

**GEOG/ENEC 437**  
**SOCIAL VULNERABILITY TO CLIMATE CHANGE**  
**FALL 2018**  
**MWF 9:05-9:55AM, Hanes Art 215**

**Instructor**

Dr. Clark Gray  
Associate Professor of Geography  
Office: Carolina Hall 308  
Office Hours: Monday 1-2pm, Wednesday 11-12am, Friday 10-11am, *no appointment needed*  
<http://clarkgray.web.unc.edu/>  
[cgray@email.unc.edu](mailto:cgray@email.unc.edu)

**Graduate Research Consultant**

Varun Goel  
PhD student in Geography  
Office Hours: Carolina Hall 308 (Clark's office), Tuesday 2:30-4pm, *no appointment needed*  
<http://varungoel.web.unc.edu/>  
[varung@live.unc.edu](mailto:varung@live.unc.edu)

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

**Required Software:** Stata/IC is required and available as a 6-month rental for \$45 at  
<https://www.stata.com/order/new/edu/gradplans/student-pricing/>

**Nature and Goals of the Course**

How does climate change affect vulnerable human populations, both in the developing and developed worlds? The Intergovernmental Panel on Climate Change, among many other authors, has 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 drawing on the rapidly growing peer-reviewed literature in this area, as well as on a semester-long data analysis project in which we will use social and climate data from around the world. 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. If all goes well, we will produce publishable findings that will subsequently be submitted to an academic journal.

**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 MWF lecture/lab/discussion rotation, and in the second half this will become a MWF writing/lab/flex-day 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>
Class participation	10%	Weekly participation in discussions, peer reviews and office hours
Weekly quizzes	10%	Eight short quizzes on the lectures and readings. Lowest grade dropped.
Presentation	5%	One short presentation on the readings
Labs	35%	Thirteen weekly lab assignments done on your laptop
Writing assignments	20%	Six short writing assignments
Final project	20%	Final paper and presentation
<b>Total</b>	<b>100%</b>	

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 standard 10-point scale (e.g. >90 = A).

If you have special needs that affect your participation in this class please let me know so that I can accommodate them as best possible.

Late assignments will be docked one letter grade per class day late. If illness, a family emergency or a religious obligation will force you to miss an exam or turn in an assignment late, it is your responsibility to contact me **BEFORE** the exam or due date to make other arrangements. Otherwise I can't guarantee that a make-up will be available.

Finally, please **take the Honor Code seriously**. Academic dishonesty *will* be reported through the Honor System.

## How to Succeed in This Course

- Every class meeting will be connected to a graded component (a lab, quiz or writing assignment, as well as participation), so it's important not to miss class. If you do need to miss class, please let me know ahead of time via email or follow up as soon as possible.
- Make use of office hours to get help on assignments and any issues with the class! This is an easy way to improve your grade.

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

Date			Activity	Content	Assignments	
Wed	Aug	22	Welcome			
Fri	Aug	24	Discussion 1	Intro to climate change	Quiz 1	
Mon	Aug	27	Lecture 1	Climate and development		
Wed	Aug	29	Lab 1	Find and analyze background data		
Fri	Aug	31	Discussion 2	Vulnerability to climate change	Quiz 2	
Wed	Sept	5	Lab 2	Download survey data	Lab 1 due	
Fri	Sept	7	Discussion 3	Migration and climate change	Quiz 3	
Mon	Sept	10	Lecture 2	Intro to Stata 1		
Wed	Sept	12	Lab 3	Descriptive analysis of social data	Lab 2 due	
Fri	Sept	14	Discussion 4	Agriculture and climate change	Quiz 4	
Mon	Sept	17	Lecture 3	Intro to Stata 2		
Wed	Sept	19	Lab 4	Multivariate analysis of survey data	Lab 3 due	
Fri	Sept	21	Discussion 5	Health and climate change	Quiz 5	
Mon	Sept	24	Lecture 4	Intro to Stata 3		
Wed	Sept	26	Lab 5	Download climate data	Lab 4 due	
Fri	Sept	28	Discussion 6	Poverty and climate change	Quiz 6	
Mon	Oct	1	Lecture 5	Intro to QGIS		
Wed	Oct	3	Lab 6	Extract climate data	Lab 5 due	
Fri	Oct	5	Discussion 7	Conflict and climate change	Quiz 7	
Mon	Oct	8	Lecture 6	Intro to multivariate analysis		
Wed	Oct	10	Lab 7	Link survey and climate data	Lab 6 due	
Fri	Oct	12	<i>UNIVERSITY DAY</i>	<i>No class</i>		
Mon	Oct	15	Discussion 8	Policy responses to vulnerability	Quiz 8	
Wed	Oct	17	Lab 8	Using Zotero	Lab 7 due	
Mon	Oct	22	Writing 1	Background	Draft 1	
Wed	Oct	24	Lab 9	Descriptive analysis of climate data	Lab 8 due	
Fri	Oct	26	Flex 1	Work on lab and writing		
Mon	Oct	29	Writing 2	Methods	Draft 2, revised 1	
Wed	Oct	31	Lab 10	Climate-health analysis 1	Lab 9 due	
Fri	Nov	2	Flex 2	Work on lab and writing		
Mon	Nov	5	Writing 3	Introduction	Draft 3, revised 2	
Wed	Nov	7	Lab 11	Climate-health analysis 2	Lab 10 due	
Fri	Nov	9	Flex 3	Work on lab and writing	Lab 12 due	
Mon	Nov	12	Writing 4	Tables	Draft 4, revised 3	
Wed	Nov	14	Lab 12	Climate-health analysis 3	Lab 11 due	
Fri	Nov	16	Flex 4	Work on lab and writing		
Mon	Nov	19	Writing 5	Results	Draft 5, revised 4	
Mon	Nov	26	Writing 6	Discussion	Draft 6, revised 5	
Wed	Nov	28	Lab 13	Climate-health analysis 4		
Fri	Nov	30	Flex 5	Work on lab and writing	Lab 13 due	
Mon	Dec	3	Writing 7	Complete draft	Draft 7, revised 6	
Wed	Dec	5	Wrap-up			
<b>Sat</b>	<b>Dec</b>	<b>8</b>	<b>Final Exam 8-11am: No early finals or make-ups.</b>			Final project

## Reading List

### Discussion 1: Intro to climate change

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., Brown, S., Gosling, S.N., Gottschalk, P., Hinkel, J., Huntingford, C., Lloyd-Hughes, B., Lowe, J.A., Nicholls, R.J., Osborn, T.J., Osborne, T.M. (2016). The impacts of climate change across the globe: a multi-sectoral assessment. *Climatic Change*, 134(3), 457-474.

Jongman, B., Winsemius, H. C., Aerts, J. C., de Perez, E. C., van Aalst, M. K., Kron, W., & Ward, P. J. (2015). Declining vulnerability to river floods and the global benefits of adaptation. *Proceedings of the National Academy of Sciences*, 201414439.

### Discussion 2: Vulnerability to climate change

Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, 16(3), 268-281.

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

Bassett, T. J., & Fogelman, C. (2013). Déjà vu or something new? The adaptation concept in the climate change literature. *Geoforum*, 48, 42-53.

### Discussion 6: Migration and climate change

Missirian, A., & Schlenker, W. (2017). Asylum applications respond to temperature fluctuations. *Science*, 358(6370), 1610-1614.

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.

Hauer, M. E. (2017). Migration induced by sea-level rise could reshape the US population landscape. *Nature Climate Change*, 7: 321–325.

### Discussion 5: Agriculture and climate change

Challinor, A. J., Watson, J., Lobell, D. B., Howden, S. M., Smith, D. R., & Chhetri, N. (2014). A meta-analysis of crop yield under climate change and adaptation. *Nature Climate Change*, 4(4), 287.

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.

Hasegawa, T., Fujimori, S., Havlík, P., Valin, H., Bodirsky, B.L., Doelman, J.C., Fellmann, T., Kyle, P., Koopman, J.F., Lotze-Campen, H. & Mason-D’Croz, D. (2018). Risk of increased food insecurity under stringent global climate change mitigation policy. *Nature Climate Change*, 8(8), 699–703.

### **Discussion 3: Poverty and climate change**

Hertel, T. W., Burke, M. B., & Lobell, D. B. (2010). The poverty implications of climate-induced crop yield changes by 2030. *Global Environmental Change*, 20(4), 577-585.

Burke, M., Hsiang, S. M., & Miguel, E. (2015). Global non-linear effect of temperature on economic production. *Nature*, 527(7577), 235.

Flatø, M., Muttarak, R., & Pelsler, A. (2017). Women, weather, and woes: The triangular dynamics of female-headed households, economic vulnerability, and climate variability in South Africa. *World Development*, 90, 41-62.

### **Discussion 4: Health and climate change**

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.

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.

Caminade, C., Kovats, S., Rocklov, J., Tompkins, A.M., Morse, A.P., Colón-González, F.J., Stenlund, H., Martens, P., & Lloyd, S. J. (2014). Impact of climate change on global malaria distribution. *Proceedings of the National Academy of Sciences*, 111(9), 3286-3291.

### **Discussion 7: Conflict and climate change**

Hsiang, S. M., Burke, M., & Miguel, E. (2013). Quantifying the influence of climate on human conflict. *Science*, 341(6151), 1235-1237.

O'Loughlin, J., Linke, A. M., & Witmer, F. D. (2014). Effects of temperature and precipitation variability on the risk of violence in sub-Saharan Africa, 1980–2012. *Proceedings of the National Academy of Sciences*, 111(47), 16712-16717.

von Uexkull, N., Croicu, M., Fjelde, H., & Buhaug, H. (2016). Civil conflict sensitivity to growing-season drought. *Proceedings of the National Academy of Sciences*, 201607542.

### **Discussion 8: Policy for climate vulnerability**

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.

Bertram-Huemmer, V., & Kraehnert, K. (2017). Does index insurance help households recover from disaster? Evidence from IBLI Mongolia. *American Journal of Agricultural Economics*, 100(1), 145-171.

Randell, H. (2016). The short-term impacts of development-induced displacement on wealth and subjective well-being in the Brazilian Amazon. *World Development*, 87, 385-400.