

EEB 8990 Sustainability Science: An interdisciplinary introduction

Fall Term 2010 – Monday, 3-4:30pm, Institute on Environment

Course website: <https://groups.nceas.ucsb.edu/sustainability-science>

Seminar Leaders:

Jeannine Cavender-Bares (cavender.bares@gmail.com), 216 Ecology and IonE, Tel: 624-6337
Stephen Polasky (polasky@umn.edu), 337E Ruttan Building, Tel: 625-9213
and 503 Ecology, Tel: 624-3663

Objective:

This is a research seminar on the core scholarly literature of sustainability science -- an emerging field of problem-driven research dealing with the interactions between human and environmental systems. The focus is on understanding how those interactions affect the challenge of sustainability: meeting the needs of present and future generations in ways that conserve the planet's life support systems over multiple generations. Its goal is to introduce active researchers interested in sustainability science to the field's principle themes, cutting-edge findings, active debates and unresolved research questions. Participants will critically discuss a set of presentations and papers covering the field in a systematic way, drawing on and integrating contemporary research from earth systems science, resource economics, institutional analysis, geography, and development studies. Participants' critiques of and additions to the presented material will contribute to a set of curriculum materials on sustainability science being developed by an international team of leaders in the field for open-access use by the global community. The interdisciplinary nature of the course and its focus on finding solutions to the great environmental and social challenges of our time is fundamental to the mission of the Institute on Environment (IonE). We gratefully acknowledge the support of IonE in developing and administering the course.

Motivation:

Sustaining the planetary systems that support life while meeting human needs is one of the greatest challenges facing humanity in the 21st century. Sustainability science is a use-inspired program of research aimed at addressing this challenge. The field emerged in the 1990s at the intersection of earth systems science, the science of socio-ecological systems, and applied research on sustainable development. Over the last decade it has grown rapidly in multiple directions, spawning new schools and degree programs, multiple journals, and a host of symposia and conferences (see the virtual [Forum on Science and Innovation for Sustainable Development](#) hosted by the AAAS for an up to date account of the current state of play).

Like any healthy new field, sustainability science today is somewhat anarchic, inhabited by multiple views of what it is and should try to become. A little anarchy is not necessarily a bad thing, particularly when it is so clear that there are great differences in the knowledge relevant to sustainability challenges such as improving energy efficiency of the US economy and sustainability challenges such as improving the performance of agroforestry in Nepal. But several workshops conducted over the past decade¹ have nonetheless called for the construction

¹ Friberg 2000 [Sustainability Science](#), Dahlem 2003 [Earth Systems Analysis for Sustainability](#), San Servolo 2006 [Grand Challenges of Sustainability Science](#), Airlie House 2009 [Toward a Science of Sustainability](#).

of a core body of sustainability science -- theory, methods, and data – that would be relevant across particular problems and places, and that all scholars working in the field – regardless of their home discipline or issue focus -- would benefit from knowing. The same workshops pointed out the need to build a community from the somewhat isolated individuals and small groups of researchers from around the world now working on sustainability science from their own disciplinary, applications, and regional perspectives. This seminar is part of one concerted effort to build both a body of core knowledge in sustainability science, and an extended peer community that will share, critique, and strengthen that core.

Strategy:

The seminar will pursue its goals by bringing together two strands of work. The first strand is an effort by a group of leading scholars in sustainability science to prepare a monograph and selection of core readings on the subject that, together, could serve as an integrated, interdisciplinary introduction to the field for interested researchers. This group has completed a first draft of both the monograph and the reader, and agreed to make these available as the core “syllabus” literature for our seminar. Members of the group will lecture to the seminar (some in person, some remotely) on selected topics covered in the draft material. The group as a whole is interested in using the seminar for critical feedback and suggestions to strengthen their final products. In addition, videos of lectures, supporting materials, and summaries of discussion available on a public web site will be made available so that others interested in sustainability science can use them in shaping their own curricula.

The second strand of work informing the seminar is the need to begin integrating the various communities working on sustainability science. The fragmentation of the community – partly by discipline, partly by institution, partly by applications focus – was noted as a major impediment to its growth and maturation by the recent workshop held by NSF to identify priority needs in the field.² In response to this finding, we proposed to develop a distributed, interdisciplinary graduate seminar on sustainability science that would begin to bring together different groups in discussion of key concepts, findings and controversies in the field. The proposal, involving six universities from the USA and Mexico³, was funded by the National Center for Ecological Analysis and Synthesis (NCEAS). Teams of graduate students, fellows and faculty from each of those universities will participate in this seminar, connected via video conferencing and a dedicated collaborative web site hosted by NCEAS. The seminar is thus also an experiment in developing approaches to the sorts of collaborative, distributed, travel-minimizing networking that almost certainly must be part of any sustainable future. Evaluation of the distributed seminar concept and its supporting technologies will be an additional objective of our work.

How the course will work:

The seminar will meet twice a week at the Institute on Environment. On Mondays, we will meet in the IonE seminar room and connect with members from each of the participating universities using information technology. On Wednesday, we will meet in the IonE Board Room for our own discussions. In those sessions, we will discuss topics addressed in the Monday session and spend some time looking forward to the subsequent week’s topic. Most Monday

² Airlie House 2009 [Toward a Science of Sustainability](#).

³ Member institutions: Arizona State University; Universidad Nacional Autonoma de Mexico; Florida International University; Harvard University; Princeton University; University of Minnesota

sessions will focus on a chapter or group of chapters from the draft *Sustainability Science* monograph, which is available to participants on the seminar web site. Supplementary readings from the “Reader” (see below) plus additional papers suggested by seminar participants will also be available. Several sessions will focus on applications of sustainability science or special topics not covered by the monograph. Each session will begin with a formal presentation of 20-30 minutes on the topic of the designated chapter, usually delivered by one of the authors of the monograph. This will be followed by prepared discussant remarks, prepared student commentary and then general discussion. Chairing responsibilities for each session will rotate among faculty of the participating institutions.

Lead responsibility for each of the sessions will lie with one of the participating university teams. Rotations have been established to assure that each team leads two sessions in the course of the term. Each student must participate in one session in which Minnesota is the lead institution. For the others session, students may choose to participate with another institution, logistics permitting. The lead team for each session will have 4 responsibilities, divided as the team sees fit among its local members:

- 1) *Designate supplemental readings* for their session at least a week in advance of the session. The team will be asked to select a few readings – say 3 to 6 – that complement the assigned book chapter and Reader entries for the day. The team should try to assure that between its suggestions and the selections from the Reader, there is at least one paper available that is more basic than the designated book chapter (for those who find the book chapter too far from their formal training to be digested without help), plus at least one paper that reflects exciting advanced research on a theme central to the chapter. In addition, it will be very useful for broadening our collective vision of sustainability science if each team can use the resources and connections of its members to find one or more research papers or case studies originating from different parts of the world. The team should post citations to and copies of its selected readings to the seminar web site, together with a brief annotation for each reading that describes why the team thinks the paper is especially worthy of attention.
- 2) *Identify three central topics* for discussion (together with the session moderator/chair) and post these on the web site by the Thursday (at the latest) prior to the Monday session. Annotate these sufficiently so that they will serve as the framework for the web discussion following the session.
- 3) *Present discussant remarks* on the designated chapter and initial presentation, immediately following the presenter and moderator. These remarks should include an assessment of what the team finds compelling about the chapter and presentations, what does not make sense, and what is missing or needs further development either in terms of theory, data or application. The discussant remarks should usually involve several members from the responsible team. The total time used in all the discussant remarks should be 15 minutes or less.
- 4) *Write a brief initial summary* of the discussion on the week’s topic. This should be on the order of 3 pages or less, and be posted on the seminar web site by the following Monday. The written summary should include the formal discussant’s remarks, as well as key themes and questions raised in the general discussion and Q&A following the discussants’ remarks, plus the subsequent web-based discussion on the week’s topic. The summary should include identification of ideas in the

assigned chapter that need further development or clarification, as well as evaluation of the adequacy of the readings.

- 5) *Write a final summary* of the assigned topic. This should be on the order of 5 pages or less, and be posted on the seminar web site within one week of the end of the course. It should be based on the initial summary detailed in (4) above, but also i) incorporate subsequent discussion germane to the assigned topic that develops during other sessions of the seminar or in off-line discussions, and ii) identify linkages and relations of the topic to other topics discussed in the seminar. This means, of course, that the team has an ongoing responsibility throughout the semester to capture or provoke relevant commentary and connections on its assigned topic.

Seminar members who are not part of the designated lead group for a particular session are nonetheless expected to participate fully. This means at least:

- 1) *Carefully read, in advance*, the assigned chapter and, where appropriate, selected supplemental material. Maintaining high standards for doing the background reading in advance will alleviate the inevitable tension between needing to get up to speed in material outside our domains and aiming the discussion at a cutting edge level.
- 2) *Participate actively in the general discussion* and Q&A following the prepared lecture and discussant remarks for each session (time permitting).
- 3) *Post written comments*, questions, responses and suggestions of key literature relevant to each session on the seminar web site. While written discussion on any topic is encouraged throughout the semester, each participant is expected to post something about the subject matter of each session within 3 days after the session is held. (This gives the team with lead responsibility for the session the opportunity to include individual written materials in their initial summary of the session, due a week after the session is held. Students are also encouraged to post suggestions for the subsequent week's student leaders.)

Additional expectations of students taking the course for credit:

Students taking the course for credit will be expected to contribute substantially to each of the tasks outlined above. For students taking the course for a grade, these contributions will constitute 50% of your grade. In addition, you will be expected to submit a longer paper developing a critical review of some aspect of sustainability science that interests you. The paper may be in the form of a standard academic review paper (or thesis "theory" chapter), summarizing and critiquing the state of the literature, highlighting major advances and controversies, and pointing to key research needs. Alternatively, the paper can bring the knowledge of sustainability science to bear on a particular applied problem of sustainability, critiquing current practice, identifying alternatives, and recommending and justifying a path forward. *A short (100-300 word) prospectus should be submitted to the seminar leaders by mid term (1 November).* A final version (5-10K words), reflecting the instructor's comments on the prospectus, must be submitted by the end of Reading Period (17 December). This paper may be solo authored, or jointly authored with any member(s) of the seminar from any of the participating universities. Joint authorship with participants from universities other than your own will not get extra credit, but will be looked upon with special enthusiasm and interest. Coauthors, if any, must be designated in the prospectus. All coauthors will receive the same grade.

Draft schedule of Monday sessions in IonE seminar room:

(All Wednesday sessions will be held in the IonE Board Room. Readings for each session are posted on the seminar web site.)

September 13

Introductions and organization

September 20

Sustainable development and sustainability science

Bill Clark presenter; **Heffernan/Ogden** moderator/discussant; **MN** students

September 27

Long-term trends and transitions in nature and society

Bob Kates presenter; **Ann Kinzig** moderator/discussant; **Princeton** students

October 4

The human-environment system: A conceptual framework

Billie Turner presenter; **Elizabeth King** moderator/discussant; **Harvard** students

October 11 (Harvard on holiday break)

The environmental services that flow from natural capital

Steve Carpenter presenter; **Patty Balvanera** moderator/discussant; **MN** students

CONCEPTUAL FOUNDATIONS

October 18

Divergent vs. convergent development models

Ivette Perfecto (U. Michigan), Cavender-Bares moderator/discussant; **CIEco** students

October 25

Human well-being, natural capital and sustainable development

Partha Dasgupta presenter, **Steve Polasky** moderator/discussant, **Princeton** students

November 1 (Princeton missing)

Worked examples of concepts in human-environment systems

Elizabeth King presenter; **Billie Turner** moderator/discussant; **FIU** students

November 8

Institutions for managing human-environment systems

Elinor Ostrom presenter; **Bill Clark** moderator/discussant; **ASU** students

INTERACTIONS

November 15

Emergent properties of coupled human-environment systems

Bill Turner presenter; **Jim Heffernan** moderator/discussant; **Harvard** students

November 22

Managing for sustainability

Pam Matson presenter; **Billie Turner** moderator/discussant; **FIU** students

November 29

Metrics for sustainable development

Steve Polasky presenter; **Luis García Barrios & Omar Masera** moderator/discussant;
ASU/Cornell students

LOOKING FORWARD

December 6

Grand challenges and core questions of sustainability science

Robert Kates presenter; **Bill Clark** moderator; Open discussion

December 15: Final papers due.