergraduate elective which is designed to familiarize students with the profession of social work and also to recruit undergraduate students into the school's MSW program. The particular social problems selected for discussion will change from year to year depending on faculty and student interest and the contemporary context. The opening sessions of the course will briefly overview the social context for the kinds of roles, interventions, and fields of service that the profession generally operates from, before exploring in depth the professions response to each selected social problem. Important professional themes like: multicultural sensitivity to various diversity dimensions such as ability, age, class, color, culture, ethnicity, family structure, gender (including gender identity and gender expression), marital status, national origin, race, religion or spirituality, sex, and sexual orientation; empowerment; prevention; and value based intervention will also be reviewed in this course. Note: this course is distinguished from a more traditional course on social problems since it focuses specifically on a limited number of selected social problems a
SW 716	International Community Organization	Graduate	Includes Sustainability	Social Work	International Community Organization --- The course examines core concepts of community practice, major models of comparative policy work, and practical steps for community-based work.Â It provides knowledge and skills in comparative urban policy, community-based work with youth, and non-governmental social justice community organization. Students will analyze the ways in which countries use different approaches to mobilizing people for collective action, challenging oppressive structures and processes, building organizational capacity, implementing action plans, and generating power in the community.
SW 723	Spirituality in Social Work Practice	Graduate	Includes Sustainability	Social Work	This course provides a framework of knowledge, values, skills, and experiences for culturally competent, ethical, and spiritually-sensitive social work practice. Â This course is focused on providing specialized understanding of spiritual diversity in social work practice along with application of that understanding to people of diverse religious and nonreligious spiritual perspectives and traditions and its relevance to practice, policy and research. Â This course will promote exploration of values, knowledge and skills to ethically and effectively provide services to clients that take into account diverse expressions of spirituality. Â The roles of religion and spirituality in supporting or impeding individual strengths and social justice will be considered. Â The relationship between spirituality concepts pertaining to gender, ethnicity, culture, race, sexual orientation, socioeconomic status, religious and spiritual beliefs, ability, social class, and age as well as spirituality across the life cycle will be addressed.
SW 724	Social Justice Advocacy for Social Work and Allied Professions	Graduate	Includes Sustainability	Social Work	Social Justice Advocacy for Social Work and Allied Professions --- This course will draw on how social justice and social work values call us to action to challenge injustice - poverty, unemployment, discrimination, racism, etc. We will learn how commutative and distributive justice require redistribution of benefits, goods, burdens and pleasures. This course will build on and integrate knowledge and skills from Interpersonal, Community and Management classes to address macro policy and the legislative process, setting the stage for advocacy within organizational, community and political systems. We will examine the intersection of empirical research and advocacy strategies from a community-based approach, including participatory research and community-based advocacy strategies. This participatory lens lends itself to the involvement of community stakeholders in defining community problems and solutions. Ultimately, the course seeks to deepen our understanding of social justice, human and civil rights, and the need to engage in advocacy in order to address oppression, social and economic justice.
URP 587	Planning for Organizational & Community Change	Graduate	Includes Sustainability	Social Work, Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course will examine social planning as a systematic process of developing and implementing plans and programs that promote social justice and well-being at the community level. A range of analytic and interactional tools will be reviewed, including those which assess community strengths and needs, set goals and priorities, formulate action plans, develop organizational structures, build support for implementation, and monitor and evaluate risk results. This course will also analyze major models of planning practice, the socio-political context within which practice takes place, and strategies for expanding institutional relationships and collaborative partnerships aimed at a more equitable distribution of goods, services, and resources.

UP 655	Neighborhood Planning	Graduate	Includes Sustainability	Social Work, Arch. and U.P. (Taubman) Â» Urban and Regional Planning	The course focuses on concepts and issues that characterize community planning for neighborhoods and explores interdisciplinary approaches to neighborhood analysis and intervention. The initiatives of community development corporations, city agencies, and the federal government are examined through lectures, readings, and guest speakers. The central questions the course examines are: Why do neighborhoods experience prosperity and decline? Which approaches (e.g. economic development, urban design, social service delivery, housing rehabilitation, community organizing and empowerment) are likely to be most effective in revitalizing neighborhoods? How do we assess existing approaches to neighborhood revitalization? Emphasis is placed on discovering appropriate information sources, learning to ask relevant planning questions, and formulating program alternatives and recommendations.
PHYSICS 630	Biological Physics	Graduate	Includes Sustainability	Literature, Science, & Arts, Literature, Science, & Arts Â» Physics	An introduction to biological physics at the cellular and supra-cellular scales, with an emphasis on understanding how robust biological function emerges from the interactions of systems of molecules, genes, and cells. Topics will be drawn from research literature of the past 20 years including signal transduction and cellular information processing, the effects of noise in living cells, the active mechanics of the cytoskeleton, and pattern formation and morphogenesis in animal development. We will pay particular attention to the process of model-building and the role that quantitative, physical models can play in shaping our understanding of biological systems. Physical and mathematical background developed as needed.
HISTORY 682	Environmental History	Graduate	Includes Sustainability	Literature, Science, & Arts, Literature, Science, & Arts Â» History	Environmental History --- This course in the rapidly evolving field of environmental history, which increasingly intersects with the history of science and of medicine. Â We will read classics from the field as well as the latest work at the frontier's of the field. Â This is a global history course with deep temporal coverage.
URP 523	Participatory Planning and Community Development	Graduate	Sustainability Focused	Arch. and U.P. (Taubman)	Participatory Planning and Community Development --- Planners world wide face the challenges of fostering community development in the context of rampant socio-economic and environmental inequalities. Â The course employs case studies from the U.S. and variety of countries to assess participatory planning practices, including methods and techniques. Â Interdisciplinary readings problematize the definition of community development.
ARCH 555	Building Systems and Energy Conservation	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	This course evaluates all building systems and services with regard to their influence on design. Of particular interest are: response to climatic factors and internal functions, integration of building fabric and environmental controls, choice of materials and construction processes, systems operation and energy consumption, energy conservation and management, and first costs versus life-cycle costs. Case studies of various building types and systems analyses are presented.
ARCH 562	Arch Design VI	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	These graduate-level studio design courses, characterized by architectural problems of increasing scale and complexity, usually one semester in length, require solutions that are thorough in their conception, development, and execution. Approximately twelve studio sections are offered in each regular term, each with a unique focus, but all dedicated to comprehensive architectural design. Examples include: aesthetic and symbolic issues, comprehensive building design, facilities planning, housing, community design, urban design, historic preservation and conservation, the architect as developer, structure, energy systems and conservation, professional practice and management, computer applications to design, and honors studio. Detailed course descriptions for each section are posted during registration. Many sections require that specific 500/600-level architecture lecture/seminar courses be taken prior to or concurrent with the design studio.
ARCH 672	Arch Design VII	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	These graduate-level studio design courses are characterized by architectural problems of increasing scale and complexity, usually one semester in length and require solutions that are thorough in their conception, development, and execution. Approximately twelve studio sections are offered in each regular termï¿½ - each with a unique focusï¿½ - but all dedicated to comprehensive architectural design. Examples include: aesthetic and symbolic issues, comprehensive building design, facilities planning, housing, community design, urban design, historic preservation and conservation, the architect as developer, structure, energy systems and conservation, professional practice and management, computer applications to design, and honors studio. Detailed course descriptions for each section are posted during registration. Many sections require that specific 500/600 level architecture lecture/seminar courses be taken prior to or concurrent with the design studio.
ARCH 739	MS Capstone	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	This course is the culmination of the academic course of study. Â Participants Â are expected to apply new skills and knowledge towards advancing the discipline through their projects. Â Intensive and research-based, participants will be required to document their research and project-based work in partial fulfillment of their degree. Â Outside expert discussion is integrated into the MS Capstone through one or a series of colloquia presentations and public exhibitions by participants.
ARCH 575	Building Ecology	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	Provides students with an understanding of ecological principles in architecture. Principles of life-cycle design, economy of resources and humanistic design are introduced and ecological factors associated with each of these principles are examined. Design strategies to increase environmental sustainability in buildings are investigated. An emphasis is given to how environmental factors (heat, light, and sound) influence thermal, visual, and acoustic qualities in built-in environments. Field trips to visit selected buildings to analyze their ecological characteristics comprise an important part of the course.
ARCH 525	Computer Applications in Environmental Technology	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	The focus of this course is the application of computers in building technology design. The course provides an understanding of environmental design methods through the use of commercial and newly-developed computer programs. State-of-the-art thermal, lighting and acoustical analysis models are introduced. The application of these models in environmental system design is explored through case studies.

ARCH 727	Health: Individual Infrastructures	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	This course covers topics related to individual (singular) health and will examine the role of design in determining the metrics of individual health within domestic, work, and recreational environments. Â Participants will examine the body at rest, work, and play in specific spatial and environmental contexts determining disparities in which such activities that place and resolving the mechanics of the infrastructural differences.
Arch 515	Sustainable Systems	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture	Sustainable Systems --- This course will introduce students, aiming to participate in the design of the build environment, to a range of perspectives comprised of theories, manifestos, tropes, and exemplary practices that will assist in positioning new thinking and actions within complex terrestrial systems. The course content will span the planetary to the surficial, quantitative and qualitative, theoretical and applied in pursuit of a position from which design might begin to operate with these cascading and networked fields. Weekly readings will be complemented by a set of co-taught lectures and detailed discussion sessions that aim to unpack contemporary positions regarding sustainability.
URP 610	URP Graduate Experimental Course	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	The topic of this course varies from semester to semester and generally concerns an emerging issue in urban and regional planning or an underdeveloped aspect of the curriculum. Â New courses are often offered under this title before they are adopted as regularly offered courses. Â One-time courses by visiting faculty are also offered under this title.
URP 504	Introduction to Statistics for Urban Planning	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course is intended primarily for students who have no background in statistics and should be taken before a planning methods course. It introduces statistical concepts such as probability, descriptive statistics, tests of differences in populations, correlation, and linear regression. The course will familiarize students with computerized spreadsheets and statistical packages.
URP 603	Integrative Field Experience	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	A one- or two-term capstone experience involving second-year students working directly with community-based organizations in urban neighborhoods and planning districts in Detroit.Â Following general introduction and orientation to the study area and issues, students form small groups to work intensively on projects in collaboration with neighborhood leaders and residents in improving their situation.Â Presentations will be made at community meetings in early December and late April.
URP 612	URP Directed Study	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This course is an original investigation into a planning problem. Â Subject for investigation will be selected by the student contingent on faculty advisor approval.
URP 584	Introduction to Economic Development Planning	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Introduction to ways of thinking about the functioning of regional, urban, and local economics and the implications for planning economic development. Â The course examines regional and metropolitan industrial locations, processes of development and growth, international and inter-regional trade, labor markets, and migration. Â Close attention is given to how planning intervention can influence the location, speed, and character of growth.
URP 573	Infrastructure Planning in the US & Developing Countries	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	Infrastructural networks (water, sewerage, electricity, information) are constitutive features of metropolitan life. In cities around the world, large numbers of urban residents lack access to basic infrastructure and services. Many city dwellers in developing countries do not have regular access to such basic amenities as piped water, sanitary toilet facilities, electricity, sewerage, paved roads, and policing). In the United States, urban infrastructures often break down, sometimes with disastrous consequences (Katrina and New Orleans, for example). The aim of this course is to explore the environmental and social impact of contemporary infrastructure planning. The basic premise is that cities are social products of transformed nature. City-building processes â€¯makeâ€™ cities into hybrids of the natural and the social, the environmental and the cultural. This course takes a comparative perspective in examining infrastructure planning and in the US and developing countries. It addresses the following questions: 1. What current theoretical perspectives can assist us in understanding the relationship between cities and nature? 2. What are the driving forces behind infrastructure planning and delivery, and what are the causes for their uneven distribution? 3. What roles have urban planners and other stakeholders played in choosing between different approaches to addressing infrastructure needs of urban residents? The course will draw heavily on case studies from cities in Asia, Latin America, Africa, and the United States. The class will be conducted in a seminar format, and students will also engage in in-class debates on controversial issues, including the balance between centralized and decentralized approaches to infrastructure delivery, the privatization of basic social services, and the role of local and community-based approaches to infrastructure delivery. Students will also be required to write either one comprehensive term paper or several shorter ones. Students will also be required to do a presentation on a case study of a specific program, policy or project related to infrastructure.
URP 580	Metropolitan Structures	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This reading seminar examines the economic, social, and political forces that shape urban development, including explanations for the size, location, and functioning, of cities and their metropolitan regions. The course draws on an interdisciplinary and constantly evolving body of knowledge that observes and interprets the form and function of human settlements. These theories are indispensable for understanding the origins of cities, the persistence of urban and regional spatial patterns, the distinctive nature of urban problems, and the importance of tracing the source of urban challenges to larger metropolitan dynamics. The course explains why cities exist, why some are big and some are small, why some are specialized, and how they are interrelated in a linked network of cities. We look at several key issues of critical importance to urban planners from the perspective of social justice and sustainability, including racial segregation, urban sprawl, regional governance, poverty, the delivery of services, and how environmental problems are related to social problems. A central theme of the course is to identify how social relations affect social inequality and environmental degradation, and to examine how a more engaged citizenship can contribute to better urban development.

URP 553	Sustainable Urbanism and Architecture	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning	An in-depth exposure to American and international urban planning, architecture, urban design, and landscape architecture that is environmentally sustainable, as well as culturally enriched, aesthetically accomplished, socially equitable, and economically viable.
UP 532	Sustainable Development: Resolviing Economic & Environmental Conflicts	Graduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	A growing body of evidence suggests that human populations world-wide are not living on the earth in ways that can be sustained indefinitely given current patterns of natural resource consumption, population growth, land development, and institutional arrangements. In response to this predicament, the concept of "sustainable development" has become prominent in popular and academic policy-making and planning debates over the past decade. Does the notion of sustainable development itself offer any useful guidance for making public policy and planning decisions, or is it merely an attractive oxymoron that different interests can agree on only at an abstract level? The goal of this class is to explore this question in depth. The course begins by considering the variety of ways in which our current lifestyles, locally and globally, are not sustainable, and then works through the concept of sustainable development from different vantage points: in terms of fundamental principles, scale (from global to local), and institutions, policies, and laws. Finally, the course addresses a variety of policy-making and planning prescriptions that have been offered and assesses whether and how those various prescriptions will likely work in practice. Working in groups, students test these theories of sustainability by applying them to selected client communities in Michigan.
STRATEGY 564	Strategies for Sustainable Development I: Competitive Environmental Strategy	Graduate	Sustainability Focused	Business (Ross)	This course deals with environmental issues from a strategic perspective. It focuses on how environmental pressures (e.g. sustainable development) and environmental problems (e.g. global warming, air pollution, waste-disposal), impact corporate mission, competitive strategy, technology choices, product development decisions, and production processes. Basic concepts of ecology and environmental science are discussed and contrasted to those associated with the traditional economic paradigm.
STRATEGY 565	Strategies for Sustainable Development II: Managing Social Issues	Graduate	Sustainability Focused	Business (Ross)	The pressure for sustainable development has significant implications for firms, particularly large multinational corporations. With free trade on the rise, long-term opportunities exist for firms able to identify, develop, and deploy technologies, products, and services that contribute to sustainable practices and resource use in the developing world. This course examines how long-term competitive positioning can be secured through strategies such as positioning can be secured through strategies such a environmental partnerships, technology cooperation, and collaborative planning.
STRATEGY 566	Systems Thinking for Sustainable Development & Enterprise	Graduate	Sustainability Focused	Business (Ross)	Challenges to a sustainable human future such as climate change, population growth, biodiversity loss and persistent poverty are characterized by extraordinary detail and dynamic complexity. This course fosters the skills of systems thinking and systems dynamics modeling necessary for understanding global environmental and social change. This holistic and dynamic understanding is employed to chart pathways for sustainable human development and business.
STRATEGY 680	Business in Society	Graduate	Sustainability Focused	Business (Ross)	The world faces many large problems such as climate change, environmental degradation, global poverty, and inequality. This has led many people to argue that business should take the lead in addressing these problems and fulfill its corporate social responsibility (CSR). At the same time, business is under increasing pressure from activist shareholders to maximize shareholder value. The primary goal of this course is to prepare you to deal with this challenge as a top executive in private or public organization by giving you an opportunity to explore competing views in depth and to work out your own position on them.
BL 530	Business and Human Rights	Graduate	Sustainability Focused	Business (Ross)	In 2011 the United Nations Human Rights Council unanimously endorsed the Guiding Principles on Business and Human Rights. Since that time, understanding and attempting to implement those principles has become a priority for many corporations. In addition, governments and NGOs are exploring ways to hold corporations accountable for their human rights performance. This course will help students understand: - The international community's approach to human rights, and the specific principles and standards on business and human rights. - The ways business can impact human rights (both positively and negatively) in various industries.Â - Corporations' obligation to respect human rights (under the UN guiding principles on Business and Human Rights), and the criticisms of this approach. - The challenges corporations face in attempting to respect human rights. - Corporations' legal accountability for human rights violations, and the limits of the legal system in this area.
TO 560	Sustainable Operations and Supply Chain Management	Graduate	Sustainability Focused	Business (Ross)	Firms today face increasing pressure from activists, investors, and customers, to reduce the environmental impacts of their operations and supply chains as well as uphold basic human rights and labor standards for the people who produce the materials / components / products. At the same time, using a sustainability lens to look at its operations and supply chain, a firm can identify new opportunities for improving efficiency and innovations. Further sustainability (environmental / social) as an artifact has to combined with a discussion of responsibility. That is, how is responsibility (for ensuring sustainability) apportioned across the extended value chain that includes the end consumers? This course examines how to design and manage environmentally and socially responsible operations and supply chains.

NRE 526	Erb Institute Seminar	Graduate	Sustainability Focused	Business (Ross), Environment and Sustainability	This Seminar surveys the integration of natural and human systems and addresses ways in which science and business can move towards a sustainable human future. It is designed to enable new and prospective Erb MS/MBA students to 1) discover what each believes about sustainable development and enterprise; 2) pinpoint what each wants to know and endeavor to learn while in the program; and 3) facilitate careful reflection about each student's future path through life and work, after they graduate. The Seminar is oriented around the Millenium Ecosystem Assessment (MA), a four year study, completed in 2005, that brought together nearly 1,400 experts from 95 countries to conduct a global inventory of the state of our ecosystems, quantify the effect that human activities are having on them and make suggestions for the future. In exploring the results of the MA, students will be introduced to a range of U of M faculty members, external practitioners, and the newly emerging theory and practice of sustainability. In addition to its cirricular objectives, the Seminar aims to collectively bond the entering Erb Institute class, both intellectually and socially.
NRE 527	Energy Markets & Energy Politics	Graduate	Sustainability Focused	Business (Ross), Environment and Sustainability	The goal of this course is to give students a solid grasp of the environmental and social impacts of, and the institutions that govern, energy use, so that you can play a more effective role in shaping future policy or business decisions. We will begin with basic scientific and technological facts regarding the major uses for and sources of energy. We will then study energy markets (including spot and future markets), and what they are capable of accomplishing; we will also study the ways energy markets may fail. This will lead into an overview of the role of government in influencing energy decisions, starting with a high-level perspective, and then working with a series of case studies that examine in depth what government has accomplished in the area of energy policy. The course will wrap up with several current policy/business issues such as renewable portfolio standards, markets for renewable energy credits, and integrating the transportation sector into a cap-and-trade system for greenhouse gas emisisions.
BA 605	Green Development	Graduate	Sustainability Focused	Business (Ross), Environment and Sustainability	The built environment is a major source of society's environment impact; and is a major opportunity to find solutions. This course explores green development from a variety of perspectives: energy, heating, water use, construction processes, architectural design, site planning, brownfield development and others.
EDUC 649	Foundational Perspectives on Educational Reform	Graduate	Sustainability Focused	Education	Critically examines selected contemporary reform efforts in education from the perspective of one or more of the foundation disciplines. Aims to develop in the career educator a broader and deeper understanding of the tensions between ideas and practice in dynamic social environments. Graduate course required of all new Educational Studies masterâ€™s students.
EDUC 650	Reflective Teaching Field Experience	Graduate	Sustainability Focused	Education	Introduces preservice teachers to school settings where observation, inquiry, and participation in the processes of teaching and learning are possible. Provides opportunities for the development of instructional strategies and teaching practices, as well as for inquiry into the contexts of classrooms and schools.
EDUC 652	Directed Teaching in the Secondary School	Graduate	Sustainability Focused	Education	Guides observation and teaching in secondary school classrooms, as well as involvement in other roles of the secondary school teacher under the joint supervision of university and public school personnel.
EDUC 654	Problems and Principles of Secondary Education	Graduate	Sustainability Focused	Education	Draws upon the resources found in the directed teaching environment; considers problems and issues in the four broad areas: students in the schools, the teacher's professional responsibilities, curriculum understandings, and administrative/organization problems.
ESENG 503	Energy Systems Engineering Project	Graduate	Sustainability Focused	Engineering	This required project course is intended to provide students with a relevant experience in energy systems
ENGR 520	Entrepreneurial Business Fundamentals for Engineers and Scientists	Graduate	Sustainability Focused	Engineering	This course provides students with a perspective in looking to form or join startup companies and those that are looking to create corporate value via industrial research. Â The students are taught the entrepreneurial business development screening tools necessary to translate opportunities into businesses with focus on: Â strategy, finance, and market positioning.
CEE 592	Biological Processes in Environmental Engineering	Graduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Theoretical principles, qualitative and quantitative description of suspended growth and biofilm processes, as applicable to wastewater treatment and the bioremediation of soils, sediments and groundwater. Bioremediation processes discussed include bioventing and biosparging, in situ intrinsic and enhanced bioremediation of chlorinated and nonchlorinated compounds.
CEE 549	Geoenvironmental Engineering	Graduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Waste generation/disposal; waste types; waste facilities regulations; geoenvironmental site characterization; soil-water-contaminant interactions; design and construction of base and cover containment systems; geosynthetic materials in geoenvironmental applications; landfill settlement and stability; introduction to bioreactor landfills and emerging technologies for waste disposal; technologies for site restoration and cleanup.
CEE 686	Case Studies in Environmental Sustainability	Graduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Case studies focusing on utilization of principles of environmental sustainability in professional practice. Development of environmental literacy through study of both current and historical environmental issues.
CEE 565	Seminars on Energy Systems, Technology and Policy	Graduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Leaders in policy and energy systems engineering discuss cutting-edge technologies, and critical barriers in their disciplines. Speakers range from research leaders, to business leaders, to policy makers. The aim of the seminar series is to provide a view at multiple scales, of challenges in developing and implementing new energy technologies. Industrial, governmental, and research perspectives will be given, on the most promising technologies and policies which will shape our energy portfolio and its environmental consequences, in the decades to come. The need to create sustainable energy systems is a common theme, and the speakers will offer their own perspectives on how policy and technology can be effective in doing so.

CEE 572	Dynamic Infrastructure Systems	Graduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Introduction to the fundamentals of dynamic system theory applied to infrastructure systems including system modeling as well as monitoring controlling structural, transportation, hydraulic, and electrical grid systems. Â Continuous-time and discrete-time linear systems are emphasized by elementary concepts in nonlinear systems are also presented.
CLIMATE 530	Engineering Climate Change	Graduate	Sustainability Focused	Engineering Â» Climate & Space Sciences	This seminar aims at gaining a better understanding of global climate change and its possible impacts. Current issues will be discussed, including development of sustainable energy production, biotic and human influences on environmental balance, and strategic approaches to minimizing the impact of global change.
EECS 529	Semi Lasers & Leds	Graduate	Sustainability Focused	Engineering Â» Electrical Eng. and Comp. Sci.	This course covers advanced and state-of-the-art topics in modern optoelectronic devices including semiconductor lasers, light-emitting diodes (LEDs), photodetectors, solar cells, and optical modulators. Familiarity with the Maxwell's equations and semiconductor pn junctions at the undergraduate level is assumed.
IOE 537	Ergonomics for Inclusive Design	Graduate	Sustainability Focused	Engineering Â» Industrial and Operations Engineering	Population again, obesity and disability prevalence has increased the profile of inclusive design as an approach to accommodating the broad spectrum of human physical, perceptual and cognitive abilities. This course is a graduate-level study of contemporary ergonomics research methods for examining human performance variability associated with again, disability and health-related factors and its relevance to inclusive systems engineering and design.
MECHENG 589	Sustainable Design of Technology Systems	Graduate	Sustainability Focused	Engineering Â» Mechanical Engineering	Scientific perspectives on grand challenges to environment and society created by the production of energy, water, materials, and emissions to support modern life styles. Integration of economic indicators with life cycle environmental and social metrics for evaluating technology systems. Case studies: sustainable design of consumer products, manufacturing, and infrastructure systems.
MECHENG 569	Control of Advanced Powertrain Systems	Graduate	Sustainability Focused	Engineering Â» Mechanical Engineering	This course will cover essential aspects of electronic engine control for spark ignition (gasoline) and compression ignition (diesel) engines followed by recent control developments for direct injection, camless actuation, active boosting technologies, hybrid-electric, and fuel cell power generation. Â Will review system identification, averaging, feedforward, feedback, multivariable (multiple SISO and MIMO), estimation, dynamic programming, and optimal control techniques.
MECHENG 571	Energy Generation & Storage Using Modern Materials	Graduate	Sustainability Focused	Engineering Â» Mechanical Engineering	Energy and power densities previously unattainable in environmentally friendly energy technologies have been achieved through use of novel materials. Insertion of new materials into power supplies has changed the landscape of options. Design strategies for power systems are described, in the context of growing global demand for power and energy.
AUTO 533	Advanced Energy Solutions	Graduate	Sustainability Focused	Engineering Â» Mechanical Engineering	Introduction to the challenges of power generation for a global society using thermodynamics to understand basic principles and technology limitations. Covers current and future demands for energy; methods of power generation including fossil fuel, solar, wind, and nuclear; associated detrimental by-products; and advanced strategies to improve power densities, efficiencies and emissions.
MECHENG 565	Battery Systems and Control	Graduate	Sustainability Focused	Engineering Â» Mechanical Engineering	This course covers battery modeling, control and diagnostic methodologies associated to battery electric and battery hybrid electric vehicles. Emphasis is placed upon system-level modeling, model order reduction from micro-scale to macro-scale and surrogate models for load control, estimation, on-board identification and diagnostics for Lithium Ion batteries.
NAVARCH 540	Marine Dynamics III	Graduate	Sustainability Focused	Engineering Â» Naval Arch. & Marine Eng.	Fundamental analysis of marine dynamical systems. Â Normal mode analysis. Matrix representation of frequency domain seakeeping equations. Â Properties of linear gravity waves. Â Wave forces on marine structures. Â Linear and non-linear time domain seakeeping, and maneuvering simulations. Â Nonlinear stability and bifurcation theory applied to mooring and capsizing. Â Shock mitigation.
NAVARCH 551	Offshore Engineering I	Graduate	Sustainability Focused	Engineering Â» Naval Arch. & Marine Eng.	Introduction to hydrodynamic loads on offshore platforms. Â Detailed study of forces on slender bodies - risers, pipelines, cables. Â Morison's equation. Flow induced motions, vortex induced vibrations, galloping. Â Two-cylinder flows. Â Mathematical modeling experiments, data processing. Marine hydrokinetic energy harnessing.
EAS 641	Social Research Methods in Environment and Sustainability	Graduate	Sustainability Focused	Environment and Sustainability	This course in intended for students who are likely to engage in reseach of any kind, formal or informal, that is concerned with people and the environment. Major emphasis on is placed on conceptualization - on going from a topic of interest to measurable constructs. A focus on anticipating possible outcomes and possible alternative interpretations leads to consideration of various research designs and strategies. A concern for ethical and humane research is examined in terms of the researcher's role both with respect to participants and the ultimate recipients of the information.
EAS 701	Master's Project	Graduate	Sustainability Focused	Environment and Sustainability	A Masterâ€™s Project is an interdisciplinary group project in which students work closely with a faculty advisor to analyze and propose solutions to a real-world environmental problem. Typically projects involve a 12- to -16 month process of problem definition, research, analysis, writing and presentation aimed at solving a problem or satisfying a need faced by a client. Each project requires individual and group analysis and reporting. Hence, projects develop abilities around content knowledge and analysis, as well as mechanisms to work effectively in teams through a group problem-solving process. Projects typically produce: Content learning (renewable energy, sustainable growth, biodiversity conservation, etc) Analytical skills (spatial analysis, design, statistical analysis, surveys, financial modeling, etc) Professional skills (writing, professional communications, evaluation ,etc) Process knowledge (team-building, facilitation, negotiation, etc) Client contacts and networks

EAS 639	Advanced Seminar in Resource Ecology	Graduate	Sustainability Focused	Environment and Sustainability	Topics include current leading-edge problems in various resource ecology related areas considered essential to a distinctive and challenging research program for doctoral and advanced masters students.
NRE 533	Negotiating Skills In Environmental Dispute Resolution	Graduate	Sustainability Focused	Environment and Sustainability	Covers bargaining and negotiation as they can be applied to the resolution of environmental disputes. It will help a student prepare for and carry out a negotiation, become a more effective communicator, and understand the psychological dimensions inherent in negotiation processes. In addition, the courses examines mechanisms for assisting negotiations including facilitation and mediation. The course employs a series of gaming simulations that allow students to engage in controlled bargaining situations, followed by debriefings that critique strategy and styles. In addition, a framework for negotiation analysis is developed that draws on literature in the areas of decision analysis, social psychology, and public policy. This course is a half-term module.
NRE 513	Strategies for Sustainable Development	Graduate	Sustainability Focused	Environment and Sustainability	This course deals with environmental issues from a strategic perspective. It focuses on how environmental pressures (e.g. sustainable development) and environmental problems (e.g. global warming, air pollution, waste-disposal), impact corporate mission, competitive strategy, technology choices, product development decisions, and production processes. Basic concepts of ecology and environmental science are discussed and contrasted to those associated with the traditional economic paradigm.
NRE 565	Principles of Sustainability	Graduate	Sustainability Focused	Environment and Sustainability	Principles for Sustainability --- What would an economy, indeed a society, look like if the material security of its citizens and the ecological integrity of its resource base was a top priority? How would it organize itself, structure its industry, shape its consumption? How would a local-global culture operate if no party could solve its environmental problems by displacing costs onto others? What are the conditions in which humans tend not to increase their use of material and energy? To answer questions like these, many people use terms like "sustainability" and "sustainable development." These terms are much debated, much used, and much abused. Some would even say they have lost all meaning. This course addresses these questions and attempts to give meaning to sustainability, both in its implications for reversing trends in environmental degradation and for promoting policies that address long-term, ecological and social goals. It does this by developing a framework of analysis focusing on: i. institutions, formal and informal rules and norms ranging from the local and regional to the international and global; and ii. sustainability, issues of durable resource use, production and consumption, property, development, local-glo
NRE 566	Public Opinion and the Environment	Graduate	Sustainability Focused	Environment and Sustainability	Examines trends in public opinion on the environment, influences on peoples concerns about the environment, and how such concerns affect personal behaviors and the political process. Specifically, the objectives will be to: 1. Examine the extent of concern for the environment in society. 2. Understand what influences peoples concerns about the environment. 3. Determine whether concern varies for different subgroups in society. 4. Assess the impact peoples concerns have on the actions they take (political actions and personal behaviors). 5. Assess the impact public opinion on the environment has on the political process. 6. Examine the environmental attitudes of policy makers. 7. Predict where public opinion on the environment is likely to head in the future.
NRE 589	Ecological Restoration	Graduate	Sustainability Focused	Environment and Sustainability	Designed to provide a practical overview of various facets of ecological restoration, particularly as related to restoring and managing the kinds of habitats found in Southeastern Michigan and the upper Midwest. Through a combination of lectures, readings, field trips, and project work, we will examine background theory and issues relating to ecological restoration and attempt to develop approaches for solving specific problems associated with local habitats. While most of the examples we will study will be local, the principles and processes will have applications world-wide.
EAS 593	Environmental Justice: Research & Policy Developments	Graduate	Sustainability Focused	Environment and Sustainability	Examine current research on the topic of environmental justice, including the evidence concerning the occurrence of environmental injustices, explanation for this phenomenon, and how affected groups and government have responded. The course will also explore solutions to the problem.
NRE 550	Systems Thinking for Sustainable Development and Enterprise	Graduate	Sustainability Focused	Environment and Sustainability	Systems Thinking for Sustainable Enterprise --- This course develops critical skills of systems thinking and systems dynamics modeling, applies them to challenges of global environmental and social change, and deduces strategic implications for organizations operating globally.
EAS 563	International Environmental Policy	Graduate	Sustainability Focused	Environment and Sustainability	The Politics of Nature and Resources in the Developing World --- The objective is to provide students with a survey of the environmental governance mechanisms and the changing landscape of environmental policy that shapes environmental outcomes in the developing world. We aim to involve students closely in reading and learning from assigned readings, encourage participatory learning, and use simulation exercises where appropriate to promote student involvement.

EAS 547	Forest Ecology in a Changing World	Graduate	Sustainability Focused	Environment and Sustainability	Â In this course we will cover the basic concepts in ecology as they apply to forests in the context of current forest ecology research.Â We will study the biological and ecological bases behind the current challenges forest ecosystems face under global change (i.e., climate change, landscape fragmentation, pollution, introduced species).Â We will also review the role and impact of humans on these communities, focusing on the services forests ecosystems provide and the emergence of urban ecology. Part of the course will involve critical discussions of current literature in the field.Â Students will subscribe to the email alerts of major ecological journals and present summaries of published work related to the topics we are covering to the class on a regular basis.Â Labs will consist on field trips during the first half of semester and wet-labs and computer labs during the second half.Â For these labs we will have the opportunity to collect and analyze field data and then learn about all the steps required in the scientific process.Â The projects will involve sampling of forest biodiversity, estimation of tree species demographic parameters, and measurement of forest carbon pools.Â Data collected in the field will be processed in the lab and analyzed during the computer labs.Â The goal of the computer labs will be to develop basic predictive models that will allow us to forecast the structure and composition of future forests.
EAS 597	Environmental Systems Analysis	Graduate	Sustainability Focused	Environment and Sustainability	Â This course takes a systems approach to environmental issues, with particular emphasis on problems with conflicting objectives such as economic and environmental concerns. Optimal solutions will be obtained mathematically using a variety of linear and non-linear techniques. Example problems span traditional environmental engineering processes, proactive management of resources, and issues in green design. The purpose of the course is to provide a rigorous mathematical framework for addressing environmental problems. By the end of the course students will be able to define systems and their boundaries, translate problems into mathematical frameworks, apply linear algebra, not appropriate algorithms, optimize systems for a set of constraints and objectives, and define a solution given conflicting objectives.
EAS 564	Localization: Transitional Thinking for the New Normal	Graduate	Sustainability Focused	Environment and Sustainability	However vast were the resources used to create industrial civilization, they were never limitless.Â Biophysical constraints, always a part of human existence, could be ignored for these past few centuries, a one-time era of resource abundance.Â This is no longer possible.Â We can accept that transition to a different live pattern is inevitable, but the form of our response is not preordained.Â The course develops one plausible response called localization.Â It focuses on place-based living within the limits of nearby natural systems.Â The course covers the drivers of localization and examples in practice.Â It also introduces the philosophies of localization and the tools needed to make the transition peaceful, democratic, just and resilient.
EAS 568	Reconnect and Revitalize	Graduate	Sustainability Focused	Environment and Sustainability	Reconnect and Revitalize: Â Transitional Thinking for the New Normal --- Faced with a great many environmental challenges, it has become urgent that we transition to a sustainable life pattern. Â While this is a necessary change, it may be a difficult transition at first. Â There are however, several unexpected aspects to recommend it. Â The course discusses how a life of voluntary frugality increases the long-term physical and psychological well-being of people. Â The course examines how the coming transition reconnects people with the natural world in unexpected ways, revitalizing mental clarity, and restoring natural and social systems, especially those that directly provide for our physical sustenance.
NRE 552	Ecosystem Services	Graduate	Sustainability Focused	Environment and Sustainability	This course will evaluate the scientific, economic, and socio-political basis for Ecosystem Services.Â Ecosystem Services - sometimes referred to as Earth's 'Natural Capital' - represent the sum of all goods and services that natural and managed ecosystems provide to humanity.Â These services include direct provisioning of goods like food, wood, and freshwater, regulating services such as climate regulation or pest and disease control, and cultural services such as recreation and tourism.Â The idea that ecosystems have natural capital has become increasingly prominent over the past decade as scientists, economists, and politicians have considered how to account for the values of ecosystems that are not included in traditional economic markets.Â This class will explore the ways in which ecosystem services are measured and related to basic ecological processes, how those services are valued and monetized by society, and how services are managed and encouraged by policy and law.Â Theoretical and practical concepts will be reinforced by student-led case studies that provide 'real-world' examples of ecosystem services being valued, including payment for ecosystem services projects, biodiversity offsets, certification schemes, and REDD+.
EAS 573	Environmental Footprinting and Input-Output Analysis	Graduate	Sustainability Focused	Environment and Sustainability	Environmental footprints characterize the impacts on the environment driven by human consumption activities throughout the whole supply chain. This course introduces theories and concepts of environmental footprints, methods and tools to quantify environmental footprints of consumption activities at the nation and international scales, and applications such as carbon footprints and hybrid life cycle analysis. The key objective of this course is to introduce the input-output analysis (IOA) framework and its application in environmental footprinting. The first part of the course aims to develop a conceptual and practical understanding of IOA. The second part of the course demonstrates how to apply basic IOA framework and its various modifications to examine environmental footprints of consumption and trade. Upon completing this course, students are expected to have a good understanding of production systems, global supply chains, and their impacts on the environment.

NRE 549	Analysis and Modeling of Ecological Data	Graduate	Sustainability Focused	Environment and Sustainability	This course will consist on an overview of standard and innovative techniques in ecological data analysis and modeling. Â Topics will include: linear regression, mixed effects models (fixed and random effects), maximum likelihood, general linear models and general additive models, survival analysis, time series, spatial analysis and Bayesian and hierarchical Bayesian approaches. Â This course is designed for students to work on their own data, or simulated data, related to their research projects or scientific interests. Â While reviewing the major statistical methods used in ecology, students will work on their projects and will be presenting their work to the class along the semester, these presentations will consist on: Â initial exploratory data analysis, selection of statistical analysis or modeling approach. Implementation, and results.
EAS 601	Industrial Ecology Experiential Learning	Graduate	Sustainability Focused	Environment and Sustainability	Â This course allows students pursuing the Graduate Certificate in Industrial Ecology to fulfill the experiential learning requirement using a practice-based activity (e.g., internship or projects related to Industrial Ecology) that has been approved by the program co-directors.
NRE 545	Applied Ecosystem Monitoring	Graduate	Sustainability Focused	Environment and Sustainability	Applied ecosystem modeling makes use of a range of approaches to analyze and assess environmental problems and their potential solutions.Â Some modeling approaches have been developed with specific applied problems in mind, while others were developed as basic science tools and later used for applied questions and concrete issues in management, decision-making, policy, or sustainability science. Â An ecosystem model is one that, at its foundation, represents the cross-scale linkages among ecosystem processes such as production, decomposition, nutrient cycling, carbon balance, water budgets, and ecophysiology.Â These models sometimes also include species dynamics or population-community level processes.Â These models have long been used as tools for synthesis and investigation in basic ecology:Â 25 years ago, the ecosystem concept was voted by the members of the Ecological Society of America as the single most important concept in ecology.Â The past few decades have seen a proliferation in the creation and application of ecosystem models.Â Applications include nutrient eutrophication and Ã¢â‚¬Â“dead zones,Ã¢â‚¬Â invasive species, acid rain, carbon sequestration, control of predator populations, the effects of climate change, forest management for timber or C storage, fisheries, function of riparian zones, wetland management and nutrient retention, and others.Â A recent and exciting development is the linking of ecosystem processes to social and economic processes in the modeling of social-ecological systems to address applied environmental problems such as habitat loss or the provision of ecosystem services in this broader interdisciplinary framework. Â
NRE 539	Landscape Ecology	Graduate	Sustainability Focused	Environment and Sustainability	Landscape ecology is a question-driven discipline in which the central question is 'how does landscape structure affect ecological processes?' This includes ecological processes at the population, community, and ecosystem levels. At the population level, we might ask whether landscape structure affects reproduction of dispersal. As the community level we might ask whether landscape structure affects predator-prey interactions or the success of invasive species. At the ecosystem level we must ask whether landscape structure affects NPP (net primary productivity), evapotranspiration, or carbon sequestration. This is an inquiry-based, evidence- and research-oriented course. We consider the questions that landscape ecology addresses and analyze studies in the primary literature that have addressed these questions. We examine papers that focus on a variety of ecological systems and habitats including wetlands grasslands, forests, and human-dominated, multiple-use landscapes. Assigned readings emphasize current literature but lectures and class discussion will cover topics from some foundational papers and texts.
EAS 537	Urban Sustainability	Graduate	Sustainability Focused	Environment and Sustainability	As engines of capital accumulation, cities have often been viewed as environmental sacrifice zones. Some critics have argued that 'sustainable cities' is an oxymoron. Nonetheless, the debate over sustainable development generally, and sustainable urbanism specifically, has succeeded in reshaping and broadening discourse around cities and Â attendant policies and outcomes-both in industrialized and industrializing countries. Implying that sustainable use of natural resources involves social justice and economic development as well as environmental concerns, the notion of sustainability has led away from narrower conceptions of urban environmentalism, toward more consideration for the future, greater integration of social and economic goals with environmental and ecological objectives, and hence a fundamental rethinking of how cities should be theorized, planned and managed. This course introduces students to the emerging field of urban sustainability from multiple disciplinary perspectives, primarily industrial ecology, urban political ecology, and urban planning. The course provides students with the theoretical and methodological tools in which to explore the potential for a sustainable urbanism. Approaches to foster more sustainable and resilient forms of urbanization and urban life, from localization's to dematerialization, are introduced and evaluated. Course deliverables include a mid-term exam, a group case-project, and three writing responses. A field trip to Detroit and meetings with stakeholders also form course components.
EAS 750	Urban Design Studio	Graduate	Sustainability Focused	Environment and Sustainability	This studio aims to further develop skills in conceptualization and visualization through consideration of contemporary urban design issues. It includes documentation and analysis of urban form and process, and explores site planning and design of the public realm. Issues of local and regional identity and sustainability inform the approach of the studio. Development of a portfolio will be a requirement of the course.
EAS 518	Wildlife Ecology and Management	Graduate	Sustainability Focused	Environment and Sustainability	Â This course focuses on the ecological processes and conservation management tools relevant to the survival of free-ranging mammal, bird, reptile and amphibian populations. Students will utilize a diversity of approaches ranging from field research to computer exercises to address wildlife ecology, management and conversation issues. Topics that will be discusses include wildlife habitat assessment, population abundance and density estimates, nutritional ecology, wildlife disease management, as well as endangered species restoration, both in a US and international context.

EAS 615	Renewable Electricity and the Grid	Graduate	Sustainability Focused	Environment and Sustainability	Due to technological advancement and supportive policies, renewable energy technologies such as wind turbines and solar panels make up a growing share of the generation mix. Bringing renewable energy to market requires an understanding of such generation technologies, grid operations and integration, resource availability, and project development.The objective of this course is to aide professional students in the development of skills, practical tools, and a knowledge base useful for careers in the energy sector, spanning project development, utilities, research, government, and environmental non-profits. This course will build an understanding of the technical, economic, and policy issues related to renewable electricity development and grid integration. Projects and problem sets will be structured from the point of view of various stakeholders and intended to introduce skills and concepts that environmental professionals employ. Upon completion of this course, students will have the ability to critically evaluate options for generation development and policies which impact the power sector.
URP 542	Environmental Planning: Issues & Concepts	Graduate	Sustainability Focused	Environment and Sustainability, Arch. and U.P. (Taubman) Â» Urban and Regional Planning	This is an introductory graduate-level course on the issues and concepts underlying environmental policy-making and planning, with a focus on the United States. Rather than concentrating on one particular type of planning method (e.g., cost-benefit analysis, impact assessment, site design), the course is designed to address recurrent value-based and analytical conflicts that cross the array of various environmental policy-making and planning processes employed in the U.S. and abroad. The principal goal of the course is to provide students with the knowledge and skills they will need to be thoughtful and creative professional capable of recognizing the key disjunctions in communication and analysis that often hinder the achievement of effective and satisfying environmental policy and planning solutions. The course is designed to: provide students the ability to recognize and tease apart the competing values and analytical assumptions made by various stakeholders in environmental policy-making and planning debates; consider how those debates are shaped by and play themselves out within the political, legal, and administrative processes that characterize environmental policy-making and planning in the U.S.; and familiarize students with the various forms of contemporary environmental policy-making and planning practice that they will likely encounter in their professional work.
RCNSCI 419	Sustainable Energy Systems	Graduate	Sustainability Focused	Environment and Sustainability, Public Policy (Ford)	Assessment of the current energy systems that encompasses resource extraction, conversion processes and end-uses. Sustainability is examined by studying global and regional environmental impacts, economics, energy efficiency, consumption patterns and energy policy.
LAW 679	Environmental Law and Policy	Graduate	Sustainability Focused	Law	This course addresses legislative, regulatory, and policy efforts to prevent harmful pollution within the practical and political constraints of an industrialized society.Â The course begins with a consideration of the core concepts involved in environmental protection, including common-law doctrinal antecedents and early efforts to address pollution in the United States.Â The course then addresses the major federal environmental statutes, including the Resource Conservation and Recovery Act, the Clean Water Act, and the Clean Air Act.Â We consider doctrinal and theoretical issues in environmental regulation, as well as challenges that emerge in the interpretation, implementation and enforcement of a complex statutory and regulatory scheme. The course includes case studies from the federal environmental program.Â The course concludes with an introduction to the topic of global climate change.
LAW 805	Environmental Justice	Graduate	Sustainability Focused	Law	In this seminar we will explore the intersection of social justice and environmental protection. The environmental justice movement coalesced in the early 1980's around allegations that facilities posing environmental risks were disproportionately located in poor communities and communities of color. The movement gained national attention when the United States General Accounting Office and the United Church of Christ Commission for Racial Justice released studies showing a correlation between hazardous waste sites, people of color, and the poor. The Church of Christ study found that race was the most significant factor in predicting the location of a commercial hazardous waste facility; the next most significant factor was income. Controversy--and criticism of the studies--ensued. From these beginnings, we will discuss both the theoretical and practical questions surrounding environmental justice. What types of justice are sought and how can they be measured? How does the environmental justice approach differ from the approach taken by the "traditional" environmental movement? What kinds of strategies and tools (both legal and non-legal) have been employed, and have they been successful? How have federal and state governments responded to environmental justice concerns? Finally, we will consider how the principles of environmental justice have been applied to the pressing issue of climate change.
LAW 575	Natural Resources Law	Graduate	Sustainability Focused	Law	Natural Resources Law provides an overview of American law having to do with the ownership and development of natural resources such as surface water (under both prior appropriations and riparian legal systems), groundwater, wetlands, minerals, forests, wind, solar, fish and wildlife. It covers the development of these resources on private and publicly-owned lands and the relevant environmental safeguards such as the National Environmental Policy Act, Federal Lands Protection and Management Protection Act, Wilderness Act, Endangered Species Act and similar state laws. The course includes an examination of the constitutional protections available to private property owners and of the administrative remedies and processes available to those who would develop and those who would preserve different types of natural resources. There are no prerequisites, although familiarity with property law and constitutional law would be helpful.

LAW 671	Climate Change and the Law	Graduate	Sustainability Focused	Law	Climate change will emerge in the decades ahead as one of the most significant challenges facing our Nation and the world. Â The evidence that human activity is altering the climate--with potentially catastrophic effects--is largely unchallenged in the scientific community, yet remains the source of significant controversy from a legal and policy perspective. Â This course will consider the evidence that the climate is changing, through readings and guest lectures, and then will focus on legal efforts to address climate change both in the United States and through international treaties. Â We will consider recent Supreme Court cases, regulatory efforts under the Clean Air Act, regional cap and trade programs, and efforts through citizen suits to compel government action using nuisance law and the public trust doctrine. Â We will examine the role of the United Nations process, culminating in the Paris Accords, and how corporate sustainability efforts contribute to climate change mitigation and adaption efforts.
LAW 741	Interdisciplinary Problem Solving	Graduate	Sustainability Focused	Law	"Interdisciplinary Problem Solving" is a course offered at the Law School through the Problem Solving Initiative (PSI). (https://problemsolving.law.umich.edu/) Â Through a team-based, experiential, and interdisciplinary learning model, small groups of U-M graduate and professional students work with faculty to explore and offer solutions to emerging, complex problems.
EPID 666	Health & Socioeconomic Development	Graduate	Sustainability Focused	Literature, Science, & Arts Â» Afroamerican and African Studies, Public Health Â» Epidemiology	Reviews links between health conditions and socioeconomic development in low-income countries and trends in health and development indicators; socio-economic determinants of health, including poverty and income, education, nutrition, fertility, and culture and behavior; impact of globalization in terms of neo-liberal policies, trade and capital flows and the urbanization and their growth of the informal economy; examines the effects of health changes on economic growth and development.
EARTH 542	Seminar in Environmental Geochemistry	Graduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This seminar will provide an in-depth investigation of various topics in environmental geochemistry. Â The field is inherently interdisciplinary and will include concepts and readings from environmental engineering, atmospheric chemisty, geology, and geochemistry. Â Participants will be expected to read and actively discuss current scientific papers.
EHS 570	Water Quality Management	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Principles of science and engineering used in the evaluation and control of water quality. Includes current legislation, types of pollution, sources and nature of pollution, introduction to water quality management practices, water supply and treatment, hydrologic concepts, effects of waste discharge on receiving waters, lake management, and water quality criteria and standards.
EHS 668	Professional Seminar in Occupational Health	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Seminars in contemporary occupational health topics and issues. Presentations by noted authorities from industry, labor organizations, governments, and academia.
EHS 624	Mechanisms of Neurotoxicology	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Analysis and integration of scientific information to enhance understanding of molecular and cellular mechanisms of neurotoxicity. Emphasis is on student discussion of theoretical and practical aspects of mechanistic studies based on assigned reading from the scientific literature.
EHS 697	Readings	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Supervised study/review of a selected topic in environmental health, occupational health, nutrition and/or toxicology. May be elected more than once for a maximum of six credits.
ENS 604	Professional Perspectives in Environmental Health	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	This project-oriented course provides the student the opportunity to integrate academic principles, practical skills and concepts in environmental health as related to the broader scope of public health. Â Students will carry out a 2 credit hour applied group project, having to synthesize their acquired knowledge from different courses and subplans to address real world problems. Students will provide oral presentation (intermediary and final) and written reports on the conducted project. This culminating capstone course will be elected during the professional students last fall term in residence.
EHS 612	Biochemical and Molecular Toxicology	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	The objective of this course is to provide an in-depth analysis of the biochemical and molecular pathways altered in cells and organisms through exposure to environmental and therapeutic chemicals. Â The content is directed toward the needs of doctoral and masters students in the basic biomedical sciences involved in laboratory research projects. Â Topics will cover areas of modern research emphasis and focus on how chemicals act to disturb cellular processes through interaction with cellular receptors, ion channels, transporters, signal transduction pathways, transcription factors, metabolic pathways, enzymes, cytoskeletal elements and other macromolecular targets. Â Specific information about the latest theories on the regulation and initiation of cell death, mediation of toxicity through herdox status and oxidative stress, mechanisms of carcinogenesis, genotoxicity and immunotoxicology will also be discussed.
EHS 614	Water & Global Health	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Poor water quality, insufficient quantity and inadequate access to water are among the most serious threats to human health worldwide.Â This course analyzes the historical and contemporary roles that water plays on global health.Â Key drivers that affect water quality and quantity (with linkages to human impacts) are investigated, including agriculture, climate change, population growth and urbanization, national resources, international trade, and regional conflicts.Â Both theoretical and practical methods are used to examine real world cases.Â A systems framework is used to develop sustainable and appropriate solutions that consider individual, social, technological, and institutional factors.
EHS 674	Environmental and Health Risk Modeling	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	This course uses a hands-on approach to experiment and interpret modeling techniques applied to environmental health assessment. Â It first addresses steady-state multimedia modeling, exposure modeling, dermal uptake and pharmacokinetic modeling. Â It then expands the theory to dynamic modeling and Monte-Carlo Approaches applied to probabilistic risk assessment.

EHS 540	Sustainability and Environmental Health	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	This course links environmental health and sustainability issues with the goal of developing sustainable strategies. It addresses environmental health determinants, underlying drivers and stressors, environmental metrics, exposures and impacts, assessment tools, and sustainable solutions. These concepts are applied to sustainable and healthy cities, transportation, food, energy, and consumer product systems.
NUTR 555	Foundations of Sustainable Food Systems	Graduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	Foundations of Sustainable Food Systems:Â This course teaches about food systems through interdisciplinary, experiential learning and dialogue-based inquiry. In addition to learning how to bridge worldviews and apply systems thinking, students will study the unique perspectives of public health nutritionists involved in addressing complex food systems problems.
EPID 768	Global Health Issues and Dynamics	Graduate	Sustainability Focused	Public Health Â» Epidemiology	This course will review the historical development of innovative ideas in public health and international health and will emphasize the importance to understand the transition from humanitarian assistance to international cooperation. We define GLOBAL HEALTH as a â€œnew dynamic approach of international health based on the analysis of the diversity and trends in the health and living conditions of people and nations, the influence of the political and socioeconomic forces, and the use of this knowledge for the solution of the identified problemsâ€. Global Health is concerned not only with pandemics but also with the challenges represented by poverty, environmental degradation, disasters and emergencies and the impact of violence and conflicts. We will review the basic concepts and the present knowledge and approaches to these issues and some of the most influential strategies like: Health Determinants, the Millennium Development Goals, Health as a Bridge for Peace and the new concept of Human Security.
EPID 617	Social Epidemiology II: Â Social and Economic Determinants of Population Health	Graduate	Sustainability Focused	Public Health Â» Epidemiology	The objective of this course is to examine, in depth, some of the key social determinants of health in populations. Â The course is organized around substantive topics areas (e.g. obesity, disability, mental health, youth and substance abuse, stress and social support, neighborhoods and environments), with a focus on understanding the role of social factors in shaping health. Â The course draws heavily on epidemiological perspectives and methods as tools to improve our understanding of population health, and is designed to expose students to different methodological approaches and their strengths/limitations in defining population health, understanding its determinants, and assessing the mechanisms by which these determinants influence population health.
HBEHED 640	Community Organization for Health Education	Graduate	Sustainability Focused	Public Health Â» Health Behavior & Education	Examines social and structural factors associated with health and illness; concepts and theories regarding planned change and community; and models and principles of community organization practice for health education. Several models of community organization are analyzed along the dimensions of: community diagnosis needs assessment, selection and implementation of action strategies, evaluation research, role of the professional and ethical considerations.
HBEHED 733	Community-Based Participatory Research	Graduate	Sustainability Focused	Public Health Â» Health Behavior & Education, Public Health	The involvement of community members in research and scholarship has emerged as a critical component for public health research. This doctoral student seminar focuses on the ways in which researchers and community members collaborate to conduct research that leads to community change, and improvement in health and quality of life. Such efforts often call for clarifications and/or redefinitions of: scientists' roles and methods, the knowledge development roles or participating community members, and the varying meaning of "community." Attention will be paid to scholarly debates, practical, and methodological issues in the conduct of community-based participatory research. This seminar will address the major issues and methods involved in conducting community-based participatory research across different disciplines. It provides the opportunity for graduate students from different schools and departments to come together to share perspectives, develop new skills and explore how they can apply this learning to community-based participatory research projects.
PUBPOL 750	Topics: Psychology of Climate Change	Graduate	Sustainability Focused	Public Policy (Ford)	From climate change, to habitat destruction, to overconsumption of natural resources, many of the world's most pressing environmental problems are the result of human behavior. If we want to solve or mitigate these problems, we must first understand what is driving these behaviors. Do people act in environmentally harmful ways because they don't know better? Is it because they doubt that scientists, politicians, or activists are telling them the truth about environmental risks? Do they not see themselves as environmentalists? Do they think their actions won't make a difference? How can we get around these types of barriers to improve environmental policies? Most policy to address environmental issues has thus far focused on legal or economic incentives such as prohibiting certain forms of pollution or giving subsidies for renewable energy. In this policy seminar, we will examine an alternative framework for motivating environmentally-friendly behavior: psychological and social incentives. Although this class will mainly cover environmental issues, the psychological tools we will discuss are used in other domains as well, so will be useful to students interested in a range of policy topics.We will explore factors affecting environmental beliefs and behaviors, including reactions to and support for environmental policies. The focus will be primarily on the US, and we will discuss policy programs and private interventions that have incorporated social psychological research to promote pro-environmental behaviors and as well as potential new applications of this research. A particular focus will be on the psychological principles at play in the polarized realm of climate change.
PUBPOL 534	The Economics of Developing Countries	Graduate	Sustainability Focused	Public Policy (Ford)	Surveys what we do and don't know about economic growth and poverty alleviation in developing countries. We begin by discussing alternative perspectives on the goals of development. The substantive sections of the course address specific topics relevant to developing countries, such as: technology and growth; international trade and investment; international migration and remittances; coping with risk; public health and education; corruption and governance; and public finance.

PUBPOL 715	Public Budgeting and Financial Planning	Graduate	Sustainability Focused	Public Policy (Ford)	Budgeting and financial planning impact nearly all aspects of organizational life in the public service arena. Indeed, few politicians and administrators are ever successful in accomplishing their goals without significant knowledge (or even mastery) of the budgeting process. Â This course focuses on understanding the theoretical foundations and hands-on applications related to budgeting. Â The course is organized into four major themes: Â (1) budge process and policy reform; (2) operating and capital budget development; (3) planning and program analysis; and (4) performance management. Â The course will utilize examples and exercises related to federal, state and local, and nonprofit organizations. Â In addition, the instructor periodically relies on speakers that are practitioner and consultants that work in the budgeting field.
PUBPOL 564	Government Regulation of Industry and Environment	Graduate	Sustainability Focused	Public Policy (Ford)	Government Regulation of Industry and Environment --- Basic economic principles and methods are used to identify the circumstances in which government intervention can improve industrial efficiency, and to investigate successful and unsuccessful regulatory strategies. The course will cover a range of topics in economic and environmental regulation including natural monopolies, market power and antitrust, market-based environmental policy instruments, and the impact of regulation on technological innovation. Examples will be drawn mainly from electricity and utilities, oil and gas, telecommunications, and transportation industries.
PUBPOL 717	Social Activism, Democracy, and Globalization from the Perspective of the Global South	Graduate	Sustainability Focused	Public Policy (Ford)	How are the inherent and intersecting relations of power including inherent structures of dominance related to the experience of violence, oppression and resistance textured into the context of politics and policy making? Â This course investigates how multifaceted historical relationships of traumatic experience including Colonization, Slavery and Apartheid can be related to the ways in which we think about policy. Â This course takes a multidisciplinary approach to how the production of culture, ecology, psychology, law, economics and politics frames the sociology and historiography of the policymaking context. Â This course provides the opportunity for student's to improve their analytical abilities. Â Whilst the material content used in this course will have a global focus local issues will also be considered.
SW 814	Community Intervention	Graduate	Sustainability Focused	Social Work	Community interventions are examined as methodologies of planned social change and community practice. The changing context of practice, major models, methods, and the uses of empirically based research to formulate and critically evaluate general practice propositions and action guidelines will be analyzed. Models of planned change to be discussed may include mass mobilization, social action, citizen participation, political advocacy, community education, and neighborhood development. Analysis will include methods of assessing community conditions, formulating strategies, building organizations, activating people, implementing plans, and monitoring and evaluating results. Research and case studies in public and private settings, in health, housing, and other human services, and in a variety of territories from neighborhood to nations will be included. Problems and issues of the economically disadvantaged, minorities, and women, and relevant ethical issues and values will be addressed.
SW 613	Behavioral, Psychosocial and Ecological Aspects of Health and Disease	Graduate	Sustainability Focused	Social Work	This course will survey the distribution, determinants, and psychological and behavioral aspects of health and disease across the life span. Social, economic, environmental, and cultural variations in and determinants of health, disease, and quality of life will be addressed, including the influence of factors such as race, gender, sexual orientation, and biological and genetic factors. Barriers to access and utilization, geopolitical influences, environmental justice, social injustice and racism, historical trends, and future directions will be reviewed. Health beliefs and models of health behavior will be presented, including help-seeking and utilization of health services. Stress, coping and social support, adaptation to chronic illness, the influences of privilege, stigma and discrimination, quality of life, and death and dying will also be covered.
SW 652	Organizing for Social & Political Action	Graduate	Sustainability Focused	Social Work	This course examines methods of organizing people for social and political action on their own behalf or on behalf of others. Students will analyze different approaches to bringing people together for collective action, building organizational capacity, and generating power in the community. The course includes the study of skills in analyzing power structures, formulating action strategies, using conflict and persuasive tactics, challenging oppressive structures, conducting community campaigns, using political advocacy as a form of mobilization, and understanding contemporary social issues as they affect oppressed and disadvantaged communities. Special emphasis will be placed on organizing communities of color, women, LGBT populations, and other under-represented groups in U.S. society.
SW 650	Community Development	Graduate	Sustainability Focused	Social Work	This course examines methods of community development as a process in which people join together and develop community-based programs and services at the local level to create community change, with or without assistance by outside agencies. It emphasizes ways in which residents can take initiative, contribute to collective action, and help themselves through community-based business and economic development, health and human services, popular education, and housing and neighborhood revitalization projects. It includes innovative examples of community development in urban and rural areas, as well as examples that involve diverse communities of interest taking into account ability, age, class, color, culture, ethnicity, family structure, gender (including gender identity and gender expression), marital status, national origin, race, religion or spirituality, sex, and sexual orientation. Special emphasis is placed on initiatives which involve individuals and families in positive pluralist and multicultural efforts to integrate human, social, economic, and community development to build upon their strengths and assets rather than focus solely on their problems and needs.

SW 674	Community-Based Policy Advocacy	Graduate	Sustainability Focused	Social Work	Community-based policy advocacy will be presented as an empowering process that helps to strengthen intra-group and inter-group solidarity as it challenges and attempts to change oppressive structures, systems, and institutions. In contrast to viewing advocacy in the traditional sense -- as a means by which experts represent group interests in legislative, judicial, and executive settings -- this course will explore ways through which traditionally excluded groups advocate for themselves and, in so doing, help build organizations and develop communities.
EPID 761	Perspectives in Social Epidemiology	Graduate	Sustainability Focused		Social epidemiologists are interested in the distribution of disease in relation gender, race/ethnicity, income/wealth, neighborhoods and other social characteristics. Â This research is challenging due to many obstacles, from conceptual definitions of the exposures to measurement, statistical modeling and causal inference. Â This course will provide a wide-ranging discussion of these problems along with modern approaches to overcome them. Â Topics include directed acyclic graphs, causal modeling, instrumental variables, and multilevel models. Â Classes will be comprised primarily of lectures and discussions, with analytic examples demonstrated using Stata software.
ARCH 425	Sustainable Systems II	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	This introductory course addresses human needs and comfort in relation to the natural and man-made environments. Specific topics include: daylighting and electrical lighting systems, building acoustics, code requirements for energy conservation, communication systems, and elevator systems.
ARCH 402	Arch Design	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	The sequence begins as small scale studio problems that deal with space, measure, structure, site, tectonics, program, and habitation while addressing human needs and interaction with the natural and built environment. As students are introduced to and explore the many dimensions of architectural environments, there will also be a focus on the context in which we build, the perception of the built environment, the interrelation of buildings to the existing context, and exterior spaces.
ARCH 412	Architectural Design I	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	The sequence continues in the integration and translation of the knowledge, understanding, experience and skill gained in previous courses into architectural solutions to satisfy given needs, conditions and means. The primary emphasis is the development of insight into the solution of building and environmental design problems: how they are studies (analysis), how they are approached and carried through (process) and how they are conceptualized and developed (synthesis). Assigned projects require the student to consider issues of human scale and behavior, environmental responsibility and building construction at a level of greater complexity than previously encountered.
ARCH 422	Architectural Design II	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	The sequence continues in complexity as most or all of the term is focused on a single design problem. The primary emphasis is in the further development and reinforcement of knowledge, understanding, experience and skill in all aspects of design communication: the analysis and design of an urban site, further comprehension of issues of context and complex building organization and design, and further experience in the application of building science skills.
ARCH 416	Design Fundamentals I	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture	This course introduces the beginning student in architecture to a working understanding of the factors and issues that underlie the translation of human needs and purposes into significant architectural form. Course objectives are: 1. To establish a base of design concepts and knowledge with an introduction to references and ideas to foster independent inquiry. 2. To develop skills in environmental analysis, concept formation, and certain aspects of design. 3. To familiarize students with images of architecture and design drawn from various times and cultures. Specific topics include the basic elements, attributes, and organizational principles of architectural form and their relationship to design intention. Related topics include framework for design, design methods, site analysis and design, human factors, and environmental factors.
ENVIRON 370	Introduction to Urban and Environmental Planning	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Architecture, Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Literature, Science, & Arts Â» Program in the Environment	This overview course explores urban and environmental planning issues and problems, and reviews the ways planners grapple with them. Speakers from within and outside of the University describe the content of the issues and state-of-the-art intervention programs and techniques. Topics covered include the origins and history of urban planning, the legal aspects of planning, planning for sustainable development, metropolitan growth and urban sprawl, urban design, housing and real estate development, transportation planning, environmental planning, planning for open space, and historic preservation, brownfield redevelopment, waste management, and third world development.
UP 425	Urban Systems	Undergraduate	Includes Sustainability	Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Arch. and U.P. (Taubman)	This course introduces students to: 1. the function of cities: the systems of infrastructure (including roads, transit, water and sewer, and IT), land use, and natural environment that together define the physical reality of cities; and 2. the tools of analysis traditionally employed by the urban planner to make sense of these systems, including demography, GIS, statistics, design, and policy analysis. The course provides a practical introduction to how cities work and how planners understand that work. It is NOT a methods course. It introduces a handful of analytic tools just enough to give students an appreciation for how those tools can help us understand urban life. Work in the course is project based, including problem sets and student presentations.

ARTDES 314	Change by Design	Undergraduate	Includes Sustainability	Art and Design (Stamps)	In this project-based class, students will respond to pressing social needs through design thinking processes, including visioning, concept generation, sketching ideas, everyday ethnography, creative experimentation, and extensive prototyping and validation. Students will form interdisciplinary teams to work on actual entrepreneurial design projects focused on food, education, health care and income issues facing our community partners. As part of the course, students acquire the theoretical frameworks and skills necessary for undertaking a social enterprise. They will then use those tools to design and develop their own ideas for aThe Entrepreneurship Practicum is an innovative, action-based learning lab led by the Center for Entrepreneurship that brings entrepreneurs across disciplines at the University to work on entrepreneurial endeavors. In this class, entrepreneurs form interdisciplinary teams and take steps to launch their own entrepreneurial ventures through a hands-on framework. You will learn to develop your entrepreneurial ideas and apply them into meaningful business models. In this class, you will experience entrepreneurship firsthand though three progressive team projects. This framework teaches important skills of entrepreneurship, such as ideation, validation, and business models and culminate in the selection of a student-selected venture to validate and launch. You will understand and experience the mindset of an entrepreneur, develop the ability to share the story of your entrepreneurial pursuits, understand customer needs, make real sales to real customers, and validate business models. venture that creates possibilities, products and systems in response to real world problems.
BE 311	Public Policies Toward Business	Undergraduate	Includes Sustainability	Business (Ross)	This course aims to enhance students' understanding of the role of government in a market economy and to develop students? analytical and presentation skills in discussing antitrust and regulatory issues. The emphasis of the course will be on the economic rationales behind government intervention in markets, the various forms of intervention, and their appropriateness in various contexts. Contexts explored will include antitrust policies, environmental, health and safety regulations. An important part of the course will be spent examining specific business cases with a focus on the type of intervention used in each and the outcome of such interventions.
STRATEGY 310	Competing in the Global Business Environment	Undergraduate	Includes Sustainability	Business (Ross)	When a firm conducts business internationally, it encounters problems and challenges not found in its domestic market. These arise from two different aspects of the international business environment. One aspect involves the crossing of national boundaries, which involves financial, legal, and political differences. The second aspect of the international environment arises from the unique cultural, economic, and political situation within each foreign market where the firm conducts business. This course introduces the student to the various dimensions of the world economy and to the characteristics of foreign countries that are important for economic activity.
STRATEGY 361	International Management	Undergraduate	Includes Sustainability	Business (Ross)	This course addresses the opportunities and challenges facing enterprises that operate across national boundaries. Â We will learn and apply analytical frameworks to assess institutional, cultural, and economic differences across countries and to evaluate management's strategic alternatives. Â The cases used in the course cover a wide variety of national contexts, including developed and emerging countries, and both established and younger enterprises across multiple industries.
BA 425	Global Practicum: Study Abroad	Undergraduate	Includes Sustainability	Business (Ross)	This course is a semester-long course focused on a given business theme, industry, or issue, and includes fieldwork away from the UM campus over spring break. This course, runs over the entire winter term, includes pre-fieldwork study and activities that build your theoretical framework on a given theme, industry, or issue, a fieldwork component of at least a week in either an international or domestic setting that allows you to put your learning in practice, and post-fieldwork time in the classroom to reflect, synthesize, and share your findings with the broader community. The themes and fieldwork locations for Global Practicum Courses vary each year and are typically announced in the fall term. More information on the current offerings can be found on M-Compass and the Ross Global initiatives website.
STRATEGY 411	The Corporation in Society	Undergraduate	Includes Sustainability	Business (Ross)	We live in extraordinary times. Corporations are among the wealthiest and most powerful institutions on the world's stage today. At the same time, corporations are more vulnerable than ever before. Globalization unleashed a set of competitive forces that place firms at risk, no matter their size. Managers face enormous pressure. Their firms' wealth and power act as a kind of magnet. Civil society routinely asks corporations to invest directly in our social life. Regardless of their productive capabilities, firms field requests to invest in such areas as education and health care. Managers must decide what, if anything, to do. And, at the same time, these same managers need to marshal their resources to produce and deliver high quality and profitable goods and services in a very competitive global marketplace. Leading a business that is at once socially responsive and economically competitive is a daunting challenge. This course will examine the role of the corporation in society and in so doing, begin to develop the leadership capability we need to meet these challenges.
STRATEGY 391	Business Model Innovation	Undergraduate	Includes Sustainability	Business (Ross)	One key task of the general manager is to acquire, develop, and allocate an organization's resources. Â Technology is a resource of paramount importance to many organizations; managing this resource for competitive advantage entails integrating it with the firm?s strategy. Â Recognizing the potential of an innovation and formulating the right strategies to exploit it are not easy. Â Those who do can gain or solidify a competitive advantage. Â Those who do not can see their competitive advantage quickly erode. Â IBM and Apple provide good examples of firms that have transformed themselves through innovation as technological and market challenges erased historical advantages. Â This course provides an integrative framework for exploring how a firm can attain and maintain a competitive advantage through innovation and the management of technology.

TO 300	Business Information Systems	Undergraduate	Includes Sustainability	Business (Ross)	In keeping with AACSB guidelines, this course focuses on information technologies as they influence the structure and processes of organizations and economies, and as they influence the roles and techniques of management. Â We will address such questions as: Â How do information systems influence organizational competitiveness? Â Why are technology infrastructures so important to modern organizations? Â What is the role of the Internet and networking technology in organizations? Â How do information systems enable organizational processes? Â How do organizations develop, acquire and implement information systems? Â What ethical, criminal and security issues do organizations face when using information systems? Â Students will acquire knowledge and skills in this area through discussion of articles selected from a variety of academic and business journals as well as several HBS cases.
BL 309	Business Ethics & Accountability	Undergraduate	Includes Sustainability	Business (Ross)	In an increasingly complex and global business world, ethical decision making is a crucial skill for all business leaders. The ability to make ethically sound judgments and persuade others of the importance of a sometimes unpopular choice-and to do so under pressure-will be an advantage during a career in any type of organization. The Business Ethics and Accountability course provides students with the tools necessary to spot and avoid ethical risk and then to use their ethical reasoning and analysis skills to succeed as leaders in their chosen field. The course will first cover the background and justification for applying ethical frameworks to business action. Next, the course addresses distinct topics such as the nature of the ethical corporation, stakeholder analysis, and the legal and economic influences on decision making and negotiation. Finally, the course examines the ethics of the commercialization of science and technology and its uses, ethical choices while weathering a crisis, and international topics and multinational operations (such as cross-cultural ethics and corruption). The course concludes with a discussion of current topics in business ethics, such as environmental sustainability and the challenges of serving the Base of the Pyramid.
MO 302	Positively Leading People and Organizations	Undergraduate	Includes Sustainability	Business (Ross)	This course prepares you to lead high-performing, successful teams and organizations.Â The course will introduce framework to help you identify organizational problems and opportunities, develop solutions that leverage strengths, and lead your team or organization to success.Â Drawing on key principles of positive organizing, you will learn how to influence others without formal authority, negotiate and make effective decisions, and build your social capital.Â You will learn how to manage conflict and lead change to help you and your organization thrive in today's dynamic, competitive, and global marketplace.Â The course draws on a variety of teaching tools including cases, video, simulations, discussions, and exercises to enrich student learning.
BA 200	Businesses and Leaders: The Positive Differences	Undergraduate	Includes Sustainability	Business (Ross)	Businesses and their leaders coexist with society and are both influenced by and influencers of societal issues.Â In this course, we explore the competing tensions of how business practices and leaders impact organizational performance as well as broader social outcomes across the private, public, and nonprofit sectors.Â We will look at social issues that arise from business operations that result in threats to public goods and market failures; how societal issues create space for business opportunities; and the leveraging of corporate resources to solve societal problems that create values for stakeholders and shareholders.Â In addition to studying the role of business in society, this course examines personal and professional responsibility.Â This will entail students examining the connections between personal values, career goals, ethical decision making, and moral courage.Â Also, students will reflect upon their responsibilities and contributions to the Ross community and the business profession, and develop personal plans to guide their actions.
BUSABRD 473	Global Semester Exchange: ICADE Business School	Undergraduate	Includes Sustainability	Business (Ross)	This course reflects the full-semester exchange opportunity for undergraduate study at the ICADE Business School,Students take university-level courses with locals or in programs structured specifically for a variety of American university students. To be considered for this opportunity, students should apply to the exchange program through Ross Global Initiatives. For more information, please contact Ross Global Initiatives.
BUSABRD 474	Global Semester Exchange: CEA Business, Design and Innovation - Barcelona	Undergraduate	Includes Sustainability	Business (Ross)	This course reflects the full-semester exchange opportunity for undergraduate study at the CEA Business, Design and Innovation - Barcelona.Students take university-level courses with locals or in programs structured specifically for a variety of American university students. To be considered for this opportunity, students should apply to the exchange program through Ross Global Initiatives. For more information, please contact Ross Global Initiatives.
BUSABRD 475	Global Semester Exchanges: IES Liberal Arts and Business - Barcelona	Undergraduate	Includes Sustainability	Business (Ross)	This course reflects the full-semester exchange opportunity for undergraduate study at the IES Liberal Arts and Business - Barcelona.Students take university-level courses with locals or in programs structured specifically for a variety of American university students. To be considered for this opportunity, students should apply to the exchange program through Ross Global Initiatives. For more information, please contact Ross Global Initiatives.
EDUC 393	Mexican Americans and Education	Undergraduate	Includes Sustainability	Education	Presents a historical perspective of Chicana and Chicano education in the U.S. Special emphasis will be placed on analyzing the ways in which race, gender, class, immigrant status, and Hollywood representations have historically shaped Chicana/o educational experiences. The course will also examine the ways Chicana/o students, parents, and communities respond to and resist political and economic forces restricting access and opportunity in education.
ENGR 100	Introduction to Engineering	Undergraduate	Includes Sustainability	Engineering	Focused team projects dealing with technical, economic, safety, environmental, and social aspects of a real-world engineering problem. Written, oral, and visual communication required within the engineering profession; reporting on the team engineering projects. Description of the role of the engineer in society; engineering ethics; organization and skills for effective teams.

ENTR 410	Finding Your Venture	Undergraduate	Includes Sustainability	Engineering	This course provides a framework for identifying clear, impactful opportunities. Every student will leave with a viable business opportunity to pursue in addition to a set of valuable and repeatable skills that will be an asset in any entrepreneurial setting.
BIOMEDE 479	Biotransport	Undergraduate	Includes Sustainability	Engineering Â» Biomedical Engineering	Fundamentals of mass and heat transport as they relate to living systems. Convection, diffusion, active transport, osmosis and conservation of momentum, mass and energy will be applied to cellular and organ level transport. Examples from circulatory, respiratory, renal and ocular physical will be examined.
BIOMEDE 221	Biophysical Chemistry & Thermodynamics	Undergraduate	Includes Sustainability	Engineering Â» Biomedical Engineering	This course covers the physico-chemical concepts and processes relevant to life. The emphasis lies on the molecular level. Topics: Biomimetics and Motivation; Energy and Driving Forces; Biochemical Equilibria; Aqueous Solutions; Molecular Self-Assembly in Chemistry, Biology, and Nanotechnology; Bio-electrochemistry; Biopolymers; Molecular Recognition and Binding Equilibria in Biology.
ENSCEN 484	Radiological Health Engineering Fundamentals	Undergraduate	Includes Sustainability	Engineering Â» Biomedical Engineering, Engineering Â» Nuclear Eng. and Radiological Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	fundamental physics behind radiological health engineering and topics in quantitative radiation protection and radiation quantities and measurement, regulations and enforcement, external and internal dose estimation, radiation biology, radioactive waste issues, radon gas, emergencies, and wide variety of radiation sources from health physics perspective.
CHE 230	Material and Energy Balances	Undergraduate	Includes Sustainability	Engineering Â» Chemical Engineering	An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Engineering problem solving, the equilibrium concept, first law of thermodynamics. Introduction to chemical engineering as a profession.
CHE 330	Chemical and Engineering Thermodynamics	Undergraduate	Includes Sustainability	Engineering Â» Chemical Engineering	Development of fundamental thermodynamic property relations and complete energy and entropy balances. Analysis of heat pumps and engines, and use of combined energy-entropy balance in flow devices. Calculation and application of total and partial properties in physical and chemical equilibria. Prediction and correlation of physical/chemical properties of various states and aggregates. Elements of statistical thermodynamics.
CHE 343	Separation Processes	Undergraduate	Includes Sustainability	Engineering Â» Chemical Engineering	Introduction and survey of separations based on physical properties, phase equilibria, and rate processes. Emphasis on analysis and modeling of separation processes. Staged and countercurrent operations. Includes applications to chemical, biological, and environmental systems.
CHE 344	Reaction Engineering and Design	Undergraduate	Includes Sustainability	Engineering Â» Chemical Engineering	Fundamentals of chemical reaction engineering. Â Rate laws, kinetics, and mechanisms of homogeneous and heterogeneous reactions. Â Analysis of rate data, multiple reactions, heat effects, bioreactors, Safety (runaway reactions). Â Design of industrial reactors.
CEE 325	Fluid Mechanics	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Description/discussion of the principles of mechanics applied to real and ideal fluids; fluid properties and statics; continuity, energy, and momentum equations by control volume analysis; differential equations of motion for laminar and turbulent flow; dimensional analysis and similitude; boundary layers, drag, and lift; incompressible flow in pipes; fluid measurement and turbomachinery.
CEE 351	Civil Engineering Materials	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Discussion of basic mechanical and physical properties of a variety of important civil and environmental engineering materials such as concrete, steel, plastic, asphalt, wood and fiber composites. Evaluation of constituents and design of mixtures and composites, load-time deformation characteristics, response to typical service environments.
CEE 421	Hydrology	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Description/discussion of fundamentals of surface-water hydrology, flow in open channels, and flood hazard mitigation; rainfall-runoff relations; unit hydrograph method; uniform and nonuniform flow in open channels; measurement and control of river flow; flood waves in rivers, floodplains, and reservoirs; design of storage basins, storm channels, and culverts.
CEE 345	Geotechnical Engineering	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Soil origins, classification, and index properties; phase relationships; earth moving and soil compaction; groundwater seepage; compressibility and consolidation; settlement; shear strength and failure; applications to foundations; retaining structures and slopes.
CEE 548	Geotechnical Earthquake Engineering	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Ground motion attenuation relationships, seismic site response analysis, evaluation and modeling of dynamic soil properties, soil-structure interaction, evaluation and mitigation of soil liquefaction, seismic code provisions and practice, seismic earth pressures, slope stability and deformation analysis, safety of dams and embankments, performance of pile foundations, and additional current topics.
CEE 546	Slopes, Dams & Retaining Structures	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Slope stability analyses, seepage through soils, settlements and horizontal movements in embankments, earthen embankment and dam design, landslide and embankment stabilization, earth pressures and retaining structure design.
CEE 580	Physicochemical Processes in Environmental Engineering	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Physicochemical separated and transformation processes in natural and engineered environmental systems; process modeling; design of operations involving state and phase transformation; chemical oxidation, reduction, sorption, stripping, and exchange processes, membrane separations, particle aggregation and coagulation, sedimentation and filtration.
CEE 303	Computational Methods of Engineering and Scientists	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Applications of numerical methods to infrastructure and environmental problems. Development of mathematical models and computer programs using a compiled language (FORTRAN). Formulation and solution of initial and boundary-value problems with emphasis on structural analysis, fluid flow, and transport of contaminants.
CEE 544	Rock Mechanics	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Engineering properties and classification of rocks. Strength and deformability of intact and jointed rock; in situ stresses; lab and field test methods. Stereonets and structural geology. Rock slopes; stability and reinforcement. Foundations on rock.

CEE 365	Environmental Engineering Principles	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	An introduction to mass balance modeling of contaminant fate, transport and removal in the environment; commonly used reactor configurations for water and air quality control; partitioning of contaminant types and sources; regional and global contemporary environmental issues.
CEE 480	Design of Environmental Engineering Systems	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Design and theoretical understanding of environmental processes; biological, physical, and chemical processes, and reactor configurations commonly used for water quality control; applications to the design of specific water and wastewater treatment operations; discussion of pollution prevention and green engineering options.
CEE 402	Professional Issues and Design	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Multidisciplinary team design experience including consideration of codes, regulations, alternate solutions, economic factors, sustainability, constructibility, reliability, and aesthetics in the solution of a civil or environmental engineering problem. Professionalism and ethics in the practice of engineering.
CEE 230	Energy and Environment	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	The laws of thermodynamics are presented and applied to energy technologies used for electric power generation, transportation, heating, and cooling. Physical properties of fuels and materials used in energy production are discussed. The environmental impacts, resource constraints, and economic factors governing conventional and alternative energy technologies are considered.
CEE 270	Statistical Methods for Data Analysis and Uncertainty Modeling	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	Statistical Methods for Data Analysis and Uncertainty Modeling --- Introductory probability and statistics with emphasis on data analysis and uncertainty modeling for engineering and environmental systems. Descriptive statistics, graphical representation of data, linear regression, correlation, discrete and continuous probability distributions, conditional probability, estimation, statistical inference, hypothesis testing, sampling design, load factors, extreme events, reliability analysis.
CEE 200	Intro to Civil & Environmental Engineering	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	An introduction to the nature and scope of the civil and environmental engineering discipline and specialty programs. Includes case studies from practice and information about academic and professional opportunities for CEE students.
CEE 465	Environmental Process Engineering	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng.	An introduction to the analysis, characterization and principles of physical, chemical and biological processes, operations and reactor configurations commonly using for water quality control; preliminary and operations; discussion of economic and legislative constraints and requirements.
CEE 522	Sediment Transport	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Engineering	Mechanics of sediment transport processes in Fluvial systems; initiation of motion; bed forms; resistance to flow; suspended sediment transport; bed load transport; cohesive sediments; geomorphology principles.
EARTH 581	Aquatic Chemistry	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Literature, Science, & Arts Â» Earth and Environmental Sciences	This course provides an introduction to the principles of aquatic chemistry and reactions applicable to the analysis of the chemical composition of natural water and engineered water treatment systems. Four chemical reaction classes are covered: acid-base precipitation-dissolution complexation oxidation-reduction reactions Emphasis is placed on developing problem solving skills and includes the use of graphical, analytical (e.g., the Tableaux method), and computer solution (MINEQL+) techniques. Problems are selected from a host of environmentally relevant systems including the geochemistry of natural waters, water treatment, groundwater remediation, and fate of inorganic pollutants in natural aquatic systems. Lectures present aquatic chemical principles in the context of contemporary environmental issues including water quality, climate change, and pollution prevention and abatement.
CEE 428	Introduction to Groundwater Hydrology	Undergraduate	Includes Sustainability	Engineering Â» Civil & Environmental Eng., Literature, Science, & Arts Â» Earth and Environmental Sciences	Basic principles which govern the flow of water in the subsurface. Development and solution of groundwater flow and contaminant transport equations, in presence and absence of pumping wells, for both confined and phreatic aquifers. Measurement and estimation of parameters governing flow and transport, including methods such as pump tests and moment analysis. Remediation of contaminated groundwater.
SPACE 462	Instruments for Atmospheric and Space Sciences	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Instruments for atmospheric and Space Sciences: Introduction to fundamentals of atmospheric, space-based, and meteorological instrumentation. Includes basics of electronic sensors, optics, lasers, radar, data acquisition/management, error analysis, and data presentation. Consists of two lecture and one lab each week, and a term-based term project.
CLIMATE 479	Atmospheric Chemistry	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Thermo-chemistry, photochemistry and chemical kinetics of the atmosphere; geo-chemical cycles, generation of atmospheric layers and the effects of pollutant are discussed.
SPACE 495	Upper Atmosphere and Ionosphere	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Basic physical and chemical processes important in controlling the upper/middle atmosphere and ionosphere: photochemistry, convection, diffusion, wave activity, ionization, heating and cooling. The terrestrial, as well as planetary atmospheres and ionospheres are to be considered.
CLIMATE 473	Climate Physics	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Introduction to physical mechanisms that determine climate, including relevant atmospheric, hydrologic, cryospheric, solar/orbital, volcanic, and human processes. Discusses quantitative and descriptive techniques to understand how radiative, thermodynamic, and dynamic processes distribute energy throughout the Earth System, drive climate feedback, and determine the sensitivity of Earth's climate to external perturbations.
AAS 432	Violent Environments: Oil, Develoopment and the Discourse of Power	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	This course will examine and compare discourses and practices concerned with resource extraction, resource distribution, energy security, and "modernity" in Africa, Europe, the Middle East, and Latin America. In particular, we'll explore how oil exploration in postcolonial states has created spaces of violence and possibilities for development, and has continually reshaped the idea of what constitutes the nation.

AOSS 466	Carbon-Climate Interactions	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences	Carbon-Climate Interaction --- The class will focus on the exchange of carbon among reservoirs in the Earth system -- atmosphere, ocean, lithosphere and biosphere -- and the role of carbon dioxide, CO2, as a greenhouse gas.
CLIMATE 475	Earth System Interactions	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Engineering Â» Civil & Environmental Eng., Literature, Science, & Arts Â» Program in the Environment	Develops students' abilities to integrate processes important to global change; surface characteristics, hydrology, vegetation, biogeochemical cycles, human dimensions. Analysis of current research advances. Interdisciplinary team projects with oral and poster presentations.
EARTH 421	Introduction of Physical Oceanography	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Engineering, Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts, Literature, Science, & Arts Â» Program in the Environment	This course examines the fundamentals of physical oceanography; the physical properties of the ocean and water masses; circulation of the atmosphere; wind-driven and buoyancy-driven ocean circulation; tides; surface and internal waves; eddies; and mixing.
EARTH 171	Introduction to Global Change -- Part I	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Biology, Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	Students learn about the evolution of the universe, Earth, our changing environment and our planets living organisms. Global Change I, which is part of the GC curriculum, assumes no prior science background. Homework and laboratories use computer-based systems modeling and analysis, and includes a group presentation.
EARTH 401	Geophysical Fluid Dynamics	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Dynamics of the oceans and atmosphere. Equations of motion in spherical coordinates, beta-plane approximation, wave properties in the oceans and atmosphere.
ENSCEN 451	Atmospheric Dynamics I	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Description/discussion of quasi-geostrophic energetics; fronts; the mean circulation; planetary and equatorial waves: overview of the dynamics of the middle atmosphere; wave-mean flow interaction; spectral methods; and tropical meteorology.
ENSCEN 463	Air Pollution Meteorology	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Weather and motion systems of the atmosphere; topographic influences in winds; atmospheric stability and inversions; atmospheric diffusion; natural cleansing processes; meteorological factors in plant location, design and operation.
CLIMATE 414	Weather Systems	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Weather Systems --- Introduction to the basic characteristics, thermodynamics, and dynamics of atmospheric weather systems on Earth and other planets. The students are exposed to observations of weather systems while reviewing non-dimensional analysis, dynamics and thermodynamics. Weather systems on earth are compared to that of other planets and analytical tools are used to gain insights into their basic physics.
EARTH 381	Introduction to Atmospheric Radiation	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Basic concepts and processes of radiative transfer including radiometric quantities, electromagnetic spectrum, absorption, emission, scattering. The physics laws governing these processes including the Planck Law and the Kirchhoff Law. Radiative properties of atmospheric constituents. Reflection and refraction. Introductory-level descriptions of relevant applications in atmospheric sciences and climate physics.
EARTH 409	Earth System Modeling	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Introduction to Earth System Modeling; discussion of energy balance models, carbon cycle models, and atmospheric chemistry models with multiple time scales; methods for numerical solution and practice building and analyzing results from models.
EARTH 454	Meteorological Analysis Laboratory	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	This course provides an introduction into the analysis of both surface-based and remotely-sensed meteorological data. The development and application of operational numerical forecast models will be discussed. Techniques for the prediction of both synoptic and mesoscale meteorological phenomena will also be presented.
EARTH 370	Solar-Terrestrial Relations	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Introduction to solar terrestrial relations with an overview of solar radiation and its variability on all time-scales. The effects of this variability on the near-Earth space environment and upper atmosphere are considered, as well as effects on the lower and middle atmosphere with connections to weather and climate. Subjects are approached through extensive data analysis, including weekly computer lab sessions.
EARTH 320	Earth Systems Evolution	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Introduction to the physics and chemistry of Earth. Gravitational energy, radiative energy, Earth's energy budget, and Earth tectonics are discussed along with chemical evolution and biogeochemical cycles. The connections among the carbon cycle, silicate weathering, and the natural greenhouse effect are discussed. Required for AOSS/GS-321, which introduces Earth system dynamics.
EARTH 321	Earth System Dynamics	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Earth Systems Dynamics --- This course will describe the major wind systems and ocean currents that are important to climate studies. The primary equations will be developed and simple solutions derived that will explain many of these motions. The relations among the dynamics and other parameters in the climate system will be illustrated by examples from both paleo and present day systems.
EARTH 350	Atmospheric Thermodynamics	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Atmospheric Thermodynamics --- Fundamentals of radiative transfer, thermodynamics, and cloud Physics of the atmosphere, including absorption, emission, and scattering of radiation, energy balance, adiabatic processes, entropy, water-air systems, and the cloud condensation, microphysics and precipitation processes.
CLIMATE 323	Earth System Analysis	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	Earth System Analysis --- Introduction to the analysis of Earth and Atmospheric Science Systems. Topics include linear systems, harmonic analysis, sampling theory and statistical error analysis. Lectures emphasize underlying mathematical concepts. Labs emphasize application of mathematical methods to analysis of field data in a computer programming environment. Applications include turbulent air motion in the planetary boundary layer, cloud and precipitation microphysical composition, oceanic wave propagation, stratospheric ozone depletion and satellite remote sensing.

EARTH 423	Boundary Layer Meteorology	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	This course explores processes in the atmospheric boundary layer, which plays an important role in the exchange of energy, mass and momentum between land and atmosphere. Topics include applications of governing atmospheric equations, atmospheric turbulence, turbulent kinetic energy, the surface energy balance, and the collection and analysis of field flux tower data.
EARTH 474	Ice Sheets, Glaciers, and Climate Change	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Earth and Environmental Sciences	They dynamics and mass balance of ice sheets and glaciers introduced along with mathematical theories describing how ice sheets and glaciers flow and current methods of observation.
ENVIRON 102	Extreme Weather	Undergraduate	Includes Sustainability	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Earth and Environmental Sciences	This course provides an introduction to the physics of extreme weather events. The course uses examples of the thunderstorms, jet stream, floods, lake-effect snowstorms, lightning, thunder, hail, hurricanes, and tornados to illustrate the physical laws governing the atmosphere. Participants apply these principles in hands-on storm forecasting and weather analysis assignments.
EECS 373	Introduction to Embedded System Design	Undergraduate	Includes Sustainability	Engineering Â» Electrical Eng. and Comp. Sci.	Principles of designing application-specific computer systems that interact with the physical world. Covers memory-mapped I/O, interrupts, analog interfacing, microprocessors, reconfigurable hardware, sensors, and actuators. Complex hardware/software system design and implementation. Substantial student-defined team design project.
EECS 496	Major Design Experience - Professionalism	Undergraduate	Includes Sustainability	Engineering Â» Electrical Eng. and Comp. Sci.	Design principles for multidisciplinary team projects, team strategies, entrepreneurial skills, ethics, social and environmental awareness, and life long learning.
EECS 463	Power Systems Design and Operations	Undergraduate	Includes Sustainability	Engineering Â» Electrical Eng. and Comp. Sci.	Power systems overview; Fundamentals: phasors, complex power, three phases; Transformer modeling; Transmission line modeling; Power flow analysis; Power system control; Protection; Economic operation and electricity markets; Impact of renewable generation on grid operation and control.
NAVSCI 202	Electronic Sensing Systems	Undergraduate	Includes Sustainability	Engineering Â» Electrical Eng. and Comp. Sci., Engineering Â» Naval Arch. & Marine Eng.	Introduction to properties and behavior of electromagnetic energy as it pertains to naval applications of communication, radar, and electro-optics. Additional topics include sound navigation and ranging (SONAR), tracking and guidance systems, and computer-controlled systems.
MFG 463	Measure & Design of Work	Undergraduate	Includes Sustainability	Engineering Â» Industrial and Operations Engineering	Design of lean manufacturing systems requires knowledge and skills for describing manual work, identifying value and non-value added work elements, designing efficient work equipment and methods, preventing fatigue and related worker health problems and predicting work performance.
BIOMEDE 410	Design & Applications of Biomaterials	Undergraduate	Includes Sustainability	Engineering Â» Macromolecular Science and Engineering, Engineering Â» Materials Science and Eng., Engineering Â» Biomedical Engineering	Biomaterials and their physiological interactions. Materials used in medicine/dentistry: metals, ceramics, polymers, composites, resorbable, smart natural materials. Material response/degradation: mechanical breakdown, corrosion, dissolution, leaching, chemical degradation, wear. Host responses: foreign body reactions, inflammation, wound healing, carcinogenicity, immunogenicity, cytoxicity, infection, local/systematic effects.
MATSCIE 480	Materials & Engineering Design	Undergraduate	Includes Sustainability	Engineering Â» Materials Science and Eng.	Design concepts. Engineering economics. Various design criteria, processes, and process control. Materials substitution. Competitive design. Case histories. Professional and ethical considerations. Written and oral presentations of solutions to design problems.
MECHENG 336	Thermodynamics II	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Description/discussion of thermodynamic power and refrigeration systems; availability and evaluation of thermodynamic properties; general thermodynamic relations, equations of state, and compressibility factors; chemical reactions; combustion; gaseous dissociation; phase equilibrium. Design and optimization of thermal systems.
MECHENG 438	Internal Combustion Engines	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Analytical approach to the engineering problem and performance analysis of internal combustion engines. Â Study of thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency, and emissions. Â Design and operating characteristics of different types of engines. Â Computer assignment. Â Engine laboratories.
MECHENG 538	Advanced Internal Combustion Engines	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Modern analytical approach to the design and performance analysis of advanced internal combustion engines. Â Study of thermodynamics, fluid flow, combustion, heat transfer, and other factors affecting the design, operating and emissions characteristics of different engine types. Â Application of course techniques to engine research projects.
MECHENG 235	Thermodynamics I	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Thermodynamics I: Introduction to engineering thermodynamics. First law, second law system and control volume analyses; properties and behavior of pure substances; application to thermodynamic systems operating in a steady state and transient processes. Heat transfer mechanisms. Typical power producing cycles and refrigerators. Ideal gas mixtures and moist air applications.
MECHENG 320	Fluid Mechanics I	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Fluid Mechanics I --- Fluid statics; conservation of mass, momentum, and energy in fixed and moving control volumes; steady and unsteady Bernoulli's equation; differential analysis of fluid flow; dimensional analysis and similitude; laminar and turbulent flow; boundary layers; lift and drag; introduction to commercial CFD packages; applications to mechanical, biological, environmental, and micro-fluidic systems.
MECHENG 335	Heat Transfer	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering	Heat transfer by conduction, convection, radiation; heat storage, energy conversion; steady-state/transient conduction heat transfer; thermal circuit modeling; multidimensional conduction; surface radiation properties, enclosure radiation exchange; surface convection/fluid streams over objects, non-dimensional number, laminar, turbulent, thermo-buoyant flow, boiling and condensation; heat exchangers; design of thermal systems, solvers for problem solving/design.
MECHENG 412	Advanced Strength of Materials	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering, Engineering	Review of energy methods, Betti's reciprocal theorem; elastic, thermo elastic and elastoplastic analysis of axisymmetric think cylinders and rotating discs; bending of rectangular and circular plates, including asymmetric problems; beams on elastic foundation; axisymmetric bending of cylindrical shells; torsion of prismatic bars.

APPPHYS 639	Heat Transfer Physics	Undergraduate	Includes Sustainability	Engineering Â» Mechanical Engineering, Literature, Science, & Arts Â» Applied Physics	Heat Transfer Physics --- This course combines fundamentals of statistical thermodynamics, quantum mechanics, transport theories, computational molecular dynamics, solid-state physics, and radiation transport, as related to heat transfer and thermal energy conversion. It presents a unified theory of heat transfer physics in its modern applications.
NAVARCH 391	Marine Engineering Laboratory I	Undergraduate	Includes Sustainability	Engineering Â» Naval Arch. & Marine Eng.	This course is the first in a two-part capstone laboratory class. It provides experimental foundation for the Engineering Mechanics part of the curriculum. Instruction includes laboratory techniques and instrumentation, as well as error analysis. Investigations include fluid dynamics and structural mechanics. Technical report writing is stressed.
NAVARCH 331	Marine Engineering I	Undergraduate	Includes Sustainability	Engineering Â» Naval Arch. & Marine Eng.	Diesel engines, steam turbines, and gas turbines as marine prime movers. Thermodynamic cycles, ratings, matching to loads. Engine-propeller matching. Mechanical transmission of power to marine loads. Principles of fluid system design. Introduction to heat transfer and heat exchangers.
NAVARCH 332	Marine Electrical Engineering	Undergraduate	Includes Sustainability	Engineering Â» Naval Arch. & Marine Eng.	Electrical circuit analysis. Â Electromagnetic interactions. Â Principles, characteristics, and properties of transformers, and DC and AC motors. Â Power electronics. Â Integrated marine electrical plants. Â Electrical power distribution, and control. Â Circuit protection. Â Introduction to fuel cells
NAVARCH 424	Hydrofoils, Propellers and Turbines	Undergraduate	Includes Sustainability	Engineering Â» Naval Arch. & Marine Eng.	Introduction to the fundamentals of lifting surfaces related to the selection, design, experimental and numerical modeling, as well as optimization of hydrofoils, propellers, and turbines.
NERS 311	Elements of Nuclear Engineering and Radiological Sciences I	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Photons, electrons, neutrons, and protons. Particle and wave properties of radiation. Introduction to quantum mechanics. Properties and structure of atoms.
NERS 421	Nuclear Engineering Materials	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	An introduction to materials used in nuclear systems and radiation effects in materials (metals, ceramics, semiconductor, organics) due to neutrons, charged particles, electrons, and photons.
NERS 441	Nuclear Reactor Theory I	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	An introduction to the theory of nuclear fission reactors including neutron transport theory, the P1 approximation, diffusion theory, criticality calculations, reactor kinetics, neutron slowing down theory, and numerical solution of the diffusion equation.
NERS 312	Elements of Nuclear Engineering and Radiological Sciences II	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Description/discussion of the production and use of nuclear radiation; alpha-, beta- and gamma-decay of nuclei; neutrons; nuclear Reactions; elementary radiation interactions and transport.
NERS 442	Nuclear Power Reactors	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Analysis of nuclear fission power systems including an introduction to nuclear reactor design, reactivity control, steady-state thermal-hydraulics and reactivity feedback, fuel cycle analysis and fuel management, environmental impact and plant siring, and transient analysis of nuclear systems. A semester-long design project of the student's choice.
NERS 472	Fusion Reactor Technology	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Study of technological topics relevant to the engineering feasibility of fusion reactors as power sources. Basic magnetic fusion and inertial fusion reactor design. Problems of plasma confinement. Energy and particle balances in fusion reactors, neutronics and tritium breeding, and environmental aspects. Engineering considerations for ITER and NIF.
NERS 211	Introduction to Nuclear Engineering and Radiological Sciences	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Introduction to Nuclear Engineering and Radiological Sciences: This course will discuss different forms of energy, the history of nuclear energy, the fundamentals of fission and fusion nuclear power, radiological health applications, and electromagnetic radiation in the environment, current topics in the media such as radon, radioactive waste, and nuclear proliferation will also be covered.
NERS 250	Fundamentals of Nuclear Engineering and Radiological Sciences	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	Technological, industrial and medical applications of radiation, radioactive materials and fundamental particles. Special relativity, basic nuclear physics, interactions of radiation with matter. Fission reactors and the fuel cycle.
NERS 320	Problems in Nuclear Engineering and Radiological	Undergraduate	Includes Sustainability	Engineering Â» Nuclear Eng. and Radiological Sciences	This course introduces junior-level NERS students to several different standard physical problems in nuclear engineering and radiological sciences, together with basic mathematical and numerical methods for solving the problems. In the course each different physical problem will be introduced, mathematical equations for the problem will be derived, and solution techniques will be presented to solve the equations. The course is meant to prepare students for more advanced senior-level NERS courses.
SI 310	Information Environments and Work	Undergraduate	Includes Sustainability	Information	This course looks at information's role in organizations, including psychological, economic, management and sociocultural perspectives. Explores sense-making and effective communication, including the importance of "story-telling." Covers key humanistic perspectives and ethical issues related to information. Goes into the nature of requirements and helps students learn to "swim in a sea of data" in organizations. The course focuses on the importance of working at the frontier.
SI 430	Information Technology and Global Society	Undergraduate	Includes Sustainability	Information	In this course, students will examine recent and current global events featuring information technology, and through both discussion and introspection, construct their own personal hypotheses of technology and society. Â Along the way, students will hear about the way in which information technology is touching the remotest places in the world, gain an introduction to formal theories of technology and society, and stress-test their critical thinking skills.

SM 332	Organizational Behavior-Sport Organization	Undergraduate	Includes Sustainability	Kinesiology	Having a fundamental understanding of how individuals work in an organizational setting is an essential ability for managing sport organizations. Â This course examines through critical readings, analysis, assignments, and class discussions organizational behavior dynamics and practices and their application to both business and sport environments. Â It deals with macro issues such as structure, centralization/decentralization, the environment, technology, and alliances and how these issues impact an individual?s functioning within an organization. Â The course also addresses micro behavioral science concepts such as motivation, conflict, leadership, decision-making, group dynamics, power, control, and communication.
KINESLGY 416	Environmental and Policy Approaches to Increasing Physical Activity	Undergraduate	Includes Sustainability	Kinesiology	Environmental and Policy Approaches to Increasing Physical Activity --- This course will describe the manner in which environments and policies influence physical activity behavior. Â The course is organized by sectors (e.g., parks, neighborhoods, schools and worksites). Â Within the context of these settings, the course will also cover issues of environmental justice, causality, targeted and universal policies and cost effectiveness.
STDABRD 463	CGIS: Central European Studies in Warsaw, Poland	Undergraduate	Includes Sustainability	Literature, Science, & Arts	This program is administered by CIEE in Warsaw, Poland at CIEE's Study Center at the Warsaw School of Economics, the oldest and largest economics university in Poland. Students are required to take a mandatory Polish language course and then select other course options taught in English from a range of in such fields as East and Central European politics, literature, history, business and economics.
UC 275	Global Intercultural Experience for Undergraduates	Undergraduate	Includes Sustainability	Literature, Science, & Arts	Global Intercultural Experience for Undergraduates (GIEU) is an interdisciplinary experiential introduction to intercultural learning that prepares diverse undergraduate students from various colleges for field experience interactions, and then helps students bring these experiences back to campus in socially and academically productive ways. It is a series of concentrated seminars of orientation, debriefing, and symposium.
UC 254	Sophomore Interdisciplinary Seminar	Undergraduate	Includes Sustainability	Literature, Science, & Arts	This course focuses on the questions and methods characteristic of the major disciplines - humanities, natural sciences, social sciences. Â It uses an interdisciplinary approach to address complex topics using tools such as: critical reading of multiple kinds of texts; an emphasis on written and oral presentations; and a robust exchange of reflections and ideas, both in class and on-line.
STDABRD 440	CGIS: University Study in Ireland - University College Dublin	Undergraduate	Includes Sustainability	Literature, Science, & Arts	Administered by Arcadia University, this program allows students to enroll in classes at the University College Dublin.
STDABRD 320	CGIS: Marine Resource Studies in The Turks and Caicos Islands	Undergraduate	Includes Sustainability	Literature, Science, & Arts	At the School for Field Studies field site in Turks and Caicos students learn about tropical marine ecology, evaluate host country recourse management and policies, and practice field research skills in the tropical Western Atlantic.
STDABRD 370	CGIS: Public Health in Ho Chi Minh City, Vietnam	Undergraduate	Includes Sustainability	Literature, Science, & Arts	Students enroll in CET courses relating to public health and development in Vietnam and may choose to participate in a 4-credit internship.
STDABRD 242	CGIS: STEM Summer Research Program in Granada, Spain	Undergraduate	Includes Sustainability	Literature, Science, & Arts	Administered by Arcadia University, this program allows students to perform STEM research for academic credit with the Andalusian Center for Environmental Research.
RCSSCI 330	Urban and Community Studies I	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies	This course is designed to help students develop historical perspectives and analytical frameworks that will guide them as they study and work in urban communities. Focusing on the collective experience of African Americans in the second half of the twentieth century, we will conduct an interdisciplinary investigation into the processes of community formation and social change impacting contemporary urban life. Course texts therefore include historical studies, urban sociology, social work, autobiography, ethnography, community studies, and film. We will begin with a review of the various meanings and uses of the idea of â€œcommunity,â€ moving next to a brief consideration of the historical development of American cities. Then we will explore the processes of African American migration and urbanization, including the exploration of specific urban areas and their dynamics of community formation. Finally, we will examine case studies of community organizing, leading us to consider broad questions concerning our understanding of contemporary urban communities, the challenges they face, and the prospects for engaged social action. Our guiding concern throughout the academic term will be the relationship between universities and their surrounding communitiesâ€”including the historical expressions, contemporary realities, and future prospects of this relationship. This is the one required course for the Urban Studies minor.
AAS 453	Culture, Class, and Conflict in Southern Africa	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies	A broad overview and detailed exploration of society, economy, and polity in Southern Africa. Â The major focus of the class is on conflict: its roots, its forms, and its impact. Â This cross-disciplinary course will be concerned with both the historical background and the contemporary situation.
AAS 103	First Year Social Science Seminar	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies	This seminar introduces first-year students to the intellectual community of social scientists working in the field of Afroamerican and African studies. Â The topic of the seminar varies from year to year.

WOMENSTD 443	Race, Gender&Health	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies	The Pedagogy of Empowerment will explore race, gender, health and activism in the context of HIV/AIDS in United States Black communities. Through this two-tiered course, students will cultivate strong background knowledge of HIV in Black communities, and explore issues of accountability, apathy, and activism as they pertain to HIV prevention. The course will explore the multifaceted dimensions of the HIV/AIDS epidemic in Black communities including: its history and epidemiology; gendered dynamics of HIV prevention; intersectionality, HIV infection, and stigma; homophobia and the politics of inclusion and exclusion; and various community responses. Students will use what they learn about the context of the epidemic to critically analyze chosen HIV prevention interventions, and explore the intersection of academia and activism. All students will learn an HIV education module designed by Professor Nesha Haniff. As an exercise in praxis, each student will be required to use and experience this HIV prevention module in a community of her or his choice. Be warned that the community of preference should be outside the University of Michigan. The theoretical text for this class will be Paulo Freiereâ€™s Pedagogy of the Oppressed. We will also examine other approaches to empowerment like The Barefoot College in India and Yunus Mohomedâ€™s Grameen Banking system.
AAS 457	When China Comes to Town: Environment and the Politics of Development in Africa	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies	This course will address post-colonial African states as a historically unique social form that presents special challenges for the socioeconomic and political analysis of environment and development. The course will focus on the growing interest of emerging world economic powers such as China in Africa's natural resources.
POLSCI 324	Black Americans and the Political System	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Afroamerican and African Studies, Literature, Science, & Arts Â» Political Science	This course focuses on the status of Blacks in the American political system. Students analyzes the capacity and the capability of the political system for negotiating internal conflicts involving Black/White relationships.
AMCULT 348	American Radicalism	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture	Starting with abolitionism and early women's rights, this course examines 150 years in the development of a modern Left in the U.S., highlighting labor-based radicalism as well as militant protest by people of color, feminists, antiwar activists, disaffected youth, and other liberation advocates of the latter 20th century, culminating with recent "anti-globalization" activism.
AMCULT 225	Space, Story and the American Self	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture	Space, Story and the American Self --- This course explores historic and cultural contexts of "what is an American: by bringing together narrative texts and architectural spaces that represent, interrogate, and complicate concepts of national identity; e.g., how race, gender, class, and ethnicity determined who did or did not belong in the idealized American social space.
AMCULT 333	Green Indigeneity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture	Green Indigeneity-Â This course examines environmental issues as they engage, relate to, and contradict with indigenous belongings to land and place in the Pacific Islands and beyond. We will examine the histories of colonialism and imperialism that set the stage for contemporary formations militarization, tourism, national parks, and genetically modified organisms, issues that engage both questions of sustainability and indigenous political sovereignty.
ENGLISH 312	Camp Davis: History and Literature of the Rockies	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture, Literature, Science, & Arts Â» English Language & Literature, Literature, Science, & Arts Â» Program in the Environment	Taught onsite at the University of Michiganâ€™s Camp Davis Geology field station south of Jackson Hole, Wyoming, this course will examine a range of human experiences and expressions of place, centered on the area of Jackson Hole, but extending in conceptual terms across the central and northern Rocky Mountain region and, from there, to the American West as a whole. Taking environment as a key focus, the course will consider the role of geology and ecology in the areaâ€™s history, examining human and non-human landscapes from the first inhabitants to contemporary debates surrounding development, recreation, and management. At the same time, we will explore human expressions of place, as found in art, literature, and landscape. The course is explicitly inter- and multi-disciplinary, drawing on the methods and knowledge found in the fields of History, Literary Studies, Geography, Geology, and Ecology. The course will function experientially, as a â€œseminar-on-the-move,â€ with a number of hikes, trips, and tours to local places.
AMCULT 369	Modern American Culture	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture, Literature, Science, & Arts Â» History	This course is designed as an intensive historical survey of U.S. mass culture over the past two centuries. We will begin the semester with the very first â€œcultural industriesâ€ of the 1830s and 40s (e.g., P.T. Barnumâ€™s traveling exhibitions and blackface minstrel shows), and then follow the expansion and evolution of U.S. commercial entertainment through the dawn of electronic media and globalization. Weekly topics may include the reinvention, commodification, and distribution of pre-industrial vernacular forms; the rise of corporate structures and syndication; the consolidation of new publics; the mechanics of promotion; the politics of production and consumption; and the manifold impacts of U.S. mass culture, both at home and abroad. Our scope will be deliberately broad and comparative, cutting across museum exhibitions, theater, dance, literature, film, radio, television, and the internet. We will also make extensive use of 19th- and 20th-century primary source materials (playbills, newspaper reviews, trade periodicals, music and video clips) in order to gauge the shifting meanings of mass culture according to historical context.
PSYCH 325	Practicum in the Multicultural Community	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture, Literature, Science, & Arts Â» Psychology	This purpose of this course is to introduce students to the guiding principles and orienting concepts of community psychology, namely, the prevention of social problems and the promotion of well-being among individuals within diverse contexts, such as families, schools, neighborhoods, and workplaces. Throughout this course we will engage in a critical examination of how we define and propose solutions to social and behavioral problems. We will be concerned with ideas of empowerment, resilience, diversity, cultural competence, and social action, among others. In order to gain a better sense of how organizations develop efforts that encompass these ideas, students will engage in community service learning in Detroit communities.

SOC 221	Social Inequality	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» American Culture, Literature, Science, & Arts Â» Sociology	The United States has higher inequality - the gap between the rich and the poor - than any of the other industrialized democracies. Further, that gap has increased dramatically since 1980. This course examines inequality in U.S. society from a sociological perspective, incorporating insights from other fields, including demography, psychology, and economics. We will explore contemporary debates and issues, with an emphasis on research evidence. A goal of the course is to encourage students to critically evaluate their own assumptions about the rich and the poor in U.S society.
ANTHRBIO 201	Introduction to Biological Anthropology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Study of human evolution with emphasis on genetic evolutionary process. Man's evolutionary history as evidenced by fossil remains and present racial variation in light of modern evolutionary theory.
ANTHRBIO 364	Nutrition & Evolution	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Study of the evolutionary basis of contemporary nutritional patterns, the short and long-term effects of industrialization on human biology during development and adulthood.
ANTHRCUL 330	Culture, Thought and Meaning	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	This course is an intensive, upper-division introduction to Cultural Anthropology and Cultural Studies. Concentrators and non-concentrators are welcome; the course is closed to Freshmen. The course introduces students to the closely interrelated concepts of "culture," "thought" and "meaning" as they are used in anthropology. Despite its centrality to the discipline of anthropology, "culture" has proved to be a highly inconsistent concept over time. This course traces the consequences of different concepts of culture from the early nineteenth century through the present and their relation to thought and meaning. It is organized around debates in anthropology about structure, interpretation, cognition, metaphor, practice, personhood, gender, the body, and place. Students have the opportunity to explore cultural difference by reading widely about other cultures, from the Trobriand Islands to the Caribbean, and to apply what they learn to their own cultural circumstances.
ANTHRCUL 357	Seminar in Sociocultural Anthropology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Readings, discussions, and reports on problems in modern sociocultural anthropology.
ANTHRCUL 439	Economic Anthropology and Development	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Introduces students to the practical and theoretical problems raised by the modernization of rural, village-based tribal and peasant economies and the urbanization and industrialization of local and national communities of the non-western world. Focuses on the rapid and exciting social and economic transformation of contemporary Third World countries of Africa, Asia, Middle East, Latin America and the Caribbean.
ANTHRCUL 349	Indigenous Political Movements	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	This seminar examines contemporary indigenous political movements, including definitions and histories, politics of culture, legal treatment, significance of place, nongovernmental organizations, social movement theory, and their intersection with global environmentalism. Â Geographical focus on Latin America, the Pacific, and Southeast Asia.
ANTHRBIO 373	Humans and Environmental Change	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	This course examines the interface of human evolutionary biology and ecology throughout the span of our evolutionary history.
ANTHRBIO 369	Topics in Biological Anthropology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Course covers in-depth topics in Biological Anthropology. Â The topics covered will vary from term to term. Students should consult the time schedule for the topic in any given term.
EEB 362	Primate Evolutionary Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Primate Evolutionary Ecology --- This course examines primate ecology within an evolutionary framework. We consider how environmental factors, evolutionary history, and ecological processes affect individuals, social groups, populations, and communities. Topics in primate and rainforest conservation biology are also discussed. Emphasis is placed on critical assessment and interpretation of quantitative and graphical evidence.
ANTHRCUL 254	The Anthropology of Food	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology	Every human eats, and yet the styles and meaning of sharing food and drink together vary enormously across cultures. This course introduces students to anthropological approaches to cooking, feasting, fasting, the politics of obesity, and the cultures of fast, slow, artisanal, local and global foods.
ANTHRBIO 467	Human Behavioral Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts	This course considers the anthropological significance of recent advances in natural selection theory. Particular topics include: cooperation, reciprocity, inclusive fitness, sexual selection, mating systems, and parental investment. Students will read the primary scientific literature to learn how anthropologists test evolutionary hypotheses in varied geographic and cultural contexts (for example, Ache hunter-gatherers of Paraguay, Dogon agriculturalists of Mali, Kipsigi pastoralists of Kenya, 19th century Europeans, and contemporary North Americans). Natural selection theory will also be used to probe the field of human reproductive ecology, with emphasis on the demographic transition, historical demography, the evolution of menstruation, and female fecundabilily. In addition to exams, students will write a term paper in which they hone their ability to discriminate among alternative view points using both qualitative and quantitative data.
ANTHRCUL 328	Globalizing Consumer Cultures	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts	Globalizing Consumer Cultures --- This course presents an anthropological perspective on consumer culture. Topics include: classic oppositions between gift exchanges vs. commodity societies; analyses of advertising, branding and retail; and ethnographic descriptions of increasingly commodified lives in places as far flung as Hungary, India, Argentina, England, Sweden and Nepal as well as in the U.S.
ANTHRCUL 473	Ethnopoetics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts Â» Linguistics	Ethnopoetics: Cross-Cultural Approaches to Verbal Art --- This course explores relationships between language and social groupings such as "tribe", "ethnic group' and "nation". Â Are such groupings based on shared language? Â Through cross-cultural case studies and historical materials, we consider how linguistic similarities and differences unite or divide people, in practice and in ideology.
CJS 281	Study Abroad in Japan	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Asian Languages & Cultures	Required course for participants in the CJS Japan Course Connections short-term study abroad program. Students meet with the trip leader to discuss travel requirements, safety, and cultural norms, and receive basic language instruction. This course prepares students for travel abroad and increases their understanding of Japanese culture through experiential learning.

ASIAN 383	Wealth and Poverty in Korea: What it means to be rich (or not) in Korea	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Asian Languages & Cultures	This course examines the various ways in which individuals and institutions have tried to come to terms with the concept of wealth and poverty in Korea. Rather than limit the notion of wealth and poverty to the possession of material goods or the lack thereof, this course explores the various ways in which wealth and poverty create and have created meaning, beauty, ugliness, social relationships, and visions of utopia in Korea. There are no prerequisites or exams for this course. Students will be expected to write weekly reading blogs and three drafts of a research paper on wealth and poverty.
ASIAN 342	Gender and Power in Southeast Asia	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Asian Languages & Cultures, Literature, Science, & Arts Â» Women's Studies	This course draws from a wide range of material including primary source documents, ethnography, literature, and film, to examine the topics of gender and sexual identities in historical and contemporary Southeast Asia.
ASTRO 101	Introductory Astronomy: The Solar System and the Search for a new Earth	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Astronomy	This class explores how data form NASA probes and other telescopes are used to understand the formation of our solar system, explain the features of our planets and their moons, and search, planets outside our own Solar System.
ASTRO 401	Exoplanets	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Astronomy	"Exoplanets" are planets found outside of our Solar System, orbiting stars other than the Sun. This course gives an overview of exoplanet science: the physics underlying topics within planet discovery and characterization; major and recent scientific results; and how these findings put our Solar System in context with and inform astrobiology.
ASTRO 142	From the Big Bang to the Milky Way	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Astronomy	This introductory course follows the evolution of the Universe from the Big Bang to the formation of galaxies such as the Milky Way with an emphasis in our current understanding of its formation, evolution, and make-up.
BIOLOGY 130	Animal Behavior	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	This course is an introduction to the behavior of animals in their natural environment. Students gain a background in evolution and learn how to use natural selection to understand why animals behave the way they do.
BIOLOGY 108	Introduction to Animal Diversity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	This course will introduce students to the amazing diversity of animals in our world. We will discuss how animals within this diversity manage to survive, function, reproduce, and behave in their natural environment. Meanwhile, we will explore interesting questions that scientists ask about animals. We ultimately want students to leave this course with
BIOLOGY 207	Introductory Microbiology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	The lectures will trace the history of microbiology, microbial growth and metabolism, microbial diversity, and the importance of microbes in the environment, industry and medicine. The laboratory sessions introduce microscopy, aseptic technique, staining, and the isolation, culture and identification of microbes from the local environment.
BIOLOGY 107	Evolution of Life	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	Evolution of Life --- This course provides an introduction to biological evolution. We consider: the evidence for evolution; an overview of the evolution of cells, organisms, and viruses; evolutionary themes of natural selection, chance, and cooperation; and the consequences of an evolutionary world view for understanding disease, biological diversity, and human culture.
BIOLOGY 171	Introductory Biology: Ecology and Evolution	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	BIOLOGY 171 is a one-term introductory course in ecology and evolutionary biology that imparts factual and conceptual knowledge on the origin and complex interactions of the earth's biodiversity and ecosystems. Its goal is to help students to develop scientific hypothesis-testing, critical-thinking and writing skills. BIOLOGY 171 is part of a two-semester introductory unit that includes BIOLOGY 172 and 173.
BIOLOGY 172	Introductory Biology - Molecular, Cellular, and Developmental	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	Introductory Biology - Molecular, Cellular, and Developmental --- BIOLOGY 172 is a one-term introductory course in molecular, cellular, and developmental biology that imparts factual and conceptual knowledge on how cells, organs, and organisms work. One of its goal is to help students develop scientific hypothesis-testing, critical-thinking and writing skills. BIOLOGY 172 is part of a two-semester introductory unit that includes BIOLOGY 171 and 173.
BIOLOGY 173	Introductory Biology Laboratory	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	BIOLOGY 173 is a integrative, project-based, one-term introductory laboratory course intended for concentrators in any of the biological sciences, other science programs, and pre-professional studies. Students should minimally have completed one of the two introductory biology lecture course, BIOLOGY 171 or 172, and be enrolled in the other.
BIOLOGY 256	Animals Functioning in Environments	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	Discover intriguing research being done by environmental physiologists, ecological morphologists and evolutionary physiologists! Learn about applications to environmental health and animal conservation. Investigate how evolutionary history influences animal form and function. Learn how physiological and functional patterns relate to the diversity of Earth's habitats. Learn from human, vertebrate, and invertebrate examples.
Biology 212	Plants and Human Health	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology	Plants and Human Health --- Plants are the ultimate source of all human food and most medicine, and also play essential roles in environment for healthy human life. In this course, students learn basic botany, human use of plants as food and medicine, and the important relationship between environment and human health.
BIOLOGY 255	Plant Diversity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts	This course examines plant diversity by groups, ranging from algae and nonvascular plants through primitive vascular plants and culminating in flowering plants. Using an evolutionary perspective, it treats plants as organisms and emphasizes the innovations and structural adaptations of the various plant groups as well as life history strategies. Weekly field trips allow exploration of local natural areas.

EEB 482	Freshwater Ecosystem: Limnology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts	*BIOSTATION* This course introduces the fundamentals of aquatic ecology (with an emphasis on lakes) from an ecosystem-level approach. General limnological principles as well as physical, chemical and biological parameters of lakes will be studied. Biological investigations include an introduction to the ecology and taxonomy of the algae, zooplankton, macroinvertebrates, macrophytes, and fishes. Field studies include a comparative lake survey in which students will gain experience in field sampling, laboratory analysis of samples, statistical analysis and interpretation of data for several types of lakes.
BIOLOGY 230	Introduction to Plant Biology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts	This course presents a broad, integrated overview of plant biology including economic and environmental aspects. The main themes are plant diversity, structure, function, development, and ecology.
BIOLOGY 288	Animal Diversity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts	Animal Diversity --- Biology 288 will provide biology majors with a survey of the animal phyla in the context of discussions of major issues in ecology and evolution. Students will see the diversity of behavior, mating systems, life history, and diverse interactions.
ENVIRON 281	General Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts Â» Program in the Environment	The course introduces the basic concepts and principles of ecology as applied to the study of individuals, populations, and communities of both plants and animals.
BIOPHYS 420	Structural Biology I	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Biophysics	This course covers topics including structure and folding of biological molecules, biochemistry of cellular processes, biochemical approaches, reaction rate and enzyme kinetics.
CHEM 216	Introductory Bioinorganic Chemistry: The Role of Metals in Life	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Chemistry	An alternative to the CHEM 302 requirement for Chemistry and Biochemistry majors, the course covers fundamental principles of inorganic chemistry in the context of the role of metals in biological systems. Special emphasis is put on the role of metals in biological systems, and the connection between fundamental (classroom) knowledge of biological processes with respect to metals, and their relation to commonly known phenomena--diseases, pollution, alternative energies, evolution, industrial processes, etc.
CHEM 126	General Chemistry Laboratory II	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Chemistry	A three-hour laboratory accompanied by a biweekly one hour discussion with a focus on experiment design, data analysis, and oral communication skills.
CHEM 303	Introductory Bioinorganic Chemistry: The Role of Metals in Life	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Chemistry	An alternative to the CHEM 302 requirement for Chemistry and Biochemistry majors, the course covers fundamental principles of inorganic chemistry in the context of the role of metals in biological systems. Special emphasis is put on the role of metals in biological systems, and the connection between fundamental (classroom) knowledge of biological processes with respect to metals, and their relation to commonly known phenomena--diseases, pollution, alternative energies, evolution, industrial processes, etc.
CHEM 474	Environmental Chemistry	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Chemistry	This course is the study of natural processes in the atmosphere, hydrosphere, and lithosphere, as well as how mankind alters these systems. Natural cycles in the environment, perturbations due to human activity, steps being taken to mitigate these effects, and the impacts on human health and climate will be covered.
CHEM 109	Natural Science: Bridging the Gaps	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Chemistry, Literature, Science, & Arts, Literature, Science, & Arts Â» Physics	An interdisciplinary, team-taught introduction to the scientific method, involving subject matter from physics, chemistry, astronomy, geology, biology, and ethics. Demonstrations provide nearly hands-on experience with relevant phenomena.
COMM 430	The Media in U.S. History	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Communication Studies	This course places the development of American mass media in historical perspective. It surveys the evolution of the mass media from colonial times to the present, focusing on the development of contemporary forms: the newspaper, magazine, broadcasting, and motion picture. Changes in the structure of the media are examined in connection with historical and economic trends in American society. While there are no specific prerequisites, a general grounding in American history is recommended.
COMM 380	Persuasion, Communication and Campaigns	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Communication Studies	This course covers theories of persuasion, how to evaluate the effects of persuasive communication on individuals and groups, as well as the design and evaluation of persuasive communications. Â As an ULWR, the course also focuses heavily on developing strong, evidence-based arguments, and communicating those arguments clearly in writing.
COMM 468	Political Misinformation and Misperceptions	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Communication Studies	Inaccurate beliefs about politics are prevalent in America and held about a range of political issues and politicians. Once they take hold, misperceptions are often difficult to correct and can impact democratic outcomes. This CAPSTONE seminar explores several factors that contribute to the spread of political misinformation and the rise of misperceptions, including the roles of media, social networks, and psychological biases. The course also examines the consequences of inaccurate political beliefs and investigates various communication strategies and media campaigns utilized to correct misperceptions.
COMM 413	Environmental Communication	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Communication Studies, Literature, Science, & Arts Â» Program in the Environment	This course serves as an introduction to the theory and practice of environmental and science communication. Topics include media depiction's of environmental issues, the role of the media in influencing public opinion and policy actions, expert environmental communication by scientists and policy-makers, and theories that guide effective strategic environmental communication. We will engage with many of the critical environmental issues of our day, including climate change, fracking, support for renewable energy initiatives, and many more.
CMPLXSYS 489	Advanced Topics in Complex Systems	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Complex Systems	This course covers a broad range of advanced topics relevant to the study of complex systems. Topics include evolutionary systems, self-organizing criticality, measures of complexity, collective intelligence, approaches to modeling complex adaptive systems and emergence.

CMPLXSYS 391	Introduction to Modeling Political Processes	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Complex Systems, Literature, Science, & Arts Â» Political Science	We study the science, art, and practice of modeling. Models help us to understand the logic of phenomena, to explain, communicate, predict, act, design, and explore. We focus on models relevant to political, economic, and social systems but we will venture into other disciplines. The models we study apply to a diverse array of types of actors ranging from individuals, to groups, to organizations, and nations. Understanding, interpreting, and applying these models requires a willingness to grasp abstractions, to interpret diagrams, and to perform algebraic manipulations of equation based models.
EARTH 107	Volcanoes and Earthquakes	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	The Earth in action; geography of earthquakes and volcanoes and catastrophic events in historic times; size and frequency of occurrence of earthquakes and volcanic eruptions; the products of volcanism, volcanic rocks, and volcanic and geologic activity through geologic time; volcanic exhalations and the evolution of the Earth's atmosphere and oceans; the relationship of earthquakes and volcanoes to plate tectonics and the internal dynamics of the Earth; and volcanism and geothermal energy, man-made earthquakes, and earthquake prediction and control.
EARTH 109	Water and Society	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course will present an overview of problems encountered through the unwise use of water resources and the resultant impact on society through the analysis of case studies. An introduction to the hydrological cycle and principles of surface and groundwater hydrology will be provided.
EARTH 305	Earth's Surface & Sediments	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Properties of sediments and their origin, transportation, desposition, lithification, and diagenesis followed by ecology and environmental analysis, paleoecology, facies analysis, and an introduction to stratigraphic methods and principles.
EARTH 422	Principles of Geochemistry	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Instruction is directed toward how geochemical methods, such as stable isotope and trace element analysis, radioactive age dating, determination of phase relations of minerals and melts at low to high temperature and pressure, and computation of or experimentation on equilibria in the hydrosphere, hydrothermal solutions, and metamorphic and igneous systems, can unravel and provide insight into the origin and chemical evolution of the earth and its parts (core, mantle, crustal rocks).
EARTH 435	Field Studies in Mineralogy, Petrology, and	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Field Studies in Mineralogy, Petrology, and Geochemistry
EARTH 436	Field Studies in Stratigraphy, Paleontology,	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Field Studies in Stratigraphy, Paleontology, and Sedimentology
EARTH 535	Seminar in Mineralogy, Petrology, or Geochemistry	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Seminar in Mineralogy, Petrology, or Geochemistry Thermodynamic and transport properties of silicate liquids (density, compressibility, heat capacity, viscosity)
EARTH 113	Planets and Moons	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	EARTH 100-115 are short (half-term) one-credit minicourses. They consist of detailed examinations of restricted geologic and environmental topics. The Department lists the specific courses from this series in theÂ Schedule of ClassesÂ for the terms they are offered.
ENVIRON 120	Geology of National Parks & Monuments	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This is an introductory course that uses the National Parks (Hawaii, Yellowstone, Crater Lake, Yosemite, Grand Canyon, Zion, Pt. Reyes, Death Valley, Grand Teton, Rocky Mtn, Glacier and Pictured Rocks) to explore the geological history of the Earth, and specifically the tectonic evolution of the North American continent. Topics include plate tectonics, global volcanism, large explosive volcanic eruptions, the age of the Earth, the history of life (fossil record), meteorite impacts, earthquakes, mountain building, the origin of the Great Lakes, and climate change throughout Earth history.
EARTH 412	Geochemistry of the Solid Earth	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course addresses the evolution of the solid Earth through magmatic and metamorphic processes. Major themes addressed are: the compositional and mineralogical stratification of the Earth and its early history (accretion, core formation, magma oceans); formation of oceanic crust at spreading ridges; hydrothermal alteration of oceanic crust and subsequent metamorphism during slab subduction; origin and evolution of continental crust at subduction zones; regional metamorphism during subduction and continent-continent collision; recycling of ancient slabs and intraplate volcanism; interaction of "hot spots" with spreading ridges and continents; large-volume silicic volcanism; large-volume basalt volcanism; continental crust formation throughout Earth history and long-term secular evolution of the mantle.
EARTH 351	Earth Structure	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Geological structures of the lithosphere and introduction to global tectonics. Three hours lecture, one laboratory weekly. Topics include: folding, faulting, stress, strain, rheology, deformation mechanisms, whole-earth structure, plate tectonics.
ENVIRON 442	Earth Surface Processes & Soils	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Study of processes resulting in landforms on the Earth's solid surface and the formation of soils on these landforms. Emphasis includes present-day processes as well as the evolution of landforms over geologic time. Several required field trips will examine landforms and processes in southern Michigan.
UP 572	Transportation and Land Use Planning	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course explores the interrelated systems of urban transportation and urban land use to discover principles and ideas that can be useful in developing plans that affect the two. The course covers four broad areas: Transportation Planning History: What assumptions and approaches have guided domestic transportation planning? How do transportation planningâ€™s roots and traditions affect current practice? In what ways did transportation planning and technologies interact to produce evolving city forms? Transportation and Land Use Theory: What frameworks have been developed to understand the interrelationships between transportation and land use, and how might these affect how we view potential transportation planning alternatives? Transportation Planning Techniques: Formal approaches to modeling domestic land use and transportation systems in the past few decades. We explore these approaches as well as their limitations. Urban Transportation Policy: Alternative definitions of â€œthe transportation problemâ€ can lead to different directions for policy. We explore various contemporary transportation planning concerns and approaches to dealing with them.

EARTH 417	Geology of the Great Lakes	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Geologic history of the late-glacial and post-glacial Great Lakes of North America, with emphasis on evaluation of evidence. Related topics such as lake circulation, bedrock setting, and physical environment of sedimentation, and paleoclimate records are examined.
EARTH 449	Marine Geology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This class provides a survey of marine geology. Subjects include: the morphology and evolution of the ocean basins; relationships among magmatic, tectonic, and hydrothermal processes at mid-ocean ridges; subduction zone processes; the development of continental margins; and the sources, distribution, and evolution of deep sea sediments.
EARTH 478	Geochemistry of Natural Waters	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	hemical compositions of natural waters, emphasizing both chemical and biogeochemical processes operating near Earth's surface; equilibrium vs. kinetic controls on chemical weathering; solute sources and mass balances in watersheds, groundwater, and river/ocean mixing zones.Â Hands-on field andÂ lab experience provides training in methods of applied geochemistry.
EARTH 153	Earthlike Planets	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Introduces, in a seminar format, the freshman or sophomore undergraduate to the terrestrial planets. Studies of solid planets are used as a vehicle to better understand our own world and the methodology and limitations of science in the presence of conflicting hypotheses and ambiguous data.
EARTH 154	Ocean Resources	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	The oceans provide many resources, including food, recreation, energy, and minerals. This course examines scientific principles behind these resources, as well as the conflicts that arise because of their utilization (the ocean as food resources vs. overfishing; development of beaches and marinas vs. preservation of wetlands; etc.).
EARTH 205	How the Earth Works: the Dynamic Planet	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	An integrated look at the dynamic Earth, with an emphasis on processes involved in its formation 4.56 billion years ago, the early development of its atmosphere, oceans and crust, and the subsequent evolution of its continents and ocean basins.
EARTH 151	The Ice Ages: Past and Present	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Explores the characteristics of the Earth's climate system and how the various components of that system operate to produce times when extensive ice sheets cover large parts of the Earth's surface. The role of each of the major components of the climate system will be discussed in detail. These include the ice sheets themselves, the astronomical inputs, the oceans, the atmosphere, and the movement of the continental and ocean boundaries. Reconstructions of past climatic conditions are presented and discussed in terms of how they are developed, what they can tell us about climatic extremes, and how they can be used to test the models that simulate modern climate patterns. The long-term climate change associated with the most recent ice age is then contrasted with more rapid climate oscillations, particularly the climatic warming which has been associated with the recent large increase in atmospheric "greenhouse gases."
EARTH 148	Seminar: Environmental Geology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This seminar examines interactions between people and their physical environment through case histories. We discuss several environmental problems, including natural hazards, water resources, nuclear waste disposal, and geologic aspects of environmental health. Emphasis will be given to current water issues.
EARTH 147	Natural Hazards	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This first-year seminar examines the geologic origin, as well as economic and societal impact of natural hazards such as earthquakes, volcanoes, landslides, floods, tsunamis, climate change, and meteorite impacts through lectures, discussion, student presentations, and research projects.
EARTH 468	Data & Models	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course introduces Earth and physical science students to data analysis techniques and methods for constraining model parameters. It will emphasize learning conceptual approaches to data analysis and applying these approaches in homework and computer exercises.
EARTH 146	Plate Tectonics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Two hundred million years ago the Earth's continents were joined together to form one gigantic super-continent, called Pangea. Plate tectonic forces broke Pangea apart and caused the continents to drift. We study the evidence for plate tectonics and the large-scale dynamics of the Earth's interior that is responsible for mountain building, earthquakes faulting, volcanic eruptions, changes in Earth's magnetic field and much more.
ENVIRON 325	Environmental Geochemistry	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course deals with the geochemistry of our environment. It focuses on the geochemistry of the lithosphere, hydrosphere and atmosphere and the ways in which they affect the biosphere. Applications of these principles to present-day problems in environmental geochemistry are discussed.
EARTH 451	Earth Structure: Introduction to Structural Geology & Tectonics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Description and interpretation of geological structures in the Earth's crust and introduction to global plate tectonics. Topics covered are: mechanics, stress, strain and deformation; hand-specimen and field description of geological structures; the kinematics and dynamics of folding and faulting; flow of rocks (rheology); introduction to dislocation theory; microstructural analysis; principles of plate tectonics; tectonic evolution of selected regions. The course is aimed at those with an interest in geology beyond the introductory level, as well as students who want a basic understanding of the outer Earth's physical properties.
CLIMATE 140	Climate and the Media	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Climate and the Media --- Few subjects garner as much media attention and controversy as stories about global warming. This seminar will introduce students to the basic concepts and observations that form the basis of our understanding of climate change and explore how these concepts are reflected and occasionally distorted by the media.

EEB 445	Biogeography	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course covers geographic aspects of ecological and evolutionary processes of populations, communities, and lineages. The course investigates the physical and biological processes shaping geographic patterns of species richness, community structure, and ecosystems over the earth and at regional and local scales, as well as the geographic structure of populations and species. Geohistorical dimensions of these topics include dispersal and vicariance, speciation, and extinction, and macroecological and macroevolutionary trends over earth history. Examples and case studies cover the full range of organisms and environments.
EARTH 446	Paleoclimatology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course examines climate change throughout Earth's history. Topics include the following: description of Earth's climate history, physics of the Earth's climate, methods of reconstructing past climate and climate forcings, and biological causes and consequences of climate change.
EARTH 331	Climate Change	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course examines the physical and chemical processes influencing Earth's climate and the methods of quantifying past and present climate change.Â Emphasis is placed on understanding the mechanisms of climate change from ice ages through the near future.Â The evidence of human-caused changes in climate is also discussed.Â Students with interests in global change and the environment are encouraged to enroll.Â A background in college science is not required.
EARTH 108	When Earth Attacks: The Science Behind Natural Disasters	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Natural disasters, such as earthquakes, volcanic eruptions, tsunamis, landslides, floods, hurricanes, and tornados, can lead to thousands of fatalities and billions of dollars in economic damage. This course explores the science behind natural disasters, concentrating on our ability, or inability, to predict them, and how this affects public perception and policy. The course also addresses how natural disasters can lead to changes in both science and public policy.
EARTH 314	Global and Applied Geophysics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course covers the use of geophysical methods for exploration of the shallow subsurface, as is used in oil and mineral exploration, search for water, and environmental problems. We discuss exploration techniques based on gravity, electromagnetics and elastic wave propagation. Lab exercises include discussion and hands-on experience with data collection techniques (using geophysical equipment on campus), data interpretation, and computer modeling.
EARTH 313	Geobiology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course addresses several core geobiological themes in two very different worlds, the microbial world and the vertebrate world. Themes include the coevolution of the biosphere and geosphere, major evolutionary innovations and events, diversity of life and metabolism, biomechanics, and biogeography.
EARTH 156	Coral Reef Dynamics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	The biology and ecology of modern reefs are studied, together with the evolution of the reef community and its composition over geologic time. The class investigates the interaction between the organisms living in association with coral reefs. It also explores the ways in which our species affect the reefs and both directly and indirectly through climate change.
EARTH 495	Methods in Research for Natural Sciences	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences	Methods in Research for Natural Sciences --- This course covers the approaches to conducting research in the natural sciences, including the tools and methods of research; the processes for performing research; the mechanisms for communicating research results; and the responsible conduct of research. Meets the NSF/NIH requirements for the responsible conduct of research.
CLIMATE 411	Cloud & Precipitation Processes	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Engineering Â» Climate & Space Sciences	The special nature of water substance; nucleation of phase changes in the free atmosphere; the structure and content of coulds; the development of physical characteristics of precipitation; and the dynamics of rain systems.
EARTH 440	Field Course in Geology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	In this broad, in-depth field course, students are trained to recognize distinct lithological units and their 3-D relationships. Mapping projects include deformed and faulted sedimentary, regional metamorphic, and igneous complexes. Digital mapping techniques and modern geophysical tools supplement traditional field observations.
EARTH 418	Transportation and Land Use Planning	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	Introduction to the principles, methods of analysis, and major controversies within paleontology; familiarization with the fossil record and its use in problems involving evolutionary biology, paleoecology, and general Earth history.
EARTH 437	Evolution of Vertebrate	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	Lectures and laboratory exercises on the anatomy, ecology, and phylogeny of fishes, amphibians, and reptiles in the fossil record, with emphasis on adaptation and evolution.
EARTH 455	Determinative Methods in Mineralogical and Inorganic Materials	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	Determinative Methods in Mineralogical and Inorganic Materials
EARTH 206	How the Earth Works: The Water Cycle & Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	This course describes behavior of earth materials in the surficial environment. Water is the main transport agent in the geological cycle; its unique properties and exchange rates among oceans, lakes, rivers, and groundwater are one focus. Interaction between water reservoirs and physical and chemical weathering of soils, sediments, and rocks also are discussed. Impact of humans on the surficial environment is a unifying theme because we can affect hydrologic and geochemical cycles. No special background required. Two lectures per week. Evaluation based on exams and participation.
EARTH 115	The Emerald Planet	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	This minicourse explores the major events in the co-evolution of plants and the Earth. Topics include: how plants moved onto land, the rise of the first forests, the invention of flowers and their impact on animals, and how plants bring about and respond to environmental change.

ENVIRON 119	Introductory Geology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	A basic single-term course in introductory geology concentrating on the evolution of the Earth in physical and chemical terms. Reference to the interaction of the external biosphere/atmosphere/hydrosphere with the earth?s interior is an essential component of the course. Topics covered include: plate tectonics: continental collision and fragmentation tsunamis, earthquakes and volcanoes evolution and extinction: dinosaurs and the fossil record glaciers, global warming, and climate change geologic time
ENVIRON 380	Mineral Resources, Economics, and the Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	This course deals with mineral resource-related problems in a complex society. The course discusses the origin, distribution, and remaining supplies of mineral resources in terms of the economic, engineering, political, and environmental factors that govern their recovery, processing, and use. Topics covered in the course include nuclear waste disposal, strip mining, continent-scale water transfers, mineral profits and taxation, and estimation of remaining mineral reserves.
ENVIRON 232	Introductory Oceanography	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	This course explores the Earth's oceans in terms of geological, chemical, physical, and biological oceanography, with emphasis on understanding the oceans as an integrated system. We study the processes that form ocean basins, the forces that govern ocean circulation, the physical and chemical properties that influence the distribution of life, and the adaptation of organisms to their aquatic environment. We also discuss the ocean's role in mitigating global change and the consequences for oceanic ecosystems and human society.
EARTH 223	Intro Ocean Lab	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	One three-hour lab each week.
ENVIRON 479	Hydrogeology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	This course provides an introduction to hydrogeology with particular emphasis to physical aspects. We will particularly focus on process and direct applications to geological settings. Problem solving is an important course component. The hydrologic cycle, physical rock framework, and properties of aquifer systems will be described and quantified. Groundwater flow and mass transport equations will be covered, as well as pump test design and analysis. Natural tracers and groundwater dating also will be discussed. An introduction to groundwater modeling with simulation of groundwater flow and mass transport will be provided.
EARTH 450	Ecosystem Science in the Rockies	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	This 4-week course explores the principles of ecosystem science using field projects in the Rocky Mountains. The unique and diverse geological history and climate of this region controls the occurrence of terrestrial and aquatic ecosystems, and the plants and animals of which they are composed. We will develop and use an understanding of geological and metrological processes to understand the distribution and function of grasslands, forests, and alpine ecosystems in the Rocky Mountains. The course is designed for majors in geological sciences, natural resources and environmental science to gain field-based knowledge and experience of Rocky Mountain geology and ecology. It is also designed for students majoring in other areas who have a general interest in this subject matter. This course will be team taught by professors from several different disciplines.
EARTH 408	Introduction to GIS in the Earth Sciences	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	Introduction to GIS in the Earth Sciences --- This course provides an understanding of Geographic Information Systems and their application in the earth sciences. Through lectures and lab exercises students are exposed to GIS theory, applications and software.
ENVIRON 202	Introduction to Earth and Environmental Sciences in the Rockies	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	Introduces students to environmental science in the Rocky Mountains through field-based studies at the U-M Camp Davis Rocky Mountain Field Station. The objective of the course is to understand through observation and hands-on experience how natural and human processes cause environmental change. Students learn the principles of the physical sciences, including aspects of earth, atmosphere, and biogeographical sciences, while experiencing the grandeur of the West. We use these principles to understand how past environmental change altered the Rocky Mountain landscape, plants and animals, and how humans are currently perturbing these natural systems. We address today's most pressing environmental issues including climate change, biodiversity loss, and air, water, and soil pollution.
EARTH 116	Intro Field Geol	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts, Literature, Science, & Arts Â» Program in the Environment	An introduction to geology in the field, this course is the equivalent of GEOSCI/ENVIRON 118/119 but is taught at Camp Davis, the University's Rocky Mountain Field Station near Jackson, Wyoming. It stresses principles and processes involved in the evolution of the earth. The course includes rigorous laboratory exercises in which students study minerals, rocks and fossils, and structures in their natural settings. Lectures are given both in camp and in the field, but much time is spent outdoors in the nearby Teton, Hoback, Gros Ventre, and Snake River Ranges. Other trips of special significance include the Wind River Range. Craters of the Moon, and Yellowstone Park.
EEB 380	Oceanography: Marine Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Marine ecology is the branch of biological oceanography that applies ecological principles to the study of marine life. Lectures cover the interrelationships of marine organisms and their environment. Organisms and communities from the following habitats are discussed: estuaries, the rocky intertidal zone, coral reefs, the coastal zone, the deep-sea and the open ocean. The course treats the ecology of diverse marine organisms ranging from bacteria to whales.
EEB 431	Ecology of Animal Parasites	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Various ecological aspects of animal parasite populations will be studied including life cycles, species diversity, diet and seasonal periodicity, intra- and interspecific competition, host specificity, longevity, recruitment, pathology and parasite-induced behavioral changes in the host. Field and laboratory techniques for studying these host-parasite relationships will be emphasized.

EEB 468	Biology of Fungi	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This course provides an introduction to all aspects of fungal biology, including: biodiversity, genetics, ecology, and the importance of fungi to society. Fungi are ubiquitous, and students will learn to recognize and identify fungi as well as to study the myriad roles they play in ecosystems as saprobes, parasites, and mutualists. Fungi are also excellent model systems and we will investigate their use as genetic models and study how the dawn of the post-genomic era has impacted the field. The course will be composed of one hour of lecture followed by two hours of laboratory exercises, experiments or field trips.
EEB 490	Evolution at the Population Level	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This course deals with evolution of life from the population-level perspective, which ignores internal structure of organisms and, instead, considers their external features, emphasizing gene transmission and natural selection.
EEB 390	Evolution	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This course covers the fundamentals of evolutionary biology with a focus on living organisms. It includes a historical survey of the development of evolutionary theory from ancient philosophers to the present, and critical examination of phylogenetic systematics, natural selection, population genetics, molecular evolution, micro-evolution, and macro-evolution.
EEB 472	Plant-Animal Interactions	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Covers basic concepts dealing with the ecology of plant-animal interactions and coevolution. Topics include such interactions as behavior, pollination, seed dispersal and predation, and various mutualisms. Readings are from the current literature.
EEB 470	Microbial Diversity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	The course describes the biological diversity of prokaryotic microorganisms, members of the Domain Bacteria and Domain Archaea, examining the evolutionary origins of microbial life, the metabolic roles extant prokaryotes carry out in maintaining the biosphere, their physiological adaptations to the environment and to environmental extremes, and modern phylogenetic approaches for their identification and evolutionary analysis.
EEB 335	Biodiversity Research Seminar	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Biodiversity Research Seminar --- This course aims to introduce undergraduates to current research topics in ecology and evolutionary biology. Students attend weekly EEB seminars presented by either outside invited scientists or by in-house faculty and graduate students. This is followed by a written critical synopsis, and instructor-led discussion, of the research presented.
EEB 485	Population and Community Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Principles governing the phenomena of single and interacting populations are examined, from basic tenets to cutting-edge research questions. Population and community-level perspectives are integrated by drawing parallels between approaches and considering how to scale up from the phenomena of one or a few species to the structure and dynamics of whole communities.
EEB 391	Introduction to Evolution: Quantitative Approach	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	Introduction to Evolution: Quantitative Approach --- This course examines evolutionary biology based on a number of key concepts and partial formal theories. It includes the history of life, microevolution, and macroevolution along with the data and methods for obtaining it. The course extensively uses simple concepts of calculus, probability theory, and computer science.
EEB 320	Rivers, Lakes, and Wetlands: Introduction to Aquatic Ecosystems	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This field course introduces fundamental physical, chemical, and biological concepts and basic techniques necessary for the study of aquatic ecosystems. Topics include physical-chemical processes, an overview of aquatic fauna and flora, and surveys of major types of aquatic ecosystems, including rivers and streams, lakes and wetlands. Interactions between the hydrological cycle and the landscape provide the basic theme around which ecosystem presentations are organized. Field trips and laboratory exercises will focus on sampling representative environments, the collection/identification of biological specimens, and learning research techniques.
EEB 442	Biology of Insects	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	The course is intended to provide an introduction to the biology and diversity of one of the most important, and certainly the most diverse, groups of organisms. The emphasis is on insects as organisms, especially evolutionary, ecological, and behavioral aspects. The course will also emphasize insect examples of general biological principles, especially in evolution and ecology. The lectures will be devoted largely to general aspects of insect biology, including morphology, physiology, embryology, behavior, ecology, and evolution. It is impossible to appreciate much of this material without a good familiarity with the diversity of insects, which is in itself one of the major reasons for studying entomology. Therefore, the emphasis of the lab will be on taxonomy: learning many insect groups and their natural history, as well as developing the ability to identify insects. This will require considerable memorization, but is essential, especially for assimilating information on patterns of insect evolution and ecology. We hope you will obtain from the course an acquaintance with some general principles of biology as illustrated by insects; an appreciation of the rich opportunities for research that insects offer in every realm of biology; some knowledge of the fascinating diversity of insects; and an ability to go out, anywhere and at almost any time, and see the wonderful variety of life with which we share the world. Early in the course, we will devote lab sessions to field trips. You may use these as opportunities to add specimens to your collection. You should wear long pants and footwear that you are prepared to get wet or muddy. The rest of the labs will be devoted to learning taxa of insects, mostly by keying out specimens provided in the lab; and, as time permits, to work on identifying specimens in your collection using the keys in Borror, Delong, and Triplehorn, An Introduction to the Study of Insects, several copies of which will be available in the lab. You must learn to use the keys in this book; they will be needed for the lab exams.
EEB 330	Biology of Birds	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	This course provides an introduction to ornithology with emphasis on field identification of the birds of eastern North America. Field trips are to a variety of habitats in the region. Labs include classification, morphology, and identification of study specimens. Lectures cover a variety of topics on the evolution, physiology, behavior, ecology and conservation of birds. Each student participates in a group project.

EEB 341	Parasitology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	An introduction to the study of parasitism, with special reference to the evolution of the parasitic habit.
EEB 453	Field Mammalogy	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	An introduction to the study of mammals. Students will learn methods of studying mammals in the field by carrying out a series of projects on the wild mammals of northern Michigan. These projects will be designed to give familiarity with areas of active research on the ecology of mammals and practical experience with the excitement and headaches of formulating hypotheses, carrying out fieldwork, and analyzing data. Some familiarity with elementary statistics is helpful but not necessary.
EEB 457	Algae in Fresh Water	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	A survey of the algae of northern Michigan with emphasis on taxonomy and ecology. Students become familiar with the algae of streams, bogs, fens, swamps, beach pools, and the Great Lakes. Special attention is given to field investigations of periphyton and phytoplankton community ecology and their application to water quality assessment.
EEB 459	Systematic Botany	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	The integration of taxonomy, evolution, and phylogenetics, focusing on flowering plants. Training in the major groups of flowering plants, including classification systems, identification, naming, morphology, molecular evolution, and biogeography. Lab emphasis on representative families and genera of major plant groups, use of identification keys, and plant collections.
EEB 480	Evolution and Ecology Inference	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	Teaches METHODS for formulating hypotheses and for generating predictions from them so that they may be tested with data. These methods will enable you, as a natural scientist, to participate responsibly in the design of your experiments and observations, and in the making of inferences from the data they provide, free of the burden of unwanted mathematical assumptions.
EEB 483	Freshwater Ecosystems: Limnology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	Freshwater ecology is the study of environmental and ecological aspects of inland lakes and streams (also called "Limnology"). Some of the topics covered in this course are: the origin of lakes; the importance of physical and chemical properties; the geochemical cycling of different elements such as carbon, phosphorous, and nitrogen; the ecology of aquatic bacteria, phytoplankton, zooplankton, benthos, macrophytes, and fish; the pollution and eutrophication of lakes; the recent concepts in stream ecology; paleolimnology; food-chain dynamics; energy flow; and experimental investigations using whole lakes.
EEB 486	Biology and Ecology of Fish	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	Lectures provide background in fish ecology, distribution and evolution, and in the geological history of North American freshwater habitats. Laboratory and field exercises, designed to investigate the physiological, behavioral, and numerical responses of fish to biotic and abiotic factors. Group exercises stress methods for studying community interactions, population ecology and limiting factors, and students are expected to design and carry out independent studies applying methods learned in class to specific problems in fish ecology.
EEB 556	Field Botany of Northern Michigan	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	*BIOSTATION* This course offers a comprehensive field approach to vascular plants of the region, including characteristic species of terrestrial and wetland habitats as well as species known for their rarity or distinctive distribution patterns. Topics covered include the major plant families of the Great Lakes area, basic terminology and techniques useful in plant identification, the general phytogeography and ecology of the region especially as these relate to recent geological history of the landscape, and field recognition of over 300 selected species. Prior familiarity with at least some families and species will be extremely helpful.
EEB 489	Soil Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment	Soils as central components of terrestrial ecosystems. Major emphasis is placed on physical, chemical, and biological properties and their relationships to plant growth and ecosystem processes. Understanding is developed using a combination of lectures, field- and laboratory-based exercises, and individual research. The function of soils in forested ecosystems is the primary focus; however, examples are drawn from a wide range of terrestrial ecosystems. This course centers on the overlap of soil science, forest ecology, and ecosystem ecology. Our goal is to understand: how the interactions of landform, topography, climate, and biota over time lead to the patterns of soil development and the distribution of soil types that we observe within the landscape; how physical, chemical, and biological properties of forest soils affect water and nutrient availability to plants and, ultimately, ecosystem productivity; and how nutrients are cycled within forest ecosystems and how these processes are influenced by land management practices.
ENVIRON 381	General Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment	General Ecology --- Fundamental concepts and principles of ecology of both plants and animals applied to the study of individual organisms, populations, and communities. Â Field and laboratory work emphasized the collection and analysis of basic data. Â A formal introduction to the discipline of ecology and suitable as a prerequisite for intermediate and advanced courses in the subject.
EEB 348	Forest Ecosystems	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment	This field course is focused on the ecology of forest species and the characteristics of ecological systems which support them. Basic concepts of ecosystem structure and function are emphasized in lectures, discussions, and twice-weekly field trips to diverse upland and wetland forests in and surrounding the Biological Station. These include some of the finest old-growth hardwood and conifer forests in Michigan as well as dry, fire-prone pine plains, mesic northern hemlock-hardwood forests on moraines, diverse forested wetlands, and red oak forests which are the legacy of Native American agriculture. Emphasis is placed on the integration of topography, soil, and vegetation at each field site. The dynamics of fire ecology, regeneration ecology, and forest succession are stressed. Knowledge of forest species and ecosystem components through hands-on field work provide the basis for understanding why plants grow where they do. This ecocentric approach is applicable in temperate forest ecosystems around the world.

EEB 487	Ecology of Fishes	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability	There is a current biodiversity crisis as the species diversity and abundances of many species decline in nature. The three classes commonly called fishes include more species of vertebrates than all other classes combined. Fishes also have a higher rate of endangerment than all other classes of vertebrates, due to human use of aquatic resources. Ecology of Fishes is a course for juniors and seniors that focuses on the dramatic interaction between fishes and their habitats, as a driver of this biodiversity crisis. The course covers: physiological, behavioral, and numerical responses of fishes to biotic and abiotic factors; the relationship between environmental factors and fish energetics, growth, survival, behavior, and reproduction; adaptations of fish for survival under different environmental constraints in major habitat types; and the role of humans in fishery declines and fish conservation.
EAS 451	Biology of Mammals	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability	ntroduces students to the diversity of mammals. Through laboratory exercises (one four-hour laboratory period/week) and lectures, participants will have an opportunity to see and learn about species representing all of the major groups of mammals. We will review their evolutionary history; examine their adaptations and lifestyles; and discuss current research in ecology, behavior, zoogeography, and systematics. An optional text supplements the lectures.
ENVIRON 476	Ecosystem Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability	Ecosystem Ecology is a lecture/discussion course that focuses on understanding the physical, chemical, and biological processes regulating the dynamics of terrestrial and aquatic ecosystems. We discuss classic and current topics in ecology that have built our understanding of ecosystem organization and function. The course integrates across disciplines of physiological, microbial, population, and community ecology to understand how and why ecosystems differ in composition, structure, and function, and how ecosystems change over time. Students are expected to have a solid background in biology and ecology. We also expect that students will be able to use general principles of mathematics, physics, chemistry, and biology as tools to understand ecological processes occurring at the ecosystem level.
EEB 466	Mathematical Ecology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts, Literature, Science, & Arts Â» Mathematics	Mathematical models are the backbone of ecological theory; they form the basis for modern approaches to understanding, managing, and predicting the dynamics of ecological systems. This course provides an overview of the major classes of ecological models, with an emphasis on ecological dynamics. We will focus on principles guiding the formulation of models and on the mathematical techniques that can be used to analyze them. We will examine deterministic and stochastic models, structured and unstructured models, single- and multiple-species models. Because ecological systems are typically nonlinear, we cannot often â€œsolveâ€ model equations. Instead, we employ techniques of nonlinear, stochastic, and numerical analysis to obtain results. This course will introduce many of these techniques in the context of ecological theory.
ECON 101	Principles of Economics I	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Economics	This course concentrates on microeconomics: how markets function, what markets do well, where markets do not work well, the distribution of income and wealth, the public sector, international trade, and environmental economics.
ECON 431	Industrial Organization and Performance	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Economics	This course will analyze the strategic interactions among firms and their effects on the social welfare. The topics will include the theory of firm, price discrimination, price/quantity competition, collusion, merger, entry deterrence, and antitrust laws. Selected news articles and antitrust cases will be used to illustrate some of the key concepts.
ECON 472	Intermediate Natural Resource Economics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Economics	Intermediate Natural Resource Economics --- An intermediate level review of Natural Resource Economics. Topics include basic optimization techniques, resource scarcity, cost-benefit analysis, depletion or exhaustible resources, harvesting of renewable resources and common property problems.
ECON 432	Government Regulation of Industry	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Economics, Literature, Science, & Arts	Analysis of government policies aimed at maintaining desirable economic performance, especially antitrust regulation and public enterprise.
ECON 437	Energy Economics & Policy	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Economics, Literature, Science, & Arts	This course is about energy markets. It is designed to help students make connections between economic concepts and real world regulatory policy questions and issues. The emphasis is on the insights that economic theory and empirical evidence can provide when thinking about the following questions: How do energy markets work? When should the government regulate energy markets? What can the structure of energy markets tells us about how to design and implement effective economic policy?
ENGLISH 290	Themes in Language and Literature	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	This course is designed to introduce students to literature through a thematic approach.
ENGLISH 319	Literature and Social Change	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	What Difference a Story Make?
ENGLISH 320	Literature and the Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	This course will look at the development of responses to American nature from the colonial period to the present. From colonial ideas about a new Eden, or a howling wilderness, we will move through Enlightenment concepts of order and/or sublimity, then to Transcendentalist claims about a spiritual nature, and finally look at 20th-century concerns about wilderness loss or management, toxicity, concepts of sustainability, and the dependence of the human on the non-human world.
ENGLISH 328	Writing & Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	This is an upper level writing course that asks for essays -descriptive, narrative, argumentative, even ones that might be strongly advocating a particular position- that grow out of knowledge or curiosity about the natural world. Examples are drawn from environmental writing, literary and scientific, in the hopes that they may be used as models or inspiration.
ENGLISH 432	Studies in Visual Culture	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	A seminar for concentrators and non-concentrators with interest in the field. Â This course is organized around a particular topic and set texts in visual culture studies, which may include film, photography, painting, and other visual arts.

ENGLISH 332	Visual Culture	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature	A lecture or lecture/discussion course for non-concentrators and concentrators. Â This course introduces students to a range of texts in visual culture studies, which may include film, photography, painting, and other visual arts.
ENVIRON 329	Environmental Writing and Great Lakes Literature	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» English Language & Literature, Literature, Science, & Arts Â» Program in the Environment	This course will introduce students to literary works and creative writing in relation to the natural world and will use analytical and observational (qualitative)skills to make connections between literature and the natural world, a broad sub-area in the field of humanities-based English Language and Literature. This course explores some classic examples of nature writing from the Great Lakes region (fiction, non-fiction, and poetry). It takes advantage of the resources of the Biological Station â€" habitat, trails and lake to stimulate written responses that are descriptive, narrative, and researched. Combining discussion of some classic examples of nature writing from this region (fiction, non-fiction, and poetry) with significant attempts by students to write essays and personal narratives about their experiences with the natural world, this course will take advantage of the resources of the Biological Station â€" habitat, trails and lake â€" to stimulate more impressionistic responses. Recognizing that students at UMBS will be involved in research and genuine scientific inquiry, the course combines that work with a medium designed for an intelligent but uninitiated reader. The reading list includes A Sand County Almanac by Aldo Leopold, The Nick Adams Stories by Ernest Hemingway, and other books.
HISTORY 466	War and Reform, U.S.	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	Building American Empire: War, Politics, and Social Reform in the US, 1901-1950. This course provides an in-depth look at the period from 1901, when Theodore Roosevelt, a bold proponent of the United States taking its place among the great empires of his time, assumed the presidency, to 1950, when the cold war was in full swing. We will examine the rise of the United States from industrial powerhouse to an unparalleled world power managing a limited welfare state at home. How did the combination of two world wars and two waves of social reform (Progressivism and the New Deal) lead to a specific kind of â€œwarfare/welfare state,â€ which some observers argue set the pattern of US society and politics to the present day? Within that framework, we will study forces of industrial development and class conflict; womenâ€™s activism; innovations in commerce, media, and art; sexual revolutions; economic catastrophe and revival; policies of social provision; the beginnings of potent campaigns for racial equality, and ideologies of nationalism and expansionism.
HISTORY 363	U.S. and the World	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	The U.S. and the World Since 1945: Â Politics, Culture, and War in the American Century --- This course will examine U.S. history from a global perspective, zooming in on the political, cultural, and economic dimensions of American intersections with nations, movements, and peoples across the globe. From Hollywood, jazz, and consumer culture, to wars and interventions in Vietnam, Iraq, the Congo, and Latin America, we will examine the role of U.S. power in global affairs as well as how global engagements have reshaped the United States.
RCSSCI 344	The History of Detroit in the 20th Century	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	This course treats 20th century Detroit as an industrial boomtown, shaped and conditioned by the rise and fall of the automobile industry. It is especially concerned with the way ethnic and racial cleavages and class conflicts have shaped the urban landscape and the workplace.
HISTORY 215	History of Disaster	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	The History of Disaster --- This course ranges widely through space and time to explore the history of natural disasters: Â fires, floods, famines, hurricanes, tsunamis, earthquakes, and more. Â We consider how such episodes can be represented and how people use such episodes to consider their place in the world.
ALA 222	Twenty Two Ways	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	Why twenty two ways? Each day in this course will provide you an experience of different ways in which knowledge is produced. In this sense, the course is multidisciplinary, for it offers a survey of the distinct ways that we as human beings have come to ask questions, to pursue answers, and to organize our thinking. By encountering this rich diversity of human thought, directed at a single topic, you will (we hope!) develop a deeper understanding of your own ways of thinking. Why food? Canâ€™t live without it! Food offers an excellent organizing principle for a course such as this: it literally makes our bodies, it defines our environments, it shapes our economies, it lubricates our social interactions, it is the occasion for our culturesâ€¦ and more. The production and consumption of food has always been a central human issue, and it makes a perfect problem for the kind of multi-sided contemplation weâ€™ll take up in this class.
HISTORY 104	Introduction to History in the Social Sciences	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	This course examines an aspect or topic in history not focused on a specific country or time period. Topics are taught from a Social Science perspective.
ENVIRON 223	Trashed! A History of Garbage in the Modern World	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History	This course traces the history of garbage since the middle of the 19th century and explores how the stuff humans discard and the methods employed for dealing with that stuff have shaped our world. This course connects global, local and public history and makes these connections tangible.
HISTART 377	Perspectives in Recent Art	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History of Art	This course considers advanced art since 1960, addressing works in painting, sculpture, photography, video, installation, and other media. Â The class encourages students to view art in its social contexts, seeing it as means of representing and thinking through social and cultural concerns.

PUBPOL 224	Global Nuclear Proliferation	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History, Literature, Science, & Arts Â» Program in the Environment, Public Policy (Ford)	This course presents a global perspective on the history and politics of nuclear weapons. It examines the science and technology of these weapons; the politics of their growth, spread, and control; environmental and health consequences of their development; and the cultural responses and social movements they have engendered. We begin with the bombing of Hiroshima and Nagasaki. Next we examine the unfolding of the Cold War, focusing particularly on the superpower arms race and exploring both U.S. and Soviet perspectives on these developments. Why and how have different states pursued nuclear weapons development? We first pose this as a general question and then move on to case studies. Along the way, we also examine the health and environmental consequences of uranium mining and nuclear testing, as well as the history of anti-nuclear protest movements. The course aims to introduce students to the complex, multi-layered history of nuclear policy issues. Students will be challenged to move past their political beliefs and ideologies (whatever these may be) in order to understand decisions and developments in historical context, and in relation to different cultural and national perspectives. They will be exposed to a variety of conceptual tools and theories to help them make sense of the material, drawing not only on the discipline of history but also on political science theory and anthropology.
RCSSCI 275	Science, Technology, Medicine, and Society	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» History, Literature, Science, & Arts Â» Residential College	From automobiles and computers to immunizations and genetically modified foods, science, technology, and medicine permeate our lives and lifestyles. This course helps you critically think critically about the social dimensions of science, technology, and medicine and their implications for the choices you must make in modern life. We will explore questions such as: How have culture and politics affected the goals and designs of technologies such as the atomic bomb? How has science been shaped by society, and vice-versa? How can history help us understand contemporary responses to the AIDS epidemic, stem cell research, and the pharmaceutical industry?
HONORS 232	Honors Core in Natural Science	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Honors Program	As part of the Honors Core Curriculum, this course introduces Honors students to the fields, questions and meta-questions, and methodologies of the Natural Sciences. The topics vary, but all are extra-disciplinary in approach, providing a broad but rigorous investigation of the natural sciences.
INTLSTD 301	Topics in International Studies	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» International & Comparative Studies	This course is a focused and in-depth investigation of global phenomena, with attention to human rights, human security (civil conflict, economic development, social welfare, and health care), and sustainable economic and ecological systems. Readings rely on multiple methods and disciplinary approaches. In the process of studying these global phenomena, students discuss the strengths of specific methods and disciplinary approaches in improving their understanding of issues and problems that cut across nation-state boundaries.
MCDB 321	Introductory Plant Physiology Lectures	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Molecular/Cellular Biology	Introductory Plant Physiology Lectures --- The course introduces the basic concepts and mechanisms that underlie plant functions: Â 1) plant cell psysiology; 2) cellular and internal transport; and 3) plant growth and development.
MCDB 436	Human Immunology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Molecular/Cellular Biology	Detailed study of the organs, cells, and molecules that constitute the human immune system; cellular interactions involved in initiating and mediating an immune response; role of the immune system in organ transplants, cancer therapy, and immunodeficiency diseases; use of Polyclonal and Monoclonal Antibodies as precise probes in all fields of modern biological and biomedical research.
MCDB 396	Science Outreach for Biology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Molecular/Cellular Biology	Students will learn the principles of inquiry-based activities that bring concepts in modern molecular, cellular and developmental biology to the general public. Students will learn what makes for an effective outreach activity and then develop and run hands-on demonstrations for the public in concert with the Natural History Museum.
MCDB 404	Genetics, Development & Evolution	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Molecular/Cellular Biology, Literature, Science, & Arts	This course introduces students to the field of evolution and development, with an emphasis on genetics as a unifying force. After reviewing fundamental principles in development and evolutionary biology, papers from the primary literature investigating the molecular mechanisms responsible for evolutionary change will be discussed.
ORGSTUDY 310	Formal Organizations and Environments	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Organizational Studies	Survey of theory and research on formal organizations from sociological and economic perspectives. Emphasizes multiple levels of analysis in organizational theory from internal structure and practice to organization-environment relationships. Students will apply theories to existing case studies and develop original case research over the course of the semester.
ENVIRON 208	Business and the Natural Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Organizational Studies, Literature, Science, & Arts Â» Program in the Environment	This course is an introduction to business and the natural environment. We will start with an overview of the triple bottom line framework, in which corporations take into account social and environmental performance in addition to financial performance. Then we will focus on contemporary business activities that address the natural environment. We will discuss the role of the natural environment on business management and strategy, operations, supply chain, product innovation, and marketing.
PHIL 355	Comtemporary Moral Problems	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Philosophy	The purpose of this course is to explore the moral issues confronting us in our daily lives and in our special disciplines. The topics discussed may include abortion, sex and sexual perversion, drugs, death and suicide, civil disobedience, punishment, pacifism, war, problems in medical ethics (eugenics, euthanasia, sanctity of life, organ transplants, defining death), environmental ethics, and the ethics of scientific research.

PHIL 320	The World-View of Modern Science	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Philosophy	Like all of us, modern science is something that has a history: it arose in the 17thÂ century, and has, in various forms, been with us ever since. This course draws upon the history of modern science to frame and address questions about worldviews, scientific and otherwise. What is a worldview, anyway, and what are they good for? Can we (and should we) get along without worldviews? What, if anything, distinguishes a scientific worldview from worldviews of other sorts, such as religious, ethical, political, ideological? Are scientific worldviews necessarily rivals to these other sorts of worldviews, or can they co-exist? Can scientific worldviews be rival to one another? After all, the history of modern science abounds in changes so rapid and dramatic that they're called revolutions. We'll study the Copernican Revolution, the Chemical Revolution, the Darwinian Revolution, as well as revolutions in geology (plate tectonics) and 20thÂ century physics (quantum mechanics, relativity) in order to ask what principles (if any!) do or should govern changes in scientific worldview. This is really a question about the objectivity of science, and it is hoped that confronting the question will help students better discharge a task they face as citizens and as moral agents: the task of evaluating scientific claims (say about climate change or proposed remedies for medical or societal ills) with practical and ethical implications.
PHIL 356	Issues in Bioethics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Philosophy	An examination of various ethical issues having to do with biology, medicine, and human and animal life in general, such as abortion, euthanasia, the idea of the rights of animals, medical care and the rights and obligations involved in it.
PHIL 155	The Nature of Science	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Philosophy, Literature, Science, & Arts	In the long human attempt to understand nature, modern science is arguably our most successful and sophisticated endeavor, one that has revealed that reality is very different from how we perceive it. However, investigation into the nature of scientific knowledge uncovers a deep tension or instability between two fundamental beliefs about science: (i) scientific claims are justified empirically through observation and experiment; (ii) science discovers the true nature of the universe. Because of (i), scientific conclusions are especially objective, secure, and trustworthy, but taking (i) seriously seems to contradict (ii) by limiting scientific investigation to what is at least indirectly observable. On the other hand, taking (ii) seriously seems to weaken the objectivity that scientific conclusions enjoy when secured by empirical evidence. What, then, is it about the nature of science that confers epistemic authority on scientific opinion, and what are the scope and limits of that authority? In trying to answer these questions, we will investigate concepts like causality, law of nature, explanation and prediction, and confirmation by experiment.
PHIL 240	Environmental Ethics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Philosophy, Literature, Science, & Arts Â» Program in the Environment	This course introduces students to environmental ethics, which concerns the value and moral status of the environment and its nonhuman elements. Topics may include theories about which parts of nature have intrinsic value, duties to future generations, the significance of wilderness, sustainability, and environmental policy and economics.
PHYSICS 135	Physics for the Life Sciences I	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Physics	Physics 135 and 235 is the best introductory physics sequence for students planning concentrations in any of the life sciences, as well as students planning to pursue medicine, kinesiology, or the health sciences as a profession. PHYSICS 135 is divided into three main topics: the mechanics of life, energy and energy flow, and fluid behavior.
POLSCI 348	Political Economy of Development	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Political Science	This course provides an introduction to the study of states, markets, and prosperity in developing countries.
AAS 356	Democracy and Development in Africa	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Political Science, Literature, Science, & Arts Â» Afroamerican and African Studies	Countries in contemporary sub-Saharan Africa vary greatly in their quality of democracy, the strength of the state, and levels of economic development. This course investigates the deep historical and more contemporary explanations for these diverse political and economic outcomes, through case studies of political development in particular countries, analyses of broader patterns for the continent as a whole, and consideration of Africa in the context of the broader developing world. The course will draw on works by political scientists, anthropologists, historians, economists, and journalists. Group discussions will be part of the course.
ENVIRON 377	Literature & the Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This course will look at the development of responses to North American nature from the pre-colonial period to the present. Beginning by understanding Amerindian peoples as willful environmental actors, we will look at European contact as, in part, a scene of conflicting land use and land-concept regimes. Then, from Columbusâ€™s anticipations of Eden to representations of wilderness trials by Puritans, we will move to Enlightenment understandings of the orderliness and/or the sublimity of American nature, and at early national attempts to make a precarious nation inevitable and â€¨naturalâ€™ through the landscape. We will read Thoreau and Emersonâ€™s Transcendentalist claims about the natural world; Muirâ€™s meditations on sacred geological time in the Sierra Mountains; and early twentieth century writers (Cather, Leopold, Faulkner, Stoneman Douglas, and Hurston) who describe changes, via settlement, deforestation, drainage, and mining, to the prairies, the California desert, and the southern wetlands and forests. We will encounter later 20th-century authors (Carson, Lopez, Dillard) concerned about toxicity, concepts of sustainability, and the dependence of the human on the non-human world. We will end by thinking about the interlocked concepts of the global and local.
ENVIRON 398	Environment Internship Program	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Undergraduate students, under the guidance of a faculty advisor, participate in an internship relevant to their field of study. Undergraduate students can receive 1-3 credits for internships. See the Program in the Environment in 1120 Undergraduate Science Building for Internship Guidelines.
ENVIRON 310	Toxicology: The Study of Environmental Chemicals and Disease	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Explores relationships between environmental chemicals and adverse human health outcomes, providing an introduction to the study of toxicology. More specifically, the course examines chemical and biological factors that determine and influence toxicity, and the role of chemical exposure in the development of specific diseases such as cancer, birth defects, and reproductive disorders.

ENVIRON 317	Conservation of Biological Diversity	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Overview of historic and present-day causes of species extinction, and of biological principles central to species conservation and sustainable management of ecosystems. Topics covered include episodes of extinction and diversification over earth history; geographic distribution strategies; and sustainable use of ecosystems. Satisfies the upper-level writing requirement
ENVIRON 320	Environmental Journalism: Reporting about Science, Policy, and Public Health	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This course aims to give students an introduction to the world of mass media, with a strong emphasis on reporting and writing about the environment and public health. This class has consistently won high praise from students for providing personalized, hands-on training in improving writing skills. Students learn from two prize-winning journalists who have more than 40 years combined experience covering the environment and public health for media outlets such as The New York Times, Newsweek, The Detroit Free Press and National Public Radio. Each week, the course focuses on a different topic in the news related to the environment and public health, such as urban sprawl, energy efficiency, climate change, environmental justice, sustainable development, garbage, the Great Lakes and cancer. Students hear from a range of leading experts on the topic of the day, learning not only about the subject itself but also about the process of journalism. Guest speakers are chosen to represent many points of view. They range from corporate executives to environmental activists, scientists, government officials and journalists. Past speakers have included SNRE Dean Rosina Bierbaum; Donele Wilkins, Executive Director of Detroiters Working for Environmental Justice; James Clift of The Michigan Environmental Council; Mike Johnston of the Michigan Manufacturersâ€™ Association; Neal Boudette, The Wall Street Journalâ€™s Detroit Bureau chief; Keith Naughton, Newsweekâ€™s Detroit Bureau Chief at the time; Rebecca Williams, producer of Michigan's Radio's Environment Report; 60 Minutes producer Alden Bourne and Sarah Mayberry, health producer for WDIV, among many others. Along the way, instructors lecture and steer discussions about media ethics, interviewing skills, freedom-of-information laws, government databases, the journalistic uses of social media and many other media-related topics. In-class exercises are featured as well. In-class critiques of student writing also point out the most successful writing techniques. The course has two field trips that show first-hand how journalism is practiced. In recent years, they have been to the Environmental Protection Agencyâ€™s National Vehicle and Fuel Emissions Lab in Ann Arbor and to the Carleton Farms landfill in Sumpter Township, (this is the controversial landfill that receives trash from Toronto). All class activities are designed to give students a broad understanding of how the mass media operates while also sharing tips on how students can participate in the mass media â€" either as full-time journalists or occasional dabblers in public discussions.
ENVIRON 309	GIS Explorations of the Past, Present, and Future	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Use of spatial analyses is growing rapidly in many disciplines, from anthropology to zoology. Employers in many fields increasingly seek job applicants with these skills. This course is intended to introduce GIS to undergraduate students from many disciplines and to give them hands-on experience in applying the concepts and using the skills required to conduct spatial analyses. This course uses geographic information systems (GIS) to help understand and analyze environmental problems as well as spatial questions in the sciences, social science and humanities. A hands-on approach is used to demonstrate GIS principles using a wide variety of examples. This course will enable undergraduate students to make maps and conduct spatial analyses for future classes, internships, and employers. It will also prepare them for more advanced GIS classes now offered at the graduate level.
ENVIRON 405	Urban Sprawl: policy & Politics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This course investigates the political imperatives and policy frameworks at the local, state, and national levels that drive land development in America. It leverages political science, history, law, and urban planning to understand how public policy does (and does not) guide land use patterns, and how it might do so differently in the future. The course uses the phenomenon of urban sprawl as a lens through which to integrate multiple disciplinary perspectives in a rich and nuanced understanding of policy change. Students are required to exercise, in written and oral work, their faculties of analysis and (especially) synthesis, unpacking a complex policy challenge into discrete elements and then analyzing the interplay among these elements. The course is first and foremost a capstone experience in critical thinking, using a policy arena with which the students are familiar as a platform for that experience. The course is organized as a seminar. While it does teach a certain policy vocabulary and test studentsâ€™ critical thinking and writing skills, it ultimately demands much more. It requires students to actively interrogate and synthesize the course material in order to generate a new, shared understanding. Studentsâ€™ formal (written) and informal (in-class) commentary on the readings are central to the organization of each class session (along with brief lectures and small-group exercises). Their research projects culminate in memos that are required reading for the final weeks of the class. In short, the course expects students to exercise the skills that professional policy work and/or graduate school require: active synthesis of new understanding.
ENVIRON 243	Topics in Environmental Natural Science	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Topics in Environmental Natural Science --- This special topics course seeks to examine environmental problems and issues from a natural science perspective. Specific natural science topics will vary by term.
ENVIRON 245	Interdisciplinary Environmental Topics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from an interdisciplinary perspective. Specific topics will vary by term.
ENVIRON 463	Topics in Environmental Natural Science	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from a natural science perspective. Specific natural science topics will vary by term.
ENVIRON 324	Water Law & Policy	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Introduction to Water Law and Policy --- This course will survey the history, politics and cultural contexts that inform United States water law and policies of prior appropriation, riparian, federal reserve, and groundwater rights. In addition, the course will examine the role of population growth, energy and climate change in formulating current and future water policy.

ENVIRON 337	Children Under Fire: Narratives of Sustainability	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	This seminar examines how children in crisis are portrayed in picture books, Y/A fiction, fairy tales, and film. How are they represented as killers or consumers, soldiers or refugees? Do empire, frontier and classic war stories still influence narratives today? How do gender, family resilience, and terrorism figure in stories?
ENVIRON 304	Topics in Culture and Environment	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment	Writing & Environment, Topics vary with each section
GEOG 201	Introduction to Environmental Science and Geography	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Earth and Environmental Sciences	This course emphasizes the scientific processes and principles behind global environmental problems. Topics include global biogeochemical cycles, human population, ecosystem management, biogeography, ecological restoration, soil-water-air pollution, environmental health, and energy resources.
ENVIRON 431	Terrestrial Biomes Past, Present & Future	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Earth and Environmental Sciences	While biomes are the major organizing feature of terrestrial ecosystems, dependent on the organisms, ecosystems and climate of the planet, the details of these environments have changed over the history of our planet and will continue to do so. To understand fully the impacts of shifting biomes and anthropogenic climate change, we need to also understand the assembly of past environments. This course focuses on the plant primary producers as it surveys important biological innovations, examples of past ecosystems from the fossil record, the relevance of climate to terrestrial environments, and the changing world of today and tomorrow.
EARTH 259	Earth's Future and a Resilient Human Society	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Earth and Environmental Sciences	Human society needs to prepare for and adapt to a changing environment, growing demands for resources and the impacts of natural processes. Planning this future must reconcile social, economic and cultural expectations, by deploying technological and social solutions as adaptation and mitigation strategies for human communities on regional and global scales.
HISTORY 236	Environment and History in Preindustrial Europe	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» History	The course surveys human interactions with European environments in ancient, medieval, and early modern times (500 BCE-1750 CE). It presents the ecological dimensions to selected episodes in the economic history of ancient Greece, imperial Rome, medieval Europe, and the Europe of early nation states. It shows that before the "anthropocene" and the Industrial Revolution of the 1800s European people established dynamic relations with their ecosystems that profoundly modified both humans and ecologies.
ENVIRON 312	Environmental Politics and Policy	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Political Science, Public Policy (Ford)	This course is an advanced offering on environmental politics and the environmental policy-making process. Considers both processes of policy formation and implementation, placing particular emphasis on the development of alternatives to conventional regulatory practices at federal, state, and local levels of government.
RCIDIV 390	Environmental Activism: Citizenship in a Republic	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts, Literature, Science, & Arts Â» Residential College	This course defines environmental activism as a social movement designed to affect positive and sustainable environmental change. We will articulate an overarching set of values to which people can respond, as well as a shared set of symbols, heroes, slogans, and other cultural referents.
PUBPOL 412	Environmental Values in Public Policy	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts, Public Policy (Ford)	Public policy embodies an assortment of value systems. While individual value systems express coherent, consistent approaches, public policy expresses an amalgam of values, with corresponding decrease in coherence/consistency. This course explores the relationships between various environmental values and public policy through analysis of policy issues at local, state, and national levels.
PSYCH 335	Introduction to Animal Behavior	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Psychology	This course is an introduction to the evolutionary study of Animal Behavior. This class will provide an opportunity for students to learn about behavior from a biological perspective. We will start by reviewing evolution and natural selection. The remainder of the course looks at why animals behave the way they do in nature, focusing on causes of behavior. We will address immediate (or â€œproximateâ€) causes of behavior including genetic, neural, and hormonal influences on behavior. However, the main emphasis of the course will be on â€œultimateâ€ (or long-term) causes of behavior. Thus, we will look at behavior primarily in relation to an animalâ€™s fitness or success. Topics covered will include foraging, habitat selection, mating systems, sexual selection, communication, and cognition. Emphasis will also be on learning how scientists study behavioral questions, including how to test adaptive hypotheses.
PSYCH 280	Introduction to Social Psychology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Psychology	An introductory study of the interrelationships of the functioning of social systems and the behavior and attitudes of individuals.
PSYCH 338	Soc Beh Primates I	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Psychology, Literature, Science, & Arts Â» Anthropology	This course will review the social systems and behavior of our closest living relatives, the primates. The course will be divided into three parts. I will begin by outlining questions about primate behavior. In this section the order primates will be introduced by examining the biology and behaviour of prosimians, monkeys, and apes. Second, various aspects of social primate systems including spacing, mating, and grouping patterns will be discussed. The course will conclude by reviewing selected topics of primate behavior, such as infanticide and vocal communication. I will draw heavily on field studies of primates and emphasize their behavior in natural environmental and social settings.
RCLANG 324	Readings in Spanish	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	Language skills are used and improved by reading, writing about, and discussing topics dealing with literature, culture, politics, and other socio-cultural areas. Classes are conducted in Spanish and are usually on an informal lecture-discussion basis. Students are encouraged to participate fully in class discussions, which enable them to exchange ideas upon which their papers are based.

RCSSCI 230	Alternative Approaches to Economic Development	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	In 1958, economist J.K. Galbraith claimed that poverty in the U.S. was no longer â€œa massive affliction [but] more nearly an afterthought.â€ Four years later, Michael Harrington published The Other America, exposing the persistence of mass poverty despite the general prosperity of the nation. For over 50 years, the poverty debates have continued to focus on the visible and invisible poor. This class will briefly explore some historical issues around poverty â€" the challenges and controversies around the various definitions of poverty, the debates in the late 1950s and early 1960s around the existence of poverty in the U.S. â€" but the majority of the course will focus on contemporary discussions of poverty, gender, race, family structure, and sexual orientation. We will use as our primary text, a new two-volume anthology of essays, The Economics of Inequality, Poverty, and Discrimination in the 21stÂ Century (2013). These articles span a wide range of discussions on the causes of and possible solutions to poverty in the U.S. We will look at labor and housing issues, immigration and welfare issues, prison and schooling issues.
RCNSCI 260	Science and Societal Issues: The Immune System	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	The course will review a variety of theoretical perspectives in medical anthropology and social medicine on the ways in which medicine and the biomedical sciences both shape and are shaped by history, political-economy, and culture. This seminar will provide students an opportunity to explore social, cultural, economic, and political influences on health, illness, and biomedicine. Students will also be introduced to current research exploring the effects of inequalities on health and the interrelationship between health and human rights. Other topics of discussion will include medicine and social justice, cross-cultural interpretations of the body and disease, and social critiques of emerging bio-sciences and technologies.
RCCORE 301	Semester in Detroit Internship	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	Community-Based Internship - Semester in Detroit --- A project-based engagement experience required as part of the Semester in Detroit curriculum.Â Students intern for 16 hours per week with a community and/or cultural arts organization in the city of Detroit with close supervision and support provided by on-site program staff and the Semester in Detroit Associate Director.
RCHUMS 338	Growing Up Near the Great Lakes: Reading and Writing Landscapes of Childhood	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	This course explores how the places where we grow up inform our inner landscapes. What constitutes "home" in picture books, Y/A fiction, legends and film? While some who enroll in this course will have grown up near the Great Lakes, any region possesses the power to influence us eternally.
RCHUMS 341	Empowering Community Through the Arts	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Residential College	The class fosters students' ability to apply the arts as a catalyst for change in issues of social justice, particularly in response to the impact of racism and classism. Students will develop the capacity to formulate creative arts interventions through exposure to engaged-learning practices and at their weekly community-based internship.
SPANISH 232	Second-Year Spanish, Continued	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Romance Languages & Literature	Continuation of SPANISH 231. Â Certain sections are devoted to readings in specialized topics.
SOC 354	Law and Society	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	This course explores theoretical perspectives on the connection between law and society; explanations for legal compliance, deviance, and resistance; the relationship between "law on the books" and "law in action;" the relationship between law and social change; and law's ubiquitous role in popular culture.
SOC 475	Introduction to Medical Sociology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	This course provides students with an understanding of the influence of social and cultural factors on health, illness, and medical care.
SOC 315	Economic Sociology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	The discipline of economics generally treats the economy as separate from social relations. In contrast, economic sociology â€œunboundsâ€ the economy by considering it as integrally related to culture and politics rather than as a separate â€œnon-socialâ€ sphere. In the first part of the course, we develop intellectual foundations for economic sociology by contrasting economic and sociological views of the economy. We then proceed to â€œunboundâ€ the economy by taking a series of institutions conventionally understood to be â€œeconomicâ€ in nature â€" money, markets, firms, production, consumption, etc. â€" and analyzing these institutions in sociological terms. In the third and final part of the course, we introduce the notion of economic citizenship through a detailed examination of taxation. This seemingly dry topic is actually rife with sociological significance, and we use taxation to raise questions about gender relations, social inequality, the welfare state, and contemporary politics in U.S. society.
SOC 105	First Year Seminar in Sociology	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	How do we develop the practice of civic engagement along with the skills of boundary-crossing in order to build a strong democracy comprised of people with perspectives and viewpoints that differ from our own? This seminar explores a wide range of issues on social identity and intergroup relations, notions of community, and everyday politics and democracy. It examines the possibilities for building community across race, gender, and class as students explore their own racial and social group identities.
SOC 240	Sociology of Culture	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	This class surveys scholarship in the sociology of culture - one of the broadest and fastest growing subfields in Sociology. The topics of study range from the study of meaning, symbols, classification, narratives, and beliefs, to inequality, organizations, arts, science, and cultural consumption.
SOC 207	Social Suffering	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	Social Suffering --- This course is a survey of the most important questions, perspectives, concepts, and research findings of a relatively new, multi-disciplinary field, known as the study of "social suffering" which focuses on the lived experience of pain, damage, injury, deprivation, and loss having their origins in society and whose devastating consequences are experienced by individuals within particular forms of culture, social structures, and power relations existing in their own societies and in the global world they live in.

WOMENSTD 416	Thinking Class: Inequality in Media, Bodies, Environment, and More	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology	According to ideals of American exceptionalism, we live in a classless society. But according to mounting evidence, 21st Century America is a class-bound society with historic, widening gulfs between upper and lower strata. Through readings, discussion, and audiovisual materials, this seminar examines class "on the ground" in various sites and contexts.
SOC 430	World Population Dynamics	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Sociology, Literature, Science, & Arts	Major demographic shifts will be examined in this course. For many centuries, world population grew very slowly, due to a general balance between the number of births and the number of deaths. Since the 18th century, the rate of growth of the worldâ€™s population has increased, due to a decline in mortality. Mortality declined first in Europe. Then, first in France and later elsewhere in Europe, fertility declined to a level close to that of mortality. Since World War II, mortality has declined in most of the less developed region of the world. In the absence of compensating declines in fertility, population growth rates in the less developed part of the world, and, consequently, in the world as a whole, increased, reaching a peak in the 1960s and 1970s. This high rate of population growth led to widespread concern about a population explosion. Since the1980s, fertility has declined in most of the less developed region of the world, although in most of the developing world, the level of fertility remains higher than the level of mortality. Some developed countries are now experiencing population decline, with most developed countries expected to experience population decline by 2020. The age structure of the populations of most countries in the world has become older, partially due to mortality declines, but especially due to fertility declines. This has led to concerns about the size of the future labor force and the source of support of a growing elderly population. International migration has increased, mainly from the less developed region of the world to the more developed region of the world. Immigration has slowed population decline in many more developed countries, although what is an acceptable level of immigration has spurred a vigorous policy debate. All of these population dynamics, the causes and the likely consequences of these changes will be examined in the course.
WOMENSTD 330	Feminist Thought	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Women's Studies	This course will examine theoretical approaches to understanding the conditions and constructions of women, focusing on close analysis of historical and contemporary texts that deal with the different kinds, causes, and possible solutions to women's oppression. This may be done by examining these issues across disciplines within academia by inviting guest speakers, by reading diverse contemporary theory, or in the case of "Black Feminist Thought," to examine slave narratives, novels historical accounts theoretical analyses and life stories.
WOMENSTD 331	Feminist Theoretical Perspectives in Gender and Health	Undergraduate	Includes Sustainability	Literature, Science, & Arts Â» Women's Studies	This course focuses on feminist theory in the context of gender and health. Topics include reproduction, men's health, addiction, intersex, environmental health. A range of theories central to feminism will be discussed, including intersectionality, post-modernism, feminist standpoint theory and related theories such as minority stress, disability theory, and script theory.
PUBHLTH 200	Health & Society: Introduction to Public Health	Undergraduate	Includes Sustainability	Public Health Â» Health Management & Policy, Public Policy (Ford)	This course will serve as an introduction to the major issues of public health and health care in the United States â€” what they are, what determines them, and how they can be addressed. The course will provide a broad overview for students looking for only an introduction to the field, as well as a good grounding for students who wish to pursue additional coursework in the subject. The course will explore the principal determinants of health and disease, with a special emphasis on environmental, social, and political influences, with explicit attention to how these determinants differ depending on a personâ€™s education, occupation, race, ethnicity and socioeconomic status. The course is designed to provide students with an understanding of the broad field of public health in both the U.S. and globally, as well as an understanding of the U.S. public health infrastructure for monitoring and improving the public's health.
PUBPOL 201	Systematic Thinking About Problems of the Day	Undergraduate	Includes Sustainability	Public Policy (Ford)	The main idea that we want to get across is implicit in the title: Systematic thinking â€” largely from the social sciences, but with the application of scientific methods and knowledge more generally â€” can make a difference in the way that we approach and solve current problems. This will be a sophomore level course, offered for four credit hours. The class will consist of three hours of lecture and one section review each week. For each topic, there will be at least two faculty members, teaching a module together. Between 3 and 6 of these topics will be covered: vaccines and drugs for diseases that are more prevalent in developing countries; the Kyoto accords and policy related to global warming; No Child Left Behind and other national education policy issues; national health insurance; AIDS (national and international); intellectual property issues (such as the case involving Google); electoral college reform; affordability of higher education; globalization, trade and U.S. workers; and stem cell research.
PUBPOL 495	Policy Seminar	Undergraduate	Includes Sustainability	Public Policy (Ford)	Policy seminars are open only to undergraduates enrolled in the Ford School. Â These small, interdisciplinary courses will focus on particular public policy issues as reflected in the title of the course. Â They emphasize working in teams, writing, and oral prescription skills. Â The final product of each seminar will be an extensive policy analysis of the issues being studied, written for an audience of policy makers. Â In these seminars, students will apply the skills they learn in other courses and have opportunities to interact with policy makers and scholars who are experts on the issue being studied.

PUBPOL 456	Local Government: Opportunity for Activism	Undergraduate	Includes Sustainability	Public Policy (Ford)	What goes on in city government is in many ways more important to our lives than what happens in Washington. This course goes beyond the structure and theory of municipal government to look at how things really happen at the local level. It will explore the underlying dynamics of the city / suburb conflict, sprawl vs. density and how these issues influence local economics and state legislatures. There will be a focus on the interaction of citizen activities and elected officials in effecting change. Topics will include running for office, environmental and affordable house campaigns and activist-generated ballot initiatives. Both past and present campaigns will be examined, including case studies of both successful and failed initiatives. Students will explore the unfolding Greenbelt and Greenway programs, and how these proposals may impact sprawl and affordable house. Guest speakers will include elected officials and activities from past and present campaigns for social and environmental change.
PUBPOL 466	The History and Future of Detroit	Undergraduate	Includes Sustainability	Public Policy (Ford)	Detroit was the nation's most important city in the Twentieth Century because of the auto industry, the emergence of the blue collar middle class and development of the New Deal.Â Now it is the most negatively stereotyped city in the nation. The course describes changes in Detroit and emphasizes policy developments in Ruse Belt metropolises as they cope with the restructuring of employment.
BIO 116	Biology of Sex	Undergraduate	Includes Sustainability		Biology of Sex --- Sex is not universally used by living organisms for reproduction. Â When and how it evolved, and the various mechanisms in which it operates is a primary concern for most biological disciplines. Â This course will cover the origins, mechanisms and implications sexuality has for biodiversity. Â The human aspects of sexual biology will be examined in terms of how we fit into the concepts.
ALA 285	Introduction to Intercultural Study	Undergraduate	Includes Sustainability		This interdisciplinary experiential course introduces students to intercultural learning. It prepares students to make the most of their off-campus field study opportunities through identifying and setting goals, developing skills for cross-cultural learning and adaptation, and formulating plans to put those skills to good use on site.
HF 446	The Role of Social Factors in Shaping Physical Activity Behavior	Undergraduate	Includes Sustainability		The Role of Social Factors in Shaping Physical Activity Behavior --- This course discusses the social determinants of health and their impact on physical activity behaviors. Â Substantive areas covered include but are not limited to socioeconomic position, income, education, neighborhood environments and stressful conditions, placing an emphasis on the role these factors play in shaping physical activity and sedentary behavior.
ENVIRON 235	Economics of Natural Resources and Environment	Undergraduate	Includes Sustainability		Economics of Natural Resources and Environment --- Applications of environmental and natural resources economics are frequent in the media. Motivating discussions on scarcity of resources - such as water and energy - and pollution control and policy through recent news coverage, this course aims to develop your understanding of environmental issues using core economic tools and concepts.
STDABRD 309	Frontiers Abroad-Geology and Earth Systems Science in Auckland and	Undergraduate	Includes Sustainability		Frontiers Abroad leads undergraduate fieldwork and research programs in earth and environmental sciences.
UP 357	Architecture, Sustainability & the City	Undergraduate	Sustainability Focused	Arch. and U.P. (Taubman) Â» Architecture, Arch. and U.P. (Taubman) Â» Urban and Regional Planning	An introduction to the design of the built environment, societyâ€™s largest investment and biggest consumer of energy, the courseâ€™s focus will range from the room to the building to the city to the metropolis, including spaces and places that are consciously planned and intentionally designed, as well as ones that are vernacular and informal. In addition to Western history, theory and practice of architecture and urban planning, case studies of buildings and cities of different cultures and periods will be presented to deepen the studentâ€™s understanding of the environmental, economic, socio-cultural and aesthetic impacts of design and urbanism. Contemporary problems and opportunities in sustainable/resilient building and urban design will be considered, including renewable energy, resource and water conservation, and waste management. Livability, walkability, bikeability and transit, as well as the importance of a vibrant, diverse public realm in a healthy community will also be studied.
MO 300	Behavioral Theory in Management	Undergraduate	Sustainability Focused	Business (Ross)	This course teaches students basic concepts in the behavioral sciences that can improve their abilities to lead and manage in organizations. Â Frameworks for individual, team, and organizational behavior are presented and discussed in the context of real-world cases. Group projects provide practice in problem-based teamwork and in applying the frameworks in practice.
STRATEGY 445	Base of the Pyramid: Business Innovation for Solving Society's Problems	Undergraduate	Sustainability Focused	Business (Ross)	In every country there are people who are very poor by either absolute or relative standards. These individuals at the economic "bottom of the pyramid" lack adequate income, health care, educational opportunities, etc. This course focuses on how business can serve the poor by remedying these conditions and make handsome profits while doing so.
ES 444	Introduction to Microfinance	Undergraduate	Sustainability Focused	Business (Ross)	Microfinance provides financial services to the poor, including credit, savings, and insurance. The field is undergoing a period of transition as microfinance institutions begin to seek money from capital markets. Â This course will explore how microfinance institutions are organized, how they raise money and are managed, and emerging trends that are shaping the field, all with an eye towards understanding the interplay between business models and poverty alleviation.
ENVIRON 382	Introduction to Environmental Education for Sustainable Development	Undergraduate	Sustainability Focused	Education, Literature, Science, & Arts, Literature, Science, & Arts Â» Earth and Environmental Sciences	This course provides students with the knowledge and skills to develop, implement and evaluate environmental education programs. Students will learn about theories, methods, and resources for effective environmental education and practice delivering environmental education lessons. Students also have the opportunity to become certified in Project Learning Tree, Project Wet or Project WILD, three of the most frequently used environmental education curricula in the country.

ENTR 412	Advanced Entrepreneurship Practicum	Undergraduate	Sustainability Focused	Engineering	The Advanced Entrepreneurship Practicum is the second part of the entrepreneurship practicum experience led by the Center for Entrepreneurship. In this course, you will experience running, growing, and leading a sustainable venture by applying fundamental and practical skills of entrepreneurship.
CHE 460	Chemical Engineering Laboratory II	Undergraduate	Sustainability Focused	Engineering Â» Chemical Engineering	Experimentation in rate and separation processes on a scale which tests process models. Â Introduction to the use of instrumental analysis and process control. Â Laboratory, conferences, reports. Â Technology communications.
CHE 488	Chemical Product Design I	Undergraduate	Sustainability Focused	Engineering Â» Chemical Engineering	Part one of a two-semester chemical product design sequence. Â Teams develop the process for a new chemical product that meets industrial, federal and local regulations. Â Survey development, literature research, and development of an appropriate manufacturing process. Â Oral and written technology and economic feasibility reports. Â Safety, environmental and ethical issues.
CHE489	Chemical Product Design II	Undergraduate	Sustainability Focused	Engineering Â» Chemical Engineering	Part two of a two-semester chemical product design sequence. Â Teams produce a consumer-ready prototype of a chemical product. Â Development of control and regulatory tests to ensure the product meets all relevant and industrial, federal, and local regulations. Â Oral and written technology and economic reports. Â Safety, environmental and ethical issues.
CEE 265	Sustainable Engineering Principles	Undergraduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Sustainable engineering principles including calculations of environmental emissions and resource consumption. Mass and energy balance calculations in context of pollution generation and prevention, resource recovery, and life-cycle assessment. Economic aspects of sustainable engineering decision-making. Social impacts of technology system design decisions including ethical frameworks, government legislation, and health risks.
ESENG 567	Energy Infrastructure Systems	Undergraduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Technologies and economics of electric power generation, transmission, and distribution are discussed. Centralized versus distributed generation, and fossil fuels versus renewable resources, are considered in regard to engineering, market, and regulatory principles. Students develop an understanding of energy challenges confronting society and investigate technologies that seek to address future needs.
CEE 591	Environmental Fluid Mechanics	Undergraduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	Fundamentals of fluid mechanics applications to the environment. Gravity and tidal waves. Internal waves and stratified flow. Models for turbulent flow. Effects of the earth's rotation, wind-driven currents and boundary resistance. Mass transfer at interfaces, entrainment and mixing. Flocculation and settling of colloidal particles. Shear dispersion in stream and estuaries.
CEE 375	Sensors, Circuits, and Signals	Undergraduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng.	This course introduces students to the fundamentals of collecting and processing experimental data. Â The course begins with an introduction to DC and AC circuits. Â The design and operation of sensors are then introduced followed by an introduction to digital signal processing.
CEE 307	Sustainable Cities	Undergraduate	Sustainability Focused	Engineering Â» Civil & Environmental Eng., Literature, Science, & Arts Â» Program in the Environment	As economic and ecological pressures increase, it has become increasingly important that greater efforts be expended to have more sustainable urban environments. Specifically, it is essential that the future operation of cities become more sustainable in terms of energy and resource use, while also safeguarding the health and well-being of local citizens. Urban environments, by their very nature, are complex systems and multiple topics must be simultaneously addressed to ensure the safety and well-being of its residents.
CLIMATE 110	Climate and Space Science and Engineering Seminar	Undergraduate	Sustainability Focused	Engineering Â» Climate & Space Sciences	Seminars by noted speakers, faculty and research scientists, designed to acquaint undergraduates with contemporary science and engineering problems, technologies and broader issues in the global climate and space sciences. Â Technical communication assignments include written and/or oral reports based upon the seminars.
ENSCEN 467	Biogeochemical Cycles	Undergraduate	Sustainability Focused	Engineering Â» Climate & Space Sciences, Engineering	Description/discussion of the biogeochemical cycles of water, carbon, nitrogen, and sulfur; the atmosphere and oceans as reservoirs and reaction media; the fate of natural and man-made sources of carbon, nitrogen, and sulfur compounds; the interactions among the major biogeochemical cycles and resultant global change; greenhouse gases, acid rain and ozone depletion.
ENSCEN 172	Introduction to Global Change -- Part II	Undergraduate	Sustainability Focused	Engineering Â» Climate & Space Sciences, Engineering Â» Civil & Environmental Eng., Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	Global environmental change encompasses the rapid, interconnected changes now occurring in the Earth system -- its climate, human population, resources, and ecosystems. ENVIRON 111 (Global Change II) is an interdisciplinary, team-taught and web-supported introduction to the human dimensions of global change. You will study the recent, explosive growth of the human population and our impacts on land, air, and water resources, including ecosystems and biological diversity. Energy and climate, which are intimately connected issues, are examined in the context of their histories and especially by looking toward our global future and critical societal decisions that need to be made. To better grasp the challenges of the transition to a more sustainable future, you will study how different groups and cultures have historically interacted with their environment, the post-colonial transformation of human production and consumption, and its interdependence with changing patterns of economic production and distribution. The course concludes with an examination of the major forces of globalization that will shape the future relationship between humans and the resources of our planet.
EAS 480	Climate Change: The Move to Action	Undergraduate	Sustainability Focused	Engineering Â» Climate & Space Sciences, Environment and Sustainability	All sectors of society are affected by climate change: science, policy, business, economics, public health, energy, ecosystems, environmental engineering, journalism, religion, etc. This course explores the intersections of these communities and exposes students the factual and contextual elements that will allow effective participation in the adaptation to climate change.

ENSCEN 105	Our Changing Atmosphere	Undergraduate	Sustainability Focused	Engineering Â» Climate & Space Sciences, Literature, Science, & Arts Â» Chemistry, Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	The greenhouse effect, stratospheric ozone depletion, the polar ozone holes, and urban smog are discussed from a scientific perspective using the latest information. Human-induced change in atmospheric composition is a primary vehicle for Global Change. These changes can affect atmospheric motions, including jet streams, fronts and violent storms. The atmosphere interacts with all other components of the environment: the oceans, the geosphere (solid earth), the biosphere (living plants and animals), and the cryosphere (glaciers and ice-caps). These interactions and "feedback mechanisms" are a central theme of this course.
EECS 320	Introduction to Semiconductor Devices	Undergraduate	Sustainability Focused	Engineering Â» Electrical Eng. and Comp. Sci.	Introduction to semiconductors in terms of atomic bonding and electron energy bands. Â Equilibrium statistics of electrons and holes. Â Carrier dynamics; continuity, drift and diffusion currents, generation and recombination process (including important optical processes). Â Introduction to: Â PN junctions, light detectors and emitters, metal-semiconductor junctions, bipolar junction transistors, and MOSFETS.
EECS 429	Semiconductor Optoelectronic Devices	Undergraduate	Sustainability Focused	Engineering Â» Electrical Eng. and Comp. Sci.	Optoelectronic devices play a crucial role in numerous technology areas including internet, data storage, high-performance computers, display, image sensors, lighting and solar cells. EECS 429 covers the fundamental device physics and materials science underlying modern optoelectronic devices including lasers, light emitting diodes, photodetectors, solar cells, and optical modulators. Special emphasis is on the concept and design of the devices as well as their applications in different technologies.
MECHENG 450	Design and Manufacturing III	Undergraduate	Sustainability Focused	Engineering Â» Mechanical Engineering	A mechanical engineering design project by which the student is exposed to the design process from concept through analysis to layout and report. Â Projects are proposed from the different areas of study within mechanical engineering and reflect the expertise of instructional faculty and industrial representatives.
MECHENG 452	Design for Manufacturability	Undergraduate	Sustainability Focused	Engineering Â» Mechanical Engineering	Conceptual design. Design for economical production, Taguchi methods, design for assembly; case studies. Product design using advanced polymeric materials and composites; part consolidation, snap fit assemblies; novel applications. Design projects.
MECHENG 489	Sustainable Engineering and Design	Undergraduate	Sustainability Focused	Engineering Â» Mechanical Engineering	This course covers economic, environmental and social aspects of sustainability as they pertain to engineering design. The course covers life cycle assessment, carbon/water/energy footprints, economic assessments, mass/energy balances, air/water pollutants modeling of environmental pollutant concentrations, engineering economics, social considerations, pollution prevention, resource conservation, human and eco-toxicity, life cycle costing, and energy system.
NAVARCH 440	Marine Dynamics II	Undergraduate	Sustainability Focused	Engineering Â» Naval Arch. & Marine Eng.	Dynamic analysis in a fluid environment. Rayleigh's principle for continuous systems. Equations of motion for ship rigid body dynamics. Wave excitation. Response Amplitude Operator (RAO). Random processes and probability. Motion in irregular seas. Introduction to time series analysis
LAW 410	Energy Law and Climate Change	Undergraduate	Sustainability Focused	Law	In this seminar, we will be learning and discussing the evolving legal issues relating to energy law and clean energy development policy solutions, and the newly emerging law of climate change.Â This seminar will take place in "real time" while:Â (1) President Obama and the United States Congress are considering federal climate change solutions legislation; (2) The federal, state and municipal governments are moving to implement the extensive clean energy development policies and financial incentives enacted in late 2008 and early 2009; (3) The private sector is rapidly accelerating investments in cleaner energy and cleaner transportation developments and strategies; and (4) The United States and the global community is preparing for the potentially landmark Copenhagen climate change treaty discussions/negotiations in December 2009.Â Â Course requirements are engaged class participation and a final paper (20-30 page) on a seminar-related topic of the student's choice.Â There are no prerequisites for the seminar, although a previous environmental law or natural resources law class, and constitutional law and administrative law course(s), will be helpful.
STDABRD 303	Environmental Studies	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Environment and Sustainable Development in San Jose, Costa Rica --- Students take classes in intensive language, ecology, Latin American political economy, and development theory. They also do fieldwork and an independent research project.
STDABRD 308	EcoQuest (Whakatiwai, New Zealand)	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Students take interdisciplinary coursework in ecology and environment policy. For Spring term, this is combined with fieldwork and a directed research project.
UC 327	Advanced Practicum	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Sustainability Scholars Interdisciplinary Thinking
UC 427	Capstone Practicum	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Sustainability Leadership Development This seminar, open only to seniors in the Graham Undergraduate Sustainability Scholars Program, explores the concepts and application of leadership through the lens of sustainability.Â Through reading seminal works in the field, exploring personal leadership styles and experiences, case studies, and interaction with practitioners, this course seeks to develop sustainability leadership skills and prepare Graham Sustainability Scholars for professional experiences.
ORGSTUDY 418	Leadership & Environ	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Leadership and Environmental Stewardship in Organizations --- This course focuses on the skills and strategies that can help you become a more effective leader for the environment. Students will learn about the importance of decision-making, influence, and teamwork for implementing organization change and innovation towards greater environmental stewardship.
ALA 256	Innovator's Toolkit	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Â "What tools do I have in my toolbox and how can I use them to make an impact?" This is the central question of The Innovator's Toolkit. By the end of this course, you will have worked to implement an innovative approach to a complex social problem related to the topic of water.

STDABRD 315	CGIS: Wildlife Management Studies in Rhotia, Tanzania	Undergraduate	Sustainability Focused	Literature, Science, & Arts	At the School for Field Studies field site in Tanzania students study wildlife ecology and behavior, explore resource management techniques in the East African ecosystem, evaluate the ecological and sociocultural impacts of cultural tourism in Tanzania, and perform directed research.
STDABRD 302	CGIS: Food, Energy, and Water Systems in Guacimo, Costa Rica	Undergraduate	Sustainability Focused	Literature, Science, & Arts	Led by UM faculty, students in this course perform field research on relationships between food, energy, and water systems at EARTH University's field campus.
WOMENSTD 365	Global Perspectives on Gender, Health, and Reproduction	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Afroamerican and African Studies	Feminists and anthropologists have produced voluminous work on the body as a site of gendered and sexualized practices. Building on this rich corpus of literature, the course uses the body as a point of entry to examine the constructions and meanings of gender, health and reproduction and their constitution of social differentiation. By using various cross-cultural examples, we will discuss how gender, racial and class differences are enacted and manifested in the divisions of social spaces and in bodily conduct, function, hygiene and sickness. In its entirety, the course attempts to introduce students to the complexity of the local and global processes underlying the cultural production of gender identities and social differentiation.
AAS 322	Intro Env Politics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Afroamerican and African Studies, Literature, Science, & Arts, Literature, Science, & Arts Â» Program in the Environment	Analyzes the role of race, gender and class in defining environmental issues and environmental action.
ANTHRCUL 440	Environmental Anthropology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Anthropology	This class examines anthropological approaches to contemporary environmental problems. We will consider what it means to live in a world in which competing ideas about nature are in dialogue with each other. We will study the way that the world is transformed by the accelerated circulation of persons, things, and ideas through globalization. We will also learn about the institutions and forces that increasingly mediate anthropogenic impacts on the environment, including the relationship between corporations and their critics, states and their legal systems, the media, and nongovernmental organizations (NGOs) focused on environmental issues.
ENVIRON 473	Statistical Modeling and Data Visualization in R	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Anthropology	This course is a boot camp in statistical modeling and data visualization using the R computer language. Topics include basic R programming, data exploration, statistical modeling, forma model comparison, parameter estimation and interpretation, and the visual display of quantitative information.
ANTHRBIO 167	Evolution, Environment, and Global Health	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Anthropology	Earth is on the brink of the Sixth extinction - likely more devastating than the asteroid impact that took out the dinosaurs. Scientific evidence shows that humans are the cause. Evolutionary anthropology can uniquely contribute to understanding how we got here and what we need to do.
ANTHRBIO 342	Nature/Culture Now!	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts	This course, co-taught by a biological and a cultural anthropologist, investigates the ongoing power of the nature/culture divide and examines anthropology's central role in formulating the nature/culture dichotomy itself. The course is broken down into four sections including, a history of nature/culture in anthropology, race, sex, and health and disease.
ENVIRON 256	Culture, Adaptation, and Environment	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Anthropology, Literature, Science, & Arts, Literature, Science, & Arts Â» Program in the Environment	This course explores anthropological approaches to human relationships with their environments and resources. We will examine diverse conceptions of culture and nature, and time and space, and the interaction between contemporary global forces, indigenous societies, and their ecosystems. Particular interest for complementary materialist and culturalist analysis of human-environment relationships, through cultural anthropology case studies of hunting and gathering, pastoralism, farming, commerce, colonialism, modernization, and globalisation issues. We will read several short books about different people, places, and environmental problems (E.E. Evans-Pritchard's "The Nuer"; Colin Turnbull's "The Forest People"; Joe Kane's "Savages"...). These books will not only provide case studies, but will also show us the way cultural anthropology has changed over the years, expanding its range of theories, descriptive practices, and audience on matters of culture, adaptation, and environment. There will also be a selection of articles about the ideas and concepts that are relevant for analyzing changing human-environment relationships, emphasizing today's interactions between economic growth, environmental change, and human health.
BIOLOGY 109	Ecological Knowledge and Environmental Problem Solving	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts	Ecological Knowledge and Environmental Problem Solving --- The main point is to gain an understanding of the types of scientific knowledge that are needed to solve environmental problems, and to develop an appreciation of problem-solving skills. This course uses a case study approach, and takes the perspective that science consists of the creation and testing of theory.
ENVIRON 101	Energy, Food & the Environment	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Biology, Literature, Science, & Arts Â» Program in the Environment	In recent years it has become apparent that current energy and food sourcing is damaging the environment from global warming to pesticide runoff. This course treats the issues of energy, food, and the environment from a biological and sociopolitical point of view. It emphasizes the historical trajectories that generated current conditions and the scientific options for revamping our energy and food systems to make them more consistent with environmental sustainability.
CHEM 126	General Chemistry Laboratory I	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Chemistry	A three-hour laboratory accompanied by a biweekly one hour discussion with a focus on experiment design, data analysis, and oral communication skills.
CHEM 463	Physical Chemistry II	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Chemistry	This is the third of a three-term sequence in physical chemistry and focuses on thermodynamics and kinetics. Both classical thermodynamics (entropy, phase, and chemical equilibrium) and statistical thermodynamics are discussed. Fundamental theories underlying chemical kinetics are discussed and solid state structures are introduced.

COMM 467	Politics & Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Communication Studies	Debating Politics and Science: Science, News, Public Opinion and Policy --- This class explores how the public consumes science and how scientific findings translate into policy. Â Through issues like evolution, climate change, and vaccinations, we explore boundaries of scientific knowledge, challenges in science journalism, popular opinion, and policy challenges. What we know and how we know it lie in the balance.
COMM 417	Marketing for Social Change	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Communication Studies	This class presents a systematic approach for using marketing techniques to shift attitudes and behaviors for both individual and social benefits. Students learn multiple skills critical for developing marketing campaigns, including behavior selection, audience segmentation, application of the 4 Ps (product, price, place, and promotion), and messaging strategies. Areas of application include the environment, poverty, and health.
PUBPOL 250	Social Systems & Energy	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Complex Systems, Public Policy (Ford), Literature, Science, & Arts Â» Program in the Environment	Energy is an incredibly complex topic by the virtue of the inter-linkages of science, technology, public policy, economics, and human behaviors. This course will examine all aspects of energy: supply and demand, technical and social, with a concerted look at the natural place of social science (behavior, pricing, externalities, social norms) in the energy sphere.
EARTH 102	Energy from the Earth	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	The nature, mode of occurrence, and the technology of exploration and exploitation of energy resources, and their relevance to the present and future world energy needs. Special attention is given to oil, gas, oil shale, tar sands, coal, uranium, and geothermal resources.
EARTH 433	Field Studies in Economic Geology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	Sustainability of Renewable Energy Resources
EARTH 110	Evolving Oceans	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course explores the impacts of climate change on the world's oceans and the history of past oceanic life, events, and environments as recorded in seafloor sediments. Lectures address the nature and rate of past and modern (anthropogenic) perturbations to the physical, chemical, and biological state of the oceans.
EARTH 467	Stratigraphy and Basin Analysis	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course focuses on continental and marine depositional environments and on sedimentary basin filling processes, including an overview of differences between various tectonic settings. Case studies will be drawn from literature examples and from real data.
EARTH 111	Climate and Humankind	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This mini-course addresses topics concerning weather and climate factors, specifically how climate affects humans and how humans affect climate.
EARTH 144	Climate Change in the Age of Humans	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This first year seminar explores how climate change and humans have influenced each other though time. Topics include the role of climate change on early human evolution, the collapse of civilizations, the spread of diseases and migration. Topics also include examples of the human impact on climate and the origins of the Anthropocene.
EARTH 114	Global Warming	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	Review of the geological evidence for global warming including geochemistry of natural and anthropogenic greenhouse gases, global radiation balance, sediment and ice core records, and ancient hot climates with discussion of possible remediation methods and their economic and political context.
EARTH 277	Water in the 21st Century	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	Water sustainability is the number one challenge of the 21st century. Freshwater scarcity is likely to worsen as global climate change intensifies and population growth continues. This class provides students with a solid understanding of the global water cycle and brings students' awareness to the most current challenging water issues.
ENVIRON 333	Inexhaustible Seas?	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	Marine Resources and Environmental Issues --- This course explores the mineral, energy and food resources of the ocean and environmental impacts that arise from the exploitation of these resources. We discuss conflicts in our competing uses of the ocean and its resources. We also examine both the popular and scientific literature surrounding these issues.
EARTH 296	Topics in the Earth and Environmental Sciences	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	Â A course on topics in Earth and environmental sciences. Content varies by term and instructor.
EARTH 219	Introduction to Environmental Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences	This course emphasizes the scientific processes and principles behind global environmental issues. Topics include global change, human population, ecosystems, biogeography, biodiversity, soil-water-air pollution, environmental health, energy systems and their environmental consequences, and environmental policy.
EARTH 159	Toward a Sustainable Human Future	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts	Todayâ€™s human society is faced with a need for adjustments to our changing environment, reconciling social, economic and cultural demands and expectations, while at the same time deriving technological and social solutions to enable the sustenance of cultures and communities from the regional to the global scale. This FYS will use a systems-based approach to examine the natural science that is needed for short- and long-term decision making in support of a sustainable human future. It will use a distinctly interactive approach, requiring reading (both articles and news reports), analysis and presentations. Use and critical analysis of online sources will be encouraged, such as Wikipedia and NYT Environment. Up to 10 project teams will be created that collectively offer a science-based, integrated analysis of the critical issues of societal sustainability. Students are encouraged to collect news reports from daily papers and blogs. Topics that will be addressed include: human population; water access and quality; future energy; climate change; economic resources; ecosystems and biodiversity; food security; and development and urbanization.x
ENVIRON 284	Environmental Geology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	Environmental Geology examines the interactions between today's human society and our dynamic planet. It begins with geologic materials and processes, and goes on to specific topics that include soils, ground water, natural hazards (volcanism, landslides, earthquakes, floods), land surface and sea level, pollution and global warming, energy resources and waste disposal.

EARTH 344	Sust Fossil Energy	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Earth and Environmental Sciences, Literature, Science, & Arts Â» Program in the Environment	This course introduces students to concepts and environmental consequences of sustainable and fossil energy sources. The course begins with an introduction to the scientific principles and terminology of the field. Students gain a deeper understanding of the topic through hands-on experiments using alternate energy systems at Camp Davis, which include a combination of solar photovoltaic, solar heating, wind generation and/or hydroelectric. The Camp Davis campus is used as a small experimental â€œcityâ€ where energy and resource use can be carefully monitored and manipulated by students. In addition, the class travels throughout Wyoming and Idaho visiting and investigating facilities important for power generation. Depending on access during a particular summer, visitations may include a nuclear reactor, hydroelectric generation station, wind farm, solar farm, and/or gas/coal generators. Studies of the ecological consequences of various power options will take the class to additional sites which may include a uranium mine, a coal mine and a natural gas field. Finally students study the ecology of forest growth and succession and deep-well injection to gain an understanding of carbon storage in soils and vegetation, and principles of carbon sequestration
EEB 492	Behavioral Ecology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This course explores the behavior of animals in their natural environment. Â Students develop their understanding of evolution and learn how to apply natural selection to understand why animals behave the way they do.
EEB 410	EEB Capstone Seminar	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	This course is required of all EEB concentrators and is intended to be taken late in the concentratorâ€™s career after exposure to both basic ecological and evolutionary theory. Priority registration is for senior EEB concentrators. All other interested students will need permission from the instructors to enroll. The course will provide the opportunity for in-depth discussion of the ecological and evolutionary principles underlying important issues in biology and human affairs. Topics will be chosen to illustrate the action (and interaction) of ecological and evolutionary processes, and discussions will explore the theory, empirical evidence, and methodologies relevant to these processes. Readings will be from both peer-reviewed (or primary) and popular literature. Students will be expected to actively participate in discussions, lead discussions, and to write essays or papers on the discussion topics. Each term typically will explore a range of topics drawn from important issues such as emerging diseases, climate change, bioethical questions, early hominid ecology and evolution, conservation biology, environmental problems, speciation, biodiversity, or illustrative case studies in ecology and evolution (e.g., those on Darwinâ€™s finches).
EEB 408	Modeling for Ecology and Evolutionary Biology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Ecology & Evolutionary Biology	An introductory course in the creation and analysis of mathematical models in ecology and evolutionary biology, teaching students the derivation and analysis of simple models formulated using ordinary differential or recursion equations, and demonstrating the application of those skills to example core models in ecology and evolutionary biology.
EEB 455	Ethnobotany	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Ecology & Evolutionary Biology, Literature, Science, & Arts	Ethnobotany is the direct cultural use of plants by people. Ethnobotany is an integrated course utilizing an ecological framework to explore the botany, mycology, anthropology, natural resource management, history, linguistics, and American Indian studies of the human-plant relationships. This course provides an intensive Northern Michigan field botany/mycology experience, followed by an applied ecology laboratory experience to test the constraints and opportunities of specific plants and fungi. Lectures explore the cultural use of plants from a local to global perspective, with a focus on Great Lakes American Indian perspective. Students will learn to identify, classify, harvest, and culturally process many of the Northern Michigan plants utilized for food, medicines, crafts, cordage, firewood, teas, smudging/smoking, and ceremonies during pre- and post- European-American contact. Local American Indian cultural experts will provide several guest lectures and/or applied workshops.
ECON 461	The Economics of Development I	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Economics	Most people live in "poor countries" with much lower average incomes (as well as worse health and education indexes) than the United States and other "rich countries" and most people in all countries live with less than the country average. These disparities have generally continued to widen. This course explores alternative conceptions and theories of economic development, investigates proposed explanations for international variations, and critically compares current strategies for alleviating global poverty and enlarging opportunities for human flourishing, especially for those who are worst off. A recurring further focus is potential implications of global development or its failure for more developed countries.
ENVIRON 375	Environmental & Resource Economics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Economics, Literature, Science, & Arts Â» Program in the Environment	A one-semester introduction to Environmental and Natural Resource Economics. Topics include externalities, unpriced goods, cost-benefit analysis, resource scarcity, exhaustible resource depletion, renewable resource harvesting and common property.
HISTORY 497	History Colloquium	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» History	Intensive examination of historical problems of limited scope either as delimited historical events (e.g., the French Revolution) as single analytical themes developed over time (e.g., urbanization in America), or as problems in the philosophy of history (e.g., objectivity, determinism). Â Classes of twenty students or less are designed to exploit an educational setting unlike that of the large lecture course. Â Major stress on critical reading and class discussion.

HISTORY 445	Topics in History	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» History	Environmental History studies how humans have interacted with nature. This course reaches outside the familiar terrain of American history to include Canada and Mexico to examine the human transformation of the continent. The comparisons focus on the different legacies of empire and environment, which continue to shape conditions in North America. We will ask how nature has shaped patterns of human change in different regions of the continent (British, French, Spanish, and American empires) and how human attitudes toward nature shaped environmental outcomes and institutions in modern nation states. From colonial times to the present, each society has faced questions of sustainability in different ways, and each has developed different approaches to conservation and environmental protection. Before the rise of modern ecology, the awareness of the need to conserve resources emerged slowly, in each society in North America. Some familiarity American, Canadian, Mexican, or Transatlantic history is helpful. Class will meet each week to discuss assigned readings. The readings will be entirely electronic and consist of electronic books, journal articles and or chapters from larger works that are posted on the course CTools site.
ENVIRON 237	Global Environmental History	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» History, Literature, Science, & Arts Â» Program in the Environment	This course is an introduction to environmental history, which combines traditional historical methods with findings from ecology to explore how humans have transformed nature and how nature has shaped human history. It focuses on how human-nature interactions can illuminate key problems in global history (e.g. inter-scalar feedbacks, human agency).
HONORS 135	Ideas in Honors	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Honors Program	Beyond Sustainability Ideas in Honors is a one-credit seminar course intended to introduce first-year Honors students to topic-driven scholarship at the advanced undergraduate level.
PHIL 224	Global Justice	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Philosophy	This interdisciplinary course on global justice, co-taught by faculty from philosophy and economics, integrates approaches from political philosophy and political economy. Foundations of development economics and theories of global justice are introduced and applied to specific issues such as immigration, free trade, and sweatshops.
PHYSICS 210	Energy for our Future	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Physics	We explore the physics, politics, economics and environmental impact of the production and use of known sources of energy including fossil fuels, nuclear, wind, solar, geothermal and hydroelectric. Students develop a viable energy plan for the future that weighs cost, environmental and human risk, and larger geopolitical impacts.
PUBPOL 481	Science, Technology and Public Policy	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Physics, Public Policy (Ford)	The course will review the historical role of national science policy in addressing the health, welfare, and security needs of the nation, and will provide an organizational map to help the reader better understand how the federal government develops and executes its science policy and why it funds science. It will explore how universities, national laboratories, and industry partner with the federal government to carry out scientific research, and why states are developing their own scientific and technological support structures. The importance of the public and attention to social values and ethical concerns will also be discussed. The course will examine the interactions between the scientific community and policymakers, and the grand challenges that face science and society, including environmental preservation, advances in new technologies, transportation, power generation, and prevention and cure of diseases.
POLSCI 309	Theoretical Perspectives on Environmental Change	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Political Science	This course draws upon concepts from Western political theory to examine the political and ethical issues posed by environmental change.
POLSCI 336	Energy Politics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Political Science	Meeting the surging energy needs of their citizens represents one of the most daunting challenges facing governments across the world. This course examines the politics of electricity provision, the impacts of natural resource wealth, and environmental politics in both democratic and non-democratic settings, with a special focus on the developing world.
ENVIRON 365	International Environmental Policy	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This course will examine policy-making on several prominent international environmental issues. Issues examined will include Canadaâ€™s tar sands, climate change, energy and water consumption and the protection of biological diversity in Papa New Guinea and India. The course will also examine the driving forces that contribute to global environmental burdens, the range of policy and institutional responses potentially available to manage them, and the relationship between international non-governmental agencies and local communities when developing policy.
ENVIRON 270	Our Common Future: Ecology, Economics & Ethics of Sustainable Development	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	An interdisciplinary foundation of the concepts and strategies of sustainability from an ecological, economic, and socio-political perspective. The quest for sustainable development is the most critical, yet challenging, issue of our times. Defining what sustainable development is and how it ought to be accomplished is profoundly influencing government, academics, business, science, and people's culture and livelihoods at the local, national, and global levels.

ENVIRON 139	First-Year Seminar in the Environment	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Inquiry into the fundamental changes occurring in the natural environment (including humans) and in human social systems and culture, to explore the question "To what extent, in what ways and why are current trends in human impacts on the environment and social relations unsustainable/sustainable?" The seminar will introduce the major contrasting responses being made to this question along with their differing scenarios of the future in terms of their visions, strategies, and examples of practices to be pursued. Learning resources will be selected from four types of information: scientific, religious/spiritual, documentation of innovative environmental, social (including economic and political) and technological practices and personal experiences and commitments. Religions to be considered include those of Native Americans and other indigenous peoples as well as world religions, e.g., Buddhism, Islam, Judaism, and Christianity. The consideration of spirituality is based on individuals' experiences and recognition of "sacred" or "ultimate" realities that are variously understood and characterized. Students will be asked to engage in interdisciplinary, seminar-based inquiry through reading and thinking critically, reflecting on and analyzing their own values, beliefs and practices, sharing the results of their own inquiries through discussions, writing, and presentations and by comparing and contrasting their own beliefs and ideas with others who have different backgrounds and current values, beliefs, and goals. It is expected that students enrolling in this seminar will have differing backgrounds of knowledge and experience in relation to the environment, science, religion / spirituality, and unsustainability / sustainability. Both students with religious commitments are welcome as well as students who are agnostics, atheists or who would describe themselves as secular humanists, skeptics, and â€œundecided" or by some other name for their highest values and related belief systems and practices. This opportunity for participatory inquiry will require enrolled students to engage in respectful dialogue along with acceptance of people with backgrounds and present commitments and beliefs that are different from their own.
RCSSCI 350	The Built Environment: Introduction to Landscape Change	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	The content of this course is broad, but critically important for helping informed citizens learn to look at the things we build and the spaces we inhabit. Built environments affect our entire lives, yet we rarely focus on their influence. This course bridges the natural science, social science, and humanities realms anticipated in the Program in the Environment. Course lectures and readings emphasize breadth over depth. Student case study work, however, will develop depth in particular landscape topics. This course is an introduction to the role of humans in shaping the built environment. It explores physical design and cultural meaning at various scales and contexts in the landscape. We explore the power of physical design and planning to enrich the human spirit, provide functional needs, interpret cultural history, and sustain natural systems. The course is concerned with exploring how Americans shape space and how, in turn, space shapes people. We take a topical approach, dealing with different aspects of landscape change, design, and planning. The course illustrates how humans have adapted and shaped landscapes for functional and aesthetic goals. A unifying theme is emphasized throughout: the important link between natural and social processes of landscape change. Landscape design and planning professional skills will not be taught directly; the goal is not to prepare students for landscape architecture practice. This course, however, is designed to encourage students to think about land from many different perspectives.
ENVIRON 302	Topics in Environmental Social Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from a social science perspective. Specific topics will vary by term.
ENVIRON 303	Topics in Environmental Natural Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Â This special topics course seeks to examine environmental problems and issues from a natural science perspective. Specific topics will vary by term.
RCSSCI 211	Social Sciences and Environmental Problems	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This course will introduce students to the range of social sciences and will show how the insights gained from these sciences can help us understand and address environmental problems. The first part of the course will provide an overview of the social sciences. As part of this overview, the perspectives of anthropology, communication/education, economics, political science, sociology, and psychology will be used to examine the causes of and solutions for environmental problems. The second part of the course will focus on two current environmental issues and will explore how the concepts and tools from the social sciences are, or can be, used to address these problems. (The course is designed for first and second year students.)
ENVIRON 306	Global Water	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	â€œWhiskey is for drinking, water is for fighting over.â€ These famous words, attributed to Mark Twain, summarize perhaps the most critical environmental issue of the coming decades: the scarcity of available freshwater. Today, nearly one billion people â€” roughly one out of seven people on the planet â€” are â€œwater deprived,â€ meaning they do not have enough freshwater to ensure their basic sanitation, irrigation, or drinking needs. With the worldâ€™s population expected to grow by 2.5 billion people by 2050 (mostly in areas of the world that are already water deprived), freshwater will be the critical challenge of the 21st century. Overpopulation, urbanization, pollution, food security, corruption, politics, technology, human rights, and governance, just to name a few issues, are all intimately connected to water availability. This course will intertwine these and other issues with four main themes: ensuring human and environmental health, balancing competing demands for freshwater, managing across borders, and coping with climate change.
ENVIRON 408	Land Use Policy, Law, and the Environment	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Â This course provides an overview of the policy and legal justifications for and institutional arrangements used to manage the use and development of land in the U.S., focusing especially on the management of privately owned land by state and local governments for environmental protection purposes.
ENVIRON 321	Climate change & Adaptation	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Climate change is the greatest environmental and development challenge facing the world. Course will introduce students to the following: human dimensions of global climate change; key concepts and examples related to impacts, mitigation, vulnerability, resilience, and adaptation; and how government, civil society, and market actors can jointly solve climate problems related to migration, public health, and urbanization.

ENVIRON 290	Food: The Ecology, Economics & Ethics of Growing & Eating	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This course engages students in one of the critical environmental and social issues of the 21st centuryâ€"foodâ€"and all that it implies about the sustainability of current practices and emerging trends. Food, or more properly, food systems, has environmental, economic, ethical, and political dimensions. And they intersect with other major issues: health, ecological resilience, biological and cultural diversity, security, justice, democracy. Whatâ€™s more, food is an issue that can be understood in terms of complex systems (natural and human), historical developments, and current practice. The course examines patterns of food production and consumption via histories, case studies and personal accounts, across cultures and across time. It examines the science of agriculture and the culture of growing food and eating food. Special attention is paid to patterns of economic expansion and environmental degradation and to the possibilities for sustainable food systems. A premise is that if society is to get on a sustainable path, it will have to do so first â€œon the ground,â€ in farming, fishing, and irrigating, for instance. And, for that, it will have to organize the distribution and consumption of food to support such efforts. The course thus approaches food from a multitude of perspectives, including those of ecology, economics, history, political science, planning and even some literature and art. The course is structured primarily as a lecture, but has features of a seminar (daily readings and discussion). Students must prepare daily, engage in discussions (including written submissions), and collaborate with each other for research, public presentation and discussion. They must also discipline themselves to â€œjust observe.â€
ENVIRON 308	Sustainability and Health	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This course explores how the environment influences health and well-being.Â In order to tackle this complex topic the physical, psychological, and social dimensions of health are considered.Â The course then explores how issues like climate change, materialism, and sprawl might impact health and the potential benefits associated with sustainable lifestyles.
ENVIRON 242	Topics in Environmental Social Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from a social science perspective. Specific social science topics will vary by term.
ENVIRON 305	Interdisciplinary Environmental Topics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from an interdisciplinary perspective. Specific topics will vary by term.
ENVIRON 462	Topics in Environmental Social Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This special topics course seeks to examine environmental problems and issues from a social science perspective. Specific social science topics will vary by term.
ENVIRON 465	Interdis Env Topics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Interdisciplinary Environmental Topics --- This special topics course seeks to examine environmental problems and issues from an interdisciplinary perspective. Specific topics will vary by term.
ENVIRON 155	Interdisciplinary Environmental Topics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This introductory special topics course seeks to examine environmental problems and issues from an interdisciplinary perspective. Specific topics will vary by term.
PUBPOL 468	Oil & Gas Policy in the US	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	Hydraulic fracturing and horizontal drilling have made the United States the world's largest producer of oil and natural gas. What does that mean for the domestic economy, energy prices, foreign policy, climate change, and local environments? This course will begin with an overview of the domestic and global energy system. It will briefly describe the history of oil and gas production in the United States, and how that history has helped shape global energy markets.
ENVIRON 395	Public Lands & Natural Resource Law and Policy	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment	This course examines the different philosophical perspectives on public lands and natural resources as well as the historic and ongoing acquisition, disposition, and management of the public domain. It explores the policy regimes and ensuing debates over the primary resources: minerals, timber, range, wildlife, recreation and preservation.
PSYCH 362	Conservation Behavior: The Psychology Of Environmental Stewardship	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Environment and Sustainability, Literature, Science, & Arts Â» Psychology	One enduring challenge of living sustainably on a finite planet is to craft a future in which we will all want to live. A materialistically simpler existence may soon be an ecological necessity. However, it is unlikely to be adopted by many people if it is promoted in the wrong way, as a form of sacrifice requiring compensation, rather than as a choice that is personally meaningful while also being good for the planet. The challenge becomes, then, how to promote sustainable living so that people accept and even embrace it. This course explores the range of behavior change models that are up to this challenge. It focuses on environmental stewardship behaviors that individuals and small groups can adopt and it reviews the effectiveness of commonly used informational and motivational techniques.
ENVIRON 222	Introduction to Environmental Justice	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts	This course explores people of color environmental concerns and specifically focuses on the connection between communities of color and low-income groups and the location of hazardous waste sites. This course also explores Native American environmental issues and the connection between the transboundary shipping of hazardous waste from developed countries to developing ones.
ENVIRON 367	Global Enterprise and Sustainable Development	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts	Examines how businesses can influence, and are influenced by, issues related to sustainable development. The course identifies external forces and strategy based reasons that motivate corporations to contribute to environmental and social goals. Through guest lectures and case studies, students learn about current best practice and future possibilities.

ENVIRON 490	War and the Environment: A Lethal Reciprocity	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts	Throughout history warfare and the preparations for war have been an integral aspect of organized societies. This has had complex and fateful impacts on the natural environment. But environmental historians have largely neglected the impacts of military mobilization and collective violence. Conversely, military historians have neglected the environmental impact of war and militarization, although the field of military history has routinely studied the ways in which climate and terrain have shaped warfare. Yet this is a vital aspect of today's challenge to limit the ecological degradation of the biosphere. Since the Vietnam War (in tandem with the rise of the environmental movement) there has been greater public awareness of the environmental consequences of both war itself and also peacetime (Cold War) military establishments. Major research institutes have been monitoring this growing problem, but they have not had much historical depth to inform their work. This provides a dual assignment for environmental history studies: first, to provide a detailed understanding of the ecological consequences of war and militarization over many centuries and in all world regions, and second, to work with contemporary researchers to integrate past perspectives with today's challenges. This course is designed primarily to survey our long history, but week by week we will also be explicitly aware of the contemporary applications of our historical study.
ENVIRON 421	Restoration Ecology	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts	Our landscapes are a product of man's engagement with the natural world. Scientists and citizens, alike, have noticed that many of our landscapes suffer reduced ecological function, and many individuals and groups are responding with efforts to improve the ecological health of these natural areas. This course is intended as a broad overview of restoration ecology in a variety of ecosystems, both local and international. We first focus on on using knowledge of ecosystem functioning to facilitate the recovery of disturbed and damaged ecosystems. Then we examine and discuss a multitude of restoration projects--urban, rural, and wild--through the use of case studies, scientific studies, local field trips, and virtual field trips (e.g., documentaries and films). Guest speakers with expertise in aspects of ecological restoration provide opportunities for students to engage more fully in analysis of restoration projects.
ENVIRON 207	Sustainablility & Society	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts	This course provides students with a broad, interdisciplinary understanding of sustainability in society and establishing a platform from which to further research, study, and put it into practice. Students learn to connect sustainability to real-world challenges, evaluate its claims, develop knowledge to participate in sustainability debates, and identify novel pathways towards a more sustainable society.
PHIL 376	Environmental Ethics	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Philosophy	The fact that humanity's relationship to nature has gone awry is rarely disputed, but the proposed cures are manifold. How should humans value the non-human world? Do humans have ethical duties to entities other than fellow humans? This course investigates a variety of proposed answers that claim to better situate humans with respect to nature. Such systems include variations on anthropocentrism, including a number of e-centric cousins (ecocentrism, biocentrism, zoocentrism, etc.) as well as movements such as deep ecology and ecofeminism. Current questions and controversies will be used to highlight the alternative visions that these various philosophies offer. Also considered will be the components of personal and communal ethics that lead to changes in praxis.
ENVIRON 360	Behavior and Environment	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Psychology, Social Work, Arch. and U.P. (Taubman) Â» Urban and Regional Planning, Environment and Sustainability	This course deals with two central themes: First, environmental problems are people problems, requiring an understanding of how people think, what they care about, and the conditions under which they behave most reasonably. Second, human behavior makes the most sense when studied in the context of the environment both present and evolutionary. The course builds a model of human nature based upon research in the field of environmental psychology.
RCNSCI 202	Ecological Issues	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Residential College	The environment is defined as the circumstances or conditions that surround an organism, and environmental science as the study of the environment and our proper place in it. These definitions point out the intricacy of understanding environmental science from a scientific, ethical, behavioral, economic, and institutional perspective. This course focuses on ecological principles and concepts underlying the management and use of natural resources, as well as socioeconomic factors and institutional roles. Throughout the course, emphasis is placed on the importance of interdisciplinary approaches to matters concerning the allocation of natural resources and the quality of our environment. Through lectures and discussions, students are encouraged not only to learn about environmental issues but also to consider their personal ethics relating to nature, resource use, and human populations. Topics covered include biodiversity, endangered species, exploitation practices, global fisheries and aquaculture, tropical deforestation, agriculture, air and water pollution, energy production and use, waste disposal, and the role of politics and economics in environmental issues. A particular focus is placed on the role of natural resources in the lives of people from the developed and developing world, and issues relating to environmental justice in the use of resources by people from both regions.
ENVIRON 391	Sustainability & the Campus	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Residential College	This â€œhands-onâ€ interdisciplinary course explores environmental (and, to a lesser degree, social and economic) sustainability in higher education generally and at the University of Michigan specifically in a dynamic, interactive way. Drawing upon theory and practice in sustainability, environmental management, organizational change and social advocacy, students conduct a substantial, hands-on group project in conjunction with a university sponsor. Past projects available at graham.umich.edu/campus-course have led to the creation of the â€œHow to be a Green Wolverine Guideâ€, the planting of a campus garden, a campus sustainability interactive map and many other direct outcomes. Through site visits, guest lectures, discussions, lectures and this project, this course addresses the real life challenges of campus environmental sustainability. The focus is on active, participation-based learning, and students leave the course with an understanding of the campus as a lever for environmental change and with the personal tools to act as change agents. Beyond directly impacting the campus, this course helps develop professional skills in environmental project management.

POLSCI 331	Environmental Public Opinion Analysis	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Program in the Environment, Literature, Science, & Arts Â» Sociology, Literature, Science, & Arts Â» Political Science	This course examines trends in environmental public opinion, influences on people's concerns about the environment, the depth and strength of concerns, and how environmental concerns affect personal behaviors and the political process. It also introduces students to useful statistical concepts and procedures for analyzing and interpreting public opinion data.
PSYCH 121	First-Year Seminar in Psychology as a Natural Science	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Psychology	A small seminar which will introduce entering students to the topic of Psychology and issues which are important in the field of psychology. Â Through this seminar, students will be able to develop an understanding of how various theories and applications of Â the discipline of psychology may be helpful in understanding the world.
ALA 429	IGR Senior Capstone: Social Justice in the Real World	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Psychology, Literature, Science, & Arts Â» Sociology	The focus is on strategies for social justice and change. The class explores alternative meanings of social justice, theories and strategies for social change, roles of change agents in traditional careers, the assessment of personal skills and resources, discussions with local social justice advocates and practice in multicultural teamwork.
RCNSCI 301	Advanced Topics in Science, Technology, Medicine, and Society	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Residential College	This course introduces a special topic above the introductory level or set of examples from science, technology, medicine, and society. Â The course emphasizes scientific or technical principles and evidence to convey the major theories, questions, and approaches of the subject. Â The course may focus on one field or survey several fields during a historical period.
SOC 203	Sociology of Multiculturalism	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Sociology	This course examines conflict solutions in sustainable, structural, and ethical ways, particularly among individuals with membership in groups of diverse class, race/ethnicity, gender, sexual orientation, citizenship, and other identity backgrounds. It explores strategies that could turn stratified, dominant, and unjust differences into differences that enrich social relationships.
AAS 347	Urban Inequality	Undergraduate	Sustainability Focused	Literature, Science, & Arts Â» Sociology, Literature, Science, & Arts Â» Afroamerican and African Studies	Examines the social and spatial factors affecting the location, social organization, structure and functioning of American cities. Both the internal arrangements and external connections of cities are analyzed. Emphasis is placed on contemporary social problems and spatial processes, such as suburbanization and residential segregation, housing deprivation and neighborhood revitalization, transit system and labor markets, city riots, poverty and the urban underclass.
PUBHLTH 350	Global Public Health: Challenges and Transformations	Undergraduate	Sustainability Focused	Public Health	Public health has taken on increasing global dimensions.Â This course examines the social, economic, and cultural factors impacting the health of societies worldwide and identifies key global health conditions, including obesity, vaccine-reventable diseases, cardiovascular diseases, cancer, tobacco, mental health, HIV/AIDS, TG, and malaria.
PUBHLTH 305	The Environment and Human Health	Undergraduate	Sustainability Focused	Public Health	This course introduces major issues of environmental health science.Â We will examine what those issues are, what determines them, and how they can be altered.Â The course provides an overview for students who want an introduction to environmental health as well as students planning to pursue additional environmental health coursework.
EHS 410	Sustainability and Environmental Health	Undergraduate	Sustainability Focused	Public Health Â» Environmental Health Sciences	This course links environmental health and sustainability issues with the goal of developing sustainable strategies. It addresses environmental health determinants, underlying drivers and stressors, environmental metrics, exposures and impact, assessment tools, and sustainable solutions. These concepts are applied to sustainable and healthy cities, transportation, food, energy, and consumer product systems.
INTLSTD 387	Topics in Global Environment and Health	Undergraduate	Sustainability Focused		Topics in Global Environment and Health --- This course will cover topics in global environment and health.