Fall 2016

ESS158: Research Methods for Sustainable Systems Analysis

Course Instructor: Steven J. Davis, Associate Professor of Earth System Science

Course Description: The overarching goal of the course is to give you the analytical skills necessary to engage and assess the sustainability of coupled human and natural systems and to effectively communicate your findings. The course will be structured around group research projects (2-3 students per group), with every phase of the projects entailing components of (1) class lecture, (2) homework and (3) class discussion.

Group projects will require using available data products and applying specific analytical methods (e.g., statistical methods, physical and economic modeling, remote sensing/spatial analysis, and life cycle assessment) drawn from different perspectives and disciplines as necessary. The emphasis will not be the tools themselves but critical thinking and developing a rigorous conceptual approach to research of human-nature interactions.

Student Learning Outcomes:

After completing the course, students should be able to:

(i) confidently and methodically plan and perform research on environmental problems that entail coupled human and natural systems; and

(ii) effectively communicate research results to different audiences and using multiple media

Students will demonstrate what they have learned by:

(i) contributing to a group research project and actively participating in class discussions at each phase of the project; and

(ii) presenting their findings in an academic or public forum beyond the classroom

Course Requirements:

Participation (50%): Participation will be evaluated by preparedness for class (including quality of homework assignments) and contributions to both whole-class discussions and small-group activities in class, which should display critical thinking and respect for others' views. A rubric for grading participation will be developed during Week 1 and both self-assessments and peer assessments of participation will be performed during the quarter.

Research Project (30%): Drafts of group project reports will be due in Week 8. Final drafts, revised on the basis of Instructor comments and class discussion, are due in Week 10. Reports will be written as short-format research papers of up to ~2500 words including an abstract, introduction, results, and discussion sections, up to four figures or tables, and about 30 references. Additional figures or information about materials and methods may be included as supplementary materials if needed to fully support the paper's conclusions.

Communication of Findings (20%): Students will present the findings of their research project in some form outside of the classroom. The mode of communication and audience are flexible (be creative!). Some possibilities include: a summary infographic posted on UCI websites and social media, a blog post, a video posted online, a poster or talk presented at a campus event or academic conference, a paper submitted for publication in an academic journal, etc. Further details of the project will be discussed in class.

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Class Schedule

Week	Lecture Topics	Discussion Topics	Homework
		Introduction to Research	
1	Review of global sustainability challenges; purposes of research; prioritization of research efforts; qualities of successful researchers	*Whole-class*: Rubric for scoring class participation; what issues of sustainability do you care about and why? (i.e. research interests)	500 word summary of research interests
		The Basis: Review of Knowledge	
2 and 3	Pathological dynamics of coupled human and natural systems; reading academic papers; useful accuracy; lit. review and data discovery; *focus*	*Group by group*: What do we know and what do we need to know?	Prepare for class presentation/ discussion
		Making a Research Plan	
4 and 5	Examples of analytical simplification (e.g., spherical cows and "toy" models); survey of methods and tools using real-life examples (e.g., statistical analyses, spatial/temporal analysis, field-based observations, modeling, remote sensing, policy analysis, economic modeling, expert elicitation)	*Group by group*: How do we learn what we need to know? What data exists or might we collect? What analytical techniques are available and how should you choose? How could the problem be simplified? *Small group activities*: Back-of-envelope calculations	Prepare for class presentation/ discussion
		Executing (and Revising) the Plan	
6 and 7	Flexibility—overcoming unexpected barriers; assumptions—what's reasonable?; typology of short-cuts; *drive* (intrinsic motivation)	*Group by group*: Preliminary results and demonstration of methods/tools	Prepare for class demonstration of methods/ tools
		Writing up Research Results	
8	Technical writing vs. other types; organization of reports/papers; visual display of quantitative information	*Small-group activities*: results writing and plot-making	Draft of project report due
		Reviewing and Revising	
9	Peer review process—advantages and disadvantages; how to review—from big comments to small	*Group by group*: detailed, constructive discussion of draft reports; what could be better and how?	Review assigned peers' report and prepare for class discussion
		Communicating Results	
10	Science communication—professional and public; relationship between science and policy; modes of presentation; metaphor; humor; graphics for non-science audiences; *empathy*	*Small-group activities*: practice communicating to different audiences	Final draft of project report due
Exam Week	Out-of-class presentations/submissions due by last day of quarter (special arrangements may be made for some presentations)		