ENVST-UA 331: Food Production and Climate Change
New York University
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Fall Semester 2021
MW 2-3:15
7 East 12th Street, Room 124

COURSE DESCRIPTION

4 points
Prerequisite: ENVST-UA 100, Environmental Systems Science

Roughly 40% of our Earth’s land surface is devoted to agriculture. Grasslands have been plowed over for industrial sized farming operations; forests have been razed to make meat, fuel, and other commodities. The food we eat has a significant environmental impact, and, in turn, our food system stands to be tested by a changing environment. Food Production and Climate Change provides a survey of our current global food system embedded within larger environmental systems that it both impacts and depends on. We will explore the evolution of intensive food production, specifically in how humans have changed the land surface, and our overall environmental systems, in order to meet increasing food demand. We will also learn how climate change, and the associated extreme events and variability, will challenge our ability to grow and harvest crops in a timely fashion to meet nutrition standards across the world. The impacts of climate change on food production vary largely across geographic, economic and even gender space. Finally, this course will assess the environmental footprint of current food system trajectories and evaluate emerging alternatives for a range of environmental, socio-economic, and nutritional outcomes.

REQUIRED MATERIALS:

This course will require weekly readings, prescribed below per lecture. These readings will either be provided as a pdf on Brightspace (under “Resources”), or you will need to
search for and download the reference through NYU Libraries or your log-in. If you are unfamiliar with how to search for and acquire references, please see me. Additionally, some readings will use the online resource: Table, by the Oxford-Martin Programme on Food: https://www.tabledebates.org/explainers?filter=chapter

On the first day of class, I will provide an overview of how best to approach reading (i.e. “speed reading”) scientific literature/papers. Please make an appointment with me if you are finding these works challenging!

The variety of reference mediums is meant to serve a multi-fold purpose for you: it will familiarize you with the field’s cutting-edge research, and enable you to evaluate the public’s response to such research and how it is communicated. Some of these readings, particularly those taken from scientific literature, may be dense and may prove initially challenging. In these cases, other materials will be supplied to help you gain a more complete understanding of the findings and implications. You will also be required, and encouraged, to conduct literature searches to access more information and delve more deeply into weekly topics.

STUDENT EXPECTATIONS

On-time attendance to Lecture and Participation
Completion of weekly readings
Completion of four (4) written assignments
Completion of one group project and related assignment
One Final Term Paper

It is NYU policy that all work is expected to be your own. Plagiarism of any kind will result in a failing grade for the class, and referral to an academic dean. Plagiarism includes: copying sentences or fragments from any source without quotes or references; not citing every source used in your papers; citing internet information without proper citation; presenting someone else's work as your own; or copying verbatim from any source. You are subject to CAS’s guidelines for Academic Integrity: http://cas.nyu.edu/page/ug.academicintegrity

You will be expected to attend every class, as the readings will cover some of the topics we discuss in class in more detail, but not all topics. Your active listening in class will help you to create a more thorough response to some of the homework prompts. This is college, and so I also expect that you will take initiative to look further into terms and topics you are unfamiliar with in the readings (this includes asking me). Active participation will be encouraged, and there will be many opportunities to do so, as an individual and as discussions questions posed to groups of students in class, so please be ready to take advantage of these opportunities. I also encourage out-of-class discussion on readings and response topics, and if several of you are pursuing similar lines of research for your final paper, I expect that you will discuss this amongst yourselves. However, at all times, all work should be your own.
GRADING CRITERIA

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<tr>
<th>Responsibility</th>
<th>Percent of Final Grade</th>
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<tr>
<td>Assignments</td>
<td>50</td>
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<tr>
<td>Regional Integrated Assessment</td>
<td>10</td>
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<tr>
<td>Term Paper</td>
<td>40</td>
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<td>Total</td>
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This course is equivalent to 4.0 credits.

ASSIGNMENTS
You will have an assignment approximately every other week. When assigned, you will have approximately one (1) week to complete each assignment. These will comprise short answer questions designed to test your comprehension and critical thinking of the assigned readings and issues discussed in class. The questions will generally ask you to summarize or describe various concepts in your own words, and then challenge you to apply these concepts in thinking about climate-agriculture interactions. The responses will most often be written, in short-answer form. You will also be asked to provide overviews and references for your final paper, and this will help you to plan for it in advance.

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<thead>
<tr>
<th>Homework</th>
<th>Assigned</th>
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<tr>
<td>1</td>
<td>9/17</td>
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The assignment will be posted on NYU Classes on Friday, and is due by 5:00 pm per the date in table above. Assignments are expected to be typed using 12 pt font and 1.5 spacing (double spacing is NOT acceptable). Assignments should either be emailed to me or uploaded via Brightspace (please do not share a Google Doc with me). You can use “Pages” instead of “Word”.

Emailed assignments should have a filename per the following example:
McDermid_HW1.doc
Assignments that do not have a name in the filename will automatically be deducted points.

Late homework **will not be accepted**, unless you have discussed an extension with me prior.

**PRESENTATION**

You will also work in groups of 4(ish) to sketch out a “Regional Integrated Assessment” of climate and agriculture for a region/area of your choice. For this project, you will be evaluated (10% of grade) based on a group presentation as a group and 3-page “policy brief”. More details on this component of your grade will be provided in class, and a rubric will be posted. Periodically, you will be given time in-class to work together, but you are also expected to coordinate outside of class.

**TERM PAPER**

**Due Wednesday, Dec 15th by midnight.** The term paper will be “open topic”, in that the student may choose any topic related to the themes discussed in class. As part of the homework assignments, students will submit a topic proposal and preliminary list of references to the instructor for approval. If the topic does not meet instructor approval, the student may seek the instructor’s guidance on how to construct a topic that is appropriate. A template/rubric for the final paper will be provided during the course. The term paper is to be 12 pages, 1.5 line spacing, including references. You may choose whatever citation style you like, but please use it consistently. A **minimum of 7 primary references are required**, but you may choose to include more.

I would encourage you to seek help from the NYU Bobst Librarians in conducting a proper literature search for your papers

**DISABILITY DISCLOSURE STATEMENT**

Academic accommodations are available for students with disabilities. The Moses Center website is www.nyu.edu/csd. Please contact the Moses Center for Student Accessibility (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

NYU's Henry and Lucy Moses Center for Students with Disabilities
726 Broadway, 2nd Floor
New York, NY 10003-6675
Telephone: 212-998-4980
Voice/TTY Fax: 212-995-4114
Web site: http://www.nyu.edu/csd

**ACADEMIC INTEGRITY, PLAGIARISM, AND CHEATING**

[https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html](https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html)
Academic integrity means that the work you submit is original. Obviously, bringing answers into an examination or copying all or part of a paper straight from a book, the Internet, or a fellow student is a violation of this principle. But there are other forms of cheating or plagiarizing which are just as serious — for example, presenting an oral report drawn without attribution from other sources (oral or written); writing a sentence or paragraph which, despite being in different words, expresses someone else’s idea(s) without a reference to the source of the idea(s); or submitting essentially the same paper in two different courses (unless both instructors have given their permission in advance). Receiving or giving help on a take-home paper, examination, or quiz is also cheating, unless expressly permitted by the instructor (as in collaborative projects).
Week 1 (9/8) – Overview: Syllabus review; systems thinking in agriculture and food systems; understanding and utilizing concepts of Food Security

Readings:

- Table
  - What is Food Security?
    https://www.tabledebates.org/building-blocks/what-food-security
  - An overview of food systems challenges:
    https://www.tabledebates.org/chapter/overview-food-system-challenges

- Provided on Brightspace
  - FAO Introduction to Food Security

- Other

Week 2 (9/13) – Environment and Agriculture: The climate and environmental determinants of global and regional agricultural production: climate zones and prevailing conditions, distribution of energy and water, modes of natural climate variability; the basics of crop physiology and responses to environmental conditions.

Readings:

- Table
  - An overview of food system challenges:
    https://www.tabledebates.org/chapter/overview-food-system-challenges

- Provided on Brightspace
  - IPCC Third Assessment Report (TAR) Overview of Climate System
  - Handbook of Climate Change and Agroecosystems Vol. 1, Chapter 1, eds. Rosenzweig and Hillel
  - UNL Plant Growth Processes

- Other

**Week 3 (9/20)** - *Current Agricultural Production*: Soil processes and human management; human land use over time; the “Green Revolution” and narratives of 20th century agricultural production and development

*Readings:*

- **Provided on Brightspace**
  - FAO, The Importance of Soil Organic Matter, pages 1-19
  - The Green Revolution: Curse or Blessing? The International Food Policy Research Institute

- **Other**

**Week 4 (9/27)** - *Current Agricultural Production con’t*: Revisiting the “Green Revolution” narratives with reflection and discussion activity; Measuring production and implications for food security; group work for project

*Readings:*

- **Other**
    - This blog post can help with the above reading: https://rajpatel.org/2014/08/29/every-factoid-is-a-mystery-how-to-
hink-more-clearly-about-the-green-revolution-and-other-agricultur
al-claims/
○ Lobell et al. (2009) Crop Yield Gaps: Their Importance, Magnitudes and
Causes. Annu. Rev. Environ. Resour. 34:179-204
management. DOI:10.1038/nature11420 - Abstract, Intro, Figures and
Captions

Week 5 (10/4) - Climate-Agriculture Interactions: modes of natural climate variability
and crop production; food shocks and vulnerabilities

Guest lecture by Dr. Michael Puma, NASA Goddard Institute for Space Studies on 10/4

Readings:

● Other:
agricultural yields. Environ. Res. Lett. 14 054010,
  https://iopscience.iop.org/article/10.1088/1748-9326/ab154b - Abstract,
Intro, Figures and Captions
  https://doi.org/10.1038/s41893-018-0210-1
  ○ Iizumi, T. et al. Impacts of El Niño Southern Oscillation on the global
yields of major crops. Nat. Commun. 5:3712 doi: 10.1038/ncomms4712
(2014) - Abstract, Intro, Figures and Captions

Week 6 (10/11) – Climate Impacts on Food Production: A primer on climate change;
global perspectives of climate change impacts on crop production and food security;
AgMIP assessment methods and comments on “stakeholder driven” research

Readings:

● Table:
  ○ Climate and environmental impacts on food systems:
    https://www.tabledebates.org/chapter/impacts-climatic-and-environmental
-change-food-systems

● Provided on Brightspace:
  ○ IPCC AR5 WG2 Food Security and Production

● Other:
Week 7 (10/18) – Climate Impacts on Food Production (con’t): Major uncertainties in projected global and regional impacts on agriculture; impacts on key inputs/resources; CO2 fertilization effects; pests and diseases; air pollution impacts; supply chain impacts

Readings:

- Other:
  - Deryng, D. et al. (2016) Regional disparities in the beneficial effects of rising CO2 concentrations on crop water productivity. Nature Climate Change, 6 (8). pp. 786-790. [https://www.nature.com/articles/nclimate2995](https://www.nature.com/articles/nclimate2995) - Abstract, Intro, Figures and Captions
  - Bebber et al., Crop pests and pathogens move polewards in a warming world. Nature Climate Change Volume 3, pages 985–988 (2013) [https://doi.org/10.1038/nclimate1990](https://doi.org/10.1038/nclimate1990) - Abstract, Intro, Figures and Captions
  - Rojas-Downing, M.M., 2017, Climate change and livestock: Impacts, adaptation and mitigation. Climate Risk Management, [https://cgspace.cgiar.org/handle/10568/66474](https://cgspace.cgiar.org/handle/10568/66474) - Read up to Section 2.2

Week 8 (10/25) – Environmental Footprint of Agriculture: Agriculture exceeding planetary boundaries; beyond climate change, agriculture as a driver of global and regional environmental change; the role of animal agriculture (and diets) in global environmental change

Guest lecture by Prof. Chris Schlottmann on 10/27
Readings:

- **Table:**
  - The Difficult Livestock Issue: https://www.tabledebates.org/chapter/focus-difficult-livestock-issue
  - Environmental Impacts of food: Introduction to LCA: https://www.tabledebates.org/chapter/environmental-impacts-food-introduction-lca

- **Other:**
  - Garnett et al., FCRN Grazed and Confused Report: https://www.fcrn.org.uk/sites/default/files/project-files/fcrn_gnc_report.pdf, Section 1, 2, 4, and 5
  - GRAIN/IATP Emissions Impossible Report, Pages 1-17: https://www.grain.org/article/entries/5976-emissions-impossible-how-big-meat-and-dairy-are-heating-up-the-planet

Week 9 (11/1) - *Environmental Footprint of Agriculture:* The role of animal agriculture (and diets) in global environmental change; marine systems and aquaculture; GHG emissions and intensity

*Guest lecture by Prof. Jennifer Jacquet on 11/3*

Readings:

- **Table:**

- **Provided on Brightspace**
  - FAO SOFIA Report: Part 1 Overview; Capture Fisheries; Aquaculture; The status of fishery resources; Governance and policy

- **Other:**
Week 10 (11/8) – *Environmental Footprint of Agriculture (con’t)*: Landuse and land cover change; land-atmosphere feedbacks from managed land systems and regional considerations; water and resource use; impacts on biodiversity; food waste

**Readings:**
- **Table:**
  - What is landuse change?:
- **Provided**
  - IPBES, Summary for Policy Makers, *Key Messages Section B; Background Section B*
- **Other:**
  - McDermid et al comment in Nature Geoscience: TBD
  - Seneviratne et al., Nature Geoscience, volume 11, pages88–96 (2018). 10.1038/s41561-017-0057-5 *Only Abstract and Table 2 comparing Solar Radiation Management to Land-Based Mitigation*

Week 11 (11/15) - *Alternative food production regimes*: New food system and production paradigms; “Sustainable intensification”; reconciling food production and biodiversity;

**Readings:**
- **Table:**
  - What is sustainable intensification?:
    - https://www.tabledebates.org/building-blocks/what-sustainable-intensification
What is the land sparing-sharing continuum?:
https://www.tabledebates.org/building-blocks/what-land-sparing-sharing-continuum

What is a healthy, sustainable eating pattern?:
https://www.tabledebates.org/chapter/what-healthy-sustainable-eating-pattern

● Provided:
  ○ EAT-Lancet Report, Executive Summary and Key Messages; Skim all Tables and Figures

● Other:
    https://royalsocietypublishing.org/doi/10.1098/rstb.2012.0273  Section 3 to end

Week 12 (11/22) – Alternative food production regimes: conservation agriculture and related management regimes; organic agriculture; data limitation and uncertainties; uncertainties in metrics for success and improvement

Readings:

● Other:
land degradation and desertification? Glob. Chang. Biol. gcb.14878. https://doi.org/10.1111/gcb.14878 Abstract; Intro; Figure 1; Table 4; Table 17; Discussion/Conclusion


Week 13 (11/29) - Alternative/modified production and food system regimes (con’t): GMOs; “regenerative” agriculture and agroecology; data limitation and uncertainties; uncertainties in metrics for success and improvement

Guest lecture by Dr. Marcia DeLonge from Union of Concerned Scientists on 11/29

Readings:

- Other:

Week 14 (12/6) – Start Integrated Assessment Presentations; Wrap-up Discussion and Comments; In-Class Future Foods Tasting – see me to contribute something!
Structure of a Research Paper
While academic disciplines vary on the exact format and style of journal articles in their field, most articles contain similar content and are divided in parts that typically follow the same logical flow. Following is a list of the parts that I will expect of your term paper:

- Title
- Introduction – Summary of Problem and why it is important
- Thesis Statement or Statement of Purpose
- Body of paper with clear delineation of arguments, literature cited
- Discussion/Inferences that you draw from the literature review and arguments. What are gaps and potential next steps?
- Conclusion
- References

Research papers are organized so that the information flow resembles an hourglass in that it goes from general to specific and then back to general again. The introduction and literature review sections will introduce the problem and provide general information. The literature review section should also serve as the basis for arguments you make supporting your thesis/purpose statement. The discussion/conclusion will discuss the findings in a larger context, and identify what more should be done.

Title – 5 points

The title should be specific and indicate the problem the research project addresses using keywords that will be helpful in literature reviews in the future.

Introduction – 15 points

The introduction begins by introducing the broad overall topic and providing basic background information. It should explicitly state why this topic is important to the themes of the class. It then narrows down to the specific research question/thesis/purpose relating to this topic. It provides the purpose and focus for the rest of the paper and sets up the justification for the research.

Main Body and Literature Review – 35 points

The purpose of the literature review and main body is to describe past important research and it relate it specifically to the arguments you are trying to make in support of your thesis statement. This section should be a synthesis of the previous literature and the new ideas being researched. You should leverage existing major theories related to the topic to date. It should include all relevant findings from credible sources, such as academic books and peer-reviewed journal articles.

Adapted Center for Innovation in Research and Teaching
https://cirt.gcu.edu/research/developmentresources/tutorials/researchpaper
Discussion/Conclusion – 35 points

This section should add value to the arguments you draw from the literature, make connections between the studies you use, and synthesize your broader arguments. You should refrain from bringing in additional citations here – rather, you should build upon the references you’ve cited in the main body and attempt to pull them together. This is the major area where you make your OWN arguments from the existing literature. You should also address the implications to the field more broadly. Your thesis/purpose/hypothesis should be answered and validated by your analysis. Here is also a good place to draw out any uncertainties and caveats to your argument.

References/Bibliography – 10 points

The research paper is not complete without the list of references. This section should be an alphabetized list of all the academic sources of information utilized in the paper. The format of the references will match the format and style used in the paper. Common formats include APA, MLA, Harvard and so forth.
Regional Integrated Assessment (RIA) Activity Prompt

You have been funded by USAID to conduct a Regional Integrated Assessment (RIA) of climate change, agriculture, and food security in a region/country of your choice.

You must **assemble a cross-disciplinary team** (e.g. climate, crops, economics), in which each dimension of change is individually characterized (e.g. “how is the climate changing in your region?”) and considered together (e.g. what do these types of climate changes mean for crops, household income, etc.?). You **must have at least one person assigned to climate, crops, and socio-economics each**.

You will have to present your findings to regional/country decision-makers so that they can act. **Note that they are not only interested in impacts, but also adaptation.** What can they do to mitigate harms and/or even facilitate gains? What do you tell them about likelihood/uncertainty? How do your findings compare to regional/country development trends and promoted/subsidized activities?

Prepare a maximum 15 minute presentation for USAID and country officials and a 3-5-page policy brief for your RIA. A grading rubric is provided below.

Tips for a successful RIA

- You can select any region/country. However, I recommend that you do not get too fine-scale in your analysis (i.e. I suggest not selecting a particular town in the middle of the USA) because you may be information/data limited. Most previous teams selected a country, but some teams chose to do particular regions in a country, a state in the USA, or other relatively larger spatial units that had more information.
- You will have ~2 more people on your team to assign focus/disciplinary areas too. What other focus areas/disciplines you select should be tailored to the context. For example, you may want water resources represented (in semi-arid and arid areas), or a public health perspective where water quality or sanitation is a chronic issue. For some regions/areas, it could serve your RIA to have someone focused on the representation of Indigenous communities and needs.
- The Intergovernmental Panel on Climate Change ([https://www.ipcc.ch/](https://www.ipcc.ch/)) is a good place to start to look at climate impacts in your region of choice. In particular, check out the region specific chapters part of Working Group 2 (e.g. [https://www.ipcc.ch/report/ar5/wg2/](https://www.ipcc.ch/report/ar5/wg2/)). From there, I suggest using Google Scholar or another search engine to look for additional studies.
- For inspiration, you can see previous teams’ slides here. However, these were not subject to grading or standardization, so make sure you follow the formatting guidelines below. [https://drive.google.com/drive/folders/1txT1IO2UfBroixkXSZruxTZzMiCO1T77?usp=sharing](https://drive.google.com/drive/folders/1txT1IO2UfBroixkXSZruxTZzMiCO1T77?usp=sharing)
Presentation

Time: You will have a total of 15 minutes. I suggest planning for ~12 minutes, and leave 3 minutes for Q&A from your classmates and myself, who will serve as your USAID evaluators and country stakeholders/decision-makers.

Content - your presentation should include:

(A) **1 slide total**: A brief background slide on the state of food security in the region/country (5 pts)

(B) **1 slide each**: An overview of key findings from each “discipline” or perspective you included.
   For example, if you included climate, crop, and economics, I would expect an overview of, respectively, climate changes, agricultural changes/development and key crops, and a description of important socio-economic development trends. (20 pts total)

(C) **2 slides total**: Your RIA findings: what are the multi-directional impacts and feedbacks between the dimensions you investigated? (20 points)

(D) **2 slides total**: Adaptation: what are possible adaptation opportunities and/or limits to adaptation? How do these intersect with points (A) and (B) above (for example, are there trade-offs and/or co-benefits across dimensions that stakeholders should be aware of)? (15 points)

(E) **1 slide total**: Summary and recommendations. These can suggest specific policies/options/solutions to pursue and/or where uncertainties lie and more research and/or data collection need to be done. (5 points)

Total: 65 points

I’ll note that this is a general guide. I expect to see the above dimensions mentioned somewhere in your presentation, but it need not be in this order specifically. For your region/context, it may make sense to foreground particular issues over others. Please see me to discuss if the above does not really suit your group’s RIA.

Policy Brief

Length: 3-5 pages

Content: You can be creative! It should be accessible-written for a decision-making audience (nothing overly technical). All figures should have captions and be explained. It should absolutely include three dimensions from your presentation: (1) main findings from your RIA, (2) adaptation options, and (3) summary and recommendations. You may choose, however, to include other considerations and/or background, but again consider the audience as well. Here is a useful guide:


Total: 35 points. 10 point for each dimension described above, and 5 points for presentation.