

GEOG/ENEC 437: SOCIAL VULNERABILITY TO CLIMATE CHANGE

Fall 2023

Tues/Thurs 9:30-10:45AM, Carolina Hall 204

Instructor

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Software: Stata/BE is available as a 6-month rental for \$48 [<https://www.stata.com/order/new/edu/gradplans/student-pricing/>] or as a remote desktop application via the UNC Virtual Lab [<https://virtuallab.unc.edu/vpn/index.html>].

Course Homepage: Readings, assignments and grades will be posted on Sakai.

Nature and Goals of the Course

How does climate change affect vulnerable human populations? The Intergovernmental Panel on Climate Change and many other scholarly organizations have named climate social science of this type as a critical research need. We will attempt to answer a shared research question on this topic by reading the rapidly-growing peer-reviewed literature in this area and by implementing a semester-long data analysis project using publicly-available survey and climate data from a country of your choice. This work will culminate in a final project in which your analytical results will be written up in the style of an academic paper, with step-by-step feedback from me and your peers.

Structure of the Course

Class meetings will include a mix of lectures, labs and writing/discussion sections. In the first half of the course, we will mostly use a Tues/Thurs discussion/lab rotation, and in the second half this will become a Tues/Thurs writing/lab rotation. Assignments will include weekly labs, presentations of the readings (to be rotated among students), writing assignments (in the second half of the class), and a final paper and presentation which will aggregate this work together. Grading will be based on these assignments plus class participation and short quizzes on the lectures and readings.

Grading

<u>Item</u>	<u>Percent</u>	<u>Notes</u>
Weekly quizzes	15%	Six short quizzes on the lectures and readings. Lowest dropped.
Presentation	5%	One short presentation on the readings
Labs	40%	Ten weekly lab assignments done on your laptop
Writing assignments	20%	Six short writing assignments
Final project	20%	Final paper and presentation
Total	100%	

Late assignments will be docked one letter grade per class day late unless previously approved. The deadline to turn in late assignments for partial credit is the last class meeting.

The final grading scale will be set at the end of the semester based on the distribution of grades at that time. This scale will be at least as generous as the traditional 10-point scale (e.g. >90 = A).

Course Policies

- *Accessibility*: I am happy to work to make this course accessible regardless of your learning needs. You can also visit the ARS website for more resources: <https://ars.unc.edu>
- *Attendance*: Every class meeting will be connected to a graded component (a lab, quiz or writing assignment), so please try not to miss class. If you do need to miss class, please email me ASAP.
- *Discrimination and Harassment* of any form are unacceptable at UNC and I am more than willing to help confront these issues. A reporting system is available online at <https://eoc.unc.edu/report-an-incident/>. More resources are also available at <https://safe.unc.edu/>
- *Grade Appeals*: If you feel like your work has been mis-graded, please let me know. You are also welcome to discuss these issues with the Director of Undergraduate Studies or the Chair of the Department of Geography & Environment, and there is also a formal grade appeals process: <https://registrar.unc.edu/academic-services/grades/grade-changes/>
- *Health*: Please prioritize your mental and physical health! I am happy to work with you if you need to miss class and turn in late assignments for these reasons. For UNC mental health support, please see: <https://caps.unc.edu/>
- *Honor Code*: Submission of work signifies understanding and acceptance of the UNC honor code: <https://catalog.unc.edu/policies-procedures/honor-code/>
- *Technology Use*: Laptops will be needed for every class meeting. Please use them respectfully.

Ideas in Action Focus Capacity: Global Understanding and Engagement

Questions for Students

1. What forces connect and distinguish the experiences of peoples, societies, and human organization around the world?
2. How can I understand and compare differing worldviews?
3. What connections and differences exist between particular worldviews, experiences, societies, or power structures?
4. What ideas, approaches, and international sources allow scholars to compare societies?

Learning Outcomes

1. Classify and analyze diverse historical, social, and political exchanges that shape nations, regions, and cultural traditions of the world.
2. Translate among contrasting civic cultures, social values, and moral commitments that characterize differences among peoples and societies, including those beyond the North Atlantic region.
3. Assess ways that political and economic institutions shape contemporary global relations.
4. Explain human and environmental challenges that transcend national borders.

Recurring Capacities

1. We will pose problems and questions that require systematic thinking about evidence, argument and uncertainty.
2. We will consider course content in the context of human difference between and within societies; the full range of legitimate debate in its field; and/or change over time.
3. The course requires: 10-20 pages of writing, presenting to the class, and collaborating in small groups to review each other's writing.

Ideas in Action Reflection and Integration: Research and Discovery

Questions for Students

1. How do I establish my point of view, take intellectual risks, and begin producing original scholarship or creative works?
2. How do I narrow my topic, critique current scholarship, and gather evidence in systematic and responsible ways?
3. How do I evaluate my findings and communicate my conclusions?

Learning Outcomes

1. Frame a topic, develop an original research question or creative goal, and establish a point of view, creative approach, or hypothesis.
2. Obtain a procedural understanding of how conclusions can be reached in a field and gather appropriate evidence.
3. Evaluate the quality of the arguments and/or evidence in support of the emerging product.
4. Communicate findings in a clear and compelling ways.
5. Critique and identify the limits of the conclusions of the project and generate ideas for future work.

Course Schedule: Dates are tentative with the exception of the final.

Date	Activity	Content	Assignments
Tuesday, August 22	Welcome		
Thursday, August 24	Lecture 1	Study design	
Thursday, August 31	Lab 1	Find and analyze background data	
Thursday, September 7	Lab 2	Download survey data	Lab 1 due
Tuesday, September 12	Discussion 1	Intro to climate change	Quiz 1
Thursday, September 14	Tutorial 1	Intro to Stata 1	
Tuesday, September 19	Discussion 2	Vulnerability to climate change	Quiz 2
Thursday, September 21	Lab 3	Set up survey data	Lab 2 due
Tuesday, September 26	Discussion 3	Health and climate change	Quiz 3
Thursday, September 28	Lab 4	Download climate data	Lab 3 due
Tuesday, October 3	Tutorial 3	Intro to QGIS	
Thursday, October 5	Lab 5	Extract climate data	Lab 4 due
Tuesday, October 10	Discussion 4	Agriculture and climate change	Quiz 4
Thursday, October 12	Lab 6	Set up climate data	Lab 5 due
Tuesday, October 17	Discussion 5	Migration and climate change	Quiz 5
Tuesday, October 24	Discussion 6	Poverty and climate change	Quiz 6
Thursday, October 26	Lab 7	Link survey and climate data	Lab 6 due
Tuesday, October 31	Writing 1	Introduction	Draft 1
Thursday, November 2	Lab 8	Climate-health analysis 1	Lab 7 due
Tuesday, November 7	Writing 2	Background	Draft 2, Revised 1
Thursday, November 9	Lab 9	Climate-health analysis 2	Lab 8 due
Tuesday, November 14	Writing 3	Methods	Draft 3, Revised 2
Thursday, November 16	Lab 10	Climate-health analysis 3	Lab 9 due
Tuesday, November 21	Catch-up	Flexible time to work on labs	Lab 10 due
Tuesday, November 28	Writing 4	Results 1	Draft 4, Revised 3
Thursday, November 30	Writing 5	Results 2	Draft 5, Revised 4
Tuesday, December 5	Writing 6	Conclusions	Draft 6, Revised 5
Tuesday, December 12	Final Exam 9am		Final project

The final exam can only be rescheduled with the approval of Academic Advising.

Reading List

Discussion 1: Intro to climate change

Liu, P. R., & Raftery, A. E. (2021). Country-based rate of emissions reductions should increase by 80% beyond nationally determined contributions to meet the 2 C target. *Communications Earth & Environment*, 2(1), 1-10.

Frame, D., Joshi, M., Hawkins, E., Harrington, L., de Roiste, M. (2017). Population-based emergence of unfamiliar climates. *Nature Climate Change* 7, 407–411.

Arnell, N. W., Lowe, J. A., Bernie, D., Nicholls, R. J., Brown, S., Challinor, A. J., & Osborn, T. J. (2019). The global and regional impacts of climate change under representative concentration pathway forcings and shared socioeconomic pathway socioeconomic scenarios. *Environmental Research Letters*, 14(8), 084046.

Carleton, T. A., & Hsiang, S. M. (2016). Social and economic impacts of climate. *Science*, 353(6304), aad9837.

Discussion 2: Vulnerability to climate change

Ford, J. D., Pearce, T., McDowell, G., Berrang-Ford, L., Sayles, J. S., & Belfer, E. (2018). Vulnerability and its discontents: the past, present, and future of climate change vulnerability research. *Climatic Change*, 151(2), 189-203.

Formetta, G., & Feyen, L. (2019). Empirical evidence of declining global vulnerability to climate-related hazards. *Global Environmental Change*, 57, 101920.

Davenport, F., Grace, K., Funk, C., & Shukla, S. (2017). Child health outcomes in sub-Saharan Africa: A comparison of changes in climate and socio-economic factors. *Global Environmental Change*, 46, 72-87.

Cooper, M. W., Brown, M. E., Hochrainer-Stigler, S., Pflug, G., McCallum, I., Fritz, S., Silva, J & Zvoleff, A. (2019). Mapping the effects of drought on child stunting. *Proceedings of the National Academy of Sciences*, 116(35), 17219-17224.

Discussion 3: Health and climate change

Dimitrova, A., Gershunov, A., Levy, M. C., & Benmarhnia, T. (2023). Uncovering social and environmental factors that increase the burden of climate-sensitive diarrheal infections on children. *Proceedings of the National Academy of Sciences*, 120(3), e2119409120.

Mora, C., Dousset, B., Caldwell, I.R., Powell, F.E., Geronimo, R.C., Bielecki, C.R., Counsell, C.W., Dietrich, B.S., Johnston, E.T., Louis, L.V., Lucas, M.P. (2017). Global risk of deadly heat. *Nature Climate Change* 7, 501–506.

Geruso, M., & Spears, D. (2018). Heat, humidity, and infant mortality in the developing world (No. w24870). National Bureau of Economic Research.

Carleton, T., Jina, A., Delgado, M., Greenstone, M., Houser, T., Hsiang, S., ... & Zhang, A. T. (2022). Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits. *The Quarterly Journal of Economics*, 137(4), 2037-2105.

Discussion 4: Food and climate change

Zhu, P., Burney, J., Chang, J., Jin, Z., Mueller, N. D., Xin, Q., ... & Ciais, P. (2022). Warming reduces global agricultural production by decreasing cropping frequency and yields. *Nature Climate Change*, 12(11), 1016-1023.

Abramoff, R. Z., Ciais, P., Zhu, P., Hasegawa, T., Wakatsuki, H., & Makowski, D. (2023). Adaptation strategies strongly reduce the future impacts of climate change on simulated crop yields. *Earth's Future*, 11(4), e2022EF003190.

Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H.C.J., Gollin, D., Rayner, M., Ballon, P. & Scarborough, P. (2016). Global and regional health effects of future food production under climate change: a modelling study. *The Lancet*, 387(10031), 1937-1946.

Beach, R. H., Sulser, T. B., Crimmins, A., Cenacchi, N., Cole, J., Fukagawa, N. K., ... & Ziska, L. H. (2019). Combining the effects of increased atmospheric carbon dioxide on protein, iron, and zinc availability and projected climate change on global diets: a modelling study. *The Lancet Planetary Health*, 3(7), e307-e317.

Discussion 5: Migration and climate change

Cattaneo, C., & Peri, G. (2016). The migration response to increasing temperatures. *Journal of Development Economics*, 122, 127-146.

Nawrotzki, R. J., & Bakhtsiyarava, M. (2017). International climate migration: Evidence for the climate inhibitor mechanism and the agricultural pathway. *Population, Space and Place*, 23(4): e2033.

Hoffmann, R., Dimitrova, A., Muttarak, R., Cuaresma, J. C., & Peisker, J. (2020). A meta-analysis of country-level studies on environmental change and migration. *Nature Climate Change*, 10(10), 904-912.

Bell, A. R., Wrathall, D. J., Mueller, V., Chen, J., Oppenheimer, M., Hauer, M., ... & Slangen, A. B. A. (2021). Migration towards Bangladesh coastlines projected to increase with sea-level rise through 2100. *Environmental Research Letters*, 16(2), 024045.

Discussion 6: Poverty and climate change

Hallegatte, S., & Rozenberg, J. (2017). Climate change through a poverty lens. *Nature Climate Change*, 7(4), 250-256.

Diffenbaugh, N. S., & Burke, M. (2019). Global warming has increased global economic inequality. *Proceedings of the National Academy of Sciences*, 116(20), 9808-9813.

Asfaw, S., Carraro, A., Davis, B., Handa, S., & Seidenfeld, D. (2017). Cash transfer programmes, weather shocks and household welfare: evidence from a randomised experiment in Zambia. *Journal of Development Effectiveness*, 9(4), 419-442.

Budolfson, M., Dennig, F., Errickson, F., Feindt, S., Ferranna, M., Fleurbaey, M., ... & Zuber, S. (2021). Climate action with revenue recycling has benefits for poverty, inequality and well-being. *Nature Climate Change*, 11, 1111-1116.