

## **ENVR-119 Green Buildings, Urban Resilience and Sustainability in Communities**

Fall 2019, Tuesdays, 7:20-9:20 p.m. U.S. Eastern Time Zone

Location: Online Synchronous Zoom Webinar

Web Page: <https://canvas.harvard.edu/courses/63212>

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### **Teaching Assistants & Office Hours**

E-mail messages responded to within 24 hours.

Day/Time TA Email

//TBD//

### **Course Description**

The built environment of our communities creates energy and material utilization patterns and subsequent ecological effects. Climate change challenges existing buildings and infrastructure which has led to conversations about resilience. Building design and location are a critical determinant of health, comfort, and productivity for occupants.

How do our communities, enterprises, and institutions manage the complexity of these interactions? What intentions result in what amount of flourishing and thriving in the urban realm? How do we measure our effects on social outcomes, on ecology, or on health?

This course introduces students to the principles of sustainability and resilience in our communities with a focus on how systems dynamics can be articulated and then managed. We use the framework of social equity and the UN sustainable development goals to explore how urban design and governance can embrace priorities for human wellbeing.

Students become familiar with international standards for sustainable design, operations, and management of buildings more favorable to the integrity of communities such as US Green Building Council's LEED certifications, Building Research Establishment Environmental Assessment Method (BREEAM), WELL Building Standard, the Living Building Challenge, and other concepts related to sustainable

design. We will ensure hands-on engagement with local policy protocols and meet practitioners who have participated in the advancement of best practice in sustainability and resilience. Relevant topics are addressed through lectures, readings, case studies, and optional site visits to exemplary green buildings on the Harvard campus and in nearby Cambridge.

### **Learning Outcomes**

1. Students will know the basic frameworks leading to sustainability and resilience in the built environment
2. Participants will gain understanding of the real estate development process and how specific projects are conceived, designed, and delivered, and how in the aggregate, policies related to specific buildings result in the overall built fabric and urban design of a community
3. Students will develop a deeper understanding of the interactions of buildings on social equity, health, and resilience of communities through time
4. Through a student-chosen ongoing course-long investigation, students will become familiar with critique and advocacy of and for urban policy enhancing the built environment

### **Course Materials**

As the topic is vast and we are focused on trends and the leading edge of policy and design science, there is no required text but there are required readings for each class session. All readings or other materials will be posted on the Canvas course site at least one week prior to when they are due and you should complete the readings before the class in which it will be discussed. Additional optional relevant reference materials will also be made available. We base the instruction with real-world policy documents, sustainability standards, and scientific research on the built environment. Students are welcome to suggest and share additional relevant materials, of course.

### **Graduate and Undergraduate Student Assignments and Evaluation**

Grades are assigned based on performance.

Assignment	Due Date	Undergraduate credit	Graduate credit
Class participation	Weekly	10%	10%
Pre-course self-intro Essay	Sept 3	10%	10%
Weekly participation/check-in quizzes			

Online Weekly before class	15%	15%
Homework #1: How would you make your favorite building greener?		
Sept. 17th	10%	10%
Homework #2: Is your community resilient?		
Oct. 29th	10%	10%
Essay I: How would you improve the policy of your choice?		
Nov. 26th	20%	20%
Essay II: How could your community ensure sustainability into the future?		
Dec. 19th	25%	
Term paper: see above, for graduate credit		
Dec. 19th		25%
Final Presentations: The Governor wants your proposal (pitches)		
Dec. 12 & Dec. 19		

### **Penalties for Late Submissions**

Assignments will be penalized one letter grade for tardiness beyond due date and an additional letter grade for each additional week late.

### **Academic Integrity**

You are responsible for understanding Harvard Extension School policies on academic integrity ([www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity](http://www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity)) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity. To support your learning about academic citation rules, please visit the Harvard Extension School Tips to Avoid Plagiarism ([www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism](http://www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism)), where you will find links to the Harvard Guide to Using Sources and two free online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.

### **Accessibility and Student Services**

The Extension School is committed to providing an accessible academic community. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. For more information, please visit:  
<https://www.extension.harvard.edu/resources-policies/accessibility-student-services>

### **Class Schedule & Assignment Due Dates**

### **Sept 3 Introductions & Overview**

The instructor will introduce himself and outline the course. Selected student intros will be shared. Topics to be included in the presentation are the fundamentals for sustainability in communities: systems thinking, leadership & engagement, real estate economics, and ecological design. We will review the “global problematique” that sustainability in the built environment seeks to address.

Readings: The Regenerative Practitioner Field Guide, J. Plaut et al:

[https://www.clearabundance.org/wp-content/uploads/2018/07/Regenerative-Practitioner-Field-Guide\\_2018\\_7.26.pdf](https://www.clearabundance.org/wp-content/uploads/2018/07/Regenerative-Practitioner-Field-Guide_2018_7.26.pdf)

IPCC SR15 <https://www.ipcc.ch/sr15/>

UN Environment 2018 Annual Report

<https://www.unenvironment.org/annualreport/2018/index.php#interstitial>

Harvard Green Building Standards <https://green.harvard.edu/topics/green-buildings>

### **Sept 10 The Ecosystem and the Built Environment**

How does the built environment interact with the ecosystem around it? We will explore impacts and also ecosystem services to society. Then, what about the Great Destabilization of the climate crisis? How are jurisdictions responding to major changes in their encompassing ecosystem and developing new requirements and protocols for the building industry.

Readings: Environmental Effects of Buildings at Environmental Science & Technology:

<https://pubs.acs.org/doi/pdf/10.1021/acs.est.5b01735>

IPCC AR5 - Chapter on Buildings:

[https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc\\_wg3\\_ar5\\_chapter9.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter9.pdf)

Architecture 2030 Programs:

[https://architecture2030.org/buildings\\_problem\\_why/](https://architecture2030.org/buildings_problem_why/)

### **Sept 17 What are Buildings, Construction and Operation**

Why do we make buildings? Let's look at what it entails. There are huge energy and materials implications in the supply chains that result in occupiable space. We'll explore the design and construction process, and then the operations lifetime of a building. What do architects do? How are buildings engineered? What is BIM? What is commissioning and continuous commissioning?

Readings: Historical Development of the Building Enclosure:

<https://www.buildingscience.com/documents/digests/bsd-007-historical-development-of-the-building-enclosure>

History of Construction:

[http://psecivil.weebly.com/uploads/2/4/3/2/24323724/history\\_of\\_construction.pdf](http://psecivil.weebly.com/uploads/2/4/3/2/24323724/history_of_construction.pdf)

Architects and Engineers together:

<https://www.autodesk.com/redshift/architecture-vs-engineering/>

Commissioning Buildings: [https://search-proquest-com.ezp-prod1.hul.harvard.edu/docview/1494747814?accountid=11311&rfr\\_id=info%3Axri%2Fsid%3Aprimo](https://search-proquest-com.ezp-prod1.hul.harvard.edu/docview/1494747814?accountid=11311&rfr_id=info%3Axri%2Fsid%3Aprimo) and:  
[https://search-proquest-com.ezp-prod1.hul.harvard.edu/docview/1738811708?accountid=11311&rfr\\_id=info%3Axri%2Fsid%3Aprimo](https://search-proquest-com.ezp-prod1.hul.harvard.edu/docview/1738811708?accountid=11311&rfr_id=info%3Axri%2Fsid%3Aprimo)

### **Sept 24      The Basics of Green Buildings**

Here we are with the title role in the course: our favorite type of buildings! This is an opportunity to ensure everyone has a firm understanding of the basics that all green building professionals should know: energy, air quality, materials, water, and site. LEED v4.1, the global standard for corporate real estate, gets it moment on the stage. And the most recent focus of our industry: the health effects of buildings.

Readings:      LEED v4.1 [download from]: <https://new.usgbc.org/leed-v41>  
                  Nine Foundations for Health: <https://9foundations.forhealth.org/>  
                  The Health Effects of Buildings:  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920980/>

### **Oct 1      The Living Future**

Getting aspirational, we'll take a deep dive into the Living Building Challenge and the idea of systemic impacts of buildings on occupants, builders, and the producers of building components. What if a building were like a tree - rooted in a place, providing shelter to living creatures, creating no pollution or waste, and only needing sunlight, ambient temperatures, and the water that arrives by nature? The International Living Future Institute (ILFI) has developed a suite of tools and processes to channel real estate development into a regenerative system. Could this scale? Could this scale fast enough to make a difference in the climate crisis?

Readings:      The Living Building Challenge Standard [downloadable at]: <https://living-future.org/lbc/resources/>  
                  Jason McLennan interview(s): <http://www.cladglobal.com/architecture-design-features?codeid=33129&source=home> and <https://www.yesmagazine.org/issues/the-yes-breakthrough-15/jason-f.-mclennan-bringing-buildings-to-life>  
                  The Bullitt Center case study: <http://www.bullittcenter.org/2015/08/06/case-study-living-proof/>

### **Oct 8      The Real Estate Development Process**

There is a lot of wonderful potential in green buildings, yet they may be less than 3% of the US commercial real estate stock, and there are only a few dozen Living Buildings in the world. The market seems not to care. Why does anyone put effort into making any building? How does real estate happen and how can that be influenced to address environmental and social challenges? Let's focus on the basics of development: envisioning the future, following the money, site acquisition, design, entitlements, approvals, construction and operation. We will

dig into the achievement of one developer that has seriously embraced the benefits of green buildings: Boston Properties.

Readings: How Real Estate Developers Think, by Peter H. Brown: <https://muse-jhu-edu.ezp-prod1.hul.harvard.edu/chapter/1507797>

Poorvu's Real Estate Game, review by Chad Carson: <https://www.coachcarson.com/the-real-estate-game-william-poorvu/>

A Citizen's Guide to Development Review Under Article 80 of the Boston Zoning Code: <http://www.bostonplans.org/getattachment/610ddaf1-a547-4eb9-bb22-4d0938f354f6>

Boston Properties Sustainability Report 2018: <http://www.bostonproperties.com/pages/sustainability>

### **Oct 15 Drivers of Change in Real Estate: ESG and SDGs**

While proponents extol the virtues of green buildings for long term community and ecosystem benefit, developers that finance buildings and ultimately cities are driven by the promise of return on investment. What is driving change such that in the past 10 years we have seen the creation of millions of square feet of green buildings? Let's look at marketing, community sanction (regulations), and financial risk management. What is "environmental, social, and governance" (ESG) in regards to real estate? How did GRESB drive change in the real estate industry? How does pursuing return on investment connect with building goodwill and prosperity in our communities at large?

Readings: The Business Case for ESG in Real Estate: <https://gresb.com/business-case-esg-real-estate/>

The Rise of ESG in Real Estate: <http://www.statestreet.com/content/dam/statestreet/documents/Articles/TheRiseofESGinRealEstate.pdf>

UNEP Finance Initiative: Global ESG Real Estate Survey Results: <https://www.unepfi.org/wordpress/wp-content/uploads/2019/03/Global-ESG-Real-Estate-Investment-Survey-Results.pdf>

GRESB 2018 Real Estate Assessment: <https://gresb.com/gresb-real-estate-assessment/>

Task Force on Climate Related Financial Disclosure (TCFD) June 2019 Update: <https://www.fsb-tcfd.org/publications/tcfd-2019-status-report/#>

### **Oct 22 Sustainability in Communities Case Studies**

In our economy, there is no way to invest, for a return, in communities in general. Cities are the aggregation of discrete investments in buildings and infrastructure, whether private or public. Even while building the "greenest" individual structures, how does that result in sustainability for an entire community? Can we evaluate sustainability in a community in a way similar to LEED? What does ecological footprinting help us understand? What does the Living Community Challenge offer as guidance? Let's look at some places that have brought it all together - through space and time.

Readings: Breaking New Ground: Promoting Environmental and Energy Programs in Local Government, by Svava, Read, & Moulder:

[http://www.businessofgovernment.org/sites/default/files/Promoting%20Environmental%20and%20Energy%20Programs%20in%20Local%20Government\\_0.pdf](http://www.businessofgovernment.org/sites/default/files/Promoting%20Environmental%20and%20Energy%20Programs%20in%20Local%20Government_0.pdf)

What does a Sustainable Community Look Like? By Kaid Benfield:

<https://www.theatlantic.com/national/archive/2011/03/what-does-a-sustainable-community-actually-look-like/72376/>

3 Big Ideas to Achieve Sustainable Cities and Communities (World Bank):

<https://www.worldbank.org/en/news/immersive-story/2018/01/31/3-big-ideas-to-achieve-sustainable-cities-and-communities>

The Ecological Footprint: <https://www.footprintnetwork.org/our-work/ecological-footprint/>

The Living Community Challenge: <https://living-future.org/lcc/basics/>

### **Oct 29 What is Urban Planning for Sustainability?**

How then are the best ideas for sustainable communities brought intentionally into an urban system? Urban planning has taken on a larger presence and role in our communities as the challenges have helped more people see that a coordinated response, a planned, anticipatory response, is more efficient and less costly than an emergency response. Yet old models of command-and-control are challenged by newer perceptions of community-based authority and social equity.

Readings: Urban Sustainability Directors Network, best practices:

<https://www.usdn.org/public/page/137/USDN-High-Impact-Practices>

What counts as real city planning? By Deland Chan:

<https://www.citylab.com/equity/2018/03/what-counts-as-real-city-planning/556082/>

Climate Change and the City, by J. Carter, G. Cavan, et. al:

<https://www.sciencedirect.com/science/article/pii/S0305900614000397>

A New Framework for Financial Stability, by S. Kavanagh:

<https://icma.org/articles/pm-magazine/pm-article-new-framework-financial-sustainability>

Don't forget about infrastructure: <https://sustainableinfrastructure.org/>

### **Nov 5 Defining and Pursuing Resilience**

The major re-framing that connects ecological responsibility, community vitality, and climate change is the concept of resilience. Can communities manage threats that are at times acute, and yet generally chronic? Will the real estate industry find a way to address economic resilience as an undergirding dimension of sustainability writ large? We'll explore ecological resilience and physical resilience, and then social and economic resilience. Can we measure resilience with a system like RELi? How can communities be designed and managed to maximize resilience and minimize disruption. While buildings can be created to be passively survivable, there is little in a community that can be passive in the event of a major disruption. We'll look at some case studies including Hurricane Sandy, Miami-Dade Water & Sewage, and Boston's Living with Water program.

Readings: Resilient Boston: [https://www.boston.gov/sites/default/files/document-file-07-2017/resilient\\_boston.pdf](https://www.boston.gov/sites/default/files/document-file-07-2017/resilient_boston.pdf)

100 Resilient Cities: [https://www.boston.gov/sites/default/files/document-file-07-2017/resilient\\_boston.pdf](https://www.boston.gov/sites/default/files/document-file-07-2017/resilient_boston.pdf)

The RELi 2.0 Resilient Design Rating System:  
<https://www.usgbc.org/resources/reli-20-rating-guidelines-resilient-design-and-construction>

## **Nov 12 Systems Change and Advocacy**

Now that we have explored the fundamentals of buildings and the ecosystem, and are anticipating the challenge of climate crisis and global environmental destabilization, what are we going to do about it? What are the systems that resist change, and what are the forces that can respond, evolve and improve systems to respond to the challenge? Industry entities are coming together to identify the material risk to real estate and community infrastructure assets and are organizing for change. Conversely, grassroots entities are working to We'll look at how these parties are driving change.

Readings: NYC Climate Mobilization Act: <https://www.smartcitiesdive.com/news/new-york-city-climate-mobilization-act/553134/>  
<https://council.nyc.gov/press/2019/04/18/1730/>  
<https://www.brightpower.com/nycs-climate-mobilization-act-what-building-owners-need-to-know/>

ClimateWise Transition Risk Framework:  
<https://www.cisl.cam.ac.uk/resources/publication-pdfs/cisl-climate-wise-transition-risk-framework-report.pdf>

## **Nov 19 Sustainable Communities Worldwide**

As we have explored systems that facilitate the understanding and pursuit of sustainability and resilience, it might be useful to explore places that seem to have gotten it right. Let's start with our own backyard: could you say Cambridge is a sustainable city? How is it expressed? How is it encouraged? What are other places that can claim the mantle and provide an example for others on how to make it happen?

Readings: City of Cambridge - Envision Cambridge Plan: <http://envision.cambridgema.gov/>  
City of Amsterdam: Sustainability and Energy Policy:  
<https://www.amsterdam.nl/en/policy/sustainability/>

Towards a Sustainable Pittsburgh by F. Fernandez-Monge:  
<https://www.dropbox.com/s/ihj16rowjycouqs/Pittsburgh%20-%20Strategic%20Planification%20for%20Sustainable%20Cities.pdf?dl=0>

Curitiba: The Greenest City on Earth, by B. Barth:  
<https://theecologist.org/2014/mar/15/curitiba-greenest-city-earth>

## **Nov 26 Green Buildings Future**



What is the urgent and brilliant future of sustainability in the built environment? How would you advocate for “more green buildings” generally and in your community in particular? How would you leverage advances in technology and design to bring sustainability and resilience forward? Let’s look at the Passive House movement, biomimicry in buildings, and circularity in the construction industry. Will smart buildings be green buildings? What are the cultural and economic forces that can be harnessed to respond to the global environmental challenge?

Readings: Beyond Sustainability in the Built Environment, by P.G. Luscuere et al:

<https://repository.tudelft.nl/islandora/object/uuid:06605f4a-d7e9-4c4b-adc1-bd82c8bd0904?collection=research>

Intelligent Buildings: the Key to Achieving Total Sustainability in the Built Environment:

[http://www.ppml.url.tw/EPPM\\_Journal/volumns/04\\_01\\_January\\_2014/ID\\_064\\_4\\_1\\_2\\_16.pdf](http://www.ppml.url.tw/EPPM_Journal/volumns/04_01_January_2014/ID_064_4_1_2_16.pdf)

Contextualizing the circular economy in building design, by Richard Boyd:

<https://www.greenbiz.com/article/contextualizing-circular-economy-building-design>

How biomimicry could shape the cities of the future, by Linda Poon:

<https://www.citylab.com/life/2016/09/a-skyscraper-made-of-bones-how-biomimicry-could-shape-the-cities-of-the-future/497969/>

Passive House by G-L Ionescu:

<https://content.sciendo.com/view/journals/jaes/7/1/article-p23.xml>

### **Dec 3 Leadership & Excellence, Transformation, and Regeneration**

As practitioners, we have all the tools, processes, and best practices to manifest sustainability and resilience in our communities. Yet we still see massive amounts of squandered energy and water, wasted materials and de-vitalizing urban design. What is going wrong? Isn’t the climate crisis obvious? Let’s explore how competing priorities, legacy decision-making processes and implicit bias can limit the adaptive capacity of our governance structures and market signals.

Readings:

The Regenerative Mindset And Five Essential Capabilities For Practitioners, By Josette M. Plaut, Emily Amedée: <https://www.thesolutionsjournal.com/article/regenerative-mindset-five-essential-capabilities-practitioners/>

The Regenerates (video): <https://vimeo.com/120837455>

The Business Case for Green Building (World Green Building Council):

[https://www.worldgbc.org/sites/default/files/Business\\_Case\\_For\\_Green\\_Building\\_Report\\_WEB\\_2013-04-11-2.pdf](https://www.worldgbc.org/sites/default/files/Business_Case_For_Green_Building_Report_WEB_2013-04-11-2.pdf)

Purpose & Profit, a letter to CEOs, by Larry Fink:

<https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter>

Why a vision is important, by Chris Maser: <http://www.chrismaser.com/vis-impo.htm>

Dec 10          Presentations

Dec 17          Presentations and Conclusion

After hearing from each other regarding leadership for sustainability in community, we will share highlights from the course and describe our optimism for facilitating change for a sustainable and resilient, regenerative even, built environment for our communities as we move on from the course.

Thank you for considering this course and being a part of the movement to transform our built environment to enable our communities to thrive.