

YSS3209
Climate Science and Policy
Semester 2 2016-17
Tues-Thurs 4:30-6:00 pm
Classroom 3
Syllabus as of January 16, 2017 (subject to change)

Instructor

Prof. Angel Hsu
RC01-2-3A
Angel.hsu@yale-nus.edu.sg

Office Hours

Wednesdays 9:30 am-12:00 pm (others by appointment)
Sign-up in Google doc: <http://tinyurl.com/ot9d5je>

Course Description

Climate change – perhaps the defining issue of the 21st century—is a highly complex problem that requires interdisciplinary collaboration to develop policy responses. This course explores the science of climate change and uses theories from multiple disciplines, including law, political science, economics, and earth and atmospheric sciences to frame solutions to this global challenge. Through the application of quantitative tools, such as climate modelling, atmospheric and earth sciences, and qualitative tools, such as global environmental governance theory, students will establish an understanding of the causes and impacts of climate change, as well as the policy options and responses to address it.

Course Format

This course is designed as both lecture and a seminar, of which active discussion and participation are key. A lecture will introduce the major themes and topics with discussion questions and presentations interspersed throughout. Engaged participation based on the readings is critical to the success of the class.

Course Goals

At the completion of this course, students will:

- Understand and be able to explain climate system science and its dynamics
- Explain sources of uncertainty in climate science
- Use quantitative (e.g., atmospheric and earth science, climate modeling, policy analysis, economics) and qualitative tools (e.g., negotiation theory, global governance frameworks) to analyze the natural and social science dimensions of global climate change

- Apply climate and economic models to evaluate policy responses to climate change
- Evaluate national and international policies to mitigate and manage climate change
- Demonstrate critical reading, writing, and discussion skills, as well as an ability to synthesize scientific texts and writing for non-expert audiences

Course Requirements and Grading

1. Attendance and General Class Participation (20%) *including in-class presentations
2. Problem sets and out of class exercises (15%)
3. Midterm Examination (20%)
4. Policy Memo (10%)
5. Climate negotiation exercise (10%)
6. Final Take-home Exam (25%)

Discussion Lead Facilitation

Each week, one student will sign up here (<http://tinyurl.com/hf7njca>) to lead class discussion, usually occurring during Thursday class (or the second half of class, if there is a double class session on Tuesday). Students are expected to first provide a synthesis of that week's readings, highlighting relevant themes/take-aways and questions to ask their classmates. While not expected, students can prepare some visual presentation (e.g., a Powerpoint) to guide their discussion in class.

Below are some tips for both Discussants and the Facilitator to ensure solid class discussion this semester (modified from Soranno, P. A. (2010). Improving student discussions in graduate and undergraduate courses: Transforming the discussion leader. *Journal of Natural Resources & Life Sciences Education*, 39(1), 84-91):

For the Discussants:

All students should do the following to prepare:

- a. Prepare by thoroughly reading the article (most likely more than once), and having a solid understanding of the big-picture of the article as well as the details.

- b. Because there will be no one who should know substantially more than others about the topic, each student should feel responsible for doing any supplemental reading/searching for components or background of the article that he/she does not understand to share with the group.
- c. Each student should write down 1–2 topics that he/she would like to discuss during the discussion. Some ideas for types of topics to discuss include: delving deeper into a particular research area, exploring the evidence the authors provide for any their conclusions, expanding on an implication of the study, exploring the implications of this particular study for understanding of different disciplinary areas or for how the research could be applied in a variety of different capacities, etc.

For the Facilitator

- a. Provide a synthesis (not necessarily a summary, although some level of summary could be helpful to ensure everyone is on the same page) of your key take-aways and themes that emerged from the readings.
- b. Ask questions: To inspire a response is perhaps the most important strategy of the facilitator. Questions should be open-ended questions, such as “what, how, who, why” type questions that encourages brainstorming and creativity.
- c. Probe in-depth into a comment/idea: Encourages more in-depth analysis, such as: “Why did you say that?” or “Could you be more specific?”
- d. Paraphrase: Only for clarification of a comment made by a student, not to evaluate or improve it.
- e. Refer back to earlier comments: Which ties the discussion to previous student’s contributions.
- f. Be comfortable with silence: The facilitator must be willing to wait once a question is posed as people need time to think and frame a response. Thus, a facilitator should not step in and answer one’s own question
- g. Give positive reinforcement: This is a way to encourage participation, especially to students who are quieter.
- h. Include quieter members: Some ways to draw people out are to ask students directly for their opinion on something that has been brought up, to refer back to comments that quieter people make to draw them out further, or to break the class into smaller groups or pairs that then report to the larger group.
- i. Shift perspective of the discussion: If all students seem to agree, it may be less likely that a single or few students who feel differently would speak up. To get these students to speak up, the facilitator can ask if there “might be another viewpoint that could be missing from the discussion.” In addition, the facilitator can ask for the implications of the topic or a big-picture question; or the facilitator can ask for a specific example or for details to enrich the discussion that may be at too broad of a level.
- i. Summarize: Occasional summary is helpful to keep the group focused. The facilitator can briefly summarize what has been said before moving on. Or, better yet, the facilitator can ask for someone else to summarize, but it is important that enough time is provided for students to think before answering.

Policy Memo

Writing brief, synthetic memos are critical in policy. You will prepare a short, 3-page memo on some aspect of climate change mitigation, adaptation, or science for a relevant government agency in a country of your choice (e.g., a memo briefing U.S.'s Department of State on need for scaled-up carbon capture and sequestration technology).

Mock UN Climate Negotiation

We will hold a special negotiation session – “The UNFCCC Without the U.S.” – during Week 13. Students will be assigned to represent a country delegation. More details will be circulated around Week 10.

Attendance and Late Assignment Penalties

You are expected to attend all classes. Students are permitted one unexcused absence (e.g., to participate in an extracurricular activity) during the semester, with advance approval. Excused absences include required fieldwork for another course, with advance permission. Students must request the permission of the faculty member to be absent from classes. Penalties for all other unexcused absences will be assessed in your participation and discussion grades.

Late assignments will be assessed as follows:

- Problem sets/out of class exercises: 1 point for each day late, with a maximum of 3 points (after that, no credit for the assignment)
- Other graded assignments (policy memo, take-home exam, etc.): 1 day late = 10% off; 2 days late = 20% off; 3 days late = 30% off; 4 days late = 100% off.

Intellectual and Professional Ethics

Students are expected to uphold standards of academic honesty. Detailed at greater length on Yale-NUS's website here – <http://studentlife.yale-nus.edu.sg/policies/academic-integrity> - the concept of academic dishonesty or cheating includes any misrepresentation of another's work as your own, including unacknowledged paraphrasing or quoting, use of another student's material, incomplete acknowledgement of sources including Internet sources, or submission of the same work to complete the requirements of more than one class.

In this course, we will hold you to the highest academic standards, which you will be expected to follow throughout your tenure at Yale-NUS. We expect each student to complete original, independent work. Plagiarism will not be tolerated. Proper citation of all sources is essential. If you are ever unclear about what constitutes academic dishonesty, it is *your* responsibility to contact me or another College resource for clarification.

Please see <http://library.yale-nus.edu.sg/plagiarism/> for more information regarding plagiarism and how to avoid it. Another good resource our library has put together to

walk you through how to write a research paper is here: <http://library.yale-nus.edu.sg/tutorials/>.

Technology-Free Policy

All class discussions will be “technology free,” meaning that laptop computers, tablets, and smartphones will not be allowed.

Readings

We will draw from a variety of texts and materials in this course, although many of the readings will come from the following:

- John Houghton, *Global Warming: The Complete Briefing*, 5th Edition, 2015, Cambridge Univ. Press.
- Stephen Schneider, Armin Rosencranz, Michael Mastrandrea Kristin Kuntz-Duriseti, eds. *Climate Change Science and Policy*, Island Press, December 2009. Available via Yale-NUS’s e-library service: <http://reader.ebib.com.libproxy.yale-nus.edu.sg> (Abbreviated below as CCSP)
- Fifth Assessment Report. Intergovernmental Panel on Climate Change (IPCC). 2013. <https://www.ipcc.ch>

Topics for Discussion (*subject to change*)

For readings, check the E-readings folder on Canvas. Required readings listed should be prepared prior to each class session.

***** indicates class will not meet on Thursday that week; instead, we will have a double class session on Tuesday from 4:30-7:30 pm and food will be provided. The classes that are currently affected are Jan. 31 and March 21 classes. Please mark these dates in your calendar!***

Week 1. Introduction to the Science of Climate Change

Course Introduction – overall expectations and goals.

Jan. 10-12 Climate science overview – physical science basis, foundation of physical climate change science

- *Climate Change Science and Policy (CCSP) Chapter 1. “Climate Change Science Overview”*
- *Global Warming: The Complete Briefing Chapters 1 and 2.*

Jan. 12 Detection and attribution of climate change

- Houghton, Ch. 5: Modelling the climate. Pp. 91-116.

- IPCC. AR5. Chapter 10 – Detection and Attribution of Climate Change: From Regional to Global. Pp. 869 – 874 (stop at Section 10.2.2); Box. 10.1; and the FAQ.
- Perception of climate change, James Hansen, Makiko Sato, and Reto Ruedy, Proceedings of the National Academy of Sciences of the USA, v109, p. E2415-E2423, 2012, DOI: 10.1073/pnas.1205276109.
- MIT Greenhouse Gas Emissions Calculator.
<http://scripts.mit.edu/~jsterman/climate/master/>. Jot down your observations in using this simulation, bring to class.

Optional:

- *Karl, T. R., & Trenberth, K. E. (2003). Modern global climate change. Science, 302(5651), 1719-1723.*
- *CCSP Chapter 2. "Detection and Attribution"*
- "In Search of the Greenhouse Fingerprint," Orion: Natural Quarterly (Winter, 1989). Pp. 4-11.
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Week 2. Impacts of Climate Change

Jan. 17 Overview of global impacts

- Houghton, Ch. 7 – The impacts of climate change (p. 163-200 only).
- Pick 2 of the following in CCSP:
 - Chapter 3: Wild Species and Extinction
 - Chapter 4. Ecosystems
 - Chapter 5: Marine Ecosystems
 - Chapter 6: Water
 - Chapter 7: Hurricanes
 - Chapter 8: Wildfires
 - Chapter 10: Global Crop Production and Food Security
 - Chapter 11: Human Health
 - Chapter 12: Unique and Valued Places
- Vital Signs according to NASA <http://climate.nasa.gov/vital-signs> - explore the website.

Jan. 19 Polar region impacts

- Kolbert, E. (2016). Greenland is Melting. The New Yorker.
<http://www.newyorker.com/magazine/2016/10/24/greenland-is-melting>
- Google Earth Tours of Glacier Change. You will need to download Google Earth Engine (pick one of the below to explore):
 - https://nsidc.org/data/google_earth/ - download the Sea Ice extents datasets and view in Google Earth.

- [Google earth tour of 50 years of glacier change on the Juneau Icefield, this is a KMZ file only opens in GE.](#) (240kB Nov27 07)
- [Google Earth Tour of North Cascade glaciers behavior over the last 50 years, this is a KMZ file only opens in GE.](#) (13kB Nov27 07)

Week 3. Understanding Risks and Uncertainty in Climate Change

Jan. 24 Uncertainty and scientific consensus

- Gullidge, J. Climate Change Risks in the Context of Scientific Uncertainty.
- CCSP Chapter 15. “Risk, Uncertainty and Assessing Dangerous Climate Change.”
- Houghton, Ch. 9 – Weighing the uncertainty. Pp. 239-247.

Jan. 26 Climate change skepticism

- Marshall, G. “Don't Even Think About It: Why Our Brains Are Wired to Ignore Climate Change.” Chs. 3,5,6,10, 11 (chapters are short)
- Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2009). Global warming’s six Americas 2009: An audience segmentation analysis. *Yale University and George Mason University. Yale Project on Climate Change Communication, New Haven, CT.* p 1-12 and skim the audience profiles, starting on p. 30
- Problem Set #1 assigned.

Optional:

- Gillenwater, M. (2014). Why do so many Americans deny climate change? <https://ghginstitute.org/2014/08/21/why-do-so-many-americans-deny-climate-change/>

Week 4. Economics of Climate Change: Cost of Action and Inaction

** Wednesday Feb. 1. Guest lecture by Prof. Francis Dennig. NOTE: Class will meet until 7:30 pm and will include a short break for a pizza dinner.

- CCSP Chapter 13. “What is the Economic Cost of Climate Change?”
- Schelling, T. C. (1992). Some economics of global warming. *The American Economic Review*, 82(1), 1-14.
- Tol, R. S. (2014). Correction and update: The economic effects of climate change. *The Journal of Economic Perspectives*, 28(2), 221-225.
- Stern: The economics of climate change, AER 2008
- William Nordhaus. Critical Assumptions in the Stern Review on Climate change. *SCIENCE VOL 317 13 JULY 2007*

Optional:

- Dennig, F., Budolfson, M. B., Fleurbaey, M., Siebert, A., & Socolow, R. H. (2015). Inequality, climate impacts on the future poor, and carbon prices. *Proceedings of the National Academy of Sciences*, 112(52), 15827-15832.

Feb. 2 NO CLASS

Week 5. Carbon, Forests, and the Global Energy System

Feb. 7 Sinks – oceans, forests, and soil

- CCSP, Ch. 48. Tropical Forests
- Managing Forests in Uncertain Times, *Nature* (2014).
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Feb. 9 Global Energy System

- IPCC, WGIII. Ch. 7 – Energy Systems. Pp. 518-532 only.
- CCSP, Ch. 43. Energy Efficiency
- CCSP, Ch. 44. Renewable Energy

Week 6. Adaptation and Resilience to Climate Change

Feb. 14 Guest lecture by Prof. Brian McAdoo

- Readings TBD in consultation with Prof. McAdoo

Feb. 16 Midterm Exam in class

Week 7. BREAK

Week 8. Addressing Climate Change Mitigation Solutions to Climate Change

Feb. 28 Policy options

- Pacala, Stephen, and Robert Socolow. 2004. Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. *Science*, 13 August, 968-972.

March 2 Policy challenges

- Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change. *Policy Sciences*, 45(2), 123-152.

Week 9. Economic and Policy Tools to Address Climate Change

March 7 Cap and Trade

- CCSP Chapter 20. Cost of Reducing CO2 Emissions.
- CCSP Chapter 19. Carbon Taxes, Trading and Offsets
- History of Cap and Trade. <https://www.youtube.com/watch?v=pA6FSy6EKrM>

March 9 Understanding the Social Cost of Carbon

- Whibey, J. (2015). Understanding the Social Cost of Carbon and Connecting it to Our Lives. <http://www.yaleclimateconnections.org/2015/02/understanding-the-social-cost-of-carbon-and-connecting-it-to-our-lives/>.
- Moore, F. C., & Diaz, D. B. (2015). Temperature impacts on economic growth warrant stringent mitigation policy. *Nature Climate Change*, 5(2), 127-131.
- Problem Set #2: Emissions modeling exercise assigned.

Week 10. Policy in Action – Case Studies

March 14 Developed countries: United States, European Union

- CCSP Chapter 32. EU Climate Policy.
- CCSP Chapter 33. National Policy (the United States).
- CCSP Chapter 36. U.S. State Climate Action
- US EPA. (2015). Fact Sheet: Overview of the US Clean Power Plan: <https://www.epa.gov/cleanpowerplan/fact-sheet-overview-clean-power-plan>.

March 16 Developing countries: China, India, Brazil

- CCSP Chapter 26. Developing Country Perspectives.
- CCSP Chapter 31. India.
- CCSP Chapter 29. Understanding the Climate Challenge in China.

*** Students will receive country assignments for mock negotiation simulation. POLICY MEMO DUE 11:59 PM MARCH 17

Week 11. International Climate Change Governance

NOTE: Class will meet until 7:30 pm on Tuesday and will include a short break for a provided dinner.

** March 21 International frameworks for governing global climate change.

- Bulkeley, H. and Newell, P. (2015). *Governing Climate Change*. Ch 2: Governing Climate Change: A Brief History.
- UNFCCC. Essential Background.
http://unfccc.int/essential_background/items/6031.php

March 23 NO CLASS

Week 12. Federalism and Multi-level Governance

March 28 Role of non-state and subnational actors

- Hsu, A., A.S. Moffat, A.J. Weinfurter, and J.D. Schwartz. “Towards a New Climate Diplomacy.” *Nature Climate Change* 5, 501–503 (2015).
- Bulkeley, H. and Newell, P. (2015). *Governing Climate Change*. Ch 5: The role of private governance in Climate Change.
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March 30 Multilateral and fragmented climate governance

- Keohane, R. O., & Victor, D. G. (2011). The regime complex for climate change. *Perspectives on politics*, 9(01), 7-23.
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Week 13. Climate change negotiation simulation

**** Class will meet in Lecture Hall 1. Come dressed in either business casual attire or national dress. Remember, negotiations in the ‘corridors’ (i.e., outside of class) can count just as much as the discussion in official plenary. Your fellow negotiators may score your decorum in these corridor discussions as much as plenary negotiations.**

- “Getting to Yes” by Fisher and Ury. Chs. 1-2, use other chapters for reference.

Week 14. Future scenarios – where do we go from here?

April 11 Technology and innovation – geoengineering

- CCSP Ch 47. Coal Capture and Storage
- CCSP Ch. 49. Geoengineering the Planet

April 13

Week 15. Reading Week

Week 16. Exam Week. Take-Home Exam due 11:59 pm SGT Wednesday, May 3.