# Interdisciplinary Modeling: Water-Related Issues and Changing Climate
# RGSC 618 (Summer 2012)

## Syllabus (as of 4/23/12)

(3 credits)

**Course Dates:** June 4 – 15, 2012, 8 a.m.-5 p.m.; 8 hrs per day, including weekends

**Course Location:** New Mexico State University (room TBD)

**Course Web Page:** http://www.cabnr.unr.edu/saito/Classes/rgsc618/rgsc618.htm

**Course Instructors:** Coordinating Instructors:

**Laurel Saito** (Dept. of Natural Resources and Environmental Science, Univ. of Nevada Reno (UNR); aquatic ecosystem modeling)
**Alexander Fernald** (Dept. of Animal and Range Sciences, New Mexico State Univ. (NMSU); surface-groundwater interaction modeling)
**Timothy Link** (Dept. of Forest Resources, Univ. of Idaho (UI); snowpack energetics modeling)

Co-Instructors:

**Ken Boykin** (Dept. of Fishery and Wildlife Sciences; NMSU; wildlife ecology modeling)
**Darko Koracin** (Div. of Atmospheric Sciences (DAS), Desert Research Institute (DRI); weather and climate modeling)
**Venkataramana Sridhar** (Dept. of Civil Engineering, Boise State Univ.; water systems modeling)
**Caiti Steele** (Jornada Agricultural Research Service, NMSU; remote sensing and GIS)

Guest lecturers:

**Sajjad Ahmad** (Dept. of Civil and Environmental Engineering, Univ. of Nevada Las Vegas (UNLV); water resources systems modeling)
**Franco Biondi** (Dept. of Geography, UNR; why the past matters)
**Carter Borden** (DHI Water and Environment; integrated modeling)
**Kelly Cobourn** (Boise State University; economics modeling)
**Levan Elbakidze** (Dept. of Agricultural Economics and Rural Sociology, UI; economics modeling)
**Iñigo Garcia-Bryce** (Dept. of History; NMSU; historical perspective)
**Moises Gonzales** (School of Architecture and Planning; UNM; community and regional planning)
**Steve Guldan** (Agricultural Science Center at Alcalde, NMSU; acequia overview)
**Robert Heinse** (Dept. of Plant, Soil, and Entomological Sciences, UI; vadose zone modeling)
**Phillip King** (Dept. of Civil and Geological Engineering, NMSU; groundwater modeling)
**David Kreamer** (Dept. of Geology, UNLV; thermal stratification modeling)
**John Mejia** (DAS, DRI; dynamical downscaling)
**Carlos Ochoa** (Dept. of Animal and Range Sciences, NMSU; systems modeling)
**Marquita Ortiz** (Acequias.org; community involvement)

**Anna Panorska** (Dept. of Mathematics and Statistics, UNR; statistical modeling)
**Scott Peckham** (Inst. of Arctic and Alpine Research, Univ. of CO; computer science)
**Jose Rivera** (Center for Regional Studies, UNM, community and regional planning)
**Mark Stone** (Dept. of Civil and Environmental Engineering, Univ. of New Mexico (UNM); water resources modeling)
**Aleksey Telyakovskiy** (Dept. of Mathematics and Statistics, UNR; mathematical modeling)
**Vince Tidwell** (Geohydrology Dept., Sandia National Labs; systems dynamics modeling)
**John Tracy** (ID Water Resources Research Institute; UI; systems dynamics modeling)
**John Wilson** (Dept. of Earth and Environmental Science; New Mexico Tech; hydrology/mathematical modeling)
**J.D. Wulfhorst** (Dept. of Ag. Economics & Rural Sociology; UI; rural sociology)

**Course Goals:** The science and management of many environmental issues including climate change is inherently interdisciplinary. One of the ways to approach the diversity of needs in managing and understanding these issues is to employ mathematical modeling. Models based on available scientific knowledge and theories can be used to bridge the gap between the ability to scientifically predict with reasonable certainty, and the need to make management decisions. This course will address: 1) the advantages and limitations of using models; 2) different spatial and temporal scales that specific disciplines are concerned with; 3) differences in degrees of uncertainty of data and models, 4) interdisciplinary modeling options; 5) communication between disciplines, where different terminology and perspectives can be a barrier to productive discussion of common issues or concerns; 6) education and training of scientists and modelers about applying interdisciplinary approaches; and 7) interaction with stakeholders and the public. The **vision** of this course is *to engage students in interdisciplinary discourse in modeling* by addressing each of these challenges. The **goals** of the course are therefore for students to: A) increase awareness of models used in different disciplines to model water-related issues and climate change; B) increase knowledge of the challenges of applying models in an interdisciplinary context; C) improve skills in working in interdisciplinary teams to address complex issues; D) increase enthusiasm for working with interdisciplinary modeling approaches for addressing water-related issues and climate change; E) increase confidence in doing interdisciplinary modeling; F) increase confidence in working in interdisciplinary teams; and G) increase interest in interdisciplinary modeling (e.g., through taking more courses, pursuing a career, or teaching).

**Course Description:** Students will be introduced to models that are available in different disciplines and how such models might be applied together to address water-related issues regarding climate change, address issues of variability and uncertainty in implementing interdisciplinary approaches, and gain experience in working in interdisciplinary teams to apply interdisciplinary modeling approaches to increase knowledge about water-related issues regarding climate change. Students will use a common software to do an interdisciplinary project regarding the New Mexico acequias project.

**Course Objectives:** Successful students will accomplish the following in this course:

1. Discuss the philosophy of modeling
2. Become aware of models in different disciplines used to address water issues related to climate change
3. Work in interdisciplinary teams to explore issues and approaches associated with interdisciplinary modeling
4. Complete an interdisciplinary modeling project that addresses one or more water-related issues related to climate change

**Prerequisite:** Graduate students in any discipline related to water including, but not limited to: hydrology, engineering, political science, law, economics, geology, atmospheric science, geochemistry, environmental science, chemistry, water resources, etc. Students should have some experience with modeling and/or at least one course in modeling or consent of coordinating instructors.

**Required Textbook:** None. Students are required to prepare with material posted on the website and wiki.

**Grading:**

| Description | Points |
|---|---|
| In-class assignments during labs (8) | 400 |
| Interdisciplinary modeling project | 500 |
| Class participation and attendance | 100 |
| TOTAL | 1000 |

*In-class assignments*: In-class assignments are designed to promote interdisciplinary discussions and interactions in the context of water-related modeling regarding climate change. Detailed instructions will be provided on the course website and when the assignments are handed out during the course. Topics include introduction to STELLA, data management, ecological modeling, statistical/mathematical modeling, watershed modeling, water quality modeling, groundwater modeling, energy budget modeling, atmospheric modeling, economic modeling, and GIS/remote sensing.

*Interdisciplinary modeling project*: The project is designed to promote interaction between students in different disciplines to gain experience with interdisciplinary modeling. Project topics will focus on an interdisciplinary issue pertaining to climate change and water resources for the New Mexico acequias project. Students will be assigned to interdisciplinary teams to work with available data and address issues with interdisciplinary modeling using STELLA, Excel, and/or modeling software they already are familiar with. Each team will prepare a written report (due June 22) and present the outcomes of their project to the class participants on June 15, 2012 as a 20-minute presentation.

*Class participation and attendance*: Attendance and participation is a key element to your success in this class. There are no exams associated with this class; rather, the class involves a variety of lectures, discussions and exercises to enhance interdisciplinary interactions. It is essential that students attend the entire course to participate in these activities. You are expected to be at the course each day for all activities. Participation includes completing evaluations of the lectures, exercises, and course, asking questions and providing comments on the issues in class, and contributing actively to group exercises in class.