WATER SCIENCE AND MANAGEMENT

Water Science and Management Courses

WSAM 470. Environmental Impacts of Land Use and Contaminant Remediation
3 Credits (3)
The course will cover the integrated assessment of soil erosion, contaminant transport in soil and water, and contaminant remediation from site scale to watershed scales. Understanding of the controlling factors for each type land use impact will be gained through the use of risk assessment, case studies, and computer modeling. Case studies will illustrate the processes under various environmental applications. This course will also cover the application of solute transport principles and methods for the remediation of contaminated soil and groundwater. It will also discuss the contaminated site characterization, monitoring, and remediation design. Discussions of innovative methodologies will be supported with case studies.
Learning Outcomes
1. Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve environmental problems.
2. Function on multidisciplinary teams and exhibit professional and ethical responsibility and communicate findings effectively.
3. Recognize the need for, and an ability to engage in, life-long learning.
4. Describe contemporary land-use impact and cleanup issues.
5. Use the techniques, skills, and modern environmental science and engineering tools necessary for current industry practice.

WSAM 550. Special Topics
1-4 Credits (1-4)
Specific subjects to be announced in the Schedule of Classes. May be repeated up to 9 credits.
Learning Outcomes
1. Readings, discussions, and/or field and laboratory investigation of selected problems.

WSAM 551. Earth Data Retrieval
3 Credits (3)
This course covers topics related to identifying sources, preprocessing, utilizing earth data that can be used to monitor some hydrological and water related variables, vegetation growth and related biophysical properties. The course focuses on developing students' skills on how to handle and analyze high-level large amounts of research data in different formats (i.e. .hdf). The course highlights the use of remote sensing and land surface models-based (NLDAS) earth observation datasets (e.g. NDVI, LST, Ta, and ET). The course uses some open-source tools including Python, API as well as MATLAB. Crosslisted with: RGSC 551.
Learning Outcomes
1. Identify, retrieve, and visualize earth observation datasets that are relevant to individual research activities.
2. Understand the nature and formats of earth observation data.
3. Handle, process, and conduct quantitative analysis of earth observation datasets using python, MATLAB, and cloud computing (GEE).
4. Development of qualitative reasoning and analytical thinking skills to address research questions related to earth observation datasets.

WSAM 575. Climate Studies, Water and Society
3 Credits (3)
The course provides a brief description of the Earth's climate system, an in-depth review and methodologies used to investigate climate change and variability, evidence of climate change on natural systems (water availability) vulnerability of human systems (e.g. agriculture) to climate change, and mitigation and adaptation strategies.
Learning Outcomes
1. Know, identify, and interrogate Earth's climate observation datasets.
2. Evaluate and understand Earth's climate systems.
3. Conduct meaningful investigations, prediction, and inferencing.
4. Critical thinking about climate change impacts on human and natural resources.

WSAM 585. Land Cover Analysis for Natural Resources
3 Credits (3)
This course is designed to help students understand, manipulate and extract Earth Observation (EO) data and to conduct land cover analysis related to natural resources including water and vegetation. The course provides and highlights means to identify and access EO data in different formats, extract meaningful information, and to help students developing critical thinking skills. The course introduces tools such as python and ArcGIS Pro to handle different data formats (e.g. hdf) efficiently; develop and present creative maps. The course provides basic information about how to conduct land use, land cover change analysis, mapping vegetation, water related variables and plant and animal distribution analysis. Crosslisted with: RGSC 585.
Learning Outcomes
1. Identify sources of and obtain land cover GIS data.
2. Handle GIS data in different formats.
3. Extract meaningful information.
4. Development of qualitative reasoning and analytical thinking skills to address research questions related to natural resources.

WSAM 589. Landscape Hydrology Modeling
3 Credits (3)
The course "Landscape Hydrology Modeling" offers topics related to the physical hydrological processes that occur at different spatial and temporal scales in terms of understanding, quantitative evaluation, modeling, and visualization. It addresses precipitation, runoff, infiltration, and evaporation, as well as understanding impact of land use change on these processes. The course highlights and provide training on the use of hydrological modeling tools including WMS software, HydroVIS and ArcGIS software to help students understand, model, manipulate, and visualize hydrological data processes. The course offers hands-on learning experience on the use of these tools.
Learning Outcomes
1. Identify the different components of a landscape scale hydrologic system and quantitatively evaluate the associated physical processes including precipitation, runoff, streamflow, infiltration, evapotranspiration.
2. Retrieve and visualize a hydrologic system data along with the associated datasets.
3. Be able to model hydrological processes within a watershed and understand the streamflow generation process and the effect of vegetation and topography on streamflow generation.
4. Gain knowledge about, and be able to use, some of the available tools that can be used in spatial and temporal hydrological process modeling.

WSAM 590. System Dynamics
3 Credits (3)
This course takes a system dynamics approach to the study of economics and natural resources management. We will examine some of the example theories such as Solow-Swan model and endogenous growth theories as well as the tragedy of the commons, using system dynamics tools to uncover the feedback and explicitly examine its impact on the dynamic behavior of the system. Through these examples, we will learn how to develop, validate, and use system dynamics models for policy design and analysis.

Learning Outcomes

1. Identify common generic structures and behavioral modes in socioeconomic and ecological systems.
2. Define important feedback theories that explain the behavioral modes in socioeconomic and ecological systems.
3. Implement the system dynamics method to translate the feedback theories into dynamic simulation models.

WSAM 595. Hands-On Transboundary Aquifer and Community System Convergence Seminar
1 Credit (1)
An opportunity for graduate researchers to build partnerships with their colleagues in the IWR cohort and with our expert collaborators. Graduate researchers present their research methods, share lessons from their research activities, and report on experiences in the field and in the IWR program. An opportunity for academic, industry, and stakeholder project partners to share career development and research convergence insight with the cohort. May be repeated up to 18 credits.

Learning Outcomes

1. Students will learn about natural and social science convergence.
2. Convergence tool skill-building.
3. Students will learn how to lead the coordination of international, multidisciplinary research collaboration.

WSAM 598. Internship
1-9 Credits (1-9)
Out-of-classroom learning experiences to gain relevant education, experience, and expertise. Field-based learning providing transformative education and hands-on training. May be repeated up to 18 credits.

Learning Outcomes

1. Gain the experience necessary to engage confidently in community-centered hydrologic and social science approaches to water research.
2. Students will learn how to lead the coordination of international, cross-disciplinary research collaboration.
3. Gain experience applying academic and research knowledge in professional capacities.
4. Develop cross-sector communication skillsets.

WSAM 599. Masters Thesis
1-15 Credits (1-15)
Thesis. May be repeated up to 88 credits. Consent of Instructor required. Restricted to: Water and Science Management majors. Thesis/Dissertation Grading.

WSAM 600. Doctoral Research
1-15 Credits (1-15)
Assigned credit for research preformed. May be repeated up to 15 credits. Consent of Instructor required.

Learning Outcomes

1. Identify appropriate research methodologies.
2. Reflect on their own research, identifying lessons learned, strengths, and ways to improve.
3. Communicate confidently and constructively with faculty advisors.

WSAM 605. Arid Land Water Resources
3 Credits (2+2P)
The course will cover various issues of relevance to water resources and water supply management within the Southwest US and other semiarid and arid regions. Discussions may include development and sustainability, climate change and drought, socioeconomic and cultural, and transboundary issues. May be repeated up to 3 credits. Crosslisted with: ENVS 605.

WSAM 610. Water and Sustainable Economic Development
3 Credits (3)
For graduate students in the Water Science and Management or other research degree programs, use the water economics literature as a model for student research leading to an M.S. thesis or Ph.D. dissertation.

WSAM 700. Doctoral Dissertation
1-15 Credits (1-15)
Dissertation for Water Sciences and Management Majors May be repeated up to 88 credits. Restricted to: Water Sciences and Management majors. Thesis/Dissertation Grading.