Course Syllabus
Climate Adaptation in Cities
PLA6773-1

Instructor: Adam Freed, af2701@columbia.edu; afreed@gmail.com
Semester: Spring 2024
Day and Time: Tuesdays, 5-7 pm
Location: 300 Buell South

Bulletin Description

Cities are on the frontlines of climate change – both in terms of feeling its impacts and responding it. This course discusses the current and future climate risks facing cities, the drivers of those risks, the actions cities can take to reduce these risks (including planning, policy, design), and the strategies to scale these actions. A focus will be placed on the inequitable distribution of climate risks and impacts in the U.S., particularly on communities of color and lower-income residents, and solutions to address this.

Detailed Description

Climate change and extreme weather events pose real and significant risks for cities. However, climate change is not the only factor increasing risks for cities. The last century of urban planning and design has drastically increased our flood risks and turned cities into ovens. Urban growth driven by the rapid adoption of automobiles has led to cities with increasing dark impermeable surfaces such as parking lots, asphalt streets and rooftops with far less green space and trees. This combined with more cars and air conditioners that exhaust hot air, leads to an intensifying urban heat island effect, and created hardened flood zones where water has no where to go. Compounding this with increased development in coastal areas has not only placed cities in the crosshairs of climate change, but put the preverbal foot on the accelerator in terms of increasing risk.

To adapt to the realities of climate change, we need to change they way we build our cities – moving towards a climate-responsive urban design, centered on people. And we need to acknowledge and proactively address the policy and design decisions that have disproportionately exacerbated the impacts of climate change on communities of color and low-income residents.

This course will explore the proven, (mostly) cost-effective solutions to adapt our cities to climate change and reduce the impacts of natural hazards, including higher temperatures, more extreme heat waves, increased flooding, droughts, sea level rise, and coastal storms. Readings and lectures will focus on projects being implemented in countries around the world and the supporting policies needed to scale their adoption – including codes, regulations, and financing. Several guest lectures will provide their unique practitioner perspective on emerging issues in the field.

Course Goals

The objective of this course is to teach students how to adapt the built and natural environments of cities to reduce the risks and impacts posed by climate change and extreme weather events.

Student Learning Objectives

By the end of the course, students will have a good understanding of:

- the climate risks facing cities and the major planning and policy factors driving them
- the adaptation strategies (physical, policy and planning) that can be implemented to mitigate climate risks
- the obstacles to implementing adaptation actions and strategies to overcome them
- what it takes to scale adaptation strategies within communities, neighborhoods, and cities

Lecture Schedule and Assignment Due Dates

Week	Date	Topics	Student Presentations	Assignments
Overview				
1	1/16	Cities and Climate Change		
2	1/23	Assessing Climate Risks		
Impacts				
3	1/30	Surface Flooding *Guest Lecture: Lauren Racusin*	Surface Flooding	Response Paper Due
4	2/6	Water Scarcity	Water Scarcity	
5	2/13	Heat	Heat	
6	2/20	Costal Storms	Coastal Storms	
7	2/27	Sea Lev Rise	Sea Level Rise	
8	3/5	Housing	-	
Spring Break (March 11-15)				
Implementation				
9	3/19	Governance	Food Security	Policy Memo Due
10	3/26	Financing *Guest Lecture: Stephen Hammer*	Migration	
11	4/2	GHG Mitigation	Wildfires	
12	4/9	Scale		
13	4/16	Final Presentations		
14	4/23	Final Presentations		Final Project Due

Course Schedule and Readings

Overview

Week 1: Cities and Climate Change
January 16

- Wallace-Wells, David. "The Uninhabitable Earth". Penguin Random House, 2019. Chapters: "Cascades" (pg. 1-36) and "Disasters No Longer Natural" (pg. 78-85).
- World Economic Forum. "The Global Risks Report 2024: 19th Edition." World Economic Forum, Geneva, Switzerland, 2023. Accessible at https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf (pg. 6-17, 37-49)
- CDP "Cities at risk: dealing with the pressures of climate change" website, accessible at https://www.cdp.net/en/research/global-reports/cities-at-risk
- IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. Accessible at https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf (pg. 4-23)

Week 2: Assessing Risk
January 23

- Kimmelman, Michael. "Climate Change as a Design Problem." June 16, 2017. https://www.nytimes.com/2017/06/16/insider/climate-change-as-a-design-problem-architecture-rotterdam.html
- Mackres, E., S. Shabou, and T. Wong. "Calculating indicators from global geospatial data sets for benchmarking and tracking change in the urban environment." Technical Note. Washington, DC: World Resources Institute, 2023. Accessible at https://files.wri.org/d8/s3fs-public/2023-03/calculating-indicators-global-geospatial-data-sets-benchmarking-tracking-change-urban-environment.pdf?VersionId=.FWwLEu9EPABPnjmA2XIsu7n5EWZvJWI
- Urban Land Institute. "A Guide for Assessing Climate Change Risk." Washington, DC: Urban Land Institute, 2015. Accessible at https://uli.org/wp-content/uploads/ULI-Documents/ULI-A-Guide-for-Assessesing-Climate-Change-Risk-final.pdf
- Social Vulnerability Index, Accessible at https://svi.cdc.gov/
- Skim Climate and Equity Screening Tool, available at https://screeningtool.geoplatform.gov/en/

Supplemental Reading

- City of New York, "A Stronger, More Resilient New York," City of New York, 2013 (Climate Analysis Chapter, pages 21-36 only). Available at http://s-media.nyc.gov/agencies/sirr/SIRR_singles_Lo_res.pdf

Impacts

Week 3: Surface Flooding
January 31 – *Response Paper Due*

- Zevenbergen, Chris; Fu, Dafang; and Pathirana, Assela. “Transitioning to Sponge Cities: Challenges and Opportunities to Address Urban Water Problems in China.” Water. September 12, 2018. Accessible at https://www.researchgate.net/publication/327615116_Transitioning_to_Sponge_Cities_Challenges_and_Opportunities_to_Address_Urban_Water_Problems_in_China/fulltext/5b99c97392851c4ba8180fea/Transitioning-to-Sponge-Cities-Challenges-and-Opportunities-to-Address-Urban-Water-Problems-in-China.pdf?origin=publication_detail
- Rebuild by Design, “Toward a Rainproof NYC.” Rebuild by Design, New York, NY, July 2022. Accessible at https://rebuildbydesign.org/wp-content/uploads/2022/09/Toward-a-Rianproof-NYC-Compressed.pdf
- Kimmelman, Michael. “Rising Waters Threaten China’s Rising Cities” April 7, 2017. https://www.nytimes.com/interactive/2017/04/07/world/asia/climate-change-china.html
- Palazzo, Elisa. “Design for flooding: How cities can make room for water” The Conversation, https://theconversation.com/design-for-flooding-how-cities-can-make-room-for-water-105844
- Christopher Flavelle, Denise Lu, Veronica Penney, Nadja Popovich and John Schwartz. “New Data Reveals Hidden Flood Risk Across America” New York Times, June 29, 2020. https://www.nytimes.com/interactive/2020/06/29/climate/hidden-flood-risk-maps.html

Supplemental Reading

- Wing, O.E.J., Lehman, W., Bates, P.D. *et al.* “Inequitable patterns of US flood risk in the Anthropocene.” *Nat. Clim. Chang.* 12, 156–162 (2022). Accessible at https://www.nature.com/articles/s41558-021-01265-6

Week 4: Water Scarcity

February 6

- Wallace-Wells, David. “The Uninhabitable Earth”. Penguin Random House, 2019. Chapter: “Freshwater Drain” (pg. 86-93)
- Vartabedian, Ralph. “In a Drought, California Is Watching Water Wash Out to Sea.” The New York Times, January 13, 2023. Accessible at https://www.nytimes.com/2023/01/13/us/california-drought-storms-water-storage.html
- McDonald, R.I and D. Shemie, “Urban Water Blueprint: Mapping conservation solutions to the global water challenge.” 2014, The Nature Conservancy, Washington, D.C. Available at http://water.nature.org/waterblueprint/////about.html
- “Cities Alive: Rethinking Cities in Arid Environments” Arup. Accessible at https://www.arup.com/perspectives/publications/research/section/cities-alive-cities-in-arid-environments
- Kimmelman, Michael. “Mexico City, Parched and Sinking, Faces a Water Crisis” February 2, 2017. https://www.nytimes.com/interactive/2017/02/17/world/americas/mexico-city-sinking.html
- Plautz, Jason. “The Town the Extended Smart Growth to its Water” City Lab. April 30, 2019. https://www.bloomberg.com/news/articles/2019-04-30/the-town-that-extended-smart-growth-to-its-water
- Alexander, Christian. “Looking Back on Cape Towns Drought and Day Zero” City Lab, April 12, 2019. https://www.bloomberg.com/news/articles/2019-04-12/looking-back-on-cape-town-s-drought-and-day-zero

Week 5: Heat
February 13

- Wallace-Wells, David. “The Uninhabitable Earth” Penguin Random House, 2019. Chapter: “Heat Death” (pg. 39-48)
- First Street Foundation. “The 6th National Risk Assessment: Hazardous Heat.” First Street Foundation, Brooklyn, NY, 2022. Accessible at https://report.firststreet.org/6th-National-Risk-Assessment-Hazardous-Heat.pdf
- Buranyi, Stephen. “The Air Conditioning Trap: How Cold Air Is Heating the World.” August 29, 2019 https://www.theguardian.com/environment/2019/aug/29/the-air-conditioning-trap-how-cold-air-is-heating-the-world
- Rodas, Mauricio. “How leaning on nature can beat urban heat.” World Economic Forum, May 23, 2022. Accessible at https://www.weforum.org/agenda/2022/05/extreme-heat-cities-reduce-natural-solutions-davos22/
- Heat and Health in American Cities. National Public Radio. https://www.npr.org/series/756048128/urban-heat
- Department of Energy and Environment, “Keep Cool DC.” Government of the District of Columbia, Washington, DC, 2022. Accessible at https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/2022%20Keep%20Cool%20DC_0.pdf

Supplemental Reading

- United Nations Environment Programme. “Beating the Heat: A Sustainable Cooling Handbook for Cities.” Nairobi. 2021. Chapter 6 (pages 68-94). Accessible at https://www.unep.org/resources/report/beating-heat-sustainable-cooling-handbook-cities

Week 6: Coastal Storms
February 21

- Wallace-Wells, David. “The Uninhabitable Earth”. Penguin Random House, 2019. Chapter: “Drowning” (pg. 49-58)
- City of New York. “A Stronger, More Resilient New York.” City of New York, 2015. Accessible at https://www1.nyc.gov/site/sirr/report/report.page (Sandy and Its Impacts, Coastal Protection, and Buildings chapters)
- Kimmelman, Michael, “What Does It Mean to Save a Neighborhood?” New York Times, December 17, 2021. Accessible at https://www.nytimes.com/2021/12/02/us/hurricane-sandy-lower-manhattan-nyc.html
- City of Boston. “Coastal Flood Resilience Design Guidelines” Boston Planning and Development Agency, September 2019. http://www.bostonplans.org/getattachment/d1114318-1b95-487c-bc36-682f8594e8b2

Week 7: Sea Level Rise
February 27

- Al, Stefan. “Adapting Cities to Sea Level Rise: Green and Gray Strategies” Island Press, 2018. Chapters 1, 6-10.
- Flavelle, Christopher, “With More Storms and Rising Sea Levels, Which U.S. Cities Should Be Saved First.” The New York Times, June 19, 2019. Accessible at https://www.nytimes.com/2019/06/19/climate/with-more-storms-and-rising-seas-which-us-cities-should-be-saved-first.html

- Peter Plastrik and John Cleveland. “Can It Happen Here? Improving the Prospect for Managed Retreat by US Cities” Innovation Network for Communities. Accessible at http://lifeaftercarbon.net/wp-content/uploads/2019/03/Managed-Retreat-Report-March-2019.pdf
- C40 Cities. “Implementation Guide: How to adapt your city to sea level rise and coastal flooding.” C40 Cities, London, UK, 2022. Accessible at https://www.c40knowledgehub.org/s/article/How-to-adapt-your-city-to-sea-level-rise-and-coastal-flooding?language=en_US
- Kimmelman, Michael. “The Dutch Have Solutions to Rising Seas. The World Is Watching.” June 15, 2017. https://www.nytimes.com/interactive/2017/06/15/world/europe/climate-change-rotterdam.html

Week 8: Housing
March 5

- Satterthwaite, David, et. al. “Building Resilience to Climate Change in Informal Settlements.” One Earth. Volume 2, Issue 2. 2020. Accessible at https://www.sei.org/wp-content/uploads/2020/07/sattherthwaite-archer-one-earth-informal-settlements-2020.pdf
- Enterprise Green Communities Criteria and Certification Checklist. Accessible at https://www.greencommunitiesonline.org/checklist
- Georgetown Climate Center. “Equitable Adaptation Legal and Policy Toolkit: Resilient Affordable Housing, Anti-Displacement & Gentrification.” Accessible at https://www.georgetownclimate.org/adaptation/toolkits/equitable-adaptation-toolkit/resilient-affordable-housing-anti-displacement-gentrification.html?chapter (Sections on Planning Tools, Regulatory Tools, and Funding Tools)
- Wiltz, Teresa. “Climate Change Is Making the Affordable Housing Crunch Worse.” Pew Charitable Trust, August 30, 2019. Accessible at https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2019/08/30/climate-change-is-making-the-affordable-housing-crunch-worse
- Global Center on Adaptation. “State and Trends in Adaptation Report 2022.” GCA, 2022. Accessible at https://gca.org/wp-content/uploads/2022/11/GCA_State-and-Trends-in-Adaptation-2022_Urban-Informality.pdf (Urban Informality Chapter only)

Supplemental Reading

- Schueltz, Jenny. “Home mortgages and insurance systems encourage development in climate-risky places, and we all pay the price.” Brookings Institute. March 9, 2022. Accessible at https://www.brookings.edu/blog/the-avenue/2022/03/09/home-mortgage-and-insurance-systems-encourage-development-in-climate-risky-places-and-we-all-pay-the-price/

Implementation

Week 8: Governance
March 19 – *Policy Memo Due*

- Wallace-Wells, David. “The Uninhabitable Earth”. Penguin Random House, 2019. Chapters: “Crisis Capitalism” (pg. 158-170) and “The Church of Technology” (pg. 171-184)

- New York Regional Planning Association. “Fourth Regional Plan” 2019, RPA. (“Fix the institutions that are failing us” section). Accessible at http://fourthplan.org/action/fix-our-institutions
- Jordan, Ella. “The Delta Act: reinventing the Dutch approach to coastal management” BCG Foundation. September 2, 2019. Accessible at https://www.centreforpublicimpact.org/case-study/delta-act-reinventing-dutch-approach-coastal-management/
- Olazabal, M., & Castán Broto, V. “Institutionalisation of urban climate adaptation: three municipal experiences in Spain.” Buildings and Cities, 3(1), pp. 570 – 588. 2022. Accessible at https://storage.googleapis.com/jnl-up-j-bc-files/journals/1/articles/208/submission/proof/208-1-6340-2-10-20220810.pdf

Week 9: Finance
March 26
Guest Speaker: Stephen Hammer, New York Climate Exchange

- Peter Plastrik, Joyce Coffee, and John Cleveland. “How Cities Are Paying for Climate Resilience” Innovation Network for Communities & Climate Resilience Consulting. July 2019. Accessible at https://static1.squarespace.com/static/5736713fb654f9749a4f13d8/t/5d275d9135b62f0001df44b5/1562860947122/Playbook+1.0+How+Cities+Are+Paying+for+Climate+Resilience+July+2019.pdf
- John Cleveland, Jon Crowe, Lois DeBacker, Trine Munk, and Peter Plastrik. “Hunting for Money: U.S. Cities Need a System for Financing Climate Resilience and Adaptation” Community Development Innovation Review, October 2017. https://www.frbsf.org/community-development/publications/community-development-investment-review/2019/october/hunting-for-money-u-s-cities-need-a-system-for-financing-climate-resilience-and-adaptation/
- European Environment Agency. “Financing urban adaptation to climate change” 2017. https://www.eea.europa.eu/publications/financing-urban-adaptation-to-climate-change/download
- Morgan Richmond, Nidhi Upadhyaya, Angela Ortega Pastor. “An Analysis of Urban Climate Adaptation Finance.” Cities Climate Finance Leadership Alliance, February 2021. Accessible at https://www.climatepolicyinitiative.org/wp-content/uploads/2021/02/An-Analysis-of-Urban-Climate-Adaptation-Finance.pdf
- Preety Bhandari, Nate Warszawski, Deirdre Cogan and Rhys Gerholdt “What Is ‘Loss and Damage’ from Climate Change? 8 Key Questions, Answered.” World Resources Institute, December 14, 2022. Accessible at https://www.wri.org/insights/loss-damage-climate-change

Supplemental Reading

- Georgetown Climate Center “Green Infrastructure Finance Toolkit” (section on “How to Pay for Green Infrastructure: Funding and Financing”) Accessible at https://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/how-to-pay-for-green-infrastructure-funding-and-financing.html

Week 10: GHG Mitigation
April 2

- McKinsey Center for Business and Environment, “Focused acceleration: A strategic approach to climate action in cities to 2030.” November 2017. Accessible at https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/a-strategic-approach-to-climate-action-in-cities-focused-acceleration
- Ayyoob Sharifi,”Co-benefits and synergies between urban climate change mitigation and adaptation measures: A literature review.” Science of The Total Environment,Volume 750,2021. Accessible at https://www.sciencedirect.com/science/article/pii/S0048969720351718
- Samuel A. Markolf, Inês M. L. Azevedo, Mark Muro, and David G. Victor, “Pledges and Progress: Steps toward greenhouse gas emissions reductions in the 100 largest cities across the United States.” Brookings Institution, 2020. Accessible at https://www.brookings.edu/wp-content/uploads/2020/10/FP_20201022_ghg_pledges_v4.pdf
- Reback, Mia. “Four Lessons for Cities in the Latest IPCC Report.” Rocky Mountain Institute, April 6, 2022. Accessible at https://rmi.org/four-lessons-for-cities-in-the-latest-ipcc-report/

Week 11: Scale
April 9

- Chu, E., A. Brown, K. Michael, J. Du, S. Lwasa, and A. Mahendra. 2019. “Unlocking the Potential for Transformative Climate Adaptation in Cities.” Background Paper prepared for the Global Commission on Adaptation, Washington, DC and Rotterdam. Accessible at https://wrirosscities.org/research/publication/unlocking-potential-transformative-climate-adaptation-cities
- Powell, Martin, ed. “Climate City.” Wiley-Blackwell, London, UK, 2022. (Chapter 24, The Adapted City) – Reading to be posted on Canvas
- McKinsey & Co and C40 Cities, “Focused Adaptation: A Strategic Approach to Climate Adaptation in Cities.” McKinsey and Company/C40 Cities Climate Leadership Group, July 2021. Accessible at https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/how%20cities%20can%20adapt%20to%20climate%20change/focused-adaptation-a-strategic-approach-to-climate-adaptation-in-cities-vf.pdf
- Copenhagen Adaptation Plan - https://en.klimatilpasning.dk/media/568851/copenhagen_adaption_plan.pdf (pg. 3-12, 62-89)
- The Economist. “Resilient Cities Index.” Economist Intelligence Unit, London, UK. 2023. Accessible at https://impact.economist.com/projects/resilient-cities/wp-content/uploads/2023/10/Resilient-Cities_Report.pdf

Course Requirements

Texts

- Wallace-Wells, David. “The Unihabitable Earth”. Penguin Random House, 2019.
- Al, Stefan. “Adapting Cities to Sea Level Rise: Green and Gray Strategies” Island Press, 2018.
- Readings placed on Canvas

Projects and Assignments

In-class presentation – During the course of the semester, each student will choose a topic and make a 10-minute in-class presentation (on the date identified in the syllabus for each topic) on how a city is adapting to the selected climate risk/impact. No more than 2 students can pick the same topic and each student must chose a different city with approval by the professor. Detailed instructions on the content and format of the presentation will be provided in class.

Response paper – Students will write a 2-3 page paper outlining their perspective on the top non-climate urban planning issues (e.g., population growth, urban form) increasing climate risks for cities. Their arguments should be supported by evidence and tied to experiences in at least four cities.

Policy memo – Students will write a 2-3 page memo outlining how can zoning be used to mitigate surface flooding or heat risks. Students should cite zoning policies adopted in other cities as examples and support their policy proposals with evidence as to why they are needed and their benefits.

Final project - Students will work together in groups to develop an adaptation program proposal for a global city (to be approved by the professor). The proposed program must address at least two of the city's biggest climate risks and have a funding or policy mechanism(s) identified for implementation. A key criterion for grading will be the scale at which the program can be delivered. Students will:

- make a 15-20 minute in-class powerpoint presentation, followed by Q&A, and
- complete an 8-10 page paper by the end of the semester.

Detailed instructions on the final project will be provided in class. Groups and topics will be selected by Week 3.

Assessment and Grades

- 20% Class attendance and participation
- 15% In-class presentation
- 15% Response paper
- 15% Policy memo
- 35% Final project

Course Policies

Late assignments will be docked one grade (e.g., from an A to an A-) for each day they are late, unless previous notice is given to the professor and approval for the delay is received.

School Policies

Academic Integrity - Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that

individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times. SCE holds each member of its community responsible for understanding and abiding by the SCE Academic Integrity and Community Standards posted at http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards.

You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings. In addition, the first person in the class to read this and email me af2701@columbia.edu in response to this prompt will receive a prize.

Accessibility - Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: http://health.columbia.edu/services/ods/support.
In addition, I want you to succeed in this course. Contact disability@columbia.edu for learning accommodations.