

## **SOSC3260 - Sustainability Science: Policy Problems and Perspectives**

**February 18, 2020**

### **Course Information**

Sustainability problems pose difficult challenges because of their complexity and uncertainty in both the technical and political realms. The goal of the course is to explore how students can make use of interdisciplinary approaches to be effective in the design and implementation of solutions that impact both society and environment. Students will work to understand complex issues and engage analytically with a range of material. The course will introduce the core concepts of sustainability science, and apply them to real problems such as climate change, urbanization, air pollution, and food production.

**Meeting times and Location:** Wednesdays and Fridays, 3:00-4:20 PM, Room 2404, Lift 17-18

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**Enrollment requirement:** Previous study of sustainable development preferred. Interest in sustainability and policy highly recommended.

### **Course Background:**

The objective of this course is to introduce you to the different disciplinary perspectives and methodological approaches that policy makers use to study sustainable development problems. We will focus on the academic field of 'sustainability science,' which is itself a problem-driven, interdisciplinary area that includes natural, physical and social sciences, along with a heavy emphasis on practical engagement. The course is intended to build on prior coursework relating to sustainability, but to introduce it from the perspective of public policy.

You will be challenged to engage with a number of different approaches, coming from different disciplines, and you will be asked to do so through a series of empirical case studies and simulation activities, along with a final group project. At the end of the course, you should have an appreciation for the complexity of the problems, the roles of different types of knowledge (from across science, engineering and social sciences) in developing solutions, and an understanding of the need for interdisciplinary approaches. You will also be encouraged to think about how individual choices impact these issues, and to become active citizen participants in their communities through their own actions and choices, personally and professionally.

This semester long course will have three main goals. 1) To examine some of the major problems of sustainability, including issues such as climate change, green technology, global health, agriculture, biodiversity and natural resource management. 2) To introduce the different disciplinary perspectives that can be brought to bear in the study and analysis of these kinds of problems. 3) To learn tools and

methods, including analytical techniques and presentation skills, that are required for effective policy analysis and decision making in this area.

Work in the course will combine theory, methodology/analytical approaches and cases, and topical issues will be presented and mastered alongside different theoretical and analytical approaches. Each week you will be introduced to one core concept, alongside a sustainability problem that illustrates the concept, while simultaneously building on previously studied ones.

*New for 2020:* This course is now being added as part of the Quantitative Social Analysis (QSA) concentration as one of the quantitative methodology electives. Throughout the course, we will be looking at (and also getting chances to work with) the analytical techniques, including system dynamics, agent-based modeling, and other simulation approaches. There will be some required readings on particular approaches, and also supplemental readings that will be marked as especially interesting/useful for QSA students.

### **Course objectives and intended learning outcomes:**

This course is meant to introduce a range of disciplines that are used to understand and tackle sustainable development challenges. You will be introduced to some of the underlying theory, concepts and approaches, in order to enable them to engage in critical problem solving. The focus of the course is on the application of these ideas to real world problems. This requires analytical and critical thought on your part (and that of your classmates), and willingness to engage and discuss in the classroom and during the final group project. For each of the cases (on Fridays), we will learn about the sustainability problem, and then consider different methods that policy makers have used in the past, and work as a group to explore what was and was not successful, and what other approaches could be useful. Overall, the course has three main learning objectives:

**Objective 1:** Demonstrate a basic understanding of the key concepts and perspectives used in sustainability science research, including human-environment systems, governance, economics, integrated assessment, analytical tools and modeling, and policy decision analysis.

**Objective 2:** Critically analyze how the concepts of sustainability science have been brought to bear by decision makers on real problems at a variety of geographic scales, from urbanization and local resource management through to climate change.

**Objective 3:** Apply the concepts introduced in the course to develop their own solutions to a sustainability problem.

You will also be given assignments to help them practice written and oral communications skills. This is especially important in a field where communication with non-academic audiences (the public, policy makers) can be a crucial factor in overall success.

### **Teaching and learning activities**

Lectures: Monday and Friday, 12-1:20pm

Join URL: <https://hkust.zoom.us/j/363381315>

**Course Topics:**

<b>Week #</b>	<b>Day</b>	<b>Date</b>	<b>Topic</b>
<b>Week 1</b>	<b>Wed</b>	<b>19-Feb</b>	<b>Intro to Sust. Science</b>
<b>Week 2</b>	<b>Mon</b>	<b>24-Feb</b>	<b>Intro to Policy</b>
	<b>Wed</b>	<b>26-Feb</b>	<b>Fishbanks</b>
<b>Week 3</b>	<b>Mon</b>	<b>2-Mar</b>	<b>Intro to SES</b>
	<b>Wed</b>	<b>4-Mar</b>	<b>System Dynamics - Bathtub models, etc...</b>
<b>Week 4</b>	<b>Mon</b>	<b>9-Mar</b>	<b>Goals and Determinants</b>
	<b>Wed</b>	<b>11-Mar</b>	<b>Cost Benefit Analysis exercises (value of human life, ecosystem services, etc...)</b>
<b>Week 5</b>	<b>Mon</b>	<b>16-Mar</b>	<b>Natural Capital</b>
	<b>Wed</b>	<b>18-Mar</b>	<b>Climate Negotiation</b>
<b>Week 6</b>	<b>Mon</b>	<b>23-Mar</b>	<b>Social Capital</b>
	<b>Wed</b>	<b>25-Mar</b>	<b>Ozone Agreement: Remote Sensing, Measurement, etc...</b>
<b>Week 7</b>	<b>Mon</b>	<b>30-Mar</b>	<b>Knowledge Capital</b>
	<b>Wed</b>	<b>1-Apr</b>	<b>Bali- Computer Simulation</b>
<b>Week 8</b>	<b>Mon</b>	<b>6-Apr</b>	<b>Manufactured Capital</b>
	<b>Wed</b>	<b>8-Apr</b>	<b>Life-cycle Analysis: Plastics Project</b>
<b>Week 9</b>	<b>Easter</b>	<b>13-Apr</b>	<b>No Class</b>
	<b>Wed</b>	<b>15-Apr</b>	<b>Poster Session</b>
<b>Week 10</b>	<b>Mon</b>	<b>20-Apr</b>	<b>Human Capital</b>
	<b>Wed</b>	<b>22-Apr</b>	<b>Pandemic Models</b>
<b>Week 11</b>	<b>Mon</b>	<b>27-Apr</b>	<b>Inequality, Power, Empowerment</b>
	<b>Wed</b>	<b>29-Apr</b>	<b>Wealth Distribution Agent based model</b>
<b>Week 12</b>	<b>Mon</b>	<b>4-May</b>	<b>Resilience</b>
	<b>Wed</b>	<b>6-May</b>	<b>Data, Models, Monitoring</b>
<b>Week 13</b>	<b>Mon</b>	<b>11-May</b>	<b>Innovation</b>
	<b>Wed</b>	<b>13-May</b>	<b>Sustainable Design</b>
	<b>Mon</b>	<b>18-May</b>	<b>Final Presentations</b>
<b>Finals Period</b>	<b>Wed</b>	<b>20-May</b>	
	<b>Mon</b>	<b>25-May</b>	

## Assessments/Grading:

Assessment Task	Weighting
Individual assignments	40% (Agent based model, climate negotiation memo, pandemics assignments, plastics assignment)
E-Poster (analytical methods)	10%
Reading Quizzes	10%
Class participation – discussion questions and inputs to discussion	15% (5% attendance, 5% discussion questions, 5% in-class case responses)
Final Team Presentation & Report	20% (10% Presentation, 10% Report)
Final Response Paper	10%

### Individual Assignments:

You will be asked to complete several individual assignments. We will post detailed assignments on the course website.

1. **Homeworks:** We will be doing a number of activities based on different modeling/game/simulation software (free, open source software). For these four activities, you will be required to complete a homework assignment based on the work that we will do in class. Each assignment is worth 10% of your grade.
2. **Online quizzes:** We will have short quizzes on Canvas for the readings most weeks (we have a few odd weeks due to holidays, so there will be some adjustments).
3. **Final Response Paper:** This will be a paper on the case topic of your choice, due during the exam period (in lieu of a final exam).

### Group Assignments:

1. **E-poster:** Teams (2-3 students) will pick a sustainability policy problem, and find a source (journal article, government report, etc..) that analyses the problem. You will put together an electronic 'poster' that provides an overview, including the problem, the methodology and data used in the analysis, main conclusions, shortcomings/areas for improvement.
2. **Final Group Project:** Presentations- ~10-15 minutes; Reports- 2000 words (max)

### Participation:

- 1) Case leaders: You will be responsible to be 'case leaders' during the first half of the of the term. This will have two elements:
  - a Prior to the case: In preparation for your assigned case, you should carefully read all of the required reading for the week, and then post 2-3 discussion questions (no later than noon of the day we will go over the case). The questions should be

thoughtful, and generally look to link readings/previous topics to the case we are working on. These will fall under your participation grade.

b During class: You will be 'leaders' of their groups during small group activities, and will be responsible for keeping their groups on topic, making sure that all members are participating, etc...

- 2) Posting resources, discussion board
- 3) In class work: We will often have short individual or group activities. We will collect these throughout the term for participation points.

***All assignments are due promptly on time, via Canvas. Late assignments will be penalized a grade level (i.e. A goes to A-) for each day they are late. Requests for extensions are more likely to be granted if they are requested well in advance of the due date (with exceptions for emergencies). Remember, partial credit is better than a 0 in all cases.***

### **Note on Class Participation**

The more every student participates, the better and more interesting the class will be. In order to facilitate this, you will be asked to submit discussion questions prior to the class where they are assigned to be 'case leaders' throughout the term (we will have a rota, to be settled once we have the final enrollment). You should expect to submit questions twice per term. The questions are not marked, but to get credit, they should be thoughtful, and not just asking for definitions of certain terms, etc...

For the final project (topic TBD – I will set it once I know what the overall interests are in the class), we will work as a class to post resources for the use of all of the groups. We will be working collaboratively (in the sense that groups are not competing against each other). We expect everyone to post at least two resources (total) during weeks 11 and 12.

Finally, we will be keeping track of attendance, as well as overall participation in the classroom. For those of you who are less comfortable speaking up to the entire room, we will also be paying attention to the various small group exercises and discussions that we will have throughout the class sessions, as well as how you work in your groups for the final project. There are lots of ways to contribute, and we expect all of you to do so. Which means showing us that you are coming to class prepared and ready to engage with your colleagues!

### **Final Project:**

For the final three weeks of the course, we will work in groups, (topic TBD based on overall interests of the students enrolled this year). We will provide the details of the project (including the exact grading scheme) later in the semester, but the groups will each give a 10-15 minute presentation (depending on the number of students and groups) on Week 13. Groups will also submit a final written report (~2000 words) by the end of the last week of the semester. The final project will account for 25% of the grade.

### **EXPECTATIONS:**

Readings and Classwork:

This is a 3000 level course – which means that it is one of the few ‘advanced’ common core courses, and also is one of the methodology electives for the SOSC QSA. By this point in your university career, I expect that you are responsible, independent students. At the same time, the topic matter (or most of it) will be new to many of you. This can mean a heavy load (intellectually) at times. The expectation is that you will do the readings for each session before the lecture, and I am making every effort to confine the required readings to manageable quantity. But because there is so much great literature, and new information and reports appear daily, I will also post interesting readings as supplemental readings. These are often useful for things like final projects.

The reason that it is so important to do the readings and class assignments is that this course is only as good as what you each are willing to put into it. Discussions will only work well if you are prepared, and come to class willing to engage in fruitful discussions. This is not a brain-transfer from the instructor to the classroom. Sustainability science is a cooperative, interdisciplinary endeavor, and working through the material together is as much an element of the course as the subject matter itself. The structure of the course gives multiple ways for all students to contribute, orally and in writing. But working on oral skills is an important element of the class, and the expectation is that all students will contribute to the discussions.

At HKUST we have fantastic students. You bring to the classroom a wealth of perspectives and experiences. So while vigorous discussion is encouraged, disrespect, inside of the classroom or out, will not be tolerated. We will work under Chatham House rules- what is said in the classroom stays in the classroom. Furthermore, under no circumstances will any student resort to personal attacks, however dry or witty. Any disrespectful or disruptive students will be asked to leave the class.

#### Graded Work and Academic Integrity:

For all of your formative and assessed work, it is expected that all assignments are original products produced by YOU. While we do a great deal of group work, the final product is your sole responsibility (except for the group presentations and report). So do not plagiarize, and make sure to be meticulous in citing your sources. If you have questions about the proper forms for citations, or issues around paraphrasing or use of quotations, please come talk with me. If you have any concerns at all about your work, please feel free to come see me during my office hours. I am always happy to help, whether you need someone to take a look at your writing, or to try out different ideas, want some extra explanation of a concept, or even just to chat about sustainability issues that interest you.

#### Textbooks:

Matson, Pamela, William C. Clark and Krister Andersson. *Pursuing Sustainability: A Guide to the Science and Practice*. Princeton University Press., Princeton, NJ. 2016.

\*\* This is our core text. There are copies on reserve, and should be some available at the Commercial Press (HKUST bookstore). It is also available to purchase as an e-book (at \$35 USD, it is not super-cheap, but it is far less than a chemistry text book, for example). We will use the book extensively, so I highly encourage you to purchase a copy.

\*\*\*I have requested some e-texts via the library, which I will add if/when they are made available for us. Hopefully soon!

Supplemental Text: De Vries, Bert J. M. *Sustainability Science*. Cambridge University Press, Cambridge, UK. 2013

\*\*For those of you with some background in this area, or who are interested in a more quantitative approach, this is an excellent resource. It's aimed at first year MSc students, but it has some excellent chapters that I will note in the reading list as supplemental readings.

There are new, interesting reports and articles coming out daily in this space. As I come across items of interest, I will post them (as supplemental readings). I encourage everyone in the class to do the same- this can include articles in the press, blogs, videos, etc... that are relevant to topics in the course. The more we read/watch/engage, the more interesting this becomes.