
GRADUATE STUDENT HANDBOOK

Masters of Science
in
Climate Science and Solutions

2022-2023

Climate Science and Solutions
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PSM Climate Science & Solutions 2022-2023

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Northern Arizona University does not discriminate on the basis of race, color, age, religion, gender, national origin, disability, or veteran status in our admissions, employment and education programs or activities.

INTRODUCTION

This handbook is designed to guide you through the policies and procedures governing your career as a Master's student in the Climate Science and Solutions (CSS) Professional Science Master's (PSM) program at NAU. This Master's degree program is part of the School of Earth and Sustainability (SES) in the College of Environment, Forestry, and Natural Science (CEFNS). Other graduate degree programs within SES include an MS in Geology, MS in Environmental Science & Policy, and the Earth Sciences and Environmental Sustainability PhD. We recognize that graduate study is much more than the meeting of mechanical deadlines, and your scholarly development is of paramount importance to the faculty. The CSS PSM program combines a foundation in climate science and sustainable systems studies with professional training and organizational skills to help our graduates succeed in the growing climate industry. These guidelines provide the information you need to understand the degree requirements and help you chart your academic studies so that you can direct your efforts toward your education and completion of your degree in a timely manner.

The Program Coordinator for SES graduate degree programs is Tracy Tiedemann. She is a great first resource for answering many of your questions regarding the graduate program. John Fegyveresi, is also a great resource as the CSS PSM Faculty Advisor and Program Director. They can help with questions regarding your academic progress and graduate studies at NAU. **For more information on the CSS PSM degree, consult our Program and the Graduate College web pages.**

The **Graduate College** sets the policies and deadlines that govern all graduate students at NAU. SES has adopted additional guidelines to insure uniformly high standards. **You should be aware of both sets of policies and review them periodically.** Written petitions for exceptions may be submitted for special cases or in extenuating circumstances. If you have questions regarding any of the policies, please feel free to discuss them with your advisor, or the Graduate Program Coordinators. Do not rely on hearsay information from other students: see it in writing. It is your responsibility to see that any changes, exceptions, or other dispensations made on your behalf with regard to any policies contained in this manual are documented **in writing. Be certain that any such documents are filed in your permanent records in the SES office and, if applicable, the Graduate College. Be sure to keep a personal copy.**

PROGRAM OF STUDY

A total of 36 units are required to complete the CSS program, including the summer internship of 3 units.

The program core courses are as follows (24 units required):

- ENV 591: The Science and Management of Greenhouse Gases (3 credits)
- ENV 595: Global Environment and Climate Change (3 credits)
- ENV 675: Topics in Environmental Discourse (3 credits each semester for a total of 9 credits)
- ECO 526: Applied Environmental Economics (3 credits)
- EES 687: Professional Development (1 credit taken during first two semesters; 2 credits)
- EES 698: Graduate Seminar (1 credit taken during last semester; 1 credit)
- EES 608: Fieldwork Experience (**Internship** - completed during the summer; 3 credits)

The remaining 12 elective units can be selected from, but are not limited to, the following list in consultation with graduate advisors. These classes are within the College of Engineering, Forestry, and Natural Sciences (CEFNS) and therefore you can take an unlimited number of units.

Department	Course Number and Title	Semester(s) Offered
Biology	BIO 426C Plants and Climate	Spring
	BIO 698 Ecosystem Ecology Graduate Seminar	Fall
Civil and Environmental Engineering	CENE 502 Principals of Environmental Transport Processes	Fall

	CENE 503 Sustainable Design and Construction	Fall
	CENE 540 Environmental Protection: Today and Tomorrow	Spring and Summer
	CENE 543 Urban Transportation and Planning	Spring
	CENE 568 Engineering in Natural Systems: Rivers and Streams	Spring
Environmental Sciences	ENV 530 Arid Land Geomorphology	Fall
	ENV 550 Historical Ecology: Reconstructing Past Ecosystems	Fall
	ENV 555 Environmental Science-Policy Interface	Fall
	ENV 571 Microbial Ecology	Spring
	ENV 650 Current Topics in Global Resource Conservation	Fall
	ENV 580 Atmospheric Change	
	ENV 599 Natural and Human Dimensions of Environmental Change	Fall
Earth and Environmental Sciences	EES 580 Climate Dynamics	Spring
	EES 680 Earth and Environmental Data Dynamics	Spring
	EES 599 Climate Dynamics	Spring
Forestry	FOR 504 Current Topics in Wildlife Ecology and Applied Conservation Biology	Spring
	FOR 563 Watershed Hydrology	Spring
	FOR 565 Watershed Restoration	Spring
	FOR 580 Ecological Restoration Principles	Spring
	FOR 582 Ecological Restoration Applications	Fall
	FOR 633 Ecological Economics	Spring
Geographic Science and Planning	GSP 514 Planning Sustainable Communities	Spring
	GSP 524 Fundamentals of Environmental Law and Professional Ethics	Fall, even years only
	GSP 531 Foundations I: Map Design and GIS	In person Fall only Online Fall and Spring
Geology	GLG 575 Environmental Geochemistry	Fall
Mechanical Engineering	ME 451 Renewable Energy	Intermittently Offered

	ME 535 Wind Energy Engineering	Fall
Political Science	POS 659 Environmental Policy	Spring
Statistics	STA 570 Statistical Methods I	Fall
	STA 571 Statistical Methods II	Spring

The following list of courses are also potential electives. However, they are non-CEFNS courses and therefore are subject to the 6-unit limit as noted below.

Department	Course Number and Title	Semester(s) Offered
Communication	COM 540 Science Communication	Fall and Spring
	COM 541 Data Metaphors and Visualization	Fall
Economics	ECO 428 Advanced Energy Economics	Fall
Sustainability	SUS 602 Elements of Sustainability Communities	Spring
	SUS 599 Agriculture, Water, and the Environment	Spring

Note: No more than 6 units of 400-level courses and/or 6 units of non-CEFNS courses can be applied towards your degree.

Note: Any grade of Incomplete received by a graduate student must be completed within one semester, or the student will be put on probation. If there are extenuating circumstances, an extension could be received in writing from the Faculty Program Advisor, with approval of the Graduate College.

Please refer to *Appendix A – All CSS Electives* for a comprehensive list of elective options for the CSS program. It is important to note, this list is not sorted by CEFNS vs. non-CEFNS courses, and not all courses are offered every semester.

Independent Study

If you don't see a course listed that into your passions, we encourage you to apply for independent course work. If approved, your independent study counts towards your elective requirements.

CSS PROGRAM FEE

The CSS program has a \$4,500 program fee, paid over 3 academic semesters (\$1,500 each semester). The CSS PSM includes an internship and hands-on career development workshops. Because of the professional component of this degree, it differs for the services typically provided for thesis-based Master's degrees. As a result, the CSS PSM works to broaden career opportunities for its graduates, and strengthen and diversify industry, government, and NGO

partnerships. The program fee allows the CSS program to fulfill the professional component of this degree program.

PROFESSIONAL INTERNSHIP

The CSS program is a non-thesis based Professional Science Master's program. The professional internship requirement of the CSS PSM is one of the aspects that sets this program apart from other master's programs. PSMs are graduate degrees designed to provide students with advanced training in the sciences, while also helping them develop workplace skills desired by employers. In the area of climate science, employers are looking for science-trained professionals that have business, project management, and communication skills. In order to provide students with the skills to compete in today's competitive job market, our CSS PSM degree is more professionally oriented than other more traditional master's of science degrees. As per the program requirements, all students are required to complete a minimum of 200 hours in a professional internship during the summer between their second and third semesters. The internship experience provides valuable professional experience and helps students to build their professional skills and network. During the internship, students will apply the science and organizational skills learned during the first year of the CSS program to a real world setting.

FINANCING YOUR EDUCATION

The Graduate College provides resources on [the costs of attending graduate school](#). It is important to fill out your [FAFSA paperwork](#) to be considered for scholarship and other financial aid. In addition, funds are available from a variety of sources to supplement student income and to defray some of the costs of the CSS program. Opportunities include the following:

WESTERN REGIONAL GRADUATE PROGRAM (WRGP)

Graduate programs included in the WRGP are identified as providing a unique, interdisciplinary graduate education experience for their students. The Western Interstate Commission on Higher Education allows graduate students who are presently residents within 15 participating states (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming) to enroll in one of 51 participating institutions outside of their home state, including NAU, and pay resident (in-state) tuition. **Note:** students that receive WRGP status are not eligible for additional tuition waivers.

TUITION WAIVERS

Tuition waivers are awarded on a competitive basis, based on academic merit and/or financial need. Decisions on tuition waivers are made at the time of acceptance into the program and are valid for 1 year. They may be extended for 1 additional semester based on availability and academic performance.

GRADUATE ASSISTANTSHIPS

Graduate Assistantships (GAs) support is not common for CSS PSM students. However, periodically there are opportunities for a full time (20 hours/week) or part time (10 hours/week) GAs. To learn of open GAships, please visit the [Graduate College page](#).

OTHER SCHOLARSHIPS

Additional scholarship and assistantship opportunities may be available through NAU. Please refer to the [Graduate College Scholarships and Fellowships page](#).

ACADEMIC POLICIES AND SATISFACTORY PROGRESS

SES adheres to the academic policies of the Graduate College, and you should be thoroughly familiar with them. In addition, every semester your progress as a graduate student will be evaluated. Our policy on evaluation of your progress and the resulting actions are as follows.

Academic Standards

- You must earn a grade of a **“B” or better** in all of your CSS **core courses**. If you get a “C” or lower in a core class, you must retake the course.
- In order to graduate, you must earn a **cumulative grade point average (GPA) of 3.0 or better**.
- A grade of D or F **cannot be applied** towards your academic degree.
- No more than 6 hours of graduate course work with a grade of “C” can be applied towards a Master's degree in SES.
- Receiving a grade of “C” or lower in 6 or more course units, or a GPA below 3.0, will place a student on academic probation (see NAU Graduate College policy at <https://policy.nau.edu/policy/policy.aspx?num=100407> for more information).

A student who is on academic probation is required to meet with their advisor to discuss the steps necessary to remediate problems that led to probation and to devise a written action plan. This written action plan must be submitted to the department chair/director and the Graduate College for final approval. If the student cannot meet the goals for improvement, they may be dismissed from the Program.

Note: Students with a Graduate Assistantship - in order to continue with an assistantship, you must remain in good academic standing, make satisfactory progress toward a degree, and complete at least 9 units of credit in their program each semester. If the student fails to make adequate progress toward a degree, or receives a grade below a "B," employment may be discontinued at the discretion of the unit.

Appendix A – All CSS Electives

Mostly Complete Electives List for CSS

BIO 426C (3cr) – Plants and Climate

Description: Analyzes plant physiological functions, including photosynthesis, transpiration, respiration, and energy balance, and interactions with the past and current climate system. 3 hours lecture. Recommended: CHM 360, BIO 284. Letter grade only.

BIO 479 (3cr) – Ecosystems and Climate Change

Description: Principles of ecosystem ecology, including the factors controlling ecosystem structure, productivity, nutrient cycling, and energy balance-with examples from the Colorado Plateau and emphasis on global environmental change. Letter grade only. Course fee required.

BIO 523 (3cr) – Meta analysis in Ecology and Evolution

Description: This is an introductory course to meta-analysis. Course is designed for advanced grad. students who have interest in ecological & evolutionary phenomena for which published data already exists. We will study the basic steps in meta-analysis design and implementation, including statistical models and the interpretation and presentation of results. Letter grade only.

BIO 567 (4cr) – Ecological Sampling and Monitoring

Description: Students will apply ecological concepts and practice standard sampling techniques. Students design and execute population censuses, describe demographic phenomena, and explore phenomena characteristics of representative ecosystems. Students create and apply sampling schema and experimental procedures, & analyze and present data using techniques exemplary of best practice in ecology. 1 hr. lect., 9 hrs. lab. Letter grade only.

BIO 568 (3cr) – Conservation And Management Of Imperiled Species

Description: The course familiarizes students with the practical, legal, political, social, and economic realities of managing regulated species, and it engages them in current conservation challenges with imperiled species and habitats. Students will lead discussions on relevant issues in conservation and resource management and to engage in deliberations and practices required of conservation professionals working with regulated species. Letter grade only.

BIO 570 (3cr) – Plant Ecology

Description: Surveys theories that explore the dynamic nature and ecological genetics of plants. Uses examples from population-level and community-level studies to demonstrate current problems in plant ecology, emphasizing paradigms unique to plants. Letter grade only

BIO 571 (3cr) – Field Biology – Stream Ecology

Description: Surveys theories that explore the dynamic nature and ecological genetics of plants. Uses examples from population-level and community-level studies to demonstrate current problems in plant ecology, emphasizing paradigms unique to plants. Letter grade only.

BIO 573 (4cr) – Field Ecology

Description: Emphasizes identification of original field research problems in diverse habitats, experimentation, data analyses, oral presentation of findings, and writing in journal format. 2 hrs. lecture, 6 hrs. lab. Letter grade only. Course fee required.

BIO 578 (3cr) - Microbial Ecology

Description: Population, community, & ecosystem ecology of microorganisms emphasizing interactions w/plants & animals & roles of microorganisms in ecosystem processes. Letter grade

BIO 682 (3cr) – Quantitative Biology

Description: Introduces quantitative analysis of biological data, including the treatment of field and lab data by computer statistical packages and mathematical models of biological and ecological processes. Letter grade only.

BIO 663 (3cr) – Biogeography

Description: Reviews factors governing the patterns of organism distribution, including biotic and physical relationships, evolutionary history, dispersal mechanisms, paleoecology, continental drift, and insular phenomena. Letter grade only. Prerequisites: undergraduate degree in biology or related field plus knowledge of basic ecological concepts.

BSCI 501 (3cr) – Sustainable Design and Construction

Description: This course is an advanced examination of contemporary building science topics, means and methods currently used in practice to deliver performance-based construction projects. The successful student will gain a broader understanding of the historical context relating to the sustainable building movement and develop increased technical skills associated with performance-based building design and construction. Letter grade only.

BSCI 532 (3cr) – Passive Architectural Design

Description: This course will explore conceptual aspects of traditional, contemporary, and emerging Architecture, place specific design as it relates to region and climate, and architectural tectonics and material application. Letter grade only.

CENE 502 (3cr) - Principles Of Environmental Transport Processes

Description: Development of the balance laws for chemical species and application of these laws to describe mass transport processes in engineered and natural environmental systems. Co-convenes with CENE 480. Letter grade only. Course fee required.

CENE 540 (3cr) - Environmental Protection: Today and Tomorrow

Description: Explores current legal and regulatory strategies for environmental protection. Examines innovative approaches to environmental management. Group and individual projects. Co-convenes with CENE 440. Letter grade only. Course fee required.

CENE 562 (3cr) - Water Quality Modeling

Description: The chemical, physical, and biological processes that control water quality in lakes and streams, and the systems of differential equations that can be used to describe these transformations. Focus on derivation and application of equations using spreadsheets and prepackaged software, procedures for calibrating and verifying models, and analysis of the capabilities and limitations of mathematical representations of natural systems. Instructor consent required. Co-convenes with CENE 462. Letter grade only.

CENE 568 (3cr) - Engineering In Natural Systems: Rivers And Streams

Description: Analysis of fluvial systems from a sustainable engineering perspective; course modules: stream geomorphology and classification; field data collection strategies; hydraulic modeling of natural channels. Letter grade only. Course fee required.

CENE 565 (3cr) – Water And Wastewater Design For Rural Areas & Developing Countries

Description: This course will focus on international guidelines associated with water supply and wastewater control and the design of low-energy, low-maintenance, and sustainable practices in water supply, wastewater treatment, and wastewater reuse. Letter grade only.

CENE 641 (3cr) – Resilience of Infrastructure Systems

Description: Concepts of infrastructure resilience including security, robustness of design, operation through changing environmental conditions, and the adaptability of threatened infrastructure. Includes content regarding water supply and treatment, climate fragility, heavy civil construction, transportation systems, and wastewater recycling. Letter grade only.

COM 540 (1cr) – Introduction to Science Communication

Description: This seminar will allow students in a variety of disciplines to experience intensive, hands-on introduction to effective strategies for communicating science. Letter grade only.

COM 541 (1cr) – Data Metaphors & Visualization

Description: This course will serve to introduce students to the most common forms of scientific graphical displays (data metaphors), uses, and misuses. Letter grade only.

COM 542 (1cr) – Ethics And Strategies In Science Communication

Description: Examination of statistical significance, the use of math skills to "translate" numbers into forms that contribute to understanding. Students learn the challenges of communicating about controversial topics in science. Letter grade only.

COM 525 (3cr) – Mass Communication and Human Behavior

Description: Studies mass communication theories and effects, messages, audience behavior, and the behavioral concomitants of mass communication. Emphasizes the key research and methodologies for studying mass communication and human behavior. Letter grade only.

COM 545 (3cr) – Writing Science

Description: Intensive writing practice aimed at improving writing skills in professional and lay settings. The class focuses on writing techniques, story structure, and effective revision. Written products will include various science communication products. Letter grade only.

COM 600 (3cr) – Communication Theory and Application

Description: Reviews the nature, history and types of communication theory with emphasis upon the use of theory in analysis and problem solving. Letter grade only.

COM 602 (3cr) – Critical Methods in Communication

Description: Survey of methods focused on developing skills in the application of critical methods to verbal artifacts and effective written expression of criticism. Letter grade only.

COM 603 (3cr) – Qualitative Research Methods

Description: Graduate level class in qualitative research methods, focusing on contemporary problems and practices of participant observation, interviewing and ethnographic inquiry, and developing background and skills to conduct qualitative research. Letter grade only.

COM 604 (3cr) – Quantitative Research Methods In Communication

Description: Students will learn the purpose, application and process of quantitative research methods in the field of Communication. Letter grade only.

ECO 424 (3cr) – Natural Resources And Climate Change

Description: This course covers basic principles and methods economists have developed to characterize the efficient use of natural resources ranging from minerals and energy to fisheries, forestry, water, etc. The focus is on the problems commonly encountered in natural resource uses, root causes, policies, and how well different policies work. Letter grade only.

EES 580 (3cr) – Climate Dynamics

Description: In this class we will develop a strong, conceptual understanding of natural climate dynamics, with a special focus on modes of variability in the climate system that explain most of the natural changes that occur over multiple time scales. Letter grade only.

EES 591 (3cr) – Basics in Greenhouse Gas Accounting (Required for CSS)

Description: This will be the updated version ENV 591 that the CSS students are already required to take. Still being developed.

EES 592 (3cr) – Community Level Greenhouse Gas Accounting

Description: Also part of proposed GHG Professional Certificate - Still being developed.

EES 593 (3cr) – Scope 3 Emissions

Description: Also part of proposed GHG Professional Certificate - Still being developed.

EES 594 (3cr) – Greenhouse Gas Mitigation (different from ENV 675 Topics: Mitigation)

Description: Also part of proposed GHG Professional Certificate - Still being developed.

EES 605 (1cr) – Regional Topics in Earth and Environmental Science and Policy

Description: Introduction to research and grant-proposal writing and to geologic, environmental, and policy issues of the Southwest, with emphasis on Arizona. Pass-fail only

EES 680 (4cr) – Earth and Environmental Data Analysis

Description: This class introduces graduate students to modern data analysis broadly across the EES, including introducing scientific programming and workflow & developing a theoretical & practical understanding of the most commonly used analytical techniques. Letter grade only.

EES 698 (1cr) – Seminar Series

Description: Reading and discussion on selected advanced topics. Pass-fail or letter grade.

ENG 530 (3cr) – Professional Environmental Writing

Description: This course will examine environmental communication. Students will incorporate field experience and produce a workable business proposal for a non-profit. Letter grade only.

ENV 430 (3cr) – Environmental Chemistry

Description: Rigorous introduction to the chemistry of natural systems, including redox properties and complex equilibria, element cycling, and atmospheric chemistry. Letter grade.

ENV 515 (3cr) – Climate Change: Solutions, Politics, and Power

Description: This class will draw from critical social theory to examine current responses to climate change as well as future possible responses. The course will examine how we might address climate change to avoid catastrophic impacts. We'll explore: 1) What are the popular approaches to reduce greenhouse gas emissions or possible impacts of climate change? 2) Will these approaches work? 3) Do they address the root drivers of climate change? 4) What other system or lifestyle changes might be effective to address climate change? Letter grade only.

ENV 525 (3cr) – Water Resources Policy

Description: This course examines water resources policy and management through an international framework. This class draws on interdisciplinary perspectives to examine case studies and analyze institutions from across the U.S. and abroad. Field Trips. Letter grade only.

ENV 530 (3cr) - Arid Land Geomorphology

Description: Analyzes arid to semiarid landforms, geomorphic processes involved in their formation and evolution, and human impact in arid to semiarid terrains. Lab emphasizes standard geomorphic techniques. 2 hrs. lecture, 3 hrs. lab. Letter grade or pass-fail.

ENV 540 (3cr) – Conservation Biology

Description: Scientific basis for conserving & managing biological diversity, emphasizing applications of ecology and genetics, drawing on other scientific disciplines, and integrating public policy and sociological analyses. Letter grade or pass-fail.

ENV 544 (3cr) – Landscape Ecology

Description: Theory & application of landscape ecology, an emerging discipline focusing on spatial patterns in natural and human-dominated landscapes and their role in determining the structure and function of ecological systems. Letter grade only.

ENV 550 (3cr) – Historical Ecology: Reconstructing Past Ecosystems

Description: Theories & methods in reconstructing past terrestrial & aquatic biotic communities, affected by climate change & human activities. Sources of info. on ecological change include pollen analysis, paleobotany, lake levels, charcoal particles, sediments, & packrats. Special topics will concentrate on the record of human influence on landscapes. Letter grade only.

ENV 555 (3cr) – The Environmental Science-Policy Interface

Description: Examines generation of scientific knowledge & how that knowledge is presented, evaluated, manipulated, and applied as political forces shape Env. policy. Letter grade only.

ENV 560 (3cr) – Evolution and Environmental Change

Description: Evolution is not only a deep-time process responsible for producing all of the biodiversity we see today, but also an ongoing part of ecological interactions and ecosystem responses to global change. This class will explore the impact of evolutionary processes on our ability to predict and respond to rapid environmental change. Coursework will focus on reading and analyzing the scientific literature on a range of applied evolutionary topics. Letter grade only

ENV 571 (3cr) - Microbial Ecology

Description: Population, community & ecosystem ecology of microorganisms emphasizing interactions w/plants & animals and the roles of microorganisms in ecosystem processes. Letter grade only.

ENV 572 (3cr) – Quaternary Pollen Analysis

Description: Analyzes pollen and spore morphology, use of pollen assemblages to deduce vegetation and climate change. Letter grade only. Course fee required. Prerequisite: coursework in ecology, plant taxonomy, or Quaternary geology.

ENV 577 (3cr) – Concepts in Ecology

Description: Theoretical and applied concepts in ecology, such as evolutionary ecology, population and community ecology, ecosystem ecology and behavioral ecology. Cross-listed with BIO 577 and FOR 577. Letter grade only.

ENV 580 (3cr) – Atmospheric Change

Description: Focuses on impact of human behavior on air quality-locally, regionally, and globally-by examining Earth's radiation budget, circulation models, and chemical processing in the atmosphere. Letter grade only.

ENV 596 (3cr) – Quaternary Climate Change

Description: Analyzes the causes and effects of climate change during the Quaternary Period and methods used to reconstruct past climates from marine and terrestrial sediments, ice cores, and biological records. Cross-listed with GLG 596. Letter grade only

ENV 650 (3cr) – Topics in Global Resource Conservation

Description: The class will evaluate the primary literature on current topics in global environmental change and resource conservation (e.g. climate and forests) and innovative solutions across scales will be addressed. Letter grade only.

FOR 500 (3cr) - Ecosystem Science And Management Principles

Description: General systems overview of biophysical, social, and political factors associated with forestry. Emphasizes wildlife, recreation, and non-commodity resources. Letter grade only.

FOR 504 (3cr) – Current Topics In Wildlife Ecology And Applied Cons. Biology

Description: The class will evaluate primary literature (instructor will provide the reading list) on a current topic in wildlife ecology or conservation biology, with an emphasis on applied ecology and conservation interventions. Letter grade only.

FOR 515 (3cr) – Advanced International Forestry

Description: Ecology, management, and policy issues related to forests around the world, including ecological, political, economic and cultural perspectives. Co-convenes with FOR 415. Letter grade only.

FOR 517 (3cr) – Dendroecology: Applied Tree-Ring Analysis

Description: Concepts and methods of dendroecology - the application of dated tree-ring information to ecological investigations. Principles of dendrochronology, cross-dating, and application to climate, hydrology, insect outbreaks, past forest conditions. Letter grade only.

FOR 525 (3cr) – GIS and Spatial Techniques in Forestry

Description: Application of geographic and spatial techniques to research and management in forestry, wildland management, and conservation planning. Seminar format may include analysis of data provided by instructor or students. Letter grade only

FOR 545 (3cr) – Rangeland Ecology & Mgmt. Topics in Global Resource Conservation

Description: This course will explore western U.S. rangeland plant community types; and plant (esp. graminoid) morphology physiology, and interactions of grazing, fire, and drought. Southwestern rangelands will be examined in depth to understand their response to a changing climate and various management practices. Letter grade only.

FOR 551 (3cr) – Fire Ecology and Management

Description: Ecological effects of wildland fires, fire regimes, fire management, prescribed fire, and the application of fire science to restoring and managing ecosystems. Letter grade only.

FOR 560 (3cr) – Wetland Ecology And Management

Description: This course covers the major environmental factors responsible for wetland structure and function, as well as current issues related to wetland management and policy. Letter grade only. Course fee required. Prerequisite: Undergraduate ecology course or permission of instructor.

FOR 563 (3cr) – Watershed Hydrology

Description: Hydrologic principles and practices related to the land-water system; emphasis on the effects of climate, soils, vegetation, and land-use factors on the quantity and quality of runoff. 2 hrs. lecture, 3 hrs. lab. Letter grade only.

FOR 565 - Watershed Restoration

Description: Students will explore the effects of natural and anthropogenic activities on watershed conditions, and learn various approaches of restoring or handling any adverse effects of such disturbances on watershed ecosystems. Letter grade only.

FOR 580 (3cr) – Ecological Restoration Principles

Description: Concepts and theories of ecological science related to restoring natural structures and processes of ecosystems. Letter grade only.

FOR 582 (3cr) – Ecological Restoration Applications

Description: Examples and applications of ecological science related to restoring natural structures and processes of ecosystems. Co-convenes with FOR 382. Letter grade only.

FOR 604 (3cr) – Wildlife Habitat Relationships

Description: Systems approach to comprehending the associations with and uses of habitat by wildlife. Letter grade only.

FOR 605 (3cr) – Natural Resources Policy Analysis

Description: Students will investigate how to analyze the natural resource policy process including; substance, actors, institutions, interest groups, and the role of social values in policy content. The course will include a review of current multi-resource philosophy, law and regulations. Letter grade only.

FOR 606 (3cr) – Applied Ecological Data Analysis

Description: Introduction and application of emerging and trending analysis techniques used to address ecological data problems. The course takes a modular structure, focusing in depth on a few such methods which may include resampling methods, structural equation modeling, ordination, nonparametric or spatial statistics, likelihood, etc. There are no hard pre-requisites, but prior undergraduate or graduate statistics or analysis courses are advised. Letter grade only.

FOR 633 (3cr) – Ecological Economics

Description: Theory of ecological economics, which is the union of ecology and economics, and its application to natural resource management. Letter grade only.

GLG 451 (4cr) – Hydrogeology

Description: Aquifer types and hydrologic properties; physical laws and mathematical equations of subsurface flow; recharge and discharge; analyses of groundwater flow systems. 3 hrs. lecture, 3 hrs. lab, plus field trips. Letter grade only. Course fee required

GLG 575 (4cr) – Environmental Geochemistry

Description: Introduces equilibrium and kinetic processes responsible for the chemical composition of natural fresh, saline, and hypersaline surface and ground waters; application of these processes to geologic problems including diagenesis, weathering, and mineral deposits. Co-convened with GLG 475. 3 hrs. lecture, 3 hrs. lab. Letter grade only. Course fee required.

GLG 670 (4cr) - Advanced Hydrogeology

Description: In-depth treatment of theories and equations of groundwater flow; investigation of prevalent groundwater problems and solutions. Specific areas of focus: field techniques, groundwater modeling, and groundwater contamination and solute transport. 3 hrs. lecture; 3 hrs. lab. Letter grade only. Course fee required.

GSP 506 (3cr) – Data Analysis And The Digital Community

Description: The analysis of community planning data and their presentation for public meetings and online settings. Pass-fail or letter grade.

GSP 514 (3cr) – Planning Sustainable Communities

Description: An examination of sustainability concepts from the household to the community level with the goal of assessing how the concepts can be incorporated into neighborhood and community planning and design. Topics include household sustainability, energy and water conservation, food and agriculture, transportation and circulation, land use and layout, community organization, business models, and built examples. Letter grade only.

GSP 529 (3cr) – Applied Remote Sensing

Description: This course will introduce the principles and applications of digital image analysis. Students will work with digital images from various satellite sensors and 3-dimensional lidar data in the latest edition of ENVI software. An individual term project will be required using the techniques learned in the course and via literature review. Letter grade only.

GSP 531 (4cr) – Foundations I: Map Design and GIS

Description: Overview of computer applications in map production, including geographic information systems using ArcGIS. 3 hrs. lecture, 3 hrs. lab. Letter grade or pass-fail.

GSP 532 (3cr) – Community and Urban GIS

Description: Use of basic desktop ESRI GIS and its application in planning or community situations. Includes hyper-linking, tabular data management, data presentation, and cartography, Census data and introductory Spatial and 3-Analyst. Letter grade only.

GSP 533 (4cr) – Foundations II: Spatial Analysis and GIS Applications

Description: Designing and implementing multiple layer geographic information system with raster & vector data using ArcGIS. 3 hr lecture, 3 hr lab. Letter grade only. Course fee required

GSP 535 (4cr) – Programming for GIS

Description: Introduction to computer programming principles and their application in a GIS environment using ArcGIS. 3 hrs. lecture, 3 hrs. lab. Letter grade only. Course fee required.

GSP 536 (4cr) – Enterprise Geodatabases

Description: Introduces the design, development, and management of enterprise geodatabases. Students build geodatabases using real-world data and develop municipal and local government GIS applications. Software includes Oracle and ArcSDE, ArcCatalog, and ArcMap. 3 hrs. lecture, 3 hrs. lab. Letter grade only. Course fee required.

INF 621 (3cr) – Topics in Ecological Modeling

Description: Study of methods, techniques, and research areas in ecological modeling, with varying emphases between offerings. Letter grade only.

INF 622 (3cr) – Topics in Environmental Data Analysis

Description: Study of methods, techniques, and research areas in environmental data analysis, with varying emphases between offerings. Letter grade only

INF 626 (3cr) – Applied Bayesian Modeling

Description: Bayesian statistical methods for analyzing data, with emphasis on ecological & biological data. Includes Bayes rule, basic Bayesian formulation (priors, posteriors, likelihoods), single- & multiple-parameter models, hierarchical models, generalized linear models, multivariate models, mixture models, models for missing data, merging statistical & process models, overview of spatial & temporal processes, and introduction to computation methods. Letter grade only.

MAT 562 (3cr) – Interest Theory For Actuarial Science

Description: Theory and applications of interest, or the time value of money. Topics include measurement of interest, annuities certain, yield rates, amortization schedules and sinking funds, bonds, and related securities. Co-convened with MAT 462. Letter grade only.

MAT 565 (3cr) – Actuarial Mathematics I

Description: Theory and applications of contingency mathematics: life and health insurance, annuities and pensions using probabilistic and deterministic models. Letter grade only.

MAT 567 (3cr) – Risk Theory

Description: Theory and applications of contingency mathematics: life and health insurance, annuities and pensions using probabilistic and deterministic models. Letter grade only.

MAT 580 (3cr) – Mathematics of Financial Modeling

Description: Mathematical concepts of financial models to describe the monetary-world phenomena of random markets. Provides experience in creating and analyzing such models. Co-convened with MAT 480. Letter grade only

ME 451 603 (3cr) – Renewable Energy

Description: Concepts of renewable energy resources, conversion technology and hybrid system design with an emphasis towards solar photovoltaic & wind energy. Letter grade only.

ME 535 (3cr) - Wind Energy Engineering

Description: Concepts, theory and design of wind energy conversion systems. Topics include wind energy resources, wind turbine aerodynamics, mechanics, subsystems, design, development, economics and policies. Letter grade only. Course fee. Prerequisite: ME 395.

PADM 410 (3cr) – Public Policy Formation And Strategies

Description: In this course students will develop an understanding of how public policy is formed and the strategies utilized in the policy-making process. Letter grade only.

PADM 411 (3cr) – Ethics, Policy, and Administration

Description: This course examines alternative approaches to ethics and relates them to the context of politics and public policy, at a variety of administrative levels. Letter grade only.

SUS 601 (3cr) – Visions Of Sustainable Communities

Description: This course provides an intro to critical conversations about social transformation toward sustainable communities, largely in the North American context. It examines dominant philosophical, social and economic worldviews and paradigms, and explores alternatives that might better support flourishing human communities and ecosystems. Letter grade only.

SUS 602 (3cr) – Elements And Contexts Of Sustainable Communities

Description: This course broadens and deepens the critical dialogue about sustainable communities, examining economic, global, and technological contexts. Students will study the role of systemic factors, in particular the relationship between the local and the global, which help to maintain or undermine good and sustainable communities. Letter grade only.

POS 501 (3cr) – Research Methods and Analyses

Description: This course is an introduction to the practice of social research, including the design of scientific research and the analysis of information. Letter grade only.

POS 527 (3cr) – Ethics Of Public Administration And Management

Description: This course examines alternative approaches to ethics in the context of public administration and management, and at the level of individuals, organizations, society, culture, and politics. Letter grade only.

POS 541 (3cr) – Public Management

Description: Introduces major contemporary and classical concepts relating to management of the public sector. Letter grade only.

POS 543 (3cr) – Organizational Management

Description: Examines dynamics of modern complex organizations, including structure of bureaucratic organizations, incremental & rational approaches to decision-making, influences of bureaucratic routines, & strategies for increasing organizational effectiveness. Letter grade only.

POS 571 (3cr) – Policy Analysis and Evaluation

Description: Explore, learn, & practice methods of policy analysis and evaluation of real-world problems, as a means of better understanding the range of effects of public policies.

POS 581 (3cr) – Current Issues in Administration

Description: Addresses theory and practice of current issues in public administration in a variable content, topics format. Letter grade only.

POS 641 (3cr) – Public Administration

Description: Overview of the field of public administration. Examines basic issues presently facing public agencies and explores problems of the future. Letter grade only.

POS 658 (3cr) – Topics in Environmental Policy

Description: Examines a variety of issues and topics in environmental politics/policy, such as Env. political theory, natural resource policy, and global Env. politics. Letter grade only.

POS 659 (3cr) – Environmental Policy

Description: Examines environmental policy in the United States. Topics include air and water policy, energy production and regulation, federal land policy, and problems associated with food and agricultural production. Letter grade only.

POS 679 (3cr) – Topics in Global Environmental Politics

Description: Explores relationships between global politics and Env. problems. Examines a variety of Env. issues and range of possible responses at global, state, and civil society levels.

PRM 530 (3cr) – Introduction to Geographic Information Systems

Description: Overview of computer applications in map production, including geographic information systems (GIS), using ArcGIS. This course is designed to be an introduction to GIS for application in parks, natural resources and public lands management. The course focus will be on map design through an immersion into ArcGIS. Letter grade only.

STA 475 (1cr) – Probability Applications in Actuarial Science

Description: Application of probability concepts and methods suitable for preparation for careers in the actuarial profession. Use of random variables, distribution theory, specific probabilistic distributions, expected value, and related concepts in insurance models including deductibles, caps, premiums, and loss. Letter grade only.

STA 570 (3cr) – Statistical Methods I

Description: Sampling, t-tests, linear regression and correlation, elementary analysis of variance. Letter grade only. Course fee required. Prerequisite: undergraduate statistics course.

STA 571 (3cr) – Statistical Methods II

Description: Analysis of variance and covariance, multiple and partial regression, nonparametric methods. Letter grade only. Course fee required.

STA 578 (3cr) – Statistical Computing

Description: Computationally intensive statistical methods. Topics include statistical learning, nonparametric methods (bootstrapping and permutation tests) as well as general-purpose algorithms (MCMC). Emphasis placed on both underlying statistical concepts and implementing resulting algorithms in a high-level programming language on non-tidy data. Letter grade only.

WU 501 (3cr) – Wind Energy Law, Policy and Regulation (Fall 2020)

WU 502 (3cr) – Wind Energy Finance, Economics and Policy (Spring 2021)