COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

Climate & Sustainability Risk Assessment

SUSTAINABILITY MANAGEMENT   CAPSTONE SECTION 006

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Our Team

Ashleigh Conroy-Zugel
Project Manager & Frameworks Team

Anusha Jain
Deputy Project Manager & Peer Benchmark Team

Noveeena Padala
Deputy Project Manager & Financial Risk Team

DeAundr'e Newsome
Regulatory, Policy, Governance Team & Presenter

Sharnell O'Neal
Regulatory, Policy, Governance Team & Presenter

Mathavee Soysingtong
Social Risk Team

Wenhao Zhao
Physical & Environmental Team

Prayogo Wahyudi
Financial Risk Team

Nigharika (Nickie) Senthil Kumar
Frameworks Team

Faizal Lihawa
Benchmark Team

Risa Fugetsu
Climate Risk Assessment Team

Holden Shikany
Benchmark Team & Presenter

Alec Lucas
Reputational Risk Team & Editor

Camila Quiroga
Reputational Risk Team & Editor

Du'Bois A'Keen
Faculty Advisor

Acknowledgements

We are deeply grateful to the Columbia University Sustainability Management professors and staff whose insights and experiences have shaped our journey in the program. They have encouraged us to think more critically, challenge assumptions, and work collectively to address the pressing sustainability challenges of our time.

We would also like to thank our Capstone Advisor, Du'Bois A'Keen, for his guidance and support throughout the semester. His mentorship and sustainability expertise have been invaluable to our team.

This report would not have been possible without the support and guidance of Columbia University's Office of Sustainability team, including Daniel Allalemdjian, Samreen Afzal, and Jessica Prata. Thank you for giving us the opportunity to work with your team, explore the university's sustainability and climate-related risks, and learn from the process. We believe through our collaboration, we have been able to provide Columbia University with a sound set of recommendations that blend financial strategy with meaningful, long-term sustainability impact.

Finally, we are also extremely thankful to the sustainability teams at Johns Hopkins University, New York University, Yale University, Massachusetts Institute of Technology, Harvard University, and the University of Pennsylvania for participating in our peer interviews and contributing to our benchmarking exercise. We also appreciate the Columbia faculty members we interviewed, Michael Gerrard and Satyajit Bose, for sharing their expertise and perspectives.

1. Executive Summary

The Integrative Capstone Section 006 of the Sustainability Management Graduate Program within Columbia University's School of Professional Studies conducted a detailed climate and sustainability risk assessment, along with a peer benchmarking for Columbia University's Office of Sustainability.

This capstone began by reviewing Columbia University's first sustainability plan, called 'Plan 2030' (Columbia University, 2021), which is a ten-year plan outlining its environmental sustainability goals to achieve Net Zero emissions by 2050. A comprehensive benchmarking evaluation comparing Columbia University to its top 17 U.S. university peers was conducted. A scorecard based on 56 environmental, social, and governance indicators was built to show where each school and across the industry there are strengths and weaknesses.

Building upon Plan 2030 and the gaps presented in the benchmarking, the team identified several different categories to evaluate risks facing Columbia University, including financial and regulatory challenges, reputational damage, physical threats, and climate change impacts. The team leveraged established risk assessment methodologies and analyzed open source data to determine risk probabilities and gauge the severity, impact, and duration. This risk assessment draws from numerous climate science tools and datasets provided by different organizations, including, but not limited to, as the New York City Panel on Climate Change (NPCC4), Federal Emergency Management Agency (FEMA), and National Oceanic and Atmospheric Administration (NOAA).

This comparison not only highlights industry-wide sustainability trends and disclosure gaps, but also indicates the leading sustainability-focused and proactive institutions, including Stanford University, the University of Pennsylvania, and the University of California, Berkeley.

The team leveraged established risk assessment methodologies and analyzed open source data to determine risk probabilities and gauge the severity, impact, and duration. This risk assessment draws from numerous climate science tools and datasets provided by different organizations, including, but not limited to, the New York City Panel on Climate Change (NPCC4), Federal Emergency Management Agency (FEMA), and National Oceanic and Atmospheric Administration (NOAA). The analysis of this information was driven by environmental, social, and governance risk frameworks derived primarily from the Task Force on Climate-Related Financial Disclosures (TCFD), International Organization for Standardization (ISO) risk principles, New York University's Return on Sustainability Investment (ROSI), and the Sustainability Accounting Standards Board (SASB) Education Industry Standards.

In combination with desktop research, peer benchmarking, and database analysis, the team developed a financial risk register to consolidate and quantify Columbia's most material risks: social, regulatory, reputational, physical and climate. The analysis highlights that Columbia University needs to enhance its climate data integration and develop better systems for organizational transparency and risk management.

In combination with desktop research, peer benchmarking, and database analysis, the team developed a financial risk register to consolidate and quantify Columbia's most material risks: social, regulatory, reputational, and climate across the short, medium, and long term. The analysis highlights that Columbia University needs to enhance its climate data integration and develop better systems for organizational transparency and risk management.

As a result, the report provides detailed strategic recommendations to help Columbia University's Office of Sustainability in the near term, medium term and long term. These recommendations cover a wide ground of risk management, ranging from peer benchmarking and regulations to food systems and governance structures. All of these recommendations will be strengthened by filling the current gaps with data collection and support annual sustainability reporting and disclosures.

2. Introduction

With accelerating climate change impacts, shifting public awareness, and evolving global regulations, climate agencies are documenting rising occurrences of severe weather events such as heatwaves, heavy rainfall, flooding, and related impacts on energy consumption. These risks lead to major institutional and operational challenges that result in financial strain and reputational damage.

For the purpose of this analysis, sustainability is defined as “Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations”, based on the principles of EPA (2025).

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The client for this capstone project is Columbia University’s Office of Sustainability. The client aims to lead efforts to promote a culture that values and protects the environment and the community while tackling sustainability-related risks and impacts. The goal of this capstone is to develop an integrated Climate and Sustainability Risk Assessment and peer-informed benchmark to evaluate the University’s most material exposures across physical, social, regulatory, financial, and reputational dimensions. The client’s team was formed in 2006 to manage environmental programs. One of its early achievements includes the Manhattanville Campus Plan, which was the first project in New York City to earn the LEED Neighborhood Development pilot as well as the first project to receive the LEED-ND Platinum certification nationally (2012) (U.S. Green Building Council, 2012; Columbia University Record, 2012).

These initial sustainability initiatives demonstrate Columbia University's commitment to sustainable campus development and infrastructure planning, which continues to hold true today, almost a decade later, as highlighted by their building electrification efforts.

Columbia University began documenting the progress of its sustainability initiatives through annual progress reports starting in 2017. Then in 2021, it published its first Sustainability roadmap, in alignment with the Paris Agreement and science-based targets, also known as 'Plan 2030'. This plan established environmental targets for 6 commitment areas: Campus Energy, Sustainable Transportation, Responsible Design & Construction, Responsible Materials Management, Water Conservation & Capture, and Culture Change & Campus as a Living Lab. This includes a Net Zero target by the year 2050, along with interim targets along the way at 2025, 2030, and 2035.

The Office of Sustainability

Jessica Prata
AVP, Office of Sustainability

Daniel Allalemdjian
Director of Sustainability and Transportation

Samreen Afzal
Director, Sustainability Analytics

As per the latest progress report from April 2025, Columbia University has only reduced 10% of their total emissions and 18% reduction in fleet emissions (w.r.t. baseline year 2019). While Columbia University uses grid electricity (which is not emission-free), it purchases carbon offsets to cancel out its share of emissions from the grid, which means its electricity consumption is essentially zero emissions.

In light of Columbia University's work thus far, the capstone team had been tasked with conducting a detailed climate and sustainability risk assessment, along with a peer benchmarking for the Office of Sustainability, in a 100-day timeline. The risk assessment draws on climate science datasets, ESG frameworks, and financial valuation tools from an educational industry perspective to develop an analytical risk register. Despite Columbia University's investments in the healthcare and real estate sectors, they were not considered for the scope of this analysis due to timeline constraints. To ensure comparability, consistency, and objectivity, only publicly available data was used for the team's analysis of Columbia University and all its peers. Additionally, eight expert interviews with Ivy League and non-Ivy representatives, as well as subject matter expert Faculty at Columbia University, were conducted to discuss analytical findings, key strengths and weaknesses, as well as challenges faced in risk mitigation.

This multi-layered methodology allowed the team to create a harmonized risk profile that supports both strategic planning in alignment with Plan 2030 and comparative evaluation to learn from peer industry standards, as well as their strengths and weaknesses.

PLAN 2030

Interim Targets

15%	42%	63%	100%
2025	2030	2035	2050

3 Progress on Plan 2030

3. Progress on Plan 2030

Against the backdrop of escalating climate-related risks and ambitious institutional commitments, Columbia University's progress under Plan 2030 represents a critical lens through which its current risk exposure, existing gaps, and mitigation capacity can be evaluated. While the University has established a comprehensive roadmap, the pace and composition of implementation to date have direct implications on progress. Consequently, assessing the progress on Plan 2030 is essential not only to measure performance against stated goals, but also to understand how effectively Columbia University is managing its most material climate and sustainability risks.

3.1 Clean Energy and Low Carbon Infrastructure

Columbia University has taken important steps toward renewable energy adoption. The University recently agreed to support a large community solar project in Croton-on-Hudson through Sol Systems, a project that is expected to deliver clean electricity to the regional grid and help reduce greenhouse gas emissions (Sol Systems, 2024). In addition, Columbia University received a state permit in 2023 to drill a deep geothermal test well, an early but meaningful move toward exploring low-carbon heating systems (Business Wire, 2023; ThinkGeoEnergy, 2023). These initiatives signal progress toward cleaner campus operations, particularly as cooling demand increases with hotter summers.

Upgrades to building systems also play an important role. For instance, also in 2023, Columbia University Irving Medical Center (CUIMC) completed LED lighting retrofits that avoided 352 metric tons of CO_2 emissions, demonstrating how incremental improvements can yield measurable benefits (Sustainable Columbia, n.d.-g). These improvements highlight the role of scalable, campus-wide efficiency measures in translating Plan 2030 commitments into measurable emissions reduction outcomes.

3.2 Sustainable Building Design and Green Infrastructure

In addition to upgrading building components, such as LED lights, Columbia University has steadily broadened its commitments to sustainable building design, particularly in its long-term approach to development in Manhattanville.

As referenced in the introduction, Columbia University's Manhattanville Campus Plan was the first pilot nationally to receive LEED-ND Platinum certification (2012) (U.S. Green Building Council, 2012; Columbia University Record, 2012). To date, Columbia University has 14 certified LEED Gold buildings, individual LEED Gold-certified floors in the Rosenfield Building at the Mailman School of Public Health, a certified LEED Silver building, and individual LEED Gold-certified floors in the Studebaker Building (Sustainable Columbia, 2022).

Furthermore, multiple buildings across the campus system incorporate vegetated roof surfaces that reduce heat absorption, improve building insulation, and help manage stormwater more effectively during peak precipitation (Sustainable Columbia, n.d.-f). In 2025, Columbia University students completed a complete tree census that mapped canopy distribution across Morningside Heights and Manhattanville, providing new data to guide shade expansion, biodiversity planning, and heat-risk reduction strategies (Elkins, 2025). These efforts show how campus planning, student research, and green infrastructure investment reinforce one another and help build resilience.

Note. Columbia Residential. (2025, August 29) - 32 fully renovated apartments, all-electric building resulted from 18-month renovation project

3.3 Transportation and Electrification

In addition to its green building efforts, Columbia University is also expanding electric mobility options through gradual electrification of campus fleet vehicles and electric vehicle (EV) charging stations (Columbia University Transportation, n.d.). As NYC accelerates electrification of its transportation ecosystem, Columbia University's investments in EV infrastructure will become increasingly important and are a core aspect of its Plan 2030.

Currently, about 40% of Columbia University's fleet is already electric (including hybrid fleet), marking a significant shift toward clean transportation options (Sustainable Columbia, n.d.-e). This progress is supported by renovations in the parking areas, such as installation of fast charging stations (Level 2 and 3 chargers). Columbia University also introduced a clear replacement rule for fleet retirement: any department vehicle that retires must be replaced with hybrid or electric models through 2027, depending on market availability (Sustainable Columbia, n.d.-i).

Columbia University is also studying fleet behavior through its "Campus as a Lab" initiative, which examines vehicle use patterns, charging needs, and operational constraints to guide future planning (Sustainable Columbia, n.d.-e). This policy is an important step as it creates a predictable transition schedule and prevents new internal combustion engine vehicles from entering the fleet.

Even with these promising advances, the long-term strategy for transportation electrification would benefit from more transparent milestones. Clear reporting on year-to-year fleet composition, charging infrastructure, and other projected expansions would help the university community understand how these changes support Plan 2030.

3.4 Waste Reduction and Circular Resource Use

Columbia University's approach to waste reduction reflects a mix of localized leadership and institution-wide initiatives, including "Know Where to Throw" campaigns and expanded composting, which demonstrate institutional commitment. However, progress and outcomes are not consistently disclosed at the University level, and it is necessary to evaluate progress toward long-term waste-reduction goals (Sustainable Columbia, 2025).

Across the university, waste-related initiatives generally focus on education, clearer signage, and targeted pilots aimed at reducing contamination. These programs include bin-standardization efforts, centralized waste-collection reviews, and research-driven projects that study the composition of waste streams in labs, offices, and dining spaces (Sustainable Columbia, n.d.-h). These activities help identify patterns of high contamination and common barriers that prevent effective composting or recycling. They also create opportunities for student participation, which can improve awareness and shift daily habits (Sustainable Columbia, n.d.-i). However, because these efforts are distributed across individual schools and departments, results are difficult to measure at the University-wide level.

Teachers College at Columbia University continues to lead in recycling and composting through its Waste Avoidance program, which provides clear guidance on diversion practices and community engagement (Teachers College, Columbia University, n.d.).

To move towards a more systematic approach, Columbia University will need a unified process for tracking waste data and reporting diversion metrics. At present, only some schools and departments publish their composting outcomes or recycling rates, which makes it challenging to assess progress toward the goals of the Plan 2030 sustainability framework.

3.5 Food Waste, Emissions, and Supply Chain Environmental Impact

In conjunction with its waste operations, Columbia University Dining has implemented several measures to reduce food waste and related environmental emissions. Residential dining halls centrally compost all food scraps from dining halls. Additionally, if reusable cutlery is either unavailable or students need to take food off premises, Columbia Dining offers compostable paper plates and bowls (since 2008), as well as reusable hard-plastic eco-containers (Columbia Dining, n.d.-c).

Since 2023, Dining Services has participated in the New York City government's Plant-Powered Carbon Challenge (PPCC), committing to reduce food procurement emissions by 25% by 2030. In the first year of participation (2023–2024), Columbia Dining achieved a 1.59% reduction in emissions intensity of food procurement (from 10.66 to 10.49 kg CO_2e per 1,000 kcal), while food procurement volume grew by 1.01% and the number of meals served rose by 10.11%. These results demonstrate that by reducing procurement of food with large carbon footprints, such as beef, and increasing the proportion of plant-based meals, dining halls can reduce the carbon intensity of the food system without reducing the total number of meals served.

However, despite early successes, the university's sustainable food efforts face structural challenges. Environmental impacts are not always traceable in food supply chains and procurement decisions, limiting transparency. Columbia Dining's geographical procurement guideline states that about 58% of food is sourced from within 250 miles of the Morningside Heights campus, reducing transportation distances and hence, emissions (Sustainable, Columbia, n.d.-j).

However, the remaining supply chain still involves long-distance transportation and complex cold chain systems, which continue to generate greenhouse gas emissions and energy consumption. More importantly, the lack of systematic estimation of upstream and transport emissions across public reporting makes it difficult for Columbia University to accurately quantify the overall carbon footprint of its food system, especially for Scope 3 emissions. Therefore, to truly integrate the food system into the university's environmental responsibility framework, a reduction of food waste, composting, and transitioning to plant-based options are insufficient. A full supply chain assessment and a life cycle assessment of procurement and transportation are needed, and this analysis should be included in annual reports and greenhouse gas accounting.

4 Peer Benchmarking

4. Peer Benchmarking

A Comprehensive Comparison on ESG indicators Across 18 Universities in the United States

4.1 Summary

As part of this capstone project, one of the deliverables was to create and complete a scorecard that ranks Columbia University's top 17 peers based on performance across environmental, social, and governance pillars. The resulting framework considers 56 indicators and provides a robust, data-driven evaluation of Columbia University's sustainability and climate positioning.

4.2 Methodology

4.2.1 List of Considered Peer Universities

17 peer universities were selected based on stature, geography, academic reputation, and client recommendations. All of the Ivy League institutions were included as they are renowned universities with similar admission standards, academic rigor, and international ranking, resulting in similar reputational risks. These institutions are all located in the Northeastern United States, which means they are subject to similar weather conditions throughout the year and physical climate risks, including extreme heat and flooding. These risks are significant as they impact operational, strategic, and financial decisions with regard to resilience building, infrastructure, energy, and water management systems, campus closures, and insurance (U.S. News Staff, 2025).

Logos of the 17 peer universities considered in this section:

Harvard University
Brown University
Yale University
Cornell University
Duke University
University of Pennsylvania
Dartmouth College
UC Berkeley
Fordham University
University of Chicago
Johns Hopkins University
Stanford University
New York University
California Institute of Technology
Massachusetts Institute of Technology
Princeton University
Northwestern University

Based on client guidance, the study also includes schools within the Ivy+, which are considered peers of the Ivy League Universities for their academic rigor, admission standards, prestige, and geographical location within the United States. The list includes 6 universities along with the core Ivy League, and they are all included in this study: Duke University, Massachusetts Institute of Technology, Stanford University, University of Chicago, Johns Hopkins University, and Northwestern University (The Ivy Institute, n.d.). These peers are expected to face similar reputational and financial risks attributable to climate change as Columbia University.

To account for local laws and regulations, the peer study includes two other universities: New York University and Fordham University, in addition to the New York State-based Ivy League, Cornell University. Along with similar regulatory risks, they also face similar physical climate risks due to their geography. Lastly, California Institute of Technology (CalTech) and University of California, Berkeley, were also considered in the peer benchmarking based on client request due to their academic reputation and prestige.

For a detailed explanation of each university's inclusion and relevance to the analysis, please refer to Table A1 in Appendix A.

4.2.2 The Different Versions of the Scorecard

4.2.2.1 Version 1

To conduct peer benchmarking, a scorecard was created wherein each of the 17 universities (plus Columbia University) would be scored and compared against each other on a wide variety of factors. The final version of the scorecard represents an improved and integrated synthesis of the two original versions, which are elaborated upon in this section.

The first iteration of the scorecard was based on best practices from leading global educational institution ratings and rankings. These included the Sustainability Tracking, Assessment & Rating System (STARS), Quacquarelli Symonds (QS), and the Times Higher Education rankings. Together, these sources helped identify categories that address core areas such as carbon and energy, water and waste, transportation, green buildings and infrastructure, education and research, governance, and social impact. Each category was then weighted to reflect its real-world significance and the availability of measurable data. For example, 'Carbon & Energy' had a weighting of 25% because of its climate relevance.

Across the categories in this iteration, each subcategory was mapped to public information and/or reasonable proxy metrics. Every category and subcategory is scored from 0 to 100 based on clear criteria and best available public data, then multiplied by its assigned weight.

Within each category, the composition of the subcategories was defined by looking at the category's specific demands and needs. For instance, within the 'Green Buildings' category, the calculation combined factors such as Leadership in Energy and Environmental Design (LEED) certified structures, energy intensity, and building policy, while the 'Social' category looks at metrics such as wellbeing programs, economic outreach, community engagement, and board diversity, each with their own weight based on the relative importance of the metrics.

The weights were assigned to reflect both real-world impact and how directly a university can control performance in that area. Environmental backbone categories like 'Carbon & Energy' and 'Green Buildings & Infrastructure' received higher weights because they drive the bulk of a campus's footprint and have strong, measurable subcategory levers (energy sourcing, building efficiency, and capital planning). Social and governance categories were given slightly lower but still meaningful weights to recognize their importance for equity, accountability, and long-term change, while acknowledging that data is often less standardized and sometimes more qualitative, so they complement rather than dominate the technical sustainability metrics.

The final overall score for this first version of the scorecard of each university is the weighted sum of these category scores, normalized for clear comparisons. By using defined indicators and a consistent weighting scheme, the scorecard aims to facilitate non-sustainability expert understanding of how scores are generated and to see where each university appears to be performing relatively strongly.

4.2.2.2 Version 2

The second iteration of the scorecard was in the form of a gap assessment built by ESG Playbook, a sustainability reporting software. The capstone team researched each university and classified them as beginner, intermediate, or leader based on their scores in relation to the assessment's methodology, broken down into four key parts:

1. **The Reporting Maturity Section** outlines how organizations can improve their sustainability reporting, moving from 'Limited integration' to 'Full integration'. It addresses key aspects such as a review of the governance, environmental, and social practices across reporting levels.
2. **The Readiness Gap Analysis Section** assesses an organization's environmental performance across various topics by posing progressive questions and indicating whether certain practices are in place.

3. **The Climate Transition Action Plan** outlines how organizations can improve their transition plan by moving from 'Existing Disclosure' to 'Leading Climate Transition Action Plan'. This involves questions on specific goals, targets, policies, and initiatives, along with tracking indicators related to ESG to identify missing areas and opportunities to strengthen your reporting and align with best practices.

4. **The Sustainability KPIs Section Tracks** 45 key performance indicators related to ESG topics, including ethics and integrity, transparency and reporting, and risk and compliance.

4.2.2.3 Version 3 (Agreed upon as the Final Version)

The final version of the scorecard, approved by the client, combined the strengths of the two aforementioned versions and resulted in a much more comprehensive iteration that graded each university across indicators. This scorecard included 56 indicators that were derived from different sustainability reporting frameworks and sources such as the Task Force on Climate-related Financial Disclosure (TCFD), Sustainability Accounting Standards Board (SASB), Sustainability Tracking, Assessment and Rating System (STARS), a Bloomberg case study from Harvard University, and the ESG Playbook. This scope ensured that the majority, if not all, relevant and significant indicators were included in the analysis.

To compare the universities' performances, each indicator was scored using publicly available information from their websites, sustainability reports, and other published documents. The scoring rubric for each indicator was either 0 (no information available), 0.5 (partial disclosure), or 1 (complete disclosure available).

Each indicator was then regrouped in two broader manners: (1) These indicators can be mapped together to form 11 subcategories, and (2) Each indicator can be classified into either Environmental, Social, or Governance pillars.

In line with the client's preferences and instructions, each of these indicators was uniformly weighed as equal (1 point x 56 indicators = total 56 points) in the calculation and analysis (Refer to Table A2 in Appendix A).

All policies and documentation were reviewed, irrespective of year of publication; However, any calculation-based disclosures (such as the greenhouse gas (GHG) emissions inventory) had to use data from 2022 or later to ensure present-day relevance and maintain data integrity.

To avoid introducing bias or subjectivity into the scoring process, the interviews conducted with peer universities (see Appendix A3-A8) were not used to inform the scorecard and intentionally excluded. This prevented any institution from gaining an advantage due to non-public information discussed during the interviews. However, the insights obtained from the interviews were used to guide our methodology and recommendations.

Figure 1

ESG indicators are categorized into environment, social, and governance themes

Environment

- GHG Carbon Emissions of CO2 Scope 1 & 2
- GHG Carbon Emissions of CO2 Scope 3
- Energy Consumption (kWh / MWh)
- Renewable Energy Percentage
- Carbon Intensity (Ratio)
- Net Zero Targets
- Biodiversity Impact Assessments
- Water Recycling Rate
- Building Energy Intensity
- Land Use and Ecological Sensitivity
- Water Waste
- Climate Risk Assessments
- LEED (or GRESB or BREEAM) Certified
- Sustainable Construction Policy
- Electrification efforts
- Total Waste Generated
- Waste Diversion Rate
- Hazardous Waste Percentage
- Packaging Material Recycled
- Circularity Metrics
- Total Water Withdrawal

Social

- Employee Wellbeing
- Working Hours
- Training and Development Resources
- Employee Turnover Rate
- Environmental Health and Safety Policy & Practices
- Community Rights & Engagement
- Local Hiring Percentage
- Socio-Economic Impact Assessments
- Public Transit Access
- Student Wellbeing
- Supplier Diversity
- Fair Labor Practices Compliance
- Grievance Mechanism Effectiveness
- Sustainability Course Offerings
- Research Output
- Sustainability Clubs
- Academic Programs
- Quality of Education,
- Employability and Opportunities
- Partnerships w.r.t. Sustainability

Governance

- Code of Conduct Compliance
- Anti-Corruption and Bribery
- Whistleblower Protections - Policy, Case studies or Hotline
- Policies w.r.t. Data Privacy and Security
- Ethical Supply Chain Assessments
- ESG Risk Assessments
- Compliance with Legal
- Cyber Security Risk Management
- Shareholder Rights and Engagement
- Sustainability Reporting Standards
- Dedicated Sustainability Office
- Board Composition
- Third-Party ESG Ratings
- Board Evaluation & Reviews
- Lobbying
- Materiality Assessment Disclosure

4.3 Findings

The analysis conducted in the peer scorecard shows an average composite ESG score of 0.6250, with the Social pillar clearly outperforming 0.7675, followed by the Governance pillar of 0.6146 and the Environmental pillar of 0.5040. This suggests that universities stand out as leaders when they can leverage their existing strengths in education, research, and community partnerships (including students, faculty, employees, and suppliers). However, most peer universities are weaker in the environmental and governance dimensions that require deep structural and logistical changes.

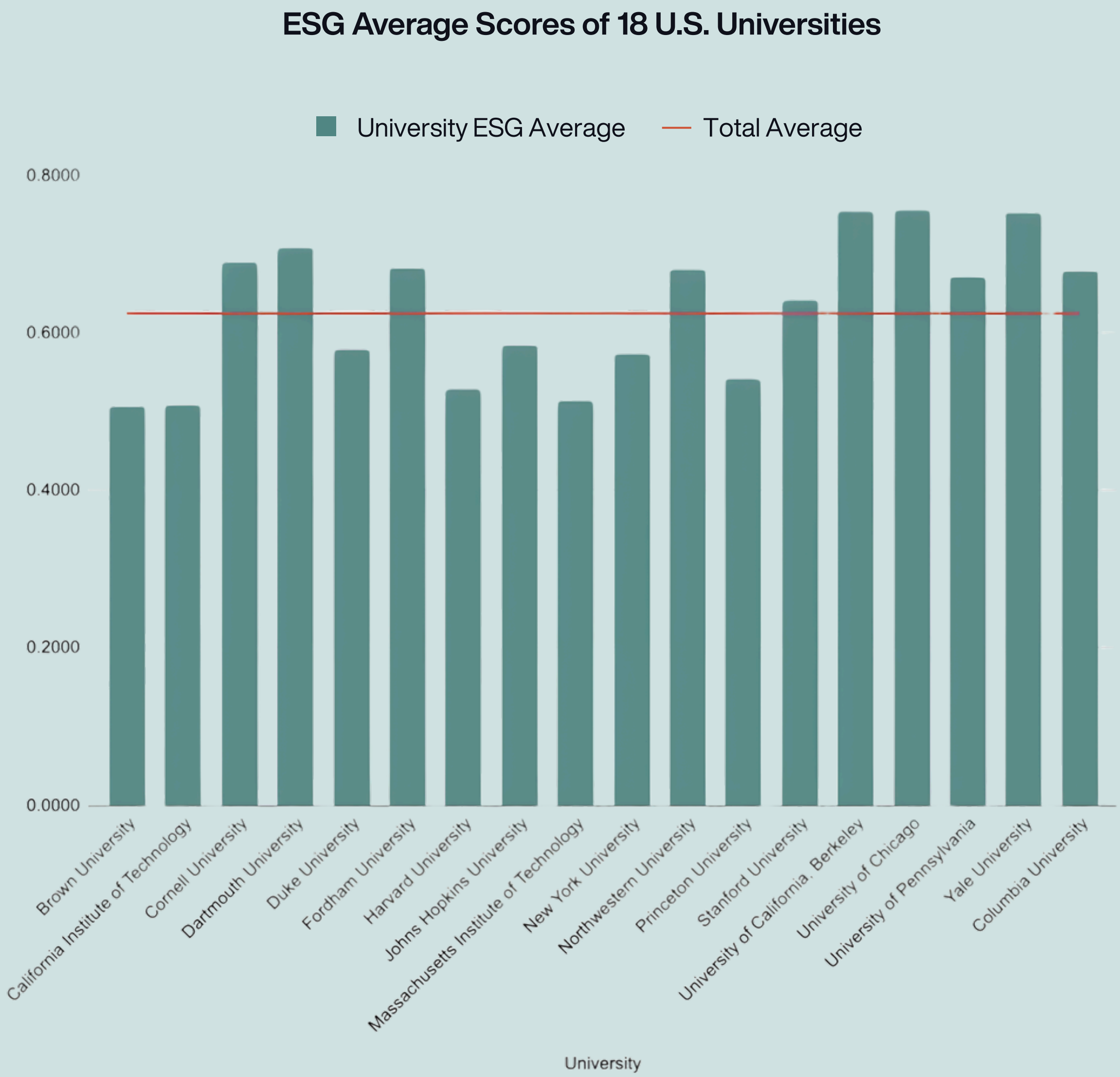
Table 1 below displays the 18 U.S. universities' ESG average scores and pillar average scores.

Table 1

ESG average scores across 18 U.S. universities

University	Environment	Social	Governance	University Average
University of California, Berkeley	0.7381	0.8158	0.7188	0.7589
University of Pennsylvania	0.6905	0.8158	0.75	0.75
Stanford University	0.5952	0.9211	0.75	0.75
Cornell University	0.6667	0.8947	0.5625	0.7143
Duke University	0.6429	0.6579	0.75	0.6786
Columbia University	0.5238	0.7632	0.7813	0.6786
University of Chicago	0.5476	0.8421	0.625	0.6696
New York University	0.5	0.7632	0.7813	0.6696
Yale University	0.5714	0.8684	0.4688	0.6429
Princeton University	0.4524	0.8158	0.6563	0.6339
Dartmouth University	0.5952	0.7368	0.4063	0.5893
Harvard University	0.381	0.8421	0.5313	0.5804
Massachusetts Institute of Technology	0.3095	0.8158	0.5938	0.5625
Northwestern University	0.4286	0.6053	0.5938	0.5357
Fordham University	0.3571	0.7632	0.4688	0.5268
John Hopkins University	0.4524	0.5263	0.5625	0.5089
California Institute of Technology	0.4762	0.5526	0.5	0.5089
Brown University	0.1429	0.8158	0.5625	0.4911
Pillar Average	**0.504**	**0.7675**	**0.6146**	**0.625**

Figure 2. *ESG Average Scores of 18 US Universities*



Based on Figure 2, overall ESG scores for 10 out of 18 assessed universities placed above the average, with Stanford University, University of California, Berkeley, and University of Pennsylvania showing the highest ESG overall scores. Top performers are seen to engage in numerous sustainability initiatives and publicly disclose these endeavors through annual sustainability reports, dedicated websites, or other university publications. Several universities are placed below average; this might be due to a lack of public disclosure of their efforts and initiatives, given that the scorecard only incorporated publicly available data in the calculations, or it might be due to a lack of sustainability initiatives.

Table 2

Average score between Ivy League and non-Ivy League universities

Subcategory	Ivy League Universities	Non-Ivy League Universities	Columbia University	Subcategory Average
Education & Research	0.9271	0.8981	1.0000	0.9118
Green Infrastructure	0.9063	0.8889	0.7500	0.8971
Employee Welfare	0.7750	0.6889	0.7000	0.7294
Ethics and Integrity	0.6625	0.7667	0.9000	0.7176
Community and Impact	0.7750	0.6556	0.7000	0.7118
Human Rights	0.7917	0.5926	0.5000	0.6863
Transparency & Reporting	0.5729	0.6481	0.7500	0.6127
Carbon Footprint & Energy	0.5313	0.6042	0.6250	0.5699
Waste Management	0.4125	0.4444	0.5000	0.4294
Risk & Compliance	0.3542	0.4537	0.6667	0.4069
Water Use & Biodiversity	0.3625	0.3889	0.3000	0.3765
Average University	**0.6230**	**0.627**	**0.6786**	**0.625**

When Ivy League and non-Ivy League universities were compared, the data show a less significant difference between average scores (0.6230 and 0.6270, respectively). Ivy League universities outperform in the social aspect, while universities outside the Ivy League perform better on environmental and governance metrics. This suggests that Ivy League Universities have higher maturity in areas such as community engagement, education, and research and human rights, but lower maturity in waste management, water use & biodiversity, and risk & compliance.

The similar average scores between the Ivy and non-Ivy League scores can likely be attributed to the combined high reputation, prestige, and similar academic standards.

Across the dataset, universities showed notably strong performance in Education & Research, Green Infrastructure, and Employee Welfare, with corresponding average scores of 0.9118, 0.8971, and 0.7294. On the contrary, three subcategories with the lowest scores are Water Use & Biodiversity, Risk & Compliance, and Waste Management, with the average of 0.3765, 0.4069, and 0.4294, respectively.

4.4 Peer Benchmarking: Terminology Sub-Section

4.4.1 Summary

Amidst widespread reporting of terminology restriction lists across U.S. federal agencies and increasing attempts at federal oversight into universities ushered in by the second Trump administration, the team analyzed whether peers have changed public-facing sustainability language to mitigate regulatory and reputational risks (Colman, 2025; Sherman, 2025). However, a movement away from sustainability terminology was not observed amongst Columbia University's peers. At this time, the Office of Sustainability's alignment with commonly used sustainability language does not appear to expose Columbia University to heightened risk. Please note that this section does not directly factor into the peer scorecard analysis mentioned earlier in Section 3 of this report.

4.4.2 Methodology

To evaluate sustainability terminology prevalence, the team examined more than 75 documents across Columbia University's 17 peer institutes. Examined documents include university sustainability office websites, progress reports, climate action plans, ESG investing reports, and other publicly available sustainability content. Materials published in 2024 or 2025 were prioritized for analysis, though earlier documents were also evaluated for shifts in language. When available, 2025 materials were compared directly to earlier iterations of the same reporting to identify trends. The team reviewed public materials for terms reportedly targeted by the second Trump administration, such as 'sustainability,' 'climate,' and 'diversity' (Colman, 2025; Sherman, 2025). Peers mentioning any of these key terms, listed in Table 3, were marked as users of sustainability-related terminology.

This analysis is not guaranteed to capture every publicly available document carrying sustainability language. Peers may have deleted or augmented earlier materials, obscuring potential shifts in language and limiting the insight of the analysis. Additionally, many of the latest sustainability materials were released in late 2024 or early 2025, so it is possible that universities are revisiting terminology in reaction to intensifying oversight into university messaging and practices from the current administration.

4.4.3 Findings

Sustainability terminology has been the subject of scrutiny on the federal level since the start of the second Trump administration, leading to shifts in messaging and reported ban lists at the Department of Energy (Colman, 2025; Sherman, 2025). However, Columbia University's peers continue to use sustainability terms in public materials, with several terms observed almost universally, as displayed in Table 3.

Table 3

Share of Columbia University Peers Using Key Sustainability Terminology

Share of Peers (%)	Terminology
100%	Sustainability
100%	Climate
94%	Climate Change
88%	GHG Emissions
82%	Carbon Neutrality
82%	Net Zero Emissions
71%	Resiliency
65%	Decarbonization
59%	Stewardship
47%	Climate Justice
41%	Environmental, Social, Governance (ESG)
24%	Diversity, Equity, and Inclusion (DEI)
18%	Global Warming

Shifts in Sustainability Language Among Peer Institutions

Generally, peers have not shifted language in response to the second Trump administration, and when available, 2025 reporting language has mirrored older iterations. Observed shifts in language, such as away from ‘global warming’ and toward ‘climate change,’ are likely related to broader trends in the sustainability space rather than risk mitigation. For example, the University of Pennsylvania’s Climate and Sustainability Action Plan 3.0, which came out in 2019, uses the term global warming several times, while the 2024 version of the report only contains ‘global warming’ once as part of the definition of global warming potential (GWP) (University of Pennsylvania, 2019; University of Pennsylvania, 2024).

Peers have not shifted language in response to the second Trump administration, and 2025 reporting language has largely mirrored older iterations.

Use of ESG, DEI, and Related Terminology

Notable acronyms such as ESG and DEI were not observed at high rates within peer sustainability materials. Peers were more likely to mention ESG in the context of investment criteria than in broader sustainability disclosures or reporting. For example, Brown University and Harvard University both integrate ESG principles into endowment management, but do not favor this framework in sustainability reporting or university websites (Brown University Investment Office, 2025; Harvard Management Company, 2025).

Only Harvard University, Dartmouth College, Massachusetts Institute of Technology, and the University of California, Berkeley included the ‘DEI’ acronym within observed sustainability materials (Dartmouth College, 2024; MIT Sloan Sustainability Initiative, 2025; University of California Office of the President, 2025; Harvard University, Office for Sustainability, 2025). Terms such as ‘climate justice’ or ‘equity’ in the context of sustainability were more common than the ‘DEI’ acronym, though not observed in public materials across a majority of peers. Several peers maintain offices of diversity, equity, and/or inclusion that appear distinct from sustainability initiatives.

47% of peers used ‘climate justice,’ and 29% used ‘equity’ in public-facing materials.

Federal Funding Sensitivities and Academic Risk

Though the team did not find reports of the Trump administration penalizing universities for the general usage of sustainability language, terminology has been linked to the cancellation of grants across the scientific community and at peer universities. In the past 12 months, trends show that previously allotted federal grants for scientific studies were either delayed or canceled due to the inclusion of terms such as ‘climate’ or ‘diversity’ (Milman, 2025). In April, the Trump administration canceled $4 million in federal funding for climate change-related research at Princeton University that was investigating sea level rise, water availability, and rainfall patterns (Plumer & Gaffney, 2025).

Federal grant trends show increasing sensitivity to terms such as ‘climate’ and ‘diversity,’ with several scientific studies experiencing delayed or canceled funding in the past 12 months

4.4.4 Recommendations

1. Do Not Retreat From Conventional Sustainability Language in Public-Facing Documents:

Peers have not shifted away from sustainability terminology in reaction to the second Trump administration or otherwise. Columbia University’s conventions are aligned with peers, and alterations related to risk mitigation are not recommended at this time.

2. Consider Language to Emphasize the Business Case for Sustainability:

Columbia University may choose to implement terminology such as ‘resilience,’ ‘risk management,’ ‘adaptation,’ and ‘stewardship’ to emphasize the business case for sustainability practices, a practice adopted by a growing number of peers, as indicated by Table 3 above. Though Columbia University’s risk exposure attributable to sustainability terminology is low, these small additions could help mitigate this exposure.

5 Social Risks

5. Social Risks

An Assessment of Columbia University's Material Social Risks

5.1 Summary

Higher education institutions across the United States and globally are operating in a social environment with rising political division, shifting federal oversight, higher community expectations on equity, and growing public attention on how large institutions interact with the community supporting them and the neighborhoods around them.

> ***These dynamics introduce material risks to not just university operations and reputation, but also long-term resilience planning, especially as sustainability goals and expectations expand under Plan 2030.***

This section discusses the major social risks Columbia University is facing and evaluates how these risks affect the university's strategy with regard to social risks and opportunities.

5.2 Methodology

This assessment applies an integrated framework that combines ISO 31000 risk guidelines, SASB Human and Social Capital standards, and Environmental Justice (EJ) principles. The integrated approach includes:

ISO 31000

Provides a structured approach for identifying risk sources and assessing their consequences and likelihood (International Organization for Standardization [ISO], 2018).

SASB Standards

Were used to classify and identify material social risks. SASB's Five Pillar framework organizes sustainability issues into key dimensions, two of which, Human Capital and Social Capital, are directly relevant to the Education industry (Sustainability Accounting Standards Board [SASB], 2017). For the education sector, Human Capital covers issues related to a company's labor force and human resources; therefore, student safety, discrimination, and workforce well-being metrics are included (SASB, 2017). While Social Capital covers community relations, access and affordability and stakeholder engagement (SASB, 2017).

Environmental Justtice Principles

Help strengthen the assessment by highlighting fairness, distribution of burdens, historic inequities, and trust-building with marginalized communities (U.S. Environmental Protection Agency, 2020).

By combining these frameworks, the assessment established the basis for determining which social risks are material for Columbia University, spanning community relationships, campus climate, regulatory exposure, governance, donor expectations, and international stability. After defining the initial categories using these frameworks, additional research, including external reports, datasets, news, and academic literature, was conducted to validate and refine the final risk findings.

5.3 Findings
5.3.1 Business Ethics

Government and regulatory factors add another layer to social risk. In 2024-25, Columbia University came under increased attention from the federal government on its campus safety and discrimination concerns based on race, color, or national origin under Title VI of the Civil Rights Act, which requires universities receiving federal funding to ensure an environment where students are protected from discriminatory harassment.

As part of campus safety and discrimination complaints, particularly related to student experiences, the U.S. Department of Education opened multiple civil rights investigations.

$400 Million

in federal funding was **temporarily suspended** (U.S. Department of Education et al., 2025).

$221 Million

including **$200 million in structured payments over three years** and an additional **$21 million to resolve related investigations**, illustrates how campus-related issues can lead to significant financial exposure in 2025 (Associated Press, 2025).

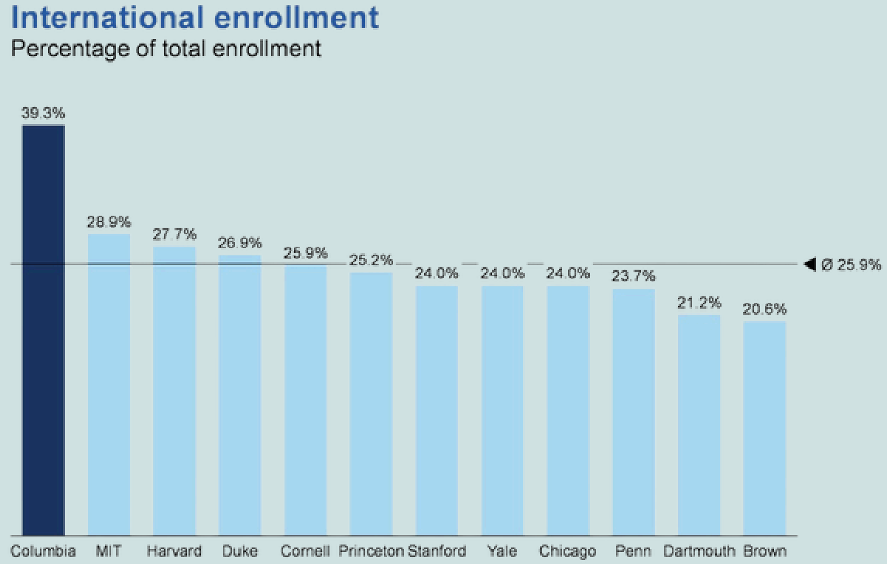
Federal agencies are increasingly linking campus safety and non-discrimination concerns to Title VI compliance, which may heighten the likelihood of future reviews or corrective actions if challenges continue. These developments demonstrate that social risks can translate into regulatory responses, legal obligations, and substantial financial impacts.

5.3.2 International Student Enrollment Decline and Immigration Policy Risk

39% *of the student body coming from abroad, the highest share among Ivy League institutions (Stand Columbia Society, 2025)*

International enrollment is one of Columbia University's most important academic and financial strengths, as illustrated in Figure 3 below. However, recent immigration policy shifts in the United States and uncertainty around Student and Exchange Visitor Program (SEVP) requirements create a challenging environment for both current and incoming international students. The decline in international student mobility is closely linked to delays in visa processing, new travel restrictions, and heightened uncertainty for prospective students. In May-June 2025, the United States Department of State paused all new student visa interviews for three weeks to implement new vetting procedures, creating significant backlogs once processing resumed. Many consulates subsequently faced months-long wait times, and F-1 visa issuances in May fell by 22% compared with the previous year (Bhatia & Fan, 2025). The United States entry records further show that international student arrivals declined by nearly 20% in August 2025 compared with August 2024 (Bhatia & Fan, 2025). This volatility from immigration may affect Columbia University's enrollment outlook, tuition revenue, and global diversity in the year ahead.

Figure 3 *International Enrollment Across Ivy Plus Universities*



Source: From Stand Columbia Society (2025).

5.3.3 Environmental Justice and Local Community Trust Risk

The relationship between Columbia University and the surrounding West Harlem, Manhattanville, and Morningside Heights has evolved amid longstanding concerns about gentrification, displacement pressures, and equitable economic benefit-sharing (Santomauro-Stenzel, 2024). While the tensions have existed since as early as 1897 when Columbia University established its Morningside Heights campus, the current relationship revolving around large-scale displacement and equitable benefit-sharing was ignited by the planning and announcement of the Manhattanville campus expansion project in 2003. These dynamics illustrate the intersection of social, environmental, and economic factors.

Community members have at times expressed reservations about institutional expansion and sought clearer evidence of how the University's presence supports local priorities. Historical accounts of earlier growth, including the Manhattanville development, note that state-supported eminent domain processes affected small businesses and shaped perceptions of uneven influence (Foster, 2018). Some residents described Columbia University as having the ability to reshape the neighborhood without the level of partnership or transparency they expected.

Note: The CU Grow program graduated its second cohort, comprised of 10 businesses (Columbia University, n.d.-a)

While initiatives such as the West Harlem Community Benefits Agreement and CU Grow Vendor Development Program, which provides expert coaching and training to expand the business portfolio of socially and economically disadvantaged individual-owned firms and locally owned businesses, have created valuable avenues for local inclusion, some community members continue to seek greater consistency in implementation. The case study by Foster (2018) suggests that certain stakeholders view engagement as procedural rather than relationship-building, which can limit long-term trust.

Ongoing construction also contributes to noise, dust, traffic, and street disruption, which can heighten concerns in areas already experiencing higher levels of environmental stress (Hinsdale, 2024; Declet-Barreto et al., 2021; Nessel & Andrews, 2021). When combined with economic pressures, these conditions can increase community sensitivity to Columbia University's actions and elevate the risk of tension or reputational challenges. As a result, community trust may weaken, which can slow down projects, make collaboration more difficult, and affect how Columbia University is viewed in the neighborhood.

5.3.4 Campus Climate Deterioration (Belonging, Discrimination and Safety)

Campus climate considerations add an important dimension to social risk. The HEALS survey, commissioned by Columbia University, provides the most comprehensive assessment of student belonging, safety, and expression to date.

More than 35,000 students were invited

Over 9,000 participated with a 25% completion rate.

The result reports that, following recent global events, both Jewish and Muslim students expressed concerns related to safety, belonging, and discrimination (NORC, 2025).

Respondents indicated elevated levels of stress, uncertainty, and hesitation in sharing identity-related perspectives.

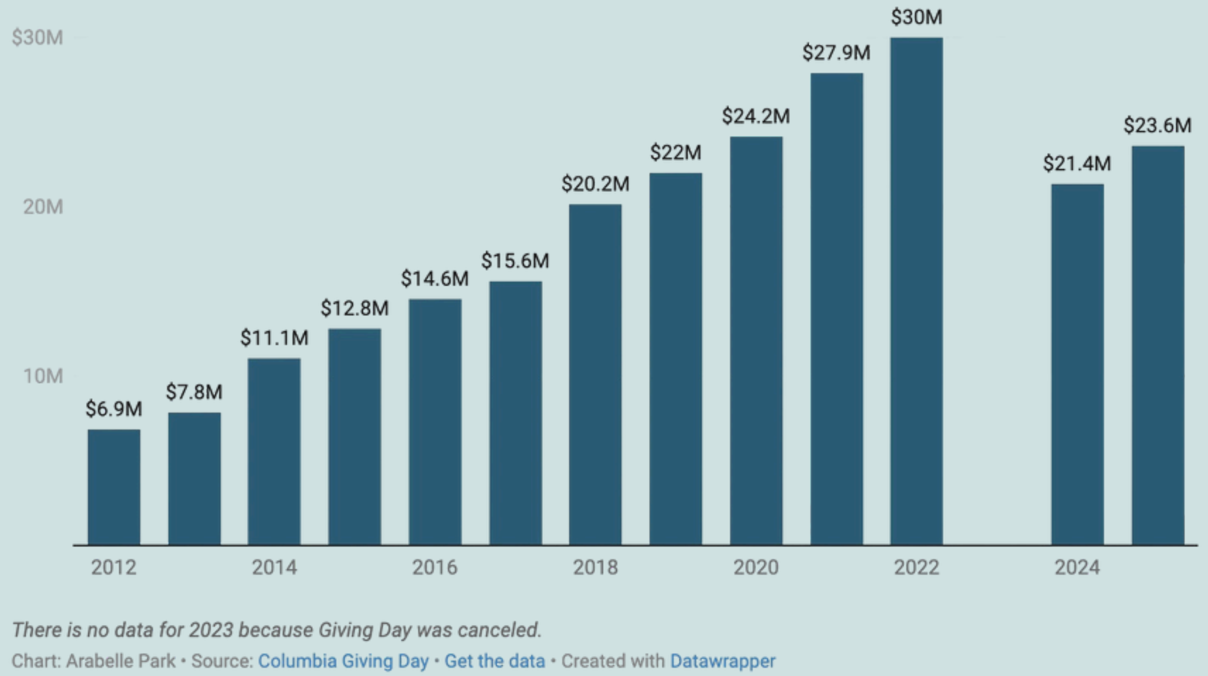
These findings point to reduced confidence in institutional systems for safety and conflict management. These dynamics can affect student well-being, academic engagement, and confidence in the University's ability to maintain a respectful learning environment. In a competitive higher-education landscape, challenges in campus climate may also affect Columbia University's global reputation and the appeal of its academic programs.

5.3.5 Donor Sentiment Risk

Alumni and donor sentiment are other important aspects of social risk. Giving Day, which is Columbia University's annual 24-hour fundraising campaign, outcomes and reported reactions in the Columbia Spectator, the University's independent student-run newspaper, indicate shifts in donor confidence linked to perceptions of the University's approach to protests, free expression, and federal engagement (Stranahan, 2025). These perceptions have contributed to negative variability in Giving Day participation and total contributions. According to Figure 4 below, contributions declined from a peak of $30 million in 2022 to $21.4 million in 2024, reflecting a decline from the pre-cancellation trend. This negative variability introduces philanthropic uncertainty that can affect academic programs, financial aid, and long-term strategic initiatives.

Figure 4

Annual Columbia Giving Day Contributions from 2012 to 2024 (Excluding 2023, which was cancelled after University and alumni leadership determined it was not an appropriate time to hold the event amid the campus tensions)



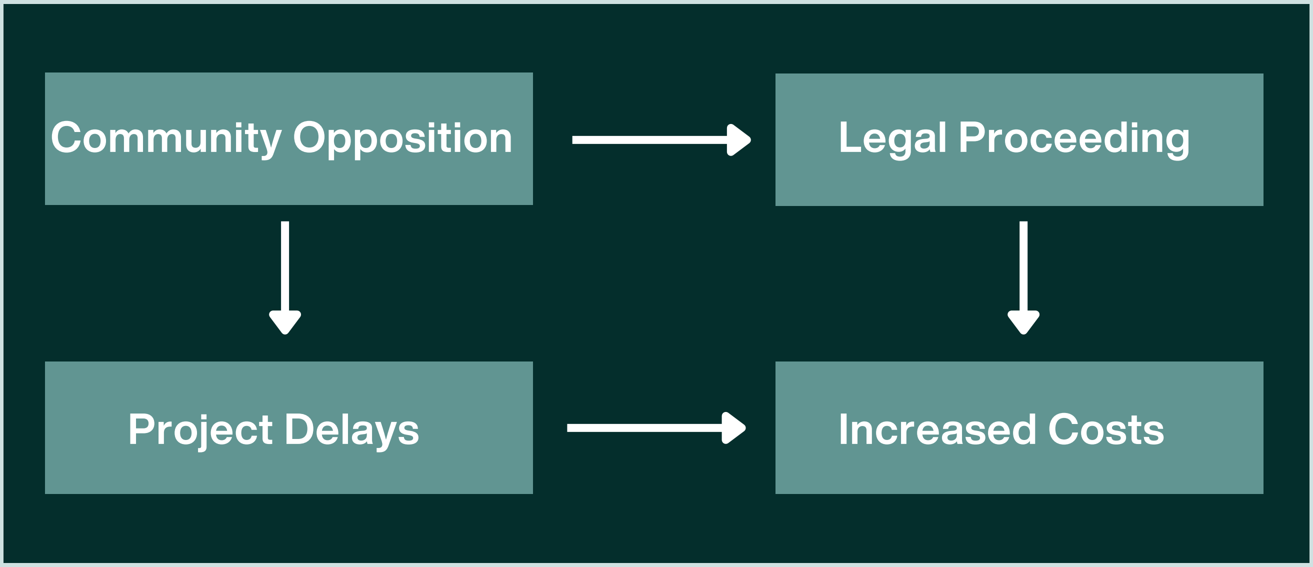
Note. From Stranahan (2025).

5.3.6 Local Economic Equity, Minority, Women, and Locally Owned Business (MWBE) Inclusion Risk

Community engagement is one of Columbia University's levers for managing social risk; however, it remains one of the most sensitive aspects of its relationship with West Harlem, Manhattanville, and Morningside Heights. The University has invested in programs that aim to strengthen local economic opportunity, including CU Grow, which supports minority, women, and locally owned businesses, as well as broader MWBE procurement and hiring pipelines. Columbia University has also committed to long-term community benefits through the $150 million West Harlem Community Benefits Agreement since 2009 as part of the Manhattanville campus expansion.

The agreement includes funding for education, affordable housing assistance, local workforce programs, and a guaranteed timeline of payments in multiple phases of the Manhattanville expansion. These initiatives demonstrate meaningful intent, but community expectations are shaped by a long history of campus expansion. In the Manhattanville case, community opposition contributed to multi-year legal proceedings and the negotiation of a benefit package that showed how trust-related concerns can slow down construction projects, create legal or political barriers, and increase the cost of mitigation or compliance (Foster, 2018; Newman & Wyly, 2006). Moreover, weaker relationships can make community cooperation during climate-related events such as extreme heat, poor air quality, or flooding more challenging. This is supported by Environmental Justice research, which shows that communities facing long-term inequities are less likely to engage with preparedness or response efforts unless they see fair treatment and shared benefit (Solorzano, 1993; Taylor, 2000).

The Cost of Mistrust



5.3.7 Food Affordability, Accessibility, and Supply Chain Equity Risk

5.3.7.1 Food Affordability

Dining plans are contributing to one of the highest recurring non-tuition costs for students.

No Rollover of Unused Meal

No Cancellation Option (Mid-Year)

First-year plans cost $3,390 per term, and higher-tier plans range from $1,781 to $3,996, without the option to cancel during mid-year and no rollover of unused meals beyond the academic year (Columbia Dining, n.d.-a). Weekly plans expire every Saturday night and will be refreshed on Sunday morning, resulting in lost value for students with evening classes, part-time jobs, or unpredictable schedules. Graduate plans, 25 to 75 meals per term at $425-$1025 or $13.67 - $17 per meal, have a significant higher cost per meal compared to undergraduate weekly plans, which have a cost per meal ranging from $11.89-$15.06 (Columbia Dining, n.d.-b). These factors create affordability pressures for low-income students, international students, and especially first-year undergraduates because they are required to enroll in a dining plan.

On the other hand, upper-class undergraduates and graduate students technically have the option to enroll, but for many students, especially those without kitchens, international students, or students in dorm-style housing, dining plans function as a requirement because of limited alternatives and the high cost of eating off-campus. Basic needs and public health research find that 20-34% of the United States college students experience food insecurity, which correlates with lower academic performance and higher stress (Payne-Sturges et al., 2017; Hope Center for Student Basic Needs, 2025). Therefore, this dynamic indicates that food affordability is not only a basic-needs concern but also a driver of students' sense of fairness and confidence in the University's support systems.

5.3.7.2 Food Accessibility

Food accessibility challenges arise from both operational and dietary constraints across Columbia University's dining system

Operational Access

Most dining halls close between 7.00 and 8.00 PM, which misaligns with student life patterns, particularly students who regularly attend evening classes. Moreover, graduate students are restricted to only 7 out of 10 dining locations, excluding major halls such as John Jay, Ferris Booth, and JJ's Place (Columbia Dining, n.d.-a). These restrictions increase food costs that they have to pay directly from their own money and reduce access during high-demand periods.

Dietary Access

Students with allergies, religious dietary needs such as halal and kosher, or restrictive diets face barriers in consistent availability and cross-contamination concerns. While halal or kosher options exist, they are not evenly distributed across dining halls, and kosher access requires a separate plan (Columbia Dining, n.d.-a). As Bosch, Niroula, and McKinley (2024) and Radtke et al. (2025) show, students with dietary restrictions experience higher rates of meal skipping, financial strain, and social exclusion when appropriate options are limited or inconsistently provided. These gaps elevate the importance of food accessibility as a social risk factor because the reliability and inclusiveness of dining options directly influence student well-being, equity and their sense of belonging on campus.

5.3.7.3 Supply Chain Equity and Procurement Practices

Columbia University reports that about 58% of all food served is sourced from vendors such as local farms, fair trade suppliers, and organic producers, within 250 miles of campus (Columbia Dining, n.d.-d). For example, milk from a New York State creamery, coffee is fair-trade and roasted locally in Brooklyn, and produce and baked goods are sourced from nearby farms and vendors, reducing food miles and supporting regional agriculture (Columbia Dining, n.d.-d).

These practices demonstrate meaningful progress toward a more sustainable procurement model. However, equity and transparency gaps remain since Columbia University does not publicly report how much of this spending goes to minority- or women-owned businesses (MWBE), making it difficult to assess whether procurement practices are equitable economic inclusion. Moreover, NYC Department of Health rules prevent Columbia University from donating prepared surplus food, increasing waste and reducing opportunities to support food-insecure students (Columbia Dining, n.d.-a). These gaps show that while Columbia University's procurement is making some sustainable progress, the procurement system still needs stronger equity and clearer transparency.

5.4 Recommendations

1. Build a social risk scenario-planning process:

Columbia University can benefit from a structured approach that anticipates possible shifts in community trust, campus climate, donor sentiment, and federal oversight. The structure approach process would outline a range of feasible scenarios from low disruption to high impact and identify early warning signals, response actions, and responsible units for each incident. This would help the University prepare proactive responses rather than reacting only after issues escalate.

2. Strengthen relationship-based community engagement:

Long-term trust with West Harlem, Manhattanville, and Morningside Heights requires engagement that is ongoing, transparent, and relationship-driven. Creating regular feedback channels and sharing progress on MWBE and hiring commitments can make interactions feel more consistent and less tied to individual projects.

3. Improve food affordability, access, and procurement equity:

Columbia University can strengthen student well-being by evaluating dining plans' flexibility, extending access hours in high-demand locations, and improving dietary inclusion. Moreover, improving transparency on minority- or women-owned businesses (MWBE) participation in the food supply chain would make the system more equitable and responsive.

6 Climate Risks

6. Climate Risks

Protecting Columbia University from Climate and Physical Risks

6.1.1 Summary

This section focuses on the climate and physical risk topics specific to NYC, given that Columbia University is domiciled within the city. This capstone's physical and climate assessment takes a multipronged approach by aligning with TCFD guidance, summarizing Columbia University's sustainability achievements and Plan 2030 goals, and drawing on climate risks identified for New York City and New York State to assess additional vulnerabilities. The analysis also incorporates insights from interviews with faculty members from peer universities' sustainability offices. The analysis also incorporates insights from interviews with faculty members from peer universities' sustainability offices.

6.1.2 Background Information

With climate-related events already becoming more common in New York City, future projections paint an even more concerning picture: temperatures are expected to rise by 4–6°F by 2050, compared with the 1981-2010 average (New York State Climate Impacts Assessment, 2024). Total precipitation throughout the year, which contributes to flooding, is also projected to increase by 4-11% by 2050 compared to the 1981-2010 average (New York State Climate Impacts Assessment, 2024).

Climate-related events pose significant risks to NYC's economy, and Columbia University, one of the city's largest landowners, faces many of the same risks.

Understanding the climate risks Columbia University faces facilitates more effective risk mitigation and creates opportunities for improved financial and investment decision-making, ultimately supporting stronger economic outcomes. (New York State Climate Impacts Assessment, 2024).

According to TCFD, climate-related risks are divided into two categories:

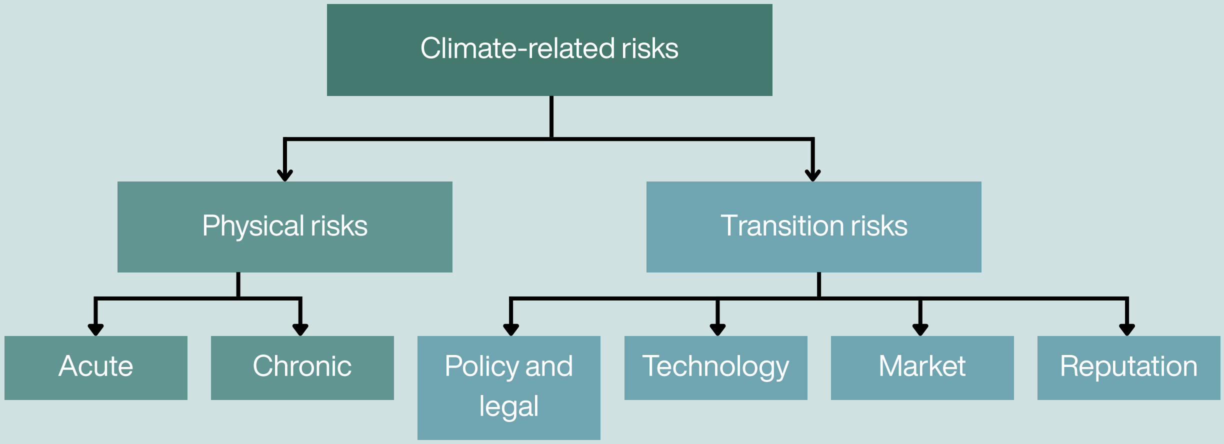
1. *Risks related to the transition to a lower-carbon economy, and*
2. *Risks related to the physical impacts of climate change (TCFD, 2017).*

The transition risks consider policy and legal risks, technology risk, market risk, and reputational risk. This section of the report focuses on physical risks:

1. Acute Risk that is event-driven and extreme weather events, and
2. Chronic Risk refers to longer-term climate pattern shifts (TCFD, 2017).

Figure 5

Climate-related risks definition



Note. From BDO Australia (2024).

Columbia University's Office of Sustainability has published a sustainability-focused Annual Progress Report each year since 2017 and, in 2021, expanded this work by developing and publishing Plan 2030, which outlines six sustainability goals and accompanying strategies (Sustainable Columbia, n.d.-a, n.d.-b).

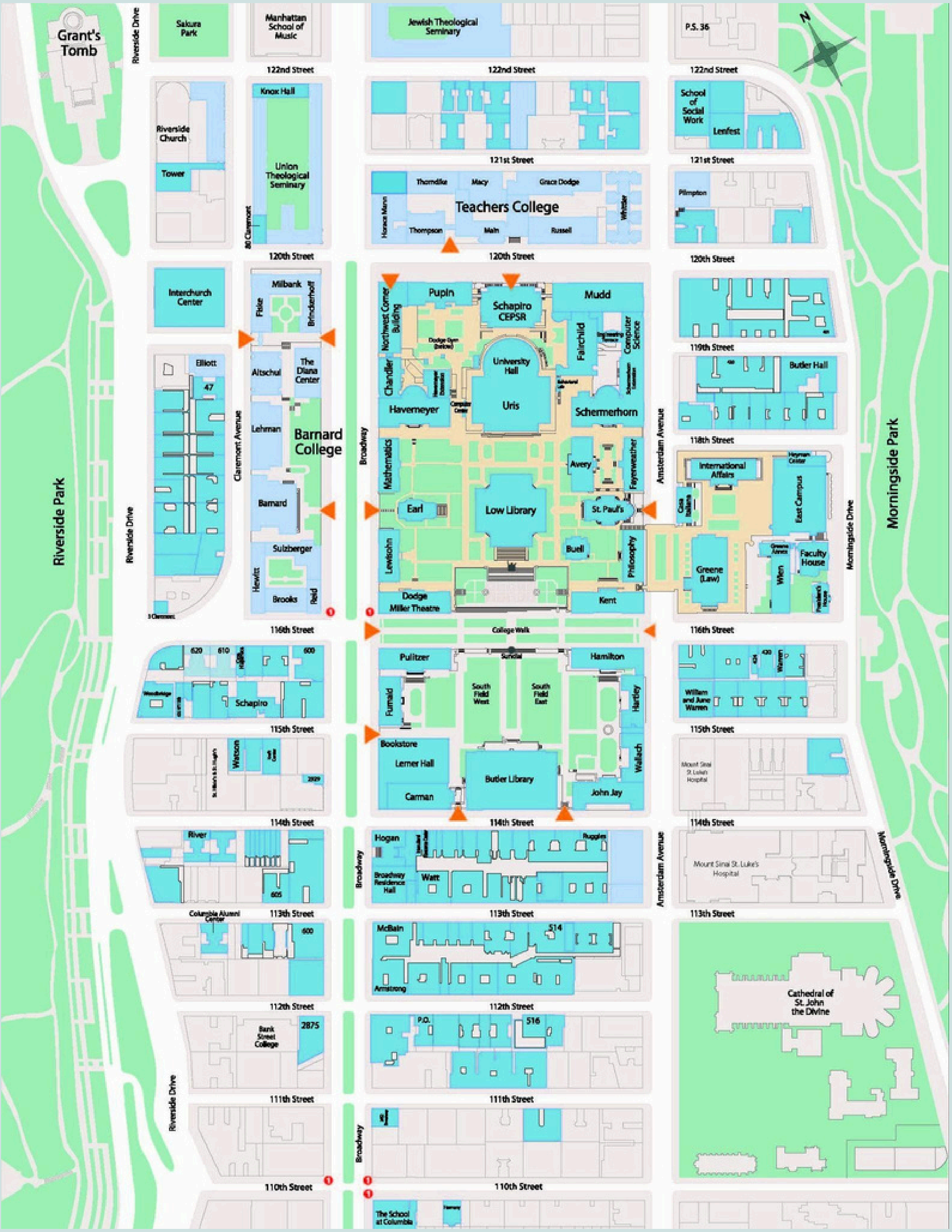
1. Campus Energy
2. Sustainable Transportation
3.Responsible Design and Construction
4.Culture Change and Campus as Living Lab
5. Responsible Materials Management
6.Water Conservation and Capture

While Plan 2030 outlines key sustainability goals, it does not fully capture the range of climate risks the university may face. This section's climate and physical risk assessment therefore, complements it by identifying recurring climate-related hazards and analyzing their potential implications for Columbia University. Section 8 builds on this by quantifying risk impacts using an expected annual loss (EAL) approach.

Due to time constraints, this Climate & Physical Risk Assessment focuses on the Morningside Heights, Manhattanville, and Columbia University Irving Medical Center (CUIMC) campuses. In future assessments, it is advised to include Lamont-Doherty Earth Observatory (LDEO), as Columbia's Plan 2030 includes LDEO Campus (The Office of Sustainability, 2025).

Figure 6

The Morningside Campus Map



Note. From *Maps and Locations* , Columbia University (n.d.-b).

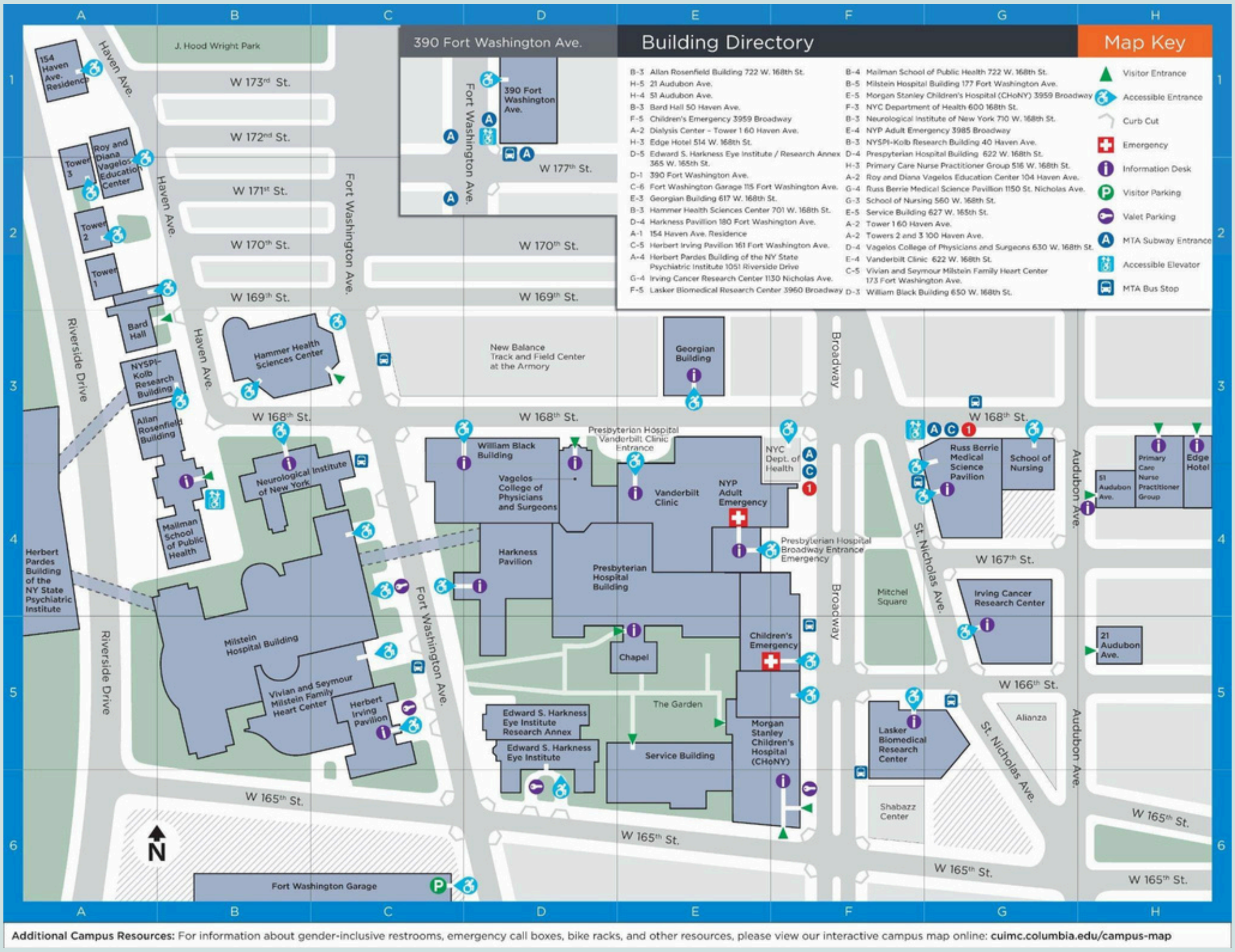
Figure 7

Manhattanville Campus Map

Note. From *Maps and Locations* , Columbia University (n.d.-b).

Figure 8

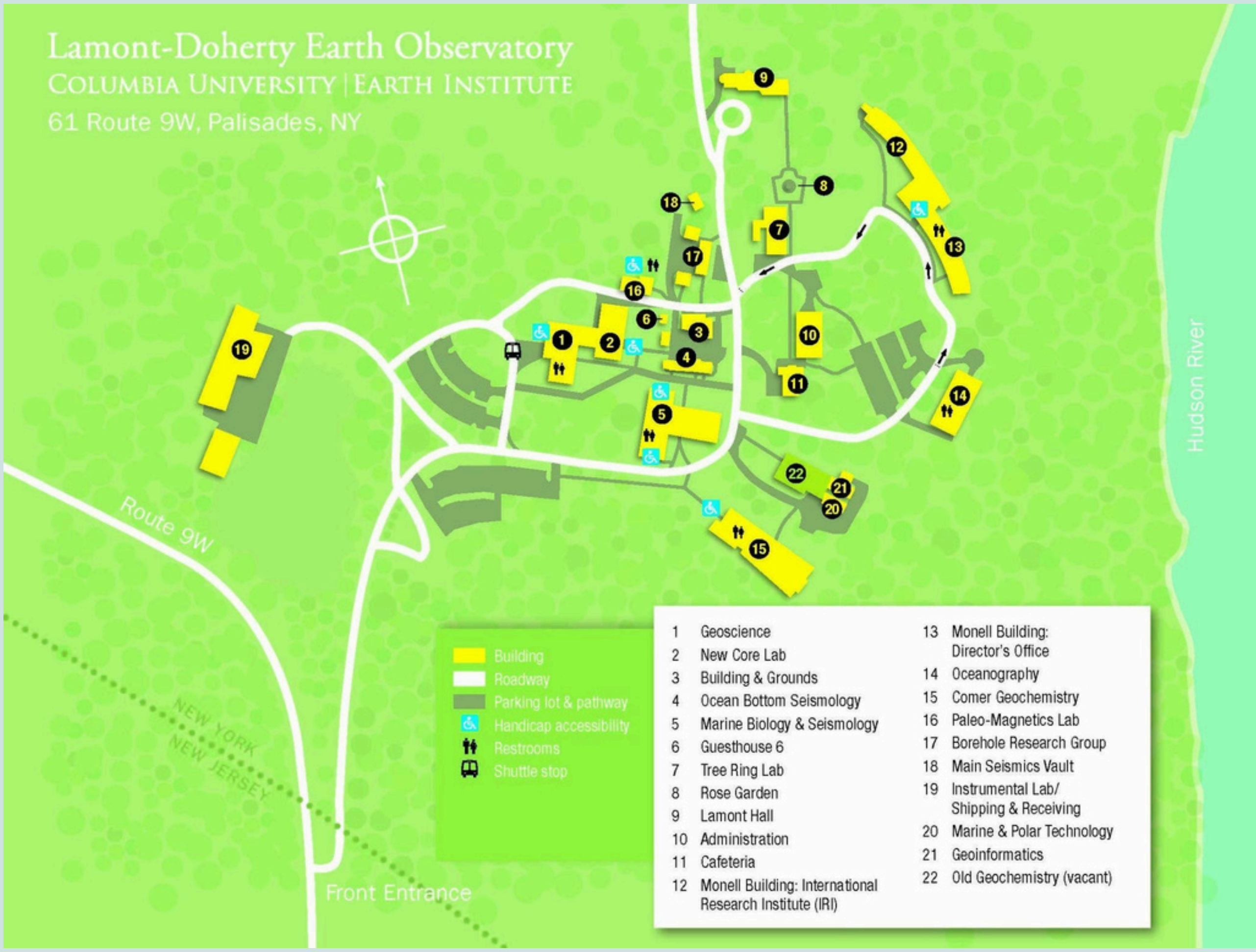
CUIMC Map



Note. From *Maps and Locations* , Columbia University (n.d.-b).

Figure 9

LDEO Map



Note. From *Maps and Locations* , Columbia University (n.d.-b).

6.2 Methodology

This assessment is intended to identify and quantify climate-related risks, prioritize risks for mitigation, align campus planning with NYC frameworks, establish a foundation for annual sustainability reports, and better track mitigation progress.

6.2.1 Rationale for Tool Selection

As this project is not funded and the client is a NYC-based institution, the selection of tools was chosen based on their open accessibility, scientific validation, widespread use, federal or UN leadership, and relevance to NYC.

To ensure NYC-specific relevance, the assessment incorporates the PlaNYC framework and NPCC4, which together address the city's climate, equity, and health-related risks and the underlying climate science. PlaNYC's mitigation goals and strategies were compared against Columbia University's Plan 2030 strategies and past actions to identify alignment and gaps. Meanwhile, NPCC4's NYC climate science projections, specific to the Morningside Heights and Manhattanville regions, provide the likelihood of various climate risk events occurring, which were used to determine the likelihood score in the assessment and the matrix.

NPCC4 provides forward-looking climate projections; conversely, FEMA's National Risk Index (NRI) supplements this with historical hazard and community vulnerability data. The capstone team developed a climate risk matrix to evaluate thirteen hazards using the two dimensions of likelihood and impact to determine Columbia University's overall exposure. Impact reflects the degree to which a hazard could disrupt academic operations, damage buildings or research facilities, or require significant repairs. Risks appear higher on the matrix when they pose significant operational, financial, or infrastructure impacts, while lower-tier risks represent only minor interruptions.

6.2.2 Data Sources Used to Identify Topics

To identify the most relevant climate risks for Columbia University, frameworks with geographic focus ranging from global scale to NYC-focused were reviewed. Through the climate risk framework and assessment analysis, recurring risk topics emerged and informed the composition of the final list. The initial analysis started with NPCC4, NYC's official climate science assessment, which includes the following climate risk topics (Braneon et al., 2024):

1. Sea Level Rise and Storm Surge
2. Inland and Coastal Flooding
3. Temperature and Precipitation that include extreme heat events, extreme cold weather events, and
4. Drought

In addition, climate risks discussed in NYC PlaNYC 2023-2024 hazard priorities (e.g. Extreme Heat, Flooding, Buildings, Clean and Reliable Energy), Columbia University's Plan 2030, and the latest Plan 2030 Progress report were integrated (Mayor's Office of Climate & Environmental Justice, 2024; Columbia University Office of Sustainability, 2021; Columbia University Office of Sustainability, 2025).

6.2.3 Final Climate Risk Topics

6.2.3.1 Climate Risk Topic Table

Table 4

Climate Risk Topics

Risk Topic	Acute/ Chronic	Risk Description	Frame-work	Peer Benchmark
Heat waves/ Extreme heat	Acute	Higher baseline temperatures and repeated extreme heat exposures diminish indoor comfort, increase heat-related health issues, and threaten continuous operations in teaching, residential, and laboratory spaces, resulting in operational interruptions and elevated energy and maintenance costs.	• SASB • NPCC • NOAA	A commonly recognized climate risk topic among peer schools (peer benchmarking score card).
Riverine/Coastal Flooding-Sea Level Rise	Acute	Storm surge and Hudson River flooding amplify risks to lower elevation facilities, especially mechanical rooms, research buildings, and energy hubs. This could cause asset damage, expensive emergency response requirements, and service disruptions that could affect mission-critical activities in health care and science.	• NPCC • IPCC	MIT publishes a report on flood risks (up river floods), based on comprehensive research and projections, along with mitigation actions (MIT Office of Sustainability, n.d.). Harvard University also recognizes this risk.
Extreme Precipitation/ Storm water	Acute	More intense rainfall events overwhelm stormwater systems, leading to localized flooding. These impacts restrict building access, disrupts classes and research activities, and increases maintenance, remediation, and continuity of operations planning demands.	• NPCC • NOAA	A commonly recognized climate risk topic among peer schools (peer benchmarking score card).
Winter storms/Extreme cold	Acute	Winter storms and prolonged freezing conditions increase heating demand, hamper campus mobility (through freeze warnings and school shuttles shutting down), and elevate chances of energy failures in laboratories and health care buildings that depend on uninterrupted environmental control for safety and research integrity.	• NOAA	Winter storm is not a commonly recognized climate risk among peer schools.

Air quality	Acute	More frequent regional wildfire smoke events deteriorate air quality and create health risks for sensitive populations, forcing operational modifications such as indoor restrictions or class cancellations that disrupt student experience and campus activity.	• TCFD • EPA • NOAA • NCA5 • NPCC4	Brown University recognizes air quality as a climate risk (Brown University, n.d.).
Earthquake	Acute	Seismic shocks from regional intraplate fault lines could damage older buildings and key utilities not designed for earthquake resilience, endangering life safety, displacing campus communities, and necessitating costly emergency repairs and recovery.	• NSHM • NYC HMP • FEMA	UC Berkeley recognizes fault lines directly under the campus and has a comprehensive study on seismic resilience of campus buildings (Office of Emergency Management, n.d.; UC Berkeley Administration, n.d.).
Long-Term Heat Increase/Heat Island Effect	Chronic	Chronic warming and increased cooling loads degrade building performance and raise operational energy spending while creating thermal-comfort and health challenges that impact student performance, workforce productivity, and research continuity.	• SASB • EPA Heat Island Index • NPCC	A commonly recognized climate risk topic among peer schools (peer benchmarking score card).
Sea-Level Rise/Coastal Erosion	Chronic	Progressive sea-level rise increases shoreline erosion and facility vulnerability at coastal sites such as Lamont-Doherty and Nevis, driving physical infrastructure damage, reduced logistics and access reliability, and long-term capital planning pressures.	• NPCC • NOAA	UC Berkeley published a report on climate vulnerability assessment recognizing high sea level rise occurrence (UC Berkeley Office of Sustainability, 2017).
Groundwater Rising	Chronic	Rising groundwater levels increase seepage and corrosion in basements, tunnels, and utility corridors, accelerating infrastructure deterioration, limiting usable space, and driving major rehabilitation needs to safeguard research assets and building functionality.	• SASB • NYC DEP Groundwater Models	MIT publishes a report on flood risks (inland floods), based on comprehensive research and projections, along with mitigation actions (MIT Office of Sustainability, n.d.).

Stormwater Management Stress	Chronic	Surface flooding caused by inadequate stormwater drainage disrupts campus transportation, affects essential utilities, elevates property-damage risk. Addressing these impacts requires increased investment in water-management infrastructure to ensure safe campus functioning.	• IPBES • TNFD • ENCORE • UCCRN - ARC3.2	Cornell University has an established stormwater management for the basement infrastructure (interview with Cornell University). Princeton University also recognizes this risk (Princeton University -Office of Sustainability, n.d.,)
Building/ Construction	Chronic	Aging campus buildings face increasing strain from extreme heat and heavy precipitation, heightening the risk of Heating, ventilation, and air conditioning (HVAC) failures, flooding, and safety hazards. As Columbia expands construction in surrounding lower-income neighborhoods, inadequate mitigation could exacerbate environmental burdens on already vulnerable residents, increasing both operational and reputational risk for the University.	• NPCC4 • EPA	Sustainable construction policy is well developed and publicly available in most peer schools except NYU (peer benchmarking score card). However, NYU has been proactively engaging with the NYC Council and will start reporting building-related emissions to the City as part of Local Law 97 beginning in 2025.
Clean/ Reliable Energy	Chronic	Increasing extreme heat events driven by climate change and NYC peak demand leads to overload cooling, electrical, and data-center infrastructure. These conditions elevate risks of equipment overheating, power outages, research loss, and disrupted learning environments that carry substantial operational and financial consequences.	• TCFD • PlaNYC • NPCC4	While overall GHG emissions, energy consumption (kWh/ MWh), and Net Zero targets are commonly addressed topics, most peers do not disclose building-level energy intensity reports (peer benchmarking score card).
Biodiversity	Chronic	Ongoing loss of urban green and blue spaces around campus weakens natural cooling and stormwater mitigation. It also elecates reputational risks if Columbia is perceived as insufficiently addressing biodiversity and ecosystem stewardship in its planning and development.	• NSHM • NYC HMP • FEMA	While most peers lack in biodiversity impact assessment, Princeton University has an extensive report and goal. UPenn, Fordham, Yale, UC Berkeley, and Duke publish extensive reports on land use and ecological sensitivity (peer benchmarking score card).

6.2.3 Climate Risk Topics

Based on NPCC4, FEMA, Plan 2030, and interviews the final climate risk topics were categorized into acute and chronic risks as listed below:

Acute Risks

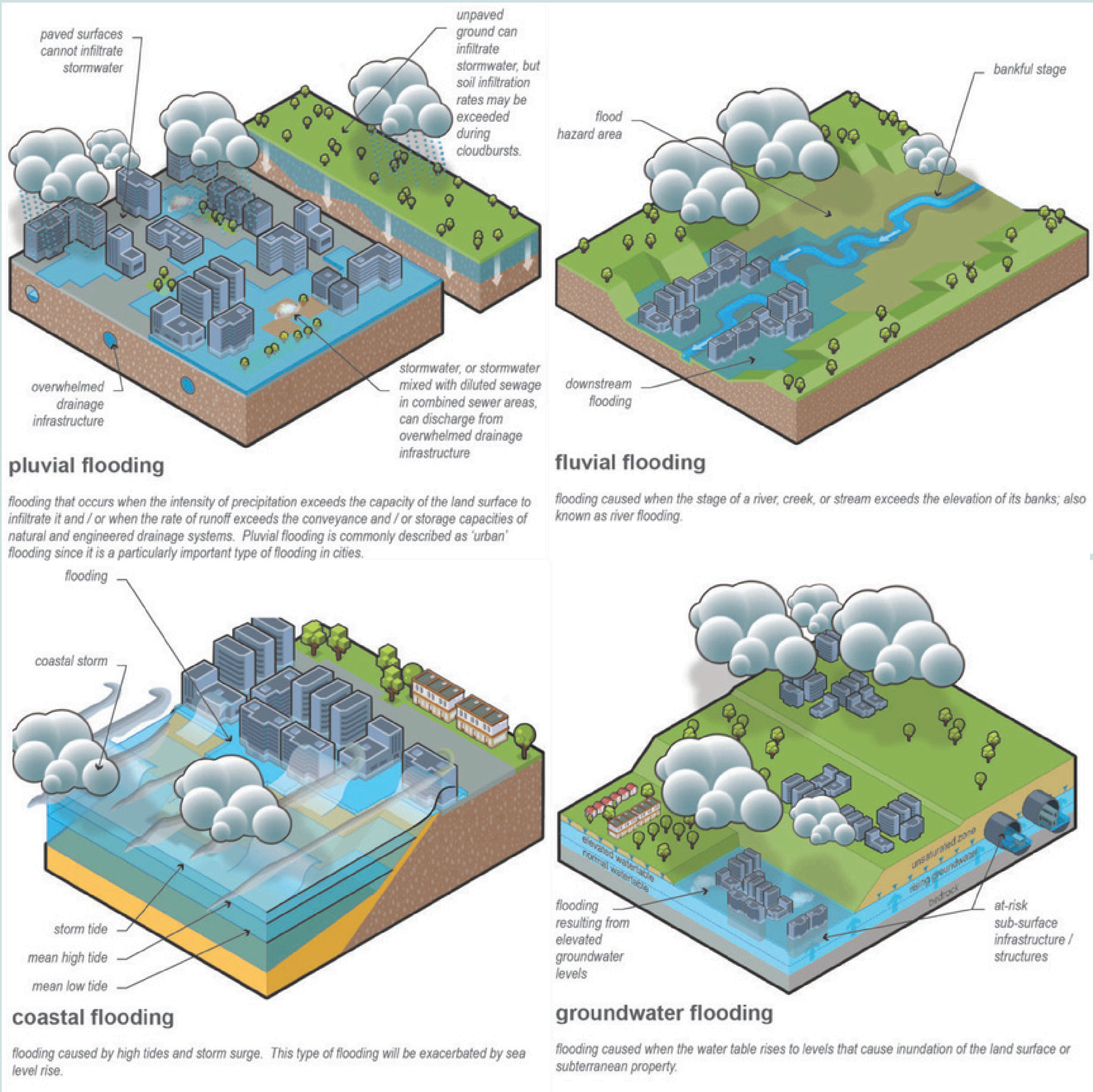
1. Heat waves/Extreme heat
2. Riverine/Coastal Flooding/Sea Level Rise
3. Extreme Precipitation/Stormwater
4. Winter storms/Extreme cold
5. Air quality
6. Earthquake

Chronic Risks

7. Long-Term Heat Increase/Heat Island Effect
8. Sea Level Rise / Coastal Erosion
9. Building / Construction
10. Stormwater Management Stress
11. Clean / Reliable Energy
12. Groundwater Rising
13. Biodiversity

Figure 10

Image of New York City flood risks compares four types of flood hazards: pluvial (rainfall), fluvial (rivers and streams), coastal (tidal and storm surge), and groundwater



Note. From NPCC (2024).

6.2.3.2 Acute Risks

This section evaluates acute climate risks most relevant to Columbia University's operations, infrastructure, and community health. Each topic reflects projections from NPCC4 and NYC climate planning documents.

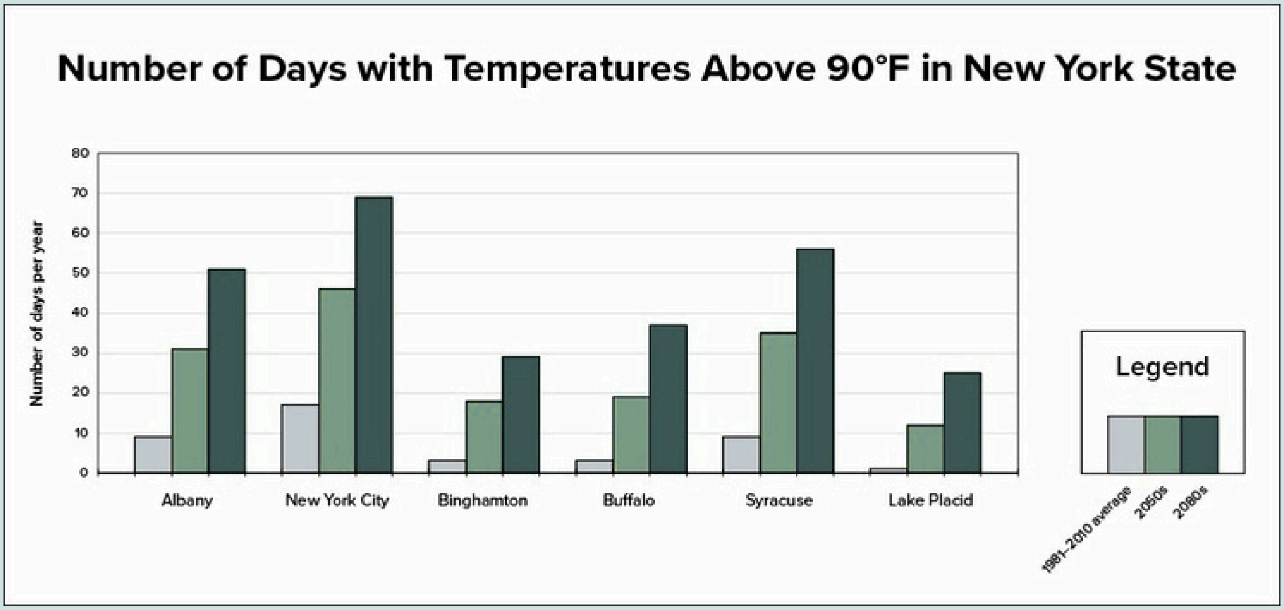
Heat waves pose significant operational and health risks for Columbia University due to the density of its campuses and its dependence on cooling-intensive facilities.

1. Heat Waves/Extreme Heat:

Risk Description: A heat wave (three or more consecutive days above 90°F) is considered a climate risk topic as both NPCC4 and PlaNYC state that NYC will experience longer, more frequent, and more intense heat waves. NYC could experience up to six events per summer and a tripling of 90°F+ days by the 2050s, up from an average of two heatwaves per year between 1970-2000 (United States Environmental Protection Agency [EPA], 2025). For more details refer to Appendix B.

Figure 11

Projected changes to the number of days per year with temperatures above 90°F at six locations across the state



Note. Projections developed for the New York State Climate Impacts Assessment by a team at Columbia University (2024).

Relevance to Columbia University: This topic is relevant to Columbia University because its campuses are in dense Manhattan neighborhoods with high impervious cover. Columbia University also operates assets that are sensitive to heat such as research labs, residence halls, and classrooms that rely heavily on mechanical cooling. Columbia Residential operates 150 buildings that house over 8,000 faculty, staff, postdocs, graduate, and select undergraduate students (Columbia Residential, n.d.-b). Most Columbia Residential units still do not include built-in AC, creating vulnerabilities during heat events (Columbia Residential, n.d.-a; Columbia Housing, 2023).

Table 5 *Heat Stress Deaths by Residence, NYC residents and non-NYC residents, May-September, 2014-2023.*

Place of residence	n	%
Brooklyn	17	30
Queens	13	23
Manhattan	9	16
Bronx	6	11
Staten Island	1	2
NY State outside NYC	3	5
Outside of NYS	4	7
Homeless*	3	5
Total	**56**	**100**

*Based on residence unknown in death certificate.

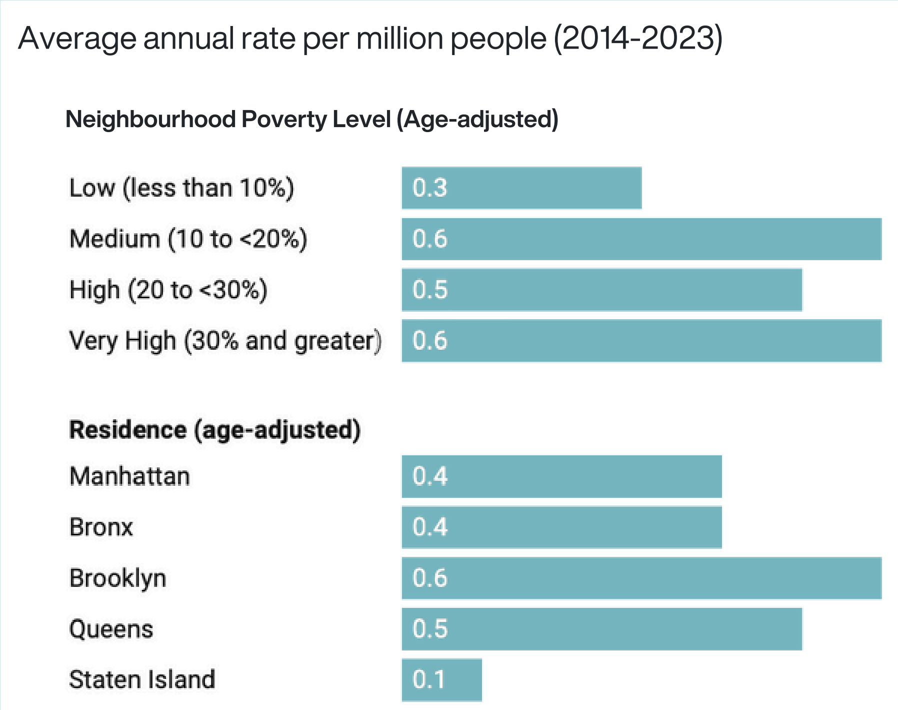
Note. From the 2025 Heat Mortality Report Appendix by the NYC Department of Health (2025).

Impact: According to the 2025 NYC Heat-Related Mortality Report, a lack of access to home AC is the most important risk factor for heat stress deaths (NYC Department of Health, 2025). The same report indicates that annual average death rates from 2014 to 2023 were higher in neighborhoods with more than 30% of residents with household incomes below the federal poverty line than in wealthier neighborhoods, pointing to underlying socioeconomic issues (NYC Department of Health, 2025).

While Manhattan has a lower rate of heat stress deaths than Brooklyn and Queens, this rate is more than twice the rate outside of New York State. If Columbia University fails to provide an adequate cooling environment for students or vulnerable members of the surrounding community, the university may face reputational risk. Failure to provide adequate indoor cooling during extreme heat could create health, operational, and reputational risks for Columbia University.

Figure 12

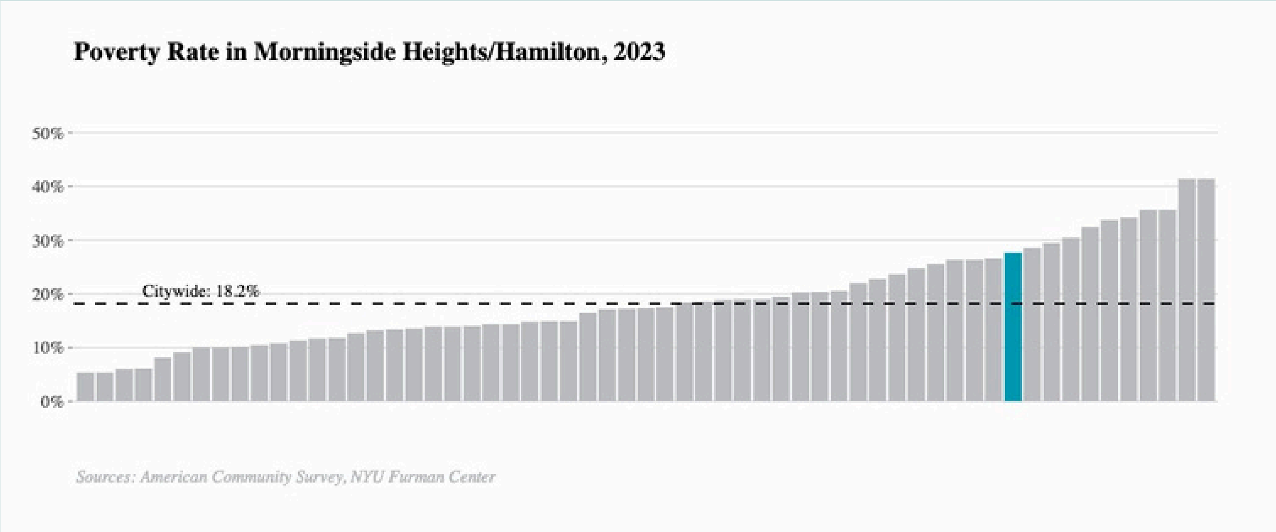
Demographic characteristics of heat-stress descendants (2014-2023).



Note. From 2025 NYC Heat-Related Mortality Report. Data from DOHMH Bureau of Vital Statistics (2025).

Figure 13

Poverty Rate in Morningside Heights/Hamilton neighborhood, 2023



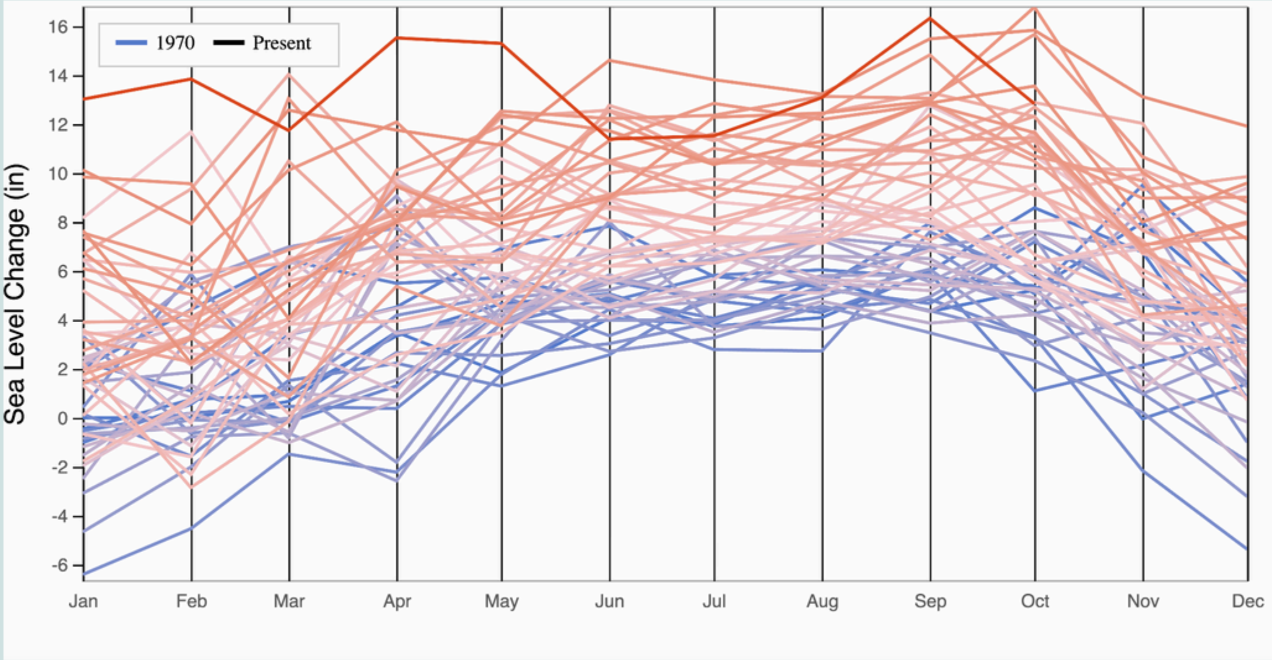
Note. From Morningside Heights/Hamilton MN09 (2023).

2. Riverine / Coastal Flooding Sea Level Rise:

Risk Description: New York's sea level has risen 8 inches since 1970 and is projected to rise another 0.9-2.0 feet by the 2050s. Rising coastal water levels increase the frequency and intensity of coastal flooding events (National Sea Level Explorer, 2024). NPCC4's flood risk chapter forecasts that sea levels could rise by another 0.9 to 2.0 feet by the 2050s, relative to a 2000-2004 baseline, which could lead to a meaningful increase in the frequency and intensity of coastal flooding around NYC (Rosenzweig et al., 2024; Braneon et al, 2024).

Figure 14

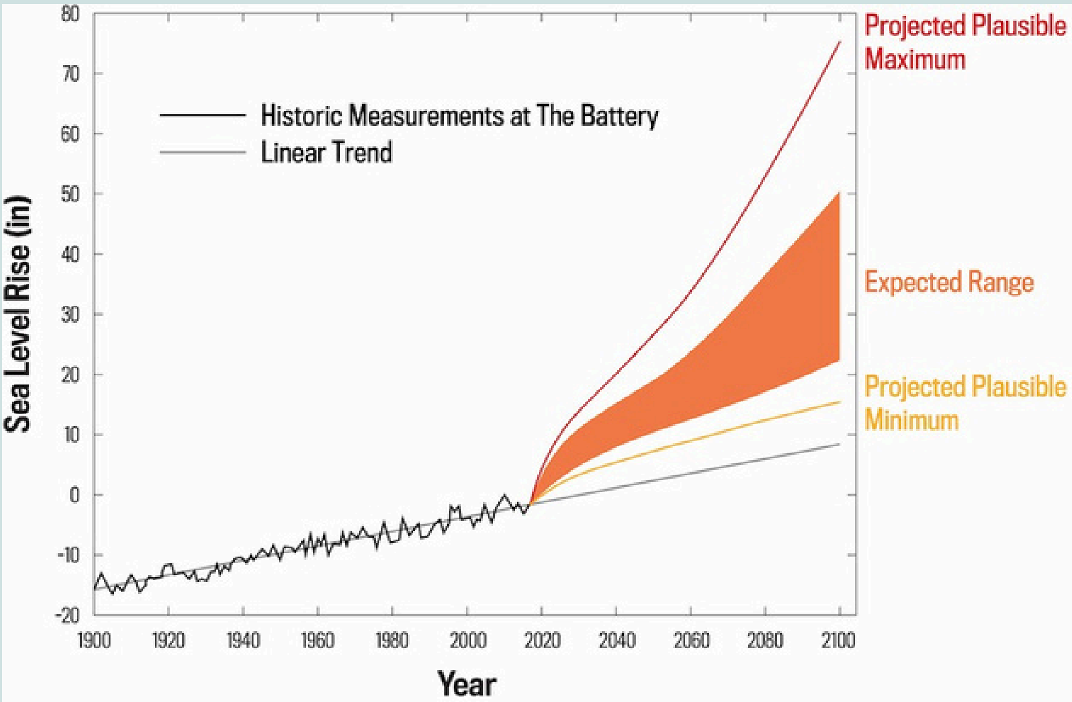
Total Sea Level Rise in New York: 1970-2024, 7.9 inches



Note. From U.S. Sea Level Change - New York (2024).

Figure 15

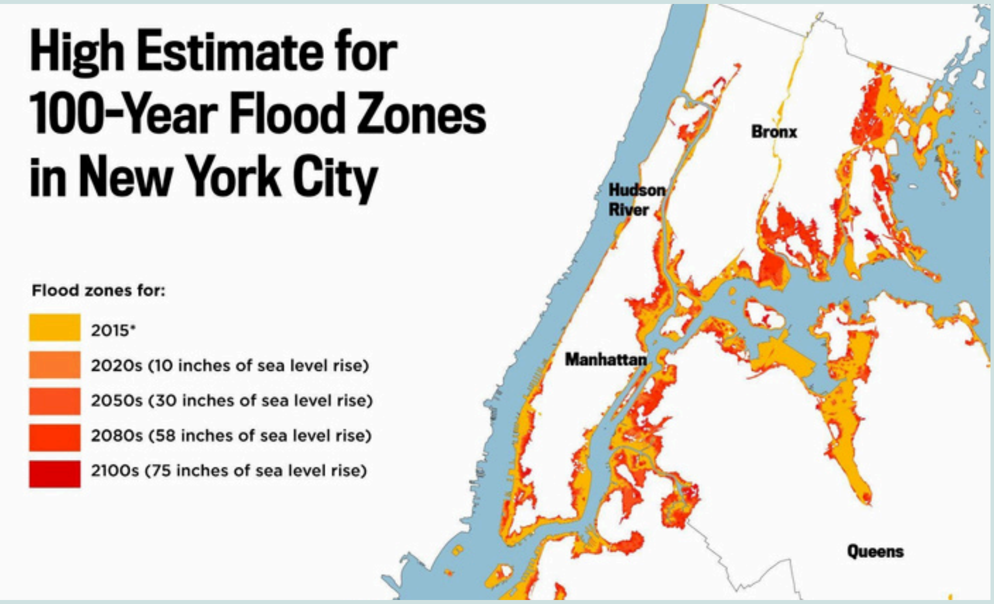
Observed sea level rise at The Battery in New York City from 1900 through 2017, compared with projected changes in sea level rise from the New York City Panel on Climate Change 2015 Report in the 2020s



Note. From Rising Tide: New York and Sea-Level Tide by the Museum of the City of New York, using data from FEMA (n.d.).

Figure 16

High estimate for 100-year flood zones in NYC

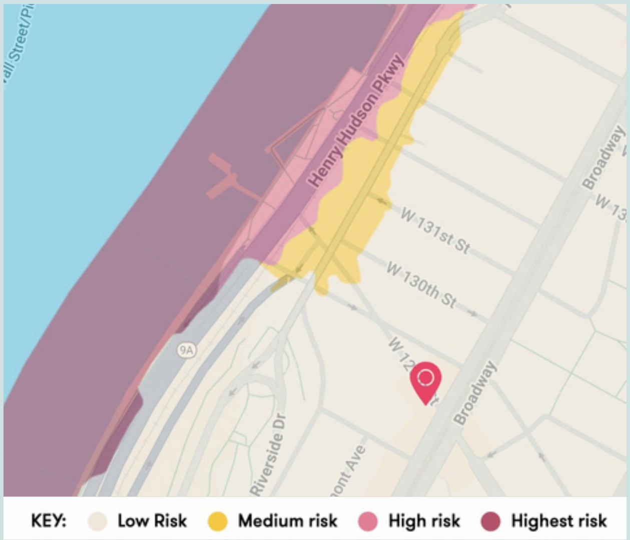


Note. From Rising Tide: New York and Sea-Level Tide by the Museum of the City of New York, using data from FEMA (n.d.).

Relevance to Columbia University: Columbia University's Manhattanville campus, with critical systems in basements and a newly built athletic facility, sits within a few blocks of the Hudson and Harlem rivers at relatively low elevations. These siting characteristics increase exposure of mechanical rooms, electrical equipment, and program spaces to potential water damage during extreme events.

Figure 17

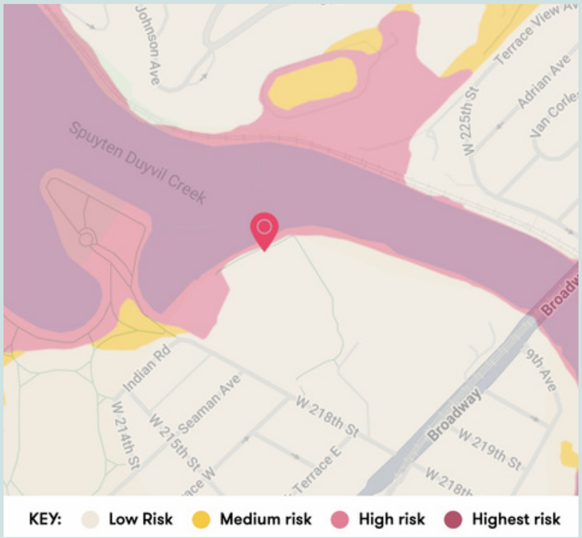
A Map of Current Coastal Flooding Risk of Manhattanville Campus



Note. From FloodHelpNY by NYC Department of Environmental Protection (2025).

Figure 18

A Map of Current Coastal Flooding Risk of Philip & Cheryl Milstein Family Tennis Center



Note. From FloodHelpNY by NYC Department of Environmental Protection (2025).

Impact: While Columbia's campuses are not within FEMA 100-year flood zones, the Manhattanville campus sits near the Hudson and Harlem Rivers, with extensive below-grade mechanical and electrical systems. These siting conditions heighten exposure to potential water intrusion during extreme events. Continued monitoring and flood-resilient design remain essential.

3. Extreme Precipitation / Stormwater:

Risk Description: On October 30, 2025, heavy rainfall in the NYC area exceeded 6 inches per hour while the city's sewer system is only designed for 1.75 inches per hour. The result was flooding, compromised subway operation systems, and the deaths of two people (Lewis & Villafane, 2025). Stormwater flooding can occur in both coastal and inland areas, and NPCC4 and NYC Climate Risk Information projects a 10-20% increase in higher intensity, short duration rainfall by the middle of the century. NYC's Stormwater Resiliency Plan and Climate Resiliency Design Guidelines explicitly highlight pluvial flooding, overloaded combined sewers, and ponding as key climate risks (NYC Mayor's Office of Resiliency, 2021).

Relevance to Columbia University: Columbia University's campuses contain large impervious areas and complex topography that increase stormwater runoff. Past events (Braneon et al., 2024) have caused localized flooding at both campuses. As such, Columbia University's campuses may face stormwater flooding. Columbia University's Manhattanville campus has also upgraded its drains to glass fiber-reinforced polymer concrete provided by Dura Trench (Dura Trench, 2023). However, the conditions of other storm drainage systems at Columbia University are not publicly available.

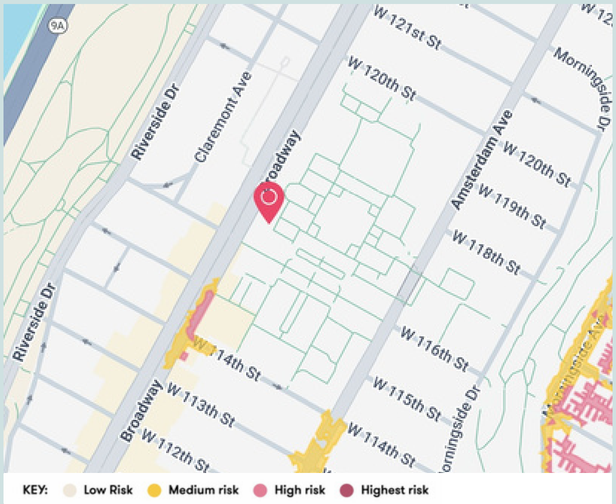
Figure 19

Extreme Stormwater Flood Risk map of Manhattanville Campus (600 W 125th St)

Note. From FloodHelpNY by NYC Department of Environmental Protection (2025).

Figure 20

Extreme Stormwater Flood Risk map of Morningside Heights Campus (535 W 116th St)



Note. From FloodHelpNY by NYC Department of Environmental Protection (2025).

Impact: Storm events can flood basements, damage building systems, and disrupt subway service, creating safety and mobility challenges for Columbia's commuter population while interrupting classes and research and increasing maintenance and drainage upgrade costs.

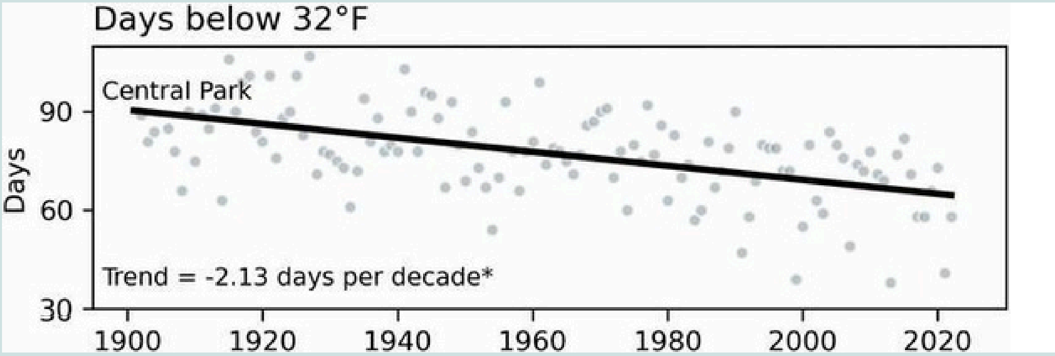
4. Winter Storms / Extreme Cold:

Risk Description: As overall temperatures rise, the number of days with minimum temperatures below freezing has been steadily declining since 1900 (New York City Panel on Climate Change 4th Assessment [NPCC4], 2024). NYC's climate risk assessment stresses that severe winter storms produce snow, sleet, extreme cold, ice, and high winds that often can damage infrastructure, disrupt transportation, and lead to other public health & safety risks (Meier et al., 2024; MitigateNY, n.d.). NYC's Hazard Mitigation Plan discusses severe winter weather, noting risks to transportation, power lines, and buildings, including snow load and pipe freezing (New York City Emergency Management, n.d.-d). Despite long-term warming trends, individual severe cold events can still produce acute operational challenges.

Relevance to Columbia University: Columbia relies on aging steam and hot-water distribution systems vulnerable to freeze-thaw cycles. A 2022 CUIMC pipe failure during a rapid temperature drop caused major flooding and operational shutdowns.

Figure 21

Number of days with temperatures below freezing (32 degrees F) in NYC from 1900 to 2021



Note. From NPCC4 using data from the Global Historical Climatology Network–Daily (GHCN-D) Version 4 (2024).

Impact: As many Columbia University students and faculty commute by public transportation, they face health and safety risks, including hypothermia, frostbite, and injuries from falls (New York City Emergency Management, n.d.-d).The CUIMC campus' clinical, research, and administrative spaces experienced catastrophic flooding caused by broken pipes due to outside temperatures plummeting from the mid-50s to less than 10 degrees fahrenheit in a single day in December 2022. The flood resulted in power outages, temporary relocation of clinical spaces, and damaged equipment (CUMIC, 2023).

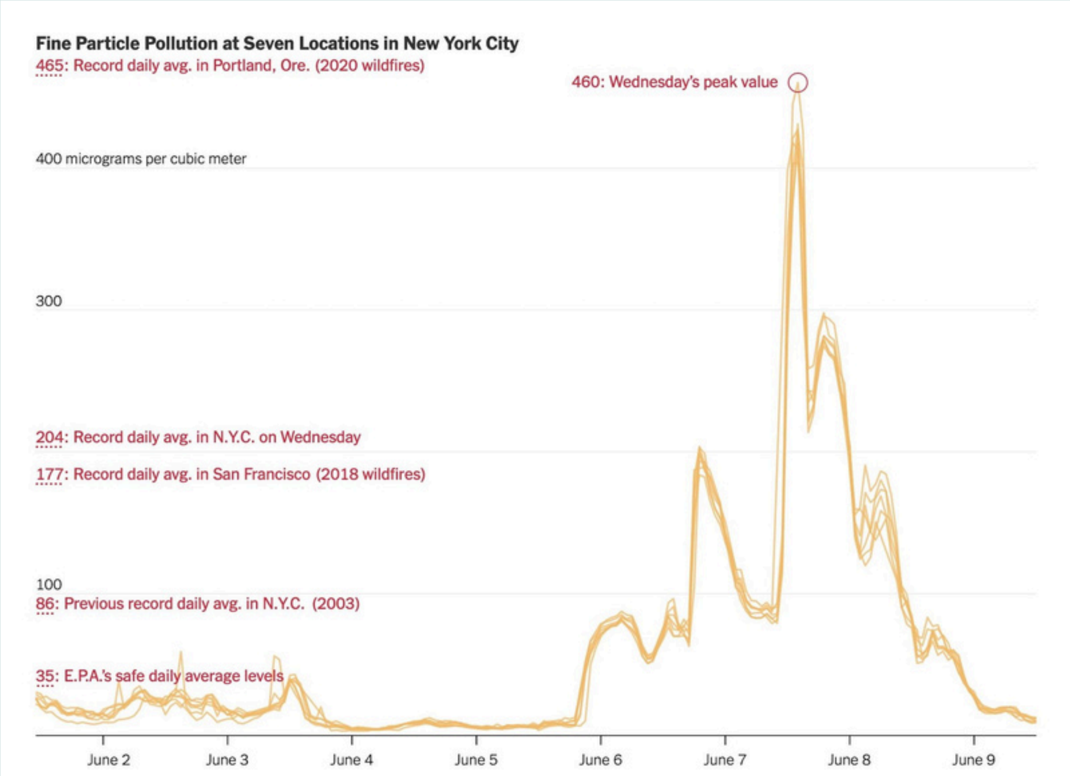
5. Air Quality:

Risk Description: In June 2023, smoke from Canadian wildfires caused NYC to experience some of the worst air quality in the world, with PM2.5 (a classification for small particulates) spikes and widespread health advisories. The severity of the event was widely attributed to climate driven change which made the fires more difficult to contain (New York City Emergency Management, n.d.-c; Williams, 2023).

Relevance to Columbia University: Poor air quality forces Columbia University to adjust outdoor activities, protect patients at CUIMC, and implement campus-wide health guidance.

Figure 22

Fine Particle Pollution at Seven Locations in New York City



Note. From the NYC Hazard Mitigation Plan: Poor Air Quality, with data provided by NYC DOHMH and republished by TheNewYork Times (2023).

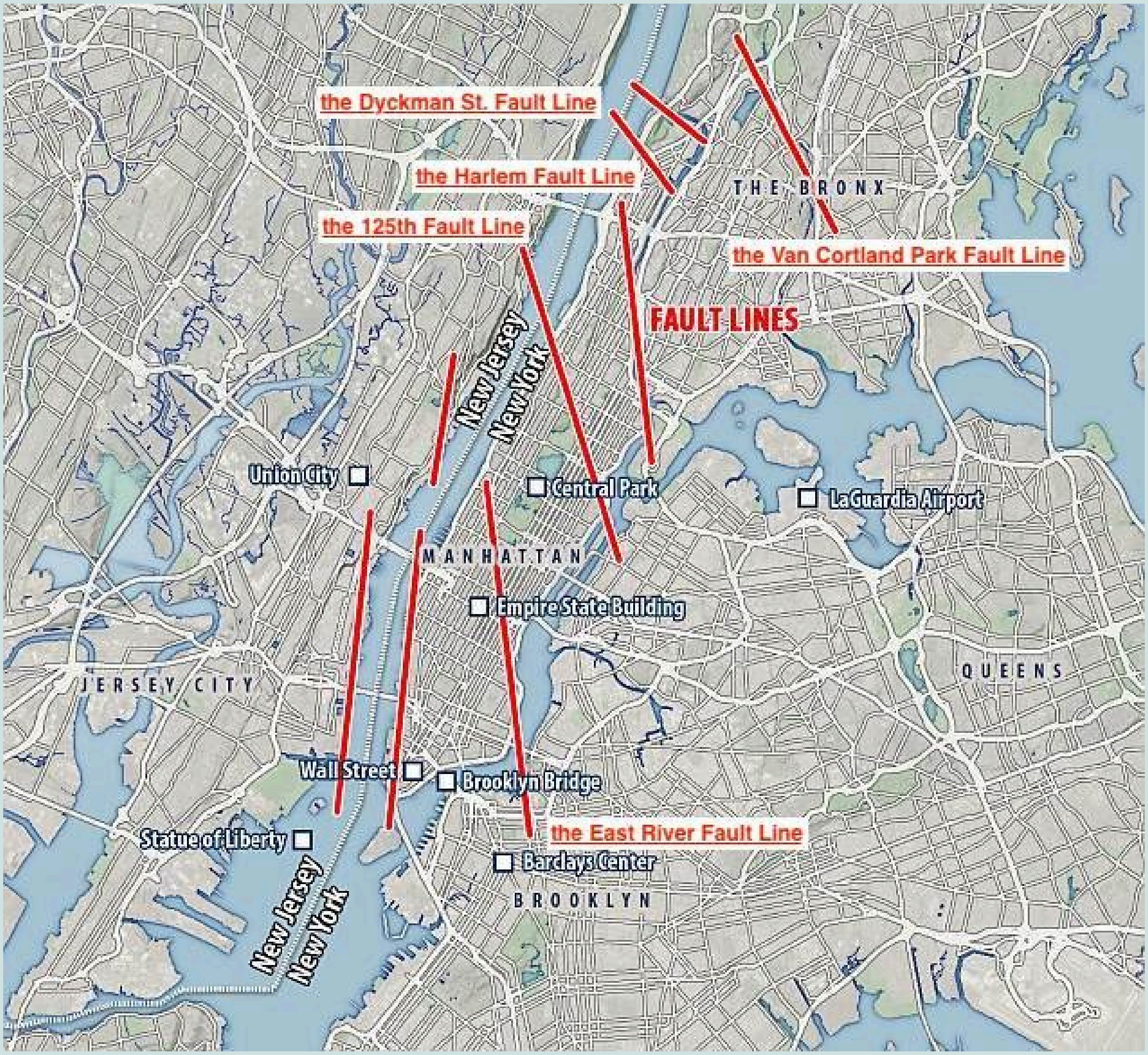
Impact: Columbia University must protect students, staff, and patients from poor air quality events, given their propensity to cause operational disruptions and adverse health impacts.

6. Earthquake:

Risk Description: Although the greater NYC region does not rest on a major tectonic plate boundary, several fault lines do expose the city to some level of seismic risk (Baum, 2024). Some notable fault lines under NYC are the 125th Street Fault, the Dyckman Street Fault, the Mosholu Parkway Fault, and the East River Fault which are pictured below in Figure 23 (Baum, 2024).

Figure 23

A Map of Fault Lines in NYC

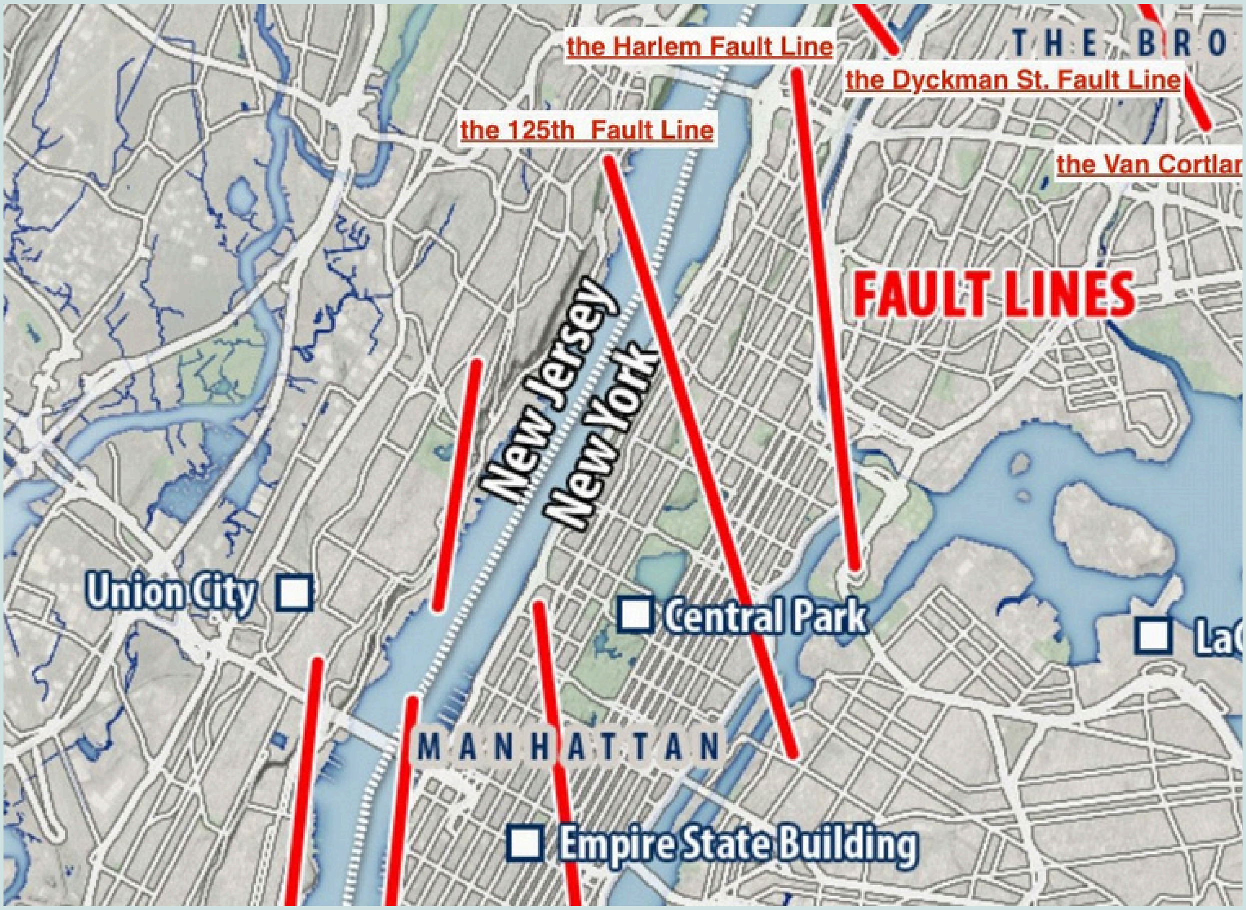


Note. From Hidden Corner of New York City: The city's fault lines by Columbia Spectator, based on an original image from Experts warn NYC could come down like a house of cards if a 5.0 earthquake struck along the 125th Street fault line, and NYC is overdue for one by the Daily Mail (2018).

Relevance to Columbia University: The 125th Street Fault is the largest, running diagonally from New Jersey to the East River, right through Columbia University's Manhattanville campus. Several academic and residential structures on Columbia University's campuses predate seismic design standards, increasing fragility during moderate shaking.

Figure 24

A Close-up Map of Fault Lines near Columbia University

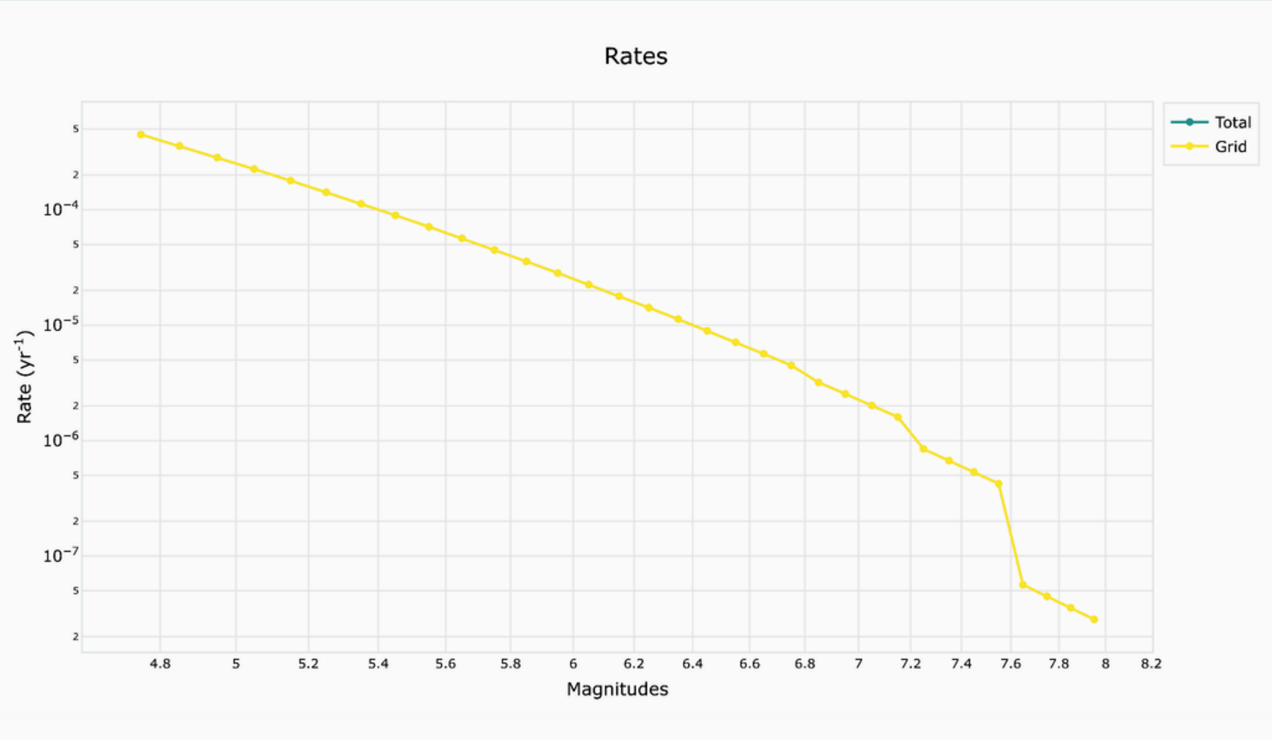


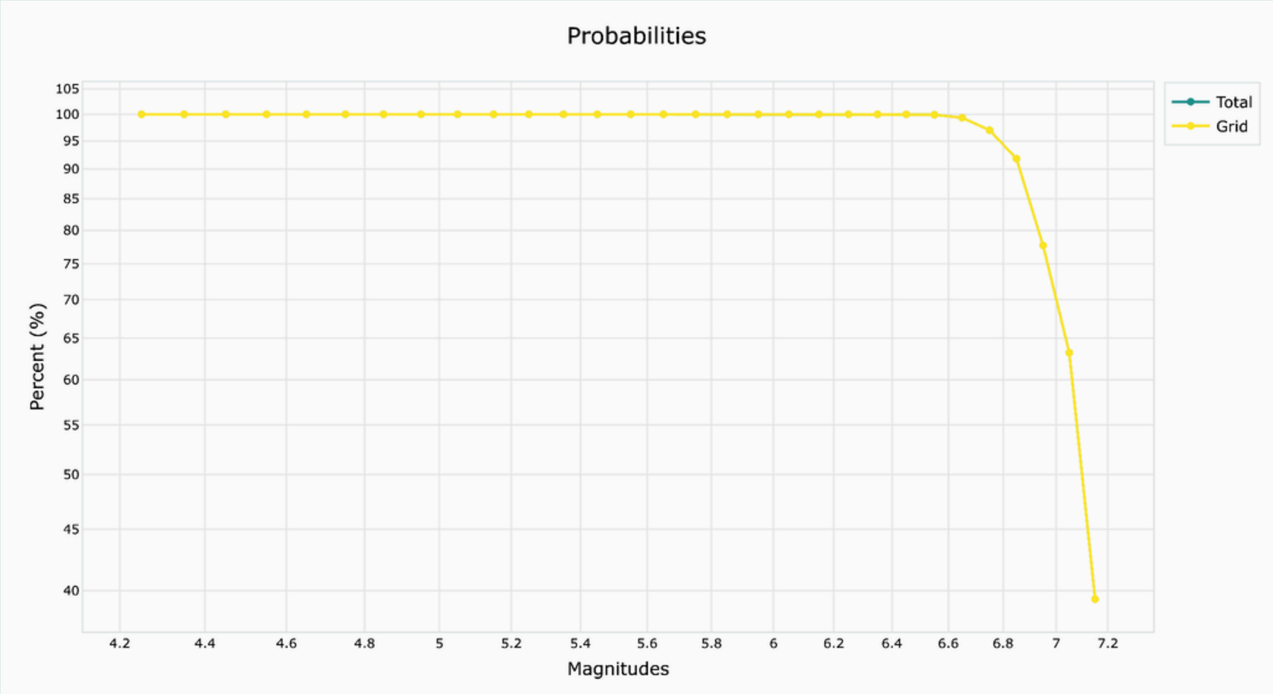
Note. From Hidden Corner of New York City: The city's fault lines by Columbia Spectator, based on an original image from Experts warn NYC could come down like a house of cards if a 5.0 earthquake struck along the 125th Street fault line, and NYC is overdue for one by the Daily Mail (2018).

Impact: Earthquakes in NYC remain infrequent and generally low magnitude, but the risk is not negligible. The 125th Street Fault likely caused a magnitude 2.4 earthquake on October 27, 2021 (Baum, 2024), and historically, the region has recorded 18 earthquakes of magnitude 2.8 or higher since 1737 (Baum, 2024). Both the NYC Hazard Mitigation Plan and the U.S. Geological Survey National Seismic Hazard Model (USGS NSHM) project a non-zero probability of damaging shaking within the next 50-100 years, and the New York City Area Consortium for Earthquake Loss Mitigation classifies NYC's hazard level as moderate (Baum, 2024). Buildings constructed before 1995 when seismic requirements were integrated into NYC building codes face heightened structural vulnerability, particularly three- to six-story structures (Toor, 2018). A moderate M5-M6 earthquake could damage older buildings, disrupt campus operations, generate significant repair and insurance costs, and pose life-safety risks (Earthquake Hazards Program, n.d.; New York City Emergency Management, n.d.-b).

Figure 25

Rates and Probabilities of Earthquake at Morningside Heights Campus





Note. From the USGS Earthquake Hazard Toolbox, Earthquake Rates and Probabilities, by the United States Geological Survey (2025).

Takeaway: Small to moderate earthquakes (up to ~M6.7) are highly likely to occur over a 100-year period, while larger earthquakes (above ~M7) are rare.

The first graph shows that earthquake occurrence rates drop rapidly as magnitude increases, following an almost straight line on a logarithmic rate scale until about magnitude 7, after which the rate becomes extremely low. The second graph shows that the probability of at least one event is essentially 100% for magnitudes up to around 6.7, then declines sharply so that events above roughly magnitude 7 become much less likely, with probabilities falling below about 40% by magnitude 7.2.

6.2.3.3 Chronic Risks

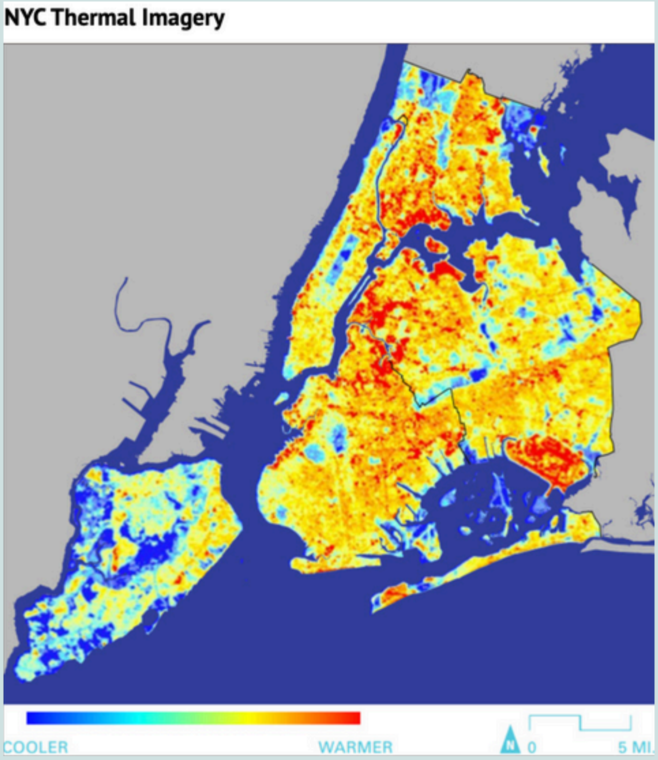
7. Long Term Heat Increase / Urban Heat Island Effect:

Risk Description: The urban heat island (UHI) phenomenon occurs when an urban area experiences significantly higher temperatures than surrounding rural areas. UHI, together with long-term heat increase trajectories, is highlighted in NPCC4 and NYC climate projections as a key risk topic. A baseline warming trend and a significant increase in the number of "hot days" and warm nights, not just isolated heat waves, have been observed in NYC (Braneon et al., 2024).Studies on NYC's urban heat island show that built surfaces such as concrete, asphalt, and brick store heat, which increases cooling demand and aggravates chronic heat stress (Ortiz et al., 2018). In a densely populated city like New York, some neighborhoods may face greater UHI-related risks because socio-economic differences result in varying levels of exposure and adaptive capacity.

Relevance to Columbia University: Campuses reflect the broader UHI pattern. On the Morningside Campus, the recent removal of seven trees has reduced canopy cover along College Walk, and limited vegetated space further intensifies local warming. UHI affects energy budgets, building envelopes, and outdoor comfort over the long term (Lakhani, 2025).

Figure 26

A Map of temperature in NYC showing a correlation to the regional socioeconomic status



Note. From *NYC Department of Environmental Protection* (n.d.).

Impact: Assessing the climate risk of chronic UHI/long-term warming, separate from acute heat waves, helps Columbia University capture slow-onset risks: rising baseload cooling demand, building performance drift, gradual decreases in building efficiency over time, and neighborhood-specific socioeconomic risk exposure.

8. Sea Level Rise / Coastal Erosion:

Risk Description: Sea level rise is identified in NPCC4 as a priority risk topic that contributes to flooding, coastal erosion, shoreline change, and chronic high tide impacts (Braneon et al., 2024). The 2019 NPCC report further describes land loss and altered shorelines as a long-term structural risk (Gornitz et al., 2019).

Relevance to Columbia University: While Columbia University's campuses are not located directly on the oceanfront, students, faculty, and staff depend on public transit, utilities, and broader city infrastructure that are increasingly exposed to shoreline change and coastal flooding (Braneon et al., 2024; Gornitz et al., 2019). Disruptions or damage to these interconnected systems could impair campus access, interrupt essential services, and complicate future expansion or partnerships in waterfront areas.

Figure 27

A photo of the Phillip & Milstein Family Tennis Center

Note. From Fast Company, photo courtesy of Perkins & Will (2024a).

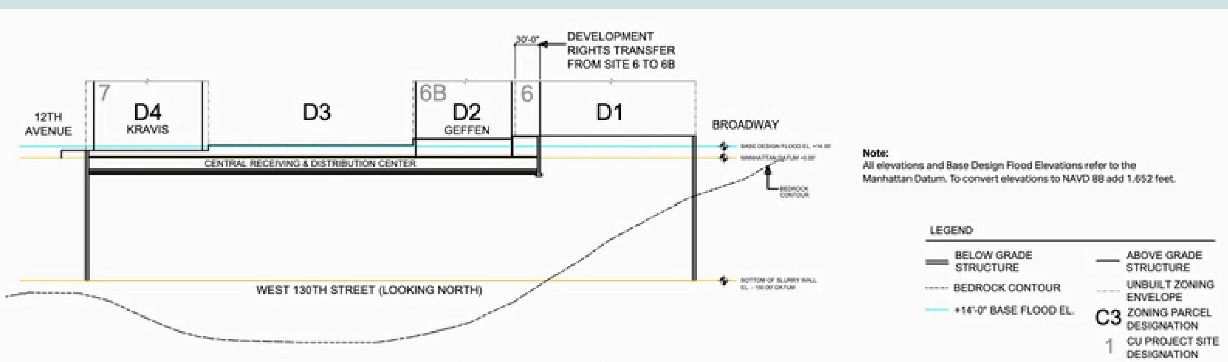
Figure 28

An image of Flood Resilient Design implemented in the Phillip & Milstein Family Tennis Center

Note. From Fast Company, image courtesy of Perkins&Will (2024b).

Figure 29

Below Grade Use Plan of the Manhattanville Campus

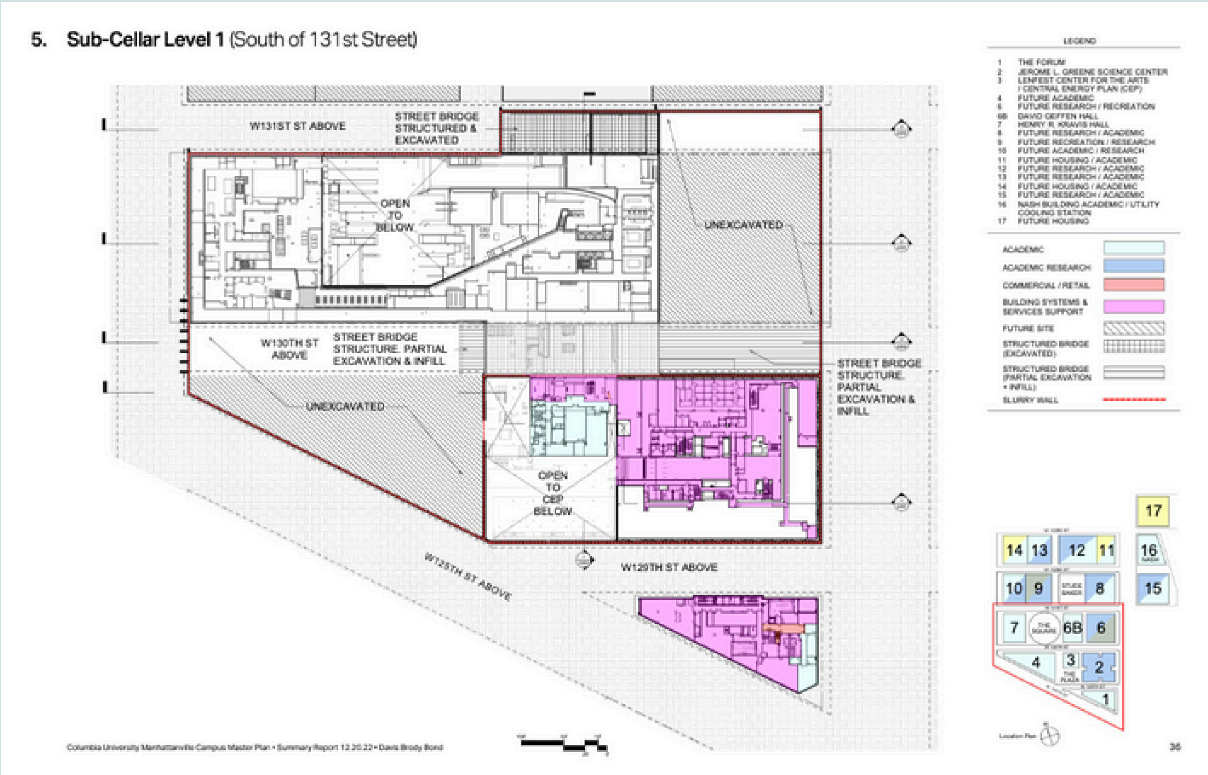


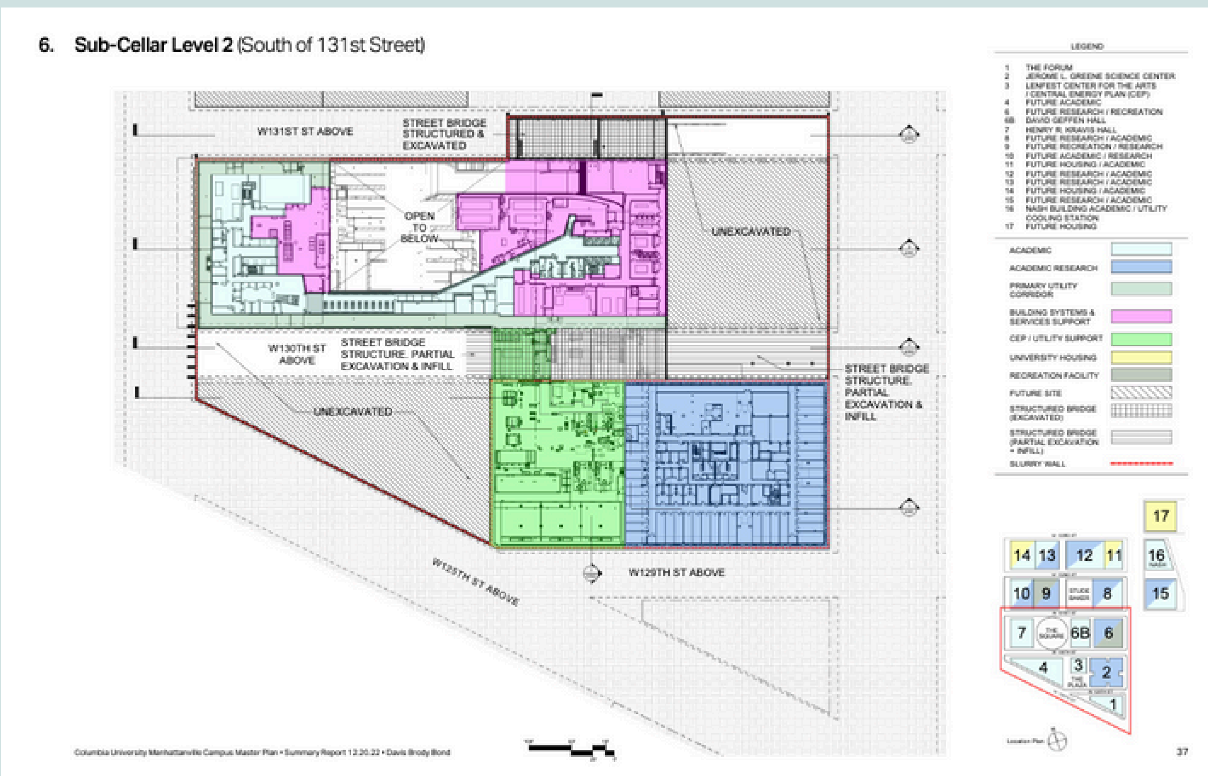
Note. From the Columbia University Manhattanville Campus Master Plan – Summary Report 12.20.22 by *Davis Brody Bond (2024).*

Impact: Future Columbia-affiliated facilities or partnerships near the waterfront may face heightened exposure to erosion and sea level rise, especially if assets are not sited, designed, or managed with these hazards in mind (Braneon et al., 2024). The Phillip & Milstein Family Tennis Center, which incorporates flood-resilient design in anticipation of local sea level rise, illustrates how these risks are already shaping capital planning and could entail additional costs, design constraints, and operational considerations for the University over time.

Figure 30

Sub-Cellar Level Use Plan of the Manhattanville campus (South of 131st Street)





Note. From the Columbia University Manhattanville Campus Master Plan – Summary Report 12.20.22 by *Davis Brody Bond (2024).*

9. Building / Construction:

Risk Description: Buildings are a fundamental asset for Columbia University, hosting the daily lives of students, faculty, and staff, and they are constantly exposed to extreme climate events. The NYC climate assessment notes that climate change impacts such as extreme heat, flooding, and freeze-thaw cycles threaten buildings, infrastructure, and construction practices. Prolonged stress on HVAC systems increases the likelihood of equipment failure, indoor overheating, and service disruptions, which can in turn affect research operations, residential comfort, and overall health and safety conditions.

Relevance to Columbia University: Columbia University has been working to mitigate physical risk through its Exterior and Historic Preservation (EHP) project, which repairs and restores building exteriors to maintain structural integrity and extend asset life. At the same time, regulatory changes specific to New York City, including Local Law 97 (LL97), require applicable institutions to meet GHG emissions limits; failure to comply results in financial penalties (City of New York, n.d.). PlaNYC further emphasizes resilient and low-carbon building design, retrofits, and code changes as core strategies for meeting these requirements.

Impact: Columbia University owns an extensive, heterogeneous portfolio that is required to meet the LL97, including historic masonry, high-rise labs, residence halls, and medical facilities. The university has been implementing GHG emissions mitigation actions, such as using geothermal energy, installing green roofs, and increasing the number of LEED building awards. Many university buildings have basement mechanical systems, single points of failure, and limited passive resilience. Construction is also where Columbia University can most directly implement adaptation to mitigate the future climate and physical risks. This category translates climate hazards into the built-asset layer, where capital planning and design standards can materially change risk in the coming decades.

10. Stormwater Management Stress:

Risk Description: NYC's Stormwater Resiliency Plan highlights capacity limits in the city's combined sewers, outfalls, and drainage networks, noting increasing combined sewer overflow (CSO) events and more frequent street flooding under intense rainfall (NYC Mayor's Office of Resiliency, 2021). Combined sewers that carry both sewage and stormwater are increasingly overwhelmed during heavy rain, exceeding system capacity. NYC's sewer system is designed to manage rainfall of 1.75 inches per hour (Lewis & Villafane, 2025).

The NYC Climate Resiliency Design Guidelines call for the use of specific "design storms," defined as the severity of storms that a structure is designed to endure before failure, and for adjusting return periods to account for climate-driven changes in rainfall when sizing pipes, storage, and green infrastructure (New York City Emergency Management, n.d.-a).

Relevance to Columbia University: Columbia University is a large institutional landholder with control over its internal drainage system. While flooding incidents at Columbia are reported under Facilities and Operations, the underlying causes are not disclosed publicly. The 2022 CUIMC flood incident, discussed under Winter Storms / Extreme Cold, was not directly caused by precipitation; however, following the incident CUIMC developed flood closets stocked with equipment to address water intrusion, enabling a faster operational response (CUIMC, 2023). This type of operational preparedness can support the initial stages of stormwater management, even as system-level capacity issues are addressed through design.

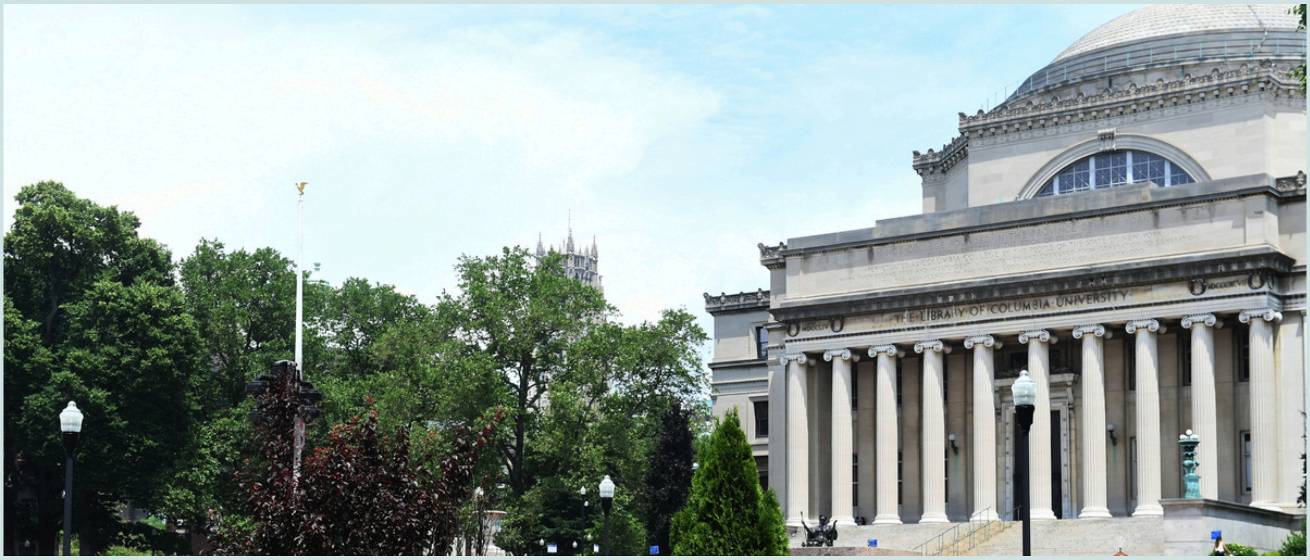
Impact: If stormwater management stress is not addressed proactively, Columbia may experience recurrent nuisance flooding, basement damage, localized erosion, and associated reputational risk tied to perceived unpreparedness (Columbia University Facilities and Operations, 2021). Differentiating Extreme Precipitation / Stormwater from Stormwater Management Stress in the risk register makes it possible to track and manage system-capacity and performance risks that the University can influence more directly through design standards, retrofits, drainage upgrades, and operational preparedness measures such as CUIMC's flood closets and rapid response protocols (CUIMC, 2023).

11. Clean / Reliable Energy:

Risk Description: NPCC4 extensively discusses "climate change, energy, and energy insecurity in New York City," emphasizing that climate change will increase summer cooling demand, strain the grid, and interact with decarbonization policies and fuel-switching to create new reliability challenges (Yoon et al., 2024). NYSERDA studies similarly show that warming significantly increases summer peak load and that energy system reliability becomes more sensitive to extreme heat and electrified heating (New York State Energy Research and Development Authority (NYSERDA), 2023).

Relevance to Columbia University: Columbia University's Plan 2030 commits to advancing decarbonization, electrification, and renewable energy, aligning the university's risk-mitigation approach with NYC's broader mitigation recommendations (Columbia University Office of Sustainability, 2021; Mayor's Office of Climate & Environmental Justice, 2024).

Impact: Clean / Reliable Energy therefore represents both a physical risk and a transition risk/opportunity. On the physical side, heat-related grid stress and outages can disrupt critical operations, including laboratories and hospitals. On the transition side, Local Law 97 compliance, renewable energy procurement, and on-site generation create both cost exposure and strategic opportunities. A structured risk assessment of energy system reliability and transition pathways will help Columbia develop a comprehensive, forward-looking energy procurement and investment strategy.



12. Groundwater Rising:

Risk Description: Rising coastal water levels can also drive groundwater levels higher inland, as denser salt water pushes fresh water upward. This process can affect basements, building foundations, and underground utility equipment even in locations that do not experience significant surface flooding.

Relevance to Columbia University: Among Columbia University campuses, the Manhattanville campus faces a higher risk from groundwater rising because it is situated approximately five feet above sea level, compared to the Morningside campus, which sits over 100 feet above sea level (Holcomb, 2024).

Impact: Many Manhattanville assets sit underground, including a central receiving and distribution center, academic research, and a central energy plant. Groundwater rise could expose these assets to corrosion and chronic moisture problems. Measurement of groundwater levels in NYC recently resumed after a pause to studies in 2013 interrupted about 50 years of routine monitoring (Maldonado, 2023). Studies indicate that higher levels of groundwater can correlate with flooding (Maldonado, 2023).

13. Biodiversity:

Risk Description: Biodiversity risk is increasingly recognized in corporate risk frameworks alongside physical, transition, and regulatory risks. Columbia University has not pledged to the Nature Positive Universities Alliance, a global higher-education alliance for biodiversity, placing it behind peer institutions that have made this commitment (Nature Positive Universities, n.d.).

Relevance to Columbia University: Since Columbia operates in an urban environment, it faces land-use change, aging campus infrastructure, and built-environment pressures that reduce green space and ecosystem services, contributing to biodiversity degradation on and around its campuses. Columbia is located in a region whose dominant vegetation type is Appalachian Oak (104) and whose dominant vegetation form is Eastern Hardwood Forest, both of which show short- and long-term decline (U.S. Potential Natural Vegetation, 2019; NYNHP, 2023).

Impact: A loss of green space also reduces natural cooling, stormwater absorption, and urban heat mitigation, which in turn increases flood and heat risk and poses reputational risks for Columbia University. While updating building infrastructure is a common approach to mitigating other climate risks, integrating biodiversity considerations into these upgrades is essential to avoid worsening ecosystem degradation and to develop a robust climate risk approach for biodiversity (Sako & McManamay, 2023).

6.3 Findings

6.3.1 Prioritization Matrix

The climate and physical risk matrix (Figure 31) evaluates 13 climate risks by scoring each hazard on two dimensions, likelihood and impact, using inputs from NPCC and NOAA regional climate projections, past climate disruptions, and assumptions about the current conditions of Columbia University's infrastructure. Each risk is assigned a severity score based on its estimated financial impact and a likelihood score based on the calibrated possibility of occurrence. The financial impact is estimated using the exposure value of campus facilities and is further explained in Section 8 of this report. Multiplying these scores produces an overall risk rating that enables prioritization and comparison.

A risk is placed higher on the matrix when the estimated disruption reaches a level that could interrupt academic operations, damage physical assets, or require costly repairs. Lower impact risks are those that may cause inconvenience or temporary service interruption but do not create large financial losses or harm over the long run.

In the current matrix, Heat Waves/Extreme Heat and Building & Construction both appear in the "Almost Certain & Minor" category. This placement reflects two factors:

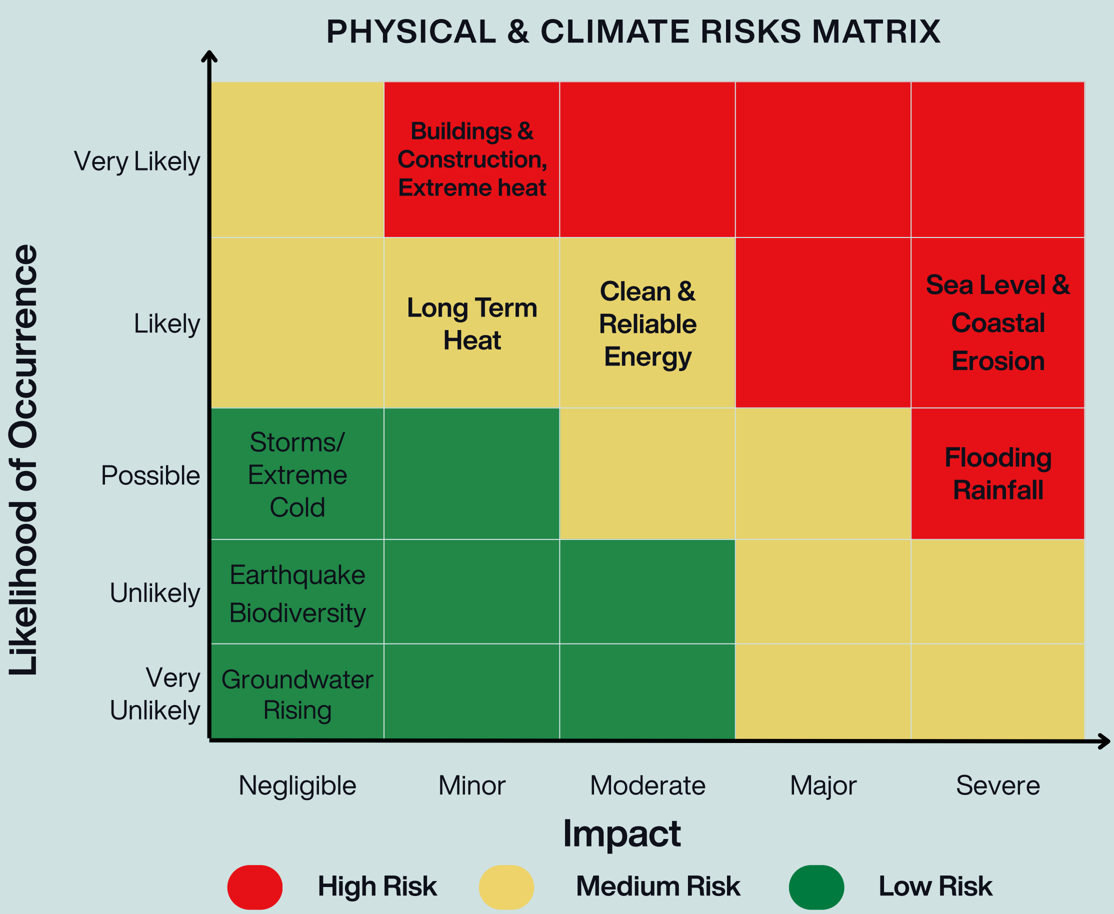
> ***1.*** *Extreme heat has already become a recurring seasonal issue in New York City that strains cooling systems across campus, and*
>
> ***2.*** *Aging building systems and Local Law 97 requirements create predictable operational pressure even when impacts are not immediately severe.*

Long-Term Heat Increase/Heat Island Effect and Clean & Reliable Energy fall under the "Likely & Moderate/Major" categories meaning they are not only probable but also have the potential to affect key campus systems. The peak-load stress associated with Clean & Reliable Energy refers to moments when campus electricity demand rises sharply, usually during severe heat, forcing energy systems to run harder than normal and increasing the chance of outages or equipment failure.

Several acute and chronic hazards, including Riverine/Coastal Flooding, Pluvial Flooding, and Sea-Level Rise & Coastal Erosion, fall within the 'Possible/Unlikely & Severe' range. These events do not occur every year, but when they do, they can seriously disrupt transit, research activity, and building operations. In addition, Winter Storms/Extreme Cold and Stormwater Management Stress fall within the 'Possible & Negligible' range because they occur irregularly yet still create operational challenges for Columbia University. Severe cold events can strain heating systems and disrupt campus access, while short, intense rainfall can overwhelm drainage infrastructure, causing localized flooding, mobility issues, and added maintenance burdens even when impacts are not severe. Similarly, Air Quality (Wildfire Smoke Transport), Groundwater Rising, Biodiversity, and Earthquake are positioned in the 'Very Unlikely' categories with 'Negligible' consequences. Although these hazards are not immediate priorities, keeping them on the matrix ensures awareness as climate patterns evolve and new evidence emerges.

Figure 31

Columbia University Climate and Physical Risk Matrix



6.4 Recommendations
6.4.1 Identification and Recommended Next Action

13
Risk areas identified

4
Climate risk tools

3
Recommendations for Assessment

Based on climate model projections, campus-specific vulnerabilities, and operational dependencies, three risks emerge as the highest priority for immediate institutional action: Building/Construction, Heat Waves/Extreme Heat, and Clean/Reliable Energy. These hazards have a high likelihood and a high operational impact within the next 10-25 years, driven by new local laws, increasing extreme heat events, and chronic urban heat intensification.

To assess climate and physical risks more accurately, consolidation of operational data such as from mechanical equipment and HVAC systems will be required and could help Columbia University prepare for necessary infrastructure updates to meet Plan 2030 goals.

6.4.2 Immediate Actions for Columbia University

Recognition to Columbia University's Climate Exposure

Columbia University has already identified key climate-related risks. This assessment indicates heat waves and extreme heat, clean and reliable energy, and building and construction risks all have a high-likelihood and high-impact and are discussed in depth in Plan 2030.

Address gaps

However, the other additional dimensions of climate risks identified in this assessment are only partially covered (Sustainable Columbia, 2021). To address these gaps and move beyond the existing Plan 2030 targets, six immediate actions are recommended, aimed at making Columbia's climate and physical risk assessment more granular and actionable.

Leverage Scenario Findings

These remediations will help shape current risk-mitigation measures and long-term planning for a climate-resilient campus. The two scenarios, looking at likelihood probability and impact, developed in this assessment also highlight opportunities to bolster resilience by enhancing emergency preparedness, improving infrastructure reliability, and advancing long-term climate adaptation across Columbia's campuses.

6.4.3 Recommendations for Assessment

STEP 1: DEVELOP A BUILDING LEVEL CLIMATE AND PHYSICAL RISK ASSESSMENT:

The climate and physical risk assessment developed for this project is at the campus level. However, for future iterations, a more granular, building-specific dataset to compliment comprehensive analysis.

STEP 2: INTEGRATE CAMPUS-SPECIFIC ASSET DATA INTO HAZARD MODELING:

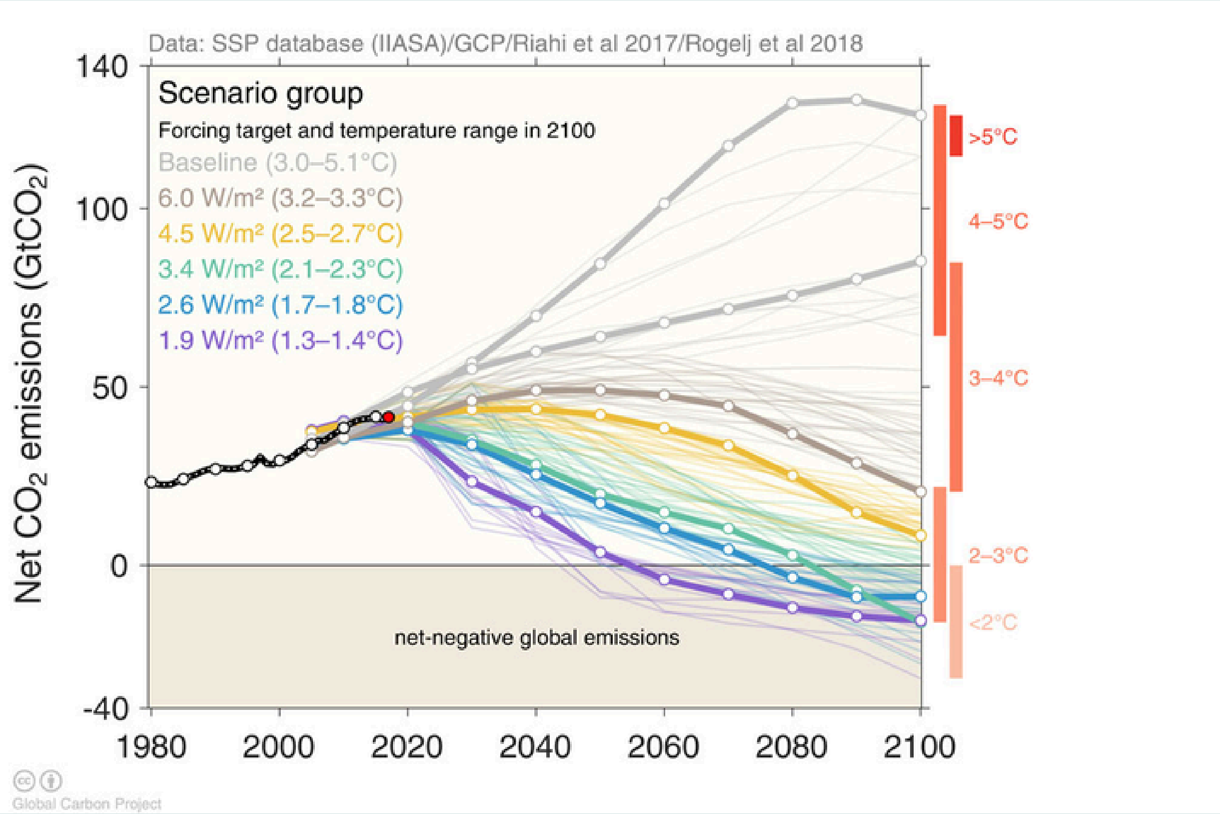
Integrate detailed, campus-specific asset information into hazard modeling so that Columbia-specific likelihood and impact can be characterized more accurately. Key inputs include building elevations, locations of mechanical rooms, inventories of aging infrastructure, drainage and utility maps, and energy-use baselines, all of which are essential for credible hazard and flood-risk models and should be consolidated in a single dataset to quantify exposure and vulnerability for each building and operation.

STEP 3: IMPLEMENT NEAR-TERM SCENARIO MODELING FOR 2030 AND 2050:

Use Shared Socioeconomic Pathway (SSP) 2-4.5 and SSP 5-8.5 climate projections (refer to Figure 32) also used in NPCC4 to stress-test building systems, energy loads, and stormwater capacity. Implementation of SSPs should include Geographic Information System (GIS) inundation modeling as it results in spatial analysis and assessment of stormwater-flow simulations, and heat-load projections for HVAC systems. GIS-based modeling is critical for pinpointing which buildings, basements, or utility corridors face the highest exposure under different climate scenarios.

Figure 32

Global Net CO_2 Emissions Pathways Under Different Climate Forcing Scenarios (1980–2100)



6.4.4 Recommendations for Climate Risk Mitigation

1. Strengthen acute flood preparedness:

Addressing acute flood risk requires a mix of immediate actions and long term planning. Columbia University's primary risk related to acute flooding is related to the flooding of the 1-train subway line, that connects through all three Manhattan campuses. Consequently, the University should develop a detailed transit disruption protocol that outlines how academic activities, laboratory operations, and clinical responsibilities will adjust when extreme rainfall affects the 1-train, such as remote instruction, onsite staffing rotations, temporary housing or workspace arrangements for employees who are unable to commute. The University should also explore agreements with local agencies for emergency shuttle service during major transit outages.

2. Expand heat resilience measures:

To address chronic heat risks, Columbia University would benefit from a campus wide heat resilience plan. This should include a full inventory of cooling systems, an evaluation of their performance during heat waves, and a prioritized list of necessary upgrades. Increasing the tree canopy and installing more green or reflective can help roofs reduce surface temperatures, as recommended by the EPA's Heat Island Program (EPA, 2022). Opportunities for energy storage and onsite generation should also be explored to reduce vulnerability to heat-related outages.

3. Integrate climate resilience into long term planning:

Long-term planning should incorporate NYC climate assessment findings to ensure new construction aligns to future temperature and precipitation conditions (Braneon et al., 2024; NPCC4, 2024). Enhancing passive design, upgrading building envelopes, and increasing shade in high-traffic areas can reduce operational strain. Communicating these risks through annual sustainability reporting will help the campus community prepare for changing conditions.

6.4.5 Recommended Core Tools

Tool 1: NPCC4 Climate Projections

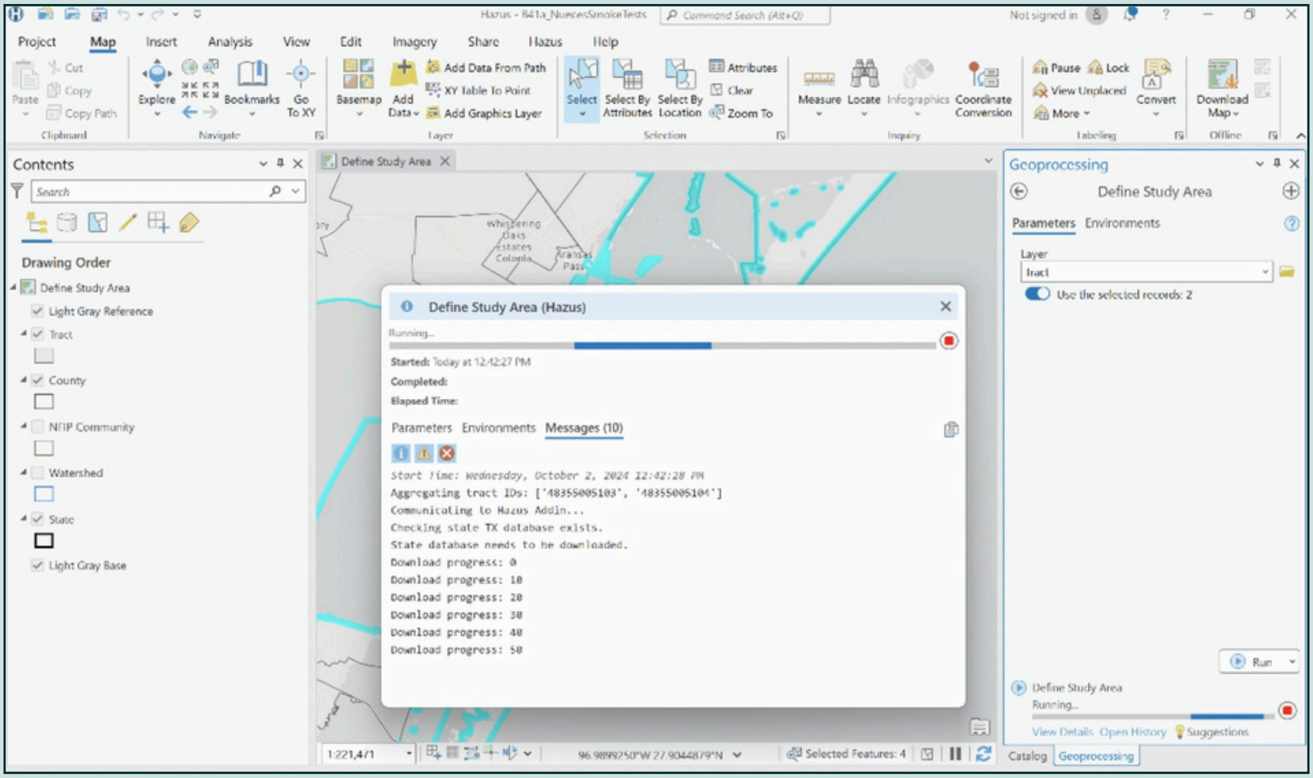
NPCC4 is responsible for NYC's official climate science assessment which provides analysis on relevant historical and forecasting data on climate change. NYC specific climate projections allow Columbia University to determine better adaptation pathways to mitigate climate risks.

Tool 2: FEMA Hazus

Hazus is a GIS based risk assessment tool that estimates the potential impacts of natural disasters such as floods, hurricanes, earthquakes, and tsunamis. The tool incorporates standardized methods for evaluating exposure, estimating damage, and projecting disruption to infrastructure and communities. Hazus scenario analysis can support Columbia University in developing emergency planning, mitigation design, and resilience frameworks. The most recent version, Hazus 7.0, is also compatible with ArcGIS Pro.

Figure 33

A Sample Page of an Interactive Hazus 7.0 Software



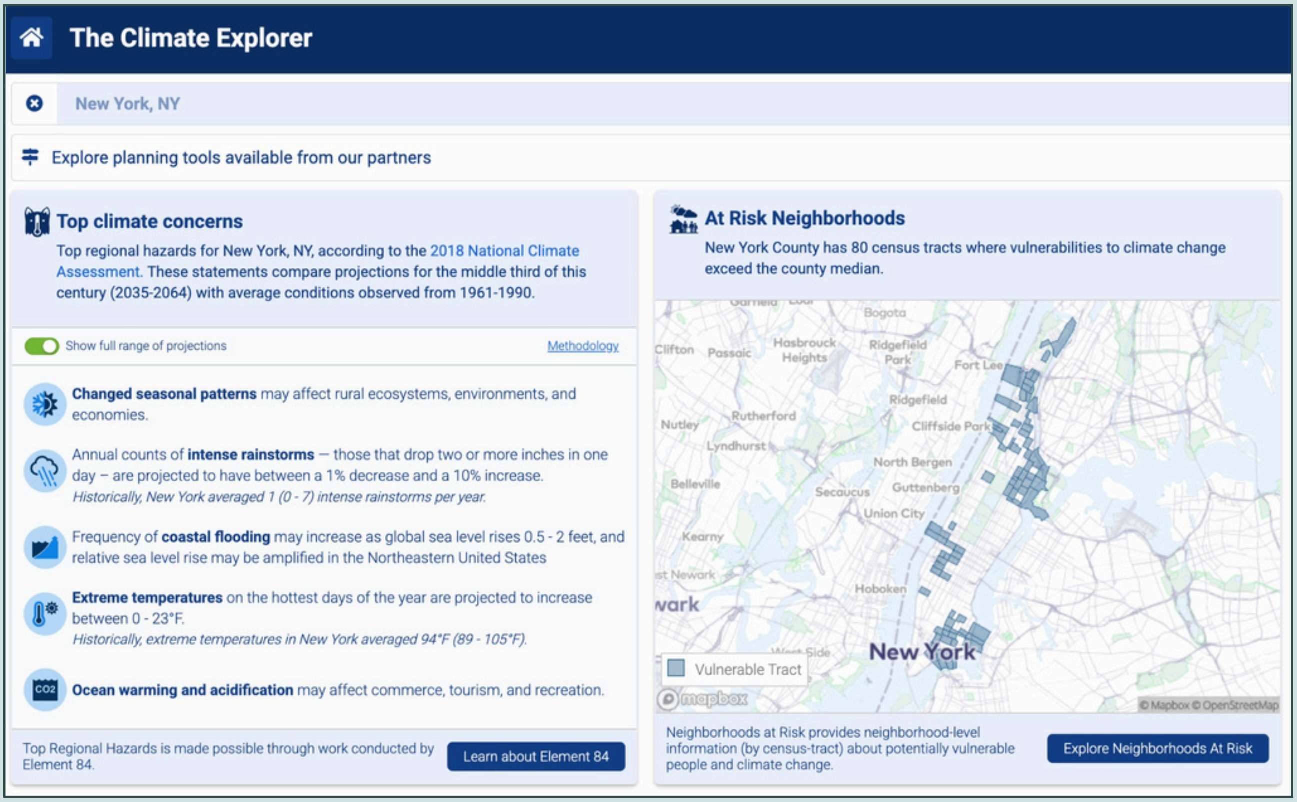
Note. From *Hazus 7.0* by FEMA (2024).

Tool 3: NOAA Climate Explorer

This interactive tool shows observed data from 1950 to 2013 and future projections from 2014 to 2100 for temperature change, coastal flooding and heavy rain events. This tool also indicates the top regional climate risk concerns, based on findings from the 2018 National Climate Assessment (NCA4) (Lipschultz et al., 2020).

Figure 34

The Climate Explorer: Top Climate Concerns page



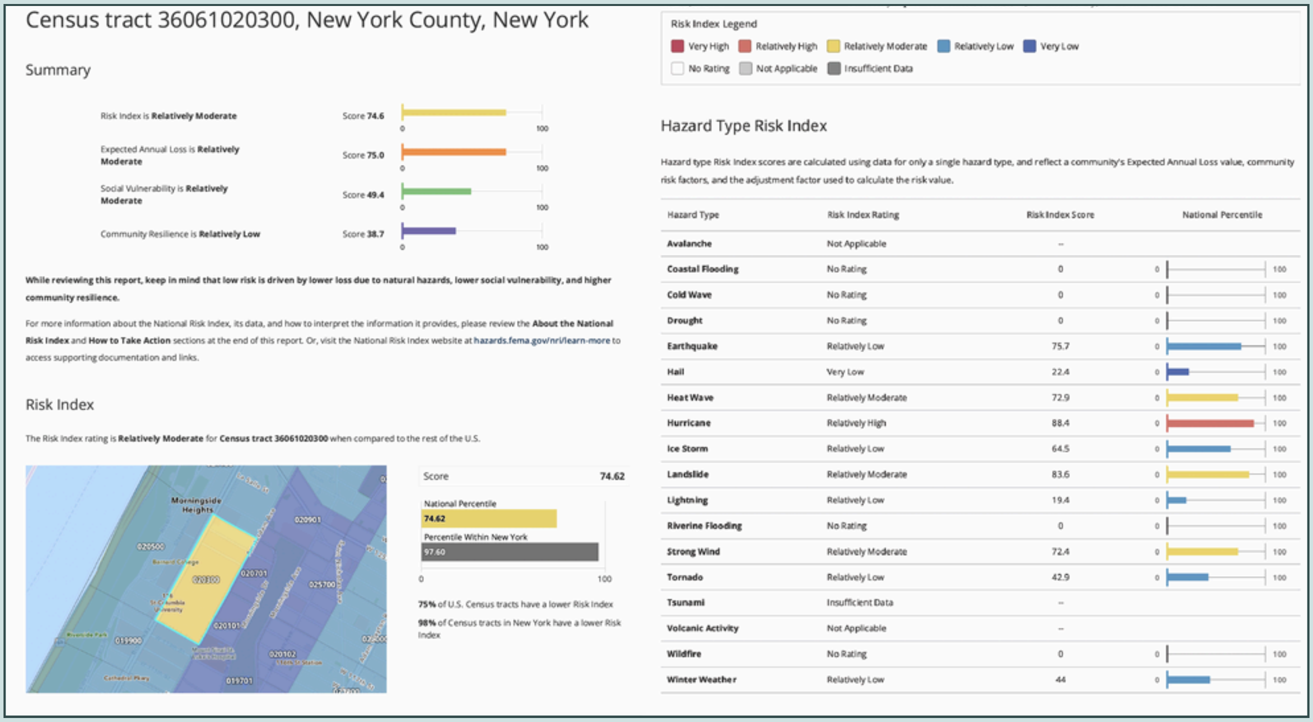
Note. *TheClimateExplorer:TopClimate Concerns page* by NOAA (2025).

Tool 4: FEMA National Risk Index (NRI)

This platform leverages census data to show site specific hazard probability and social vulnerability mapping of the Morningside Heights, Manhattanville, and CUMIC campuses. The NRI can calculate the likelihood of a climate risk event occurring as well as the expected impact in the form of an estimated annual loss metric.

Figure 35

Summary and hazard risk likelihood of Census Tract 36061020300 (Morningside Heights Campus).



Note. From FEMA NRI (n.d.).

7 Regulatory Risks

7. Regulatory Risks

Local, State, & Federal Landscape Review

7.1 Summary

Columbia University and its peers are in a unique position as they navigate federal scrutiny and reputational risk while also striving to provide a return on investment through their actions. For Columbia University, Plan 2030 predominantly focuses on regulations from an energy and emissions compliance lens, but there is a broader scope of regulatory pressures occurring at the state and federal levels around data security, anti-discrimination, immigration policy, civil rights, and more. Hence, regulatory risks involve operational, financial, and reputational consequences from underperforming governance and non-compliance with local, state, and federal statutes. Current and incoming laws and regulations are not only risks and opportunities for Columbia University, but can also directly affect the commitments of Plan 2030.

7.2 Methodology

This regulatory risk analysis included numerous methodologies to capture the full scope of the landscape. Through desktop research, a detailed mapping of local, state, and federal regulations was conducted, and where possible, aligned with Plan 2030 as well as with other key areas identified elsewhere in the report, such as climate, physical, and social risks.

This primarily included a collection of New York City Local Laws that related to buildings, energy, and emissions compliance, including: Local Law 33 of 2018 (LL33), Local Law 55 of 2018 (LL55), Local Law 55 of 2024 (LL55x2), Local Law 84 of 2009 (LL84), Local Law 87 of 2009 (LL87), Local Law 88 of 2009 (LL88), Local Law 92 of 2019 (LL92), Local Law 94 of 2019 (LL94), Local Law 154 of 2024, and the Climate Leadership and Community Protection Act of 2019 (CLCPA).

7.3 Findings

Columbia University faces an interconnected set of regulatory risks related to Plan 2030 that presents challenges for enterprise risk management and has financial implications for the University. Without mitigation efforts, the University could be subject to financial, operational, and reputational implications that are driven by stringent climate, energy use, housing, data security, international student, anti-trust requirements, Title VI, and Title IX. The findings discussed below align directly with the Top Risks Report by United Educators (2024), involving over 160 institutions, where regulatory and legal compliance were ranked as the fifth-highest institutional risk. United Educators also ranks student enrollment, data security in their top 6 institutional risks, further aligning with our capstone findings overall.

Additionally, the structure and pace of regulatory change means that today's compliance pathway may not match tomorrow's expectations, especially where climate, social, and governance issues intersect, which creates a moving target for all institutions, including Columbia University, Regulations shape not only penalties and enforcement risk, but also the standards by which peer institutions, funders, and the public evaluate whether the university is a credible leader on sustainability and institutional integrity. Section 6.3 of this report connects key risk areas to local, state, and federal regulations that have active and future implications for Columbia University and Plan 2030.

7.3.1 State Federal Landscape

The existing divergence between state and federal climate regulations represents one of the most unpredictable sources of regulatory risk for Columbia University.
New York State (NYS) has set up one of the most stringent state-level GHG reduction mandates in the country through the Climate Leadership and Community Protection Act of 2019 (CLCPA) (The New York State Senate, 2019). This law aims to:

- achieve 70% of the state's electric generation to be sourced from renewables by 2030
- achieve a zero-emission electrical grid by the year 2040
- reduce GHG levels by 85% by the year 2050 (compared to the baseline year 1990).

Hence, the CLCPA works to create a cleaner electric grid, which will reduce emissions factors throughout the coming years (NYSERDA, n.d.) and support Columbia University in achieving deeper carbon reductions through building electrification and high-performance design, thereby strengthening Plan 2030's ability to meet its decarbonization goals.

However, given the recent NYS Supreme Court ruling that requires the state to begin issuing CLCPA regulations by February 2026, institutions such as Columbia University will be held accountable to mandates (such as accelerated decarbonization and reporting requirements) without support from the federal government (such as limited availability of federal tax credits, grants, or technical assistance to offset those costs) (Earth Justice, 2025). Planning large capital projects such as deep energy retrofits, electrification of major buildings, or new district energy systems becomes more complex when the regulatory "floor" is rising but the funding "ceiling" is unstable, increasing the risk of stranded investments or delayed action.

More recently, NYS established its Mandatory GHG Reporting Program, requiring all major entities (that emit over 10,000 metric tons of CO2eq per year) to disclose emissions annually (starting 2027). This data collection and reporting facilitates disclosure of vital information that can support strategy development for emission reduction and investments in clean energy technologies (Wenzel, 2025).

Concurrently, on the federal level, regulations implemented under the Biden administration that support green initiatives, such as the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA), remain politicized. Over the last year, the federal government's stance shifted from support for decarbonization initiatives to billions of dollars of rollbacks in clean energy and sustainability funding under the second Trump administration (Guarna & Turner, 2025; Climate Action Campaign, 2025).

From a risk management standpoint, it is clear that Columbia University must consider regulatory risks and opportunities as part of its sustainability strategy. Recent examples showcase how noncompliance and oversight can lead to negative monetary impacts and cause significant reputational harm. For instance, Columbia University recently had to settle an agreement of $221 million for alleged Title VI compliance failures (Columbia Spectator, 2025). Another separate federal review this year regarding alleged ranking misrepresentations resulted in a $9 million settlement (Pickering, 2025). There was also a recent data privacy exposure to Columbia University's system, signaling a need for increased cybersecurity and governance in this highly material space (Columbia University Information Technology, 2025).

These incidents demonstrate that regulatory risk is not confined to environmental non-compliance. Governance and ethical failures can rapidly deplete financial and management capacity that could otherwise be used to support climate and sustainability investments. For the Office of Sustainability, this implies that aligning climate action with enterprise risk management, regulatory caution, and compliance functions is not optional but a prerequisite to maintaining credibility and ensuring effective institutional governance.

7.3.2 Local Law 33 of 2018: Energy Grading

Local Law 33 (LL33) mandates each building in excess of 25,000 square feet to post their individual annual energy letter grade (on a scale of A-F) based upon the specific building's benchmarking information (NYC Department of Buildings, n.d.-b). For Columbia University, the largest private landowner in NYC with over 300 buildings (Haag & Kolodner, 2023), each receives an individual grade, and together, these 300+ grades become an institutional accountability indicator (McKee, 2023).

Since LL33 grades are visible, simple, and easily compared across neighboring institutions, they act as a scorecard for students, staff, and community members who may not read formal sustainability reports but still can draw conclusions about Columbia's performance from what they see at building entrances. Poor grades may invite scrutiny into the facilities management departments as well as the commitment level of the university.

Aligning LL33 outcomes with Plan 2030, therefore requires not only technical improvements in energy use but also better integration of building-level data into communications, governance, and capital planning so that poor grades trigger systematic responses rather than isolated fixes.

7.3.3 Local Law 55 of 2018: Asthma-Free Housing Act

The Asthma-Free Housing Act links environmental compliance to the issue of health equity by requiring regular assessment and mitigation of indoor allergens like mold, pests, and moisture (New York City, 2018). For Columbia University, which oversees tens of thousands of student, faculty, and staff housing units, this Local Law 55 (LL55) (2018) links concerns for public health to the university's sustainability initiatives.

This means that the same infrastructure responsible for overseeing carbon reduction measures and energy management must also address the decrease in quality of life due to potential exposure to environmental hazards. Failure to comply would result in adverse consequences to the institutional credibility of the university in terms of Environmental Justice (Thomas, 2025).

7.3.4 Local Law 55 of 2024: EV Infrastructure

Local Law 55 (LL55) (2024) targets decarbonization in the transportation sector, supporting a transition to the use of electric vehicles (EV) within the city. The law requires all new and heavily renovated car park facilities in NYC to be retrofitted with the electrical infrastructure necessary, by January 1st, 2035, to support the growing use of EVs (Brannan et al., 2024; Li, 2025). As Columbia University plans to build or retrofit additional facilities, there is a need to forecast additional capital expenditures associated with the mandated EV infrastructure.

With Columbia University's growing investments in expanding their EV fleet, this local law's requirement of compliant infrastructure is even more critical for meeting the University's operational and functional needs, as well as Plan 2030 goals.

7.3.5 Local Law 84 of 2009: Benchmarking Law

Local Law 84 (LL84) of 2009 provides the foundation for energy and water regulations through its annual benchmarking requirement for large buildings that exceed 25,000 square feet, and for two or more buildings in the same tax lot that exceed 100,000 square feet (NYC Department of Buildings, n.d.-c). This has set the precedent for NYC's building measurement requirements, driving large institutions, like Columbia University, to conduct annual monitoring, reporting, and disclosure. Failure to submit annual benchmarking reports, by May 1st every year, results in a fine of $500 per quarter per missed deadline, for each non-compliant building (New York City, n.d.-a). Additionally, this information helps the university prioritize the order in which buildings should be retrofitted or renovated.

7.3.6 Local Law 87 of 2009: Energy Audits and Retro-Commissioning

Local Law 87 (LL87) is relevant for owners of certain large buildings (that exceed 50,000 square feet, and for two or more buildings in the same tax lot that exceed 100,000 square feet) to undergo energy audits and retro-commissioning every decade to identify measures to save energy and increase efficiency (NYC Department of Buildings, n.d.-d).

Institutions that fail to comply are threatened with fines amounting to $3,000 during their initial year and $5,000 each year after (New York City, n.d.-a). LL87 requires Columbia University to incorporate energy reviews into long-term capital budgeting, coordinate building operations with sustainability reports, and budget for capital expenditures years ahead.

7.3.7 Local Law 88 of 2009: Lighting and Submetering

Local Law 88 (LL88) requires large buildings that exceed 25,000 square feet, and for two or more buildings in the same tax lot that exceed 100,000 square feet, to implement new lighting systems and to install submeters for areas larger than 5000 square feet (New York City Department of Buildings, n.d.-a). The requirements of LL88 impact numerous facilities at Columbia University because many of its academic, administrative, residential, and research buildings fall within the scope defined by NYC. The installation of lighting systems as per regulation will decrease power consumption which, in turn, reduces expenditures. Simultaneously, enhancing indoor environmental quality by reducing heat from old fixtures and easing the load on building ventilation systems in all academic buildings regardless of building infrastructure age.

The submetering system monitors Columbia University's electricity consumption, by installing a system after the main utility meter, to track specific zone usage to have accurate management of the consumption. This can improve energy management decisions as part of Plan 2030, save costs, and abate carbon. Failure to comply might result in incurring additional expenses from insurance or permit denials. A fine of 1,500 annual fine for noncompliance of either requirements, plus $500 for each space without a required sub-meter, until compliance is met (Janay, 2025).

7.3.8 Local Law 92: Solar Roofs

Local Law 92 (LL92) requires all new construction projects and major roof replacement work to incorporate solar photovoltaic systems or create spaces for future solar panel installations (New York City Department of Buildings, n.d.-e). The evaluation process for each roof needs to occur at the beginning of project development because building shade, roof direction, structural strength, and system size requirements all inform solar potential.

For instance, previous evaluations at the Morningside Heights campus identified that multiple existing buildings are expected to face New York City roof limitations, including shading, structural weight restrictions and physical barriers that block renewable energy system placement (Urban Green Council, 2019). Hence, LL92 is a critical consideration for this campus and the solar-readiness of its older buildings.

On the other hand, the new Manhattanville campus captures modern construction design and solar roofing standards, allowing for smoother integration of this Local Law, unlike Morningside Heights (Columbia University, n.d.-b).

7.3.9 Local Law 94: Green Roofs

Local Law 94 (LL94) requires all new construction projects and major roof replacement initiatives to incorporate sustainable roofing zones through either green roof or solar panel installations (LL92) (New York City Department of Buildings, n.d.-e). Assuming the roof replacement schedule at Columbia University matches the requirements of LL94, this brings multiple environmental advantages through better insulation and stormwater management, and heat island reduction in urban areas.

The academic value of green roofs emerges through their dual function as research facilities and practical learning areas for students studying environmental science, architecture, and sustainability. The installations on extensive roof areas help decrease summer cooling requirements, which supports Plan 2030 goals for energy and water conservation. The university stands to benefit from LL94 by building nature-based solutions and renewable energy systems into its current development projects, which will strengthen its position as a sustainable campus leader.

Additionally, the law allows organizations to combine solar system evaluations (LL92; Refer Section 7.3.8) with this Local Law, which further improves environmental results from their capital spending.

7.3.10 Local Law 97 of 2019: Carbon Emissions Limits

Local Law 97 (LL97) requires large buildings (that exceed 25,000 square feet) to meet annual emission targets in order to reduce emissions by 40% by 2030 and to reach net zero by 2050. It imposes substantial financial penalties on buildings that fail to meet emission targets: $268 per metric ton of CO_2e exceeding the allowed emissions (NYC Buildings, n.d.). The energy-intensive nature of Columbia University's laboratories and medical facilities demands strategic emission reduction through electrification, retrofits, and enhanced mechanical system performance. The decarbonization goal of Plan 2030 receives direct support from LL97 because it establishes specific yearly emission reduction targets for all Columbia University buildings on campus.

7.3.11 Local Law 133 of 2016: Benchmarking and Energy Efficiency Rating

Local Law 133 (LL133) is an amendment to LL84, requiring additional buildings to benchmark for energy and water efficiency. The expanded benchmarking system now tracks smaller academic buildings, residential row houses, and auxiliary facilities, which used to go unmonitored. This means that additional buildings owned and operated by Columbia University need to comply with annual energy and water use reporting (City of New York, 2016).

The benchmarking system enables Columbia University to detect buildings that consume elevated levels of energy and hence enables the university to better track the need for energy efficiency enhancement projects. The public disclosure of this information enhances university sustainability performance transparency while supporting NYC's goal to enhance energy accountability for all building types.

7.3.12 Local Law 154: Building Electrification

Local Law 154 (LL154) restricts new buildings from emitting more than 25 kg CO_2/MMBtu from onsite fuel combustion, in order to reduce emissions and improve local air quality across NYC. This Local Law is directed at the use of fossil fuels in Heating, ventilation, and air conditioning (HVAC) systems, cooking ranges, and laundry facilities (City of New York, 2021).

To comply, all upcoming construction projects at Columbia University must adopt electric heat pumps, electric boilers, and other high-efficiency systems that use electricity, reducing the need for fuel combustion. This will result in lower emissions throughout a building's operational lifetime.

7.4 Recommendations

1. Conduct a Sustainability Governance Review

Evaluate whether the Office of Sustainability's placement within the university structure allows for clear, institution-wide governance, addresses existing data gaps, strengthens accountability and risk management to build resiliency and facilitate opportunities for sustainability. This must be supplemented with regular audits and risk assessments to mitigate risks and stand out as a leader among its peers.

2. Align Plan 2030 with Regulatory Developments

With evolving regulatory requirements in a dynamic landscape, Columbia University's Plan 2030 initiatives must proactively prioritize high-impact actions and programs tat incorporate compliance of local, state and federal regulations to avoid the risk of penalties and associated reputational risk. Developing scenario analysis and fostering student and faculty engagement could further facilitate risk mitigation and strong regulatory compliance.

8 Reputational Risks

8. Reputational Risks

Reputation Risk Drivers & Strategic Communication Pathways to Recovery

8.1 Summary

Columbia University’s reputation is its most valuable and intangible asset, directly impacting student recruitment, donor support, and research funding. In the current volatile political and information environment, shaped by campus protests, federal investigations, and intense media scrutiny, the University faces material reputational risks. A dominant public narrative focused on institutional conflict overshadows Columbia University's considerable strengths. A proactive, unified communications strategy that elevates leadership in sustainability and climate science is critical to rebalancing this narrative, mitigating financial exposure, and strengthening long-term resilience. This section identifies the current reputational status and outlines how Columbia University’s sustainability leadership can be leveraged as a primary tool for narrative recovery and trust building.

8.2 Methodology

Beginning with desktop research, an in-depth analysis of corporate and higher education communication trends was undertaken, including Behavioral Science & Public Sentiment Research on bipartisan support for climate issues and effective public engagement from sources including the Yale Program on Climate Change Communication, Morgan Stanley, and Harvard Law School.

Following this, a qualitative analysis of high-engagement posts on social media was conducted to gauge the organic narrative. Approximately 10–12 high-engagement posts (from Jan 2023 - Sep 2025) per platform (Reddit, X/Twitter, Instagram, TikTok) were manually reviewed and coded. Posts were identified using platform-specific metrics. On Reddit, posts are categorized as ‘New,’ “Rising, ‘Top,’ ‘Hot,’ or ‘Best’ in relevant subreddits (e.g., r/columbia); on Twitter/X, and Instagram, posts with high shares, quotes, or comments; and on TikTok, videos with high view counts and engagement ratios. Across the platforms, search methodology utilized keywords such as ‘Columbia University’ and ‘Columbia sustainability’, hence providing an exploratory snapshot of the dominant sentiment drivers shaping Columbia University’s public narrative.

8.3 Findings

8.3.1. Social Monitoring Reveals a Severe Reputational Deficit.

An analysis of Columbia's social media presence indicates a widespread reputational crisis online: institutional integrity issues dominate discourse (45%), followed by campus climate and safety (35%), and financial concerns (12%). Key qualitative insights highlight a 'Missed Sustainability Opportunity,' indicating that Columbia's sustainability strengths, from renewable energy research to sustainable agriculture, are largely absent from the crisis narrative.

By strategically highlighting these consensus-driven, bipartisan issues, Columbia can leverage its research credibility to rebuild trust, strengthen corporate partnerships, and anchor public messaging in areas unlikely to provoke political controversy. While Columbia has recently resolved multiple federal investigations, including a $200 million settlement and a $21 million Equal Employment Opportunity Commission (EEOC) agreement, and reinstated the vast majority of its previously paused federal research funding (Columbia University, 2025), public scrutiny and reputational challenges remain. Sustainability-related initiatives provide a safe and effective way to redirect the narrative toward areas of broad support.

Figure 36

Reputational Risk Distribution Across Social Media Conversations (2023–2025)

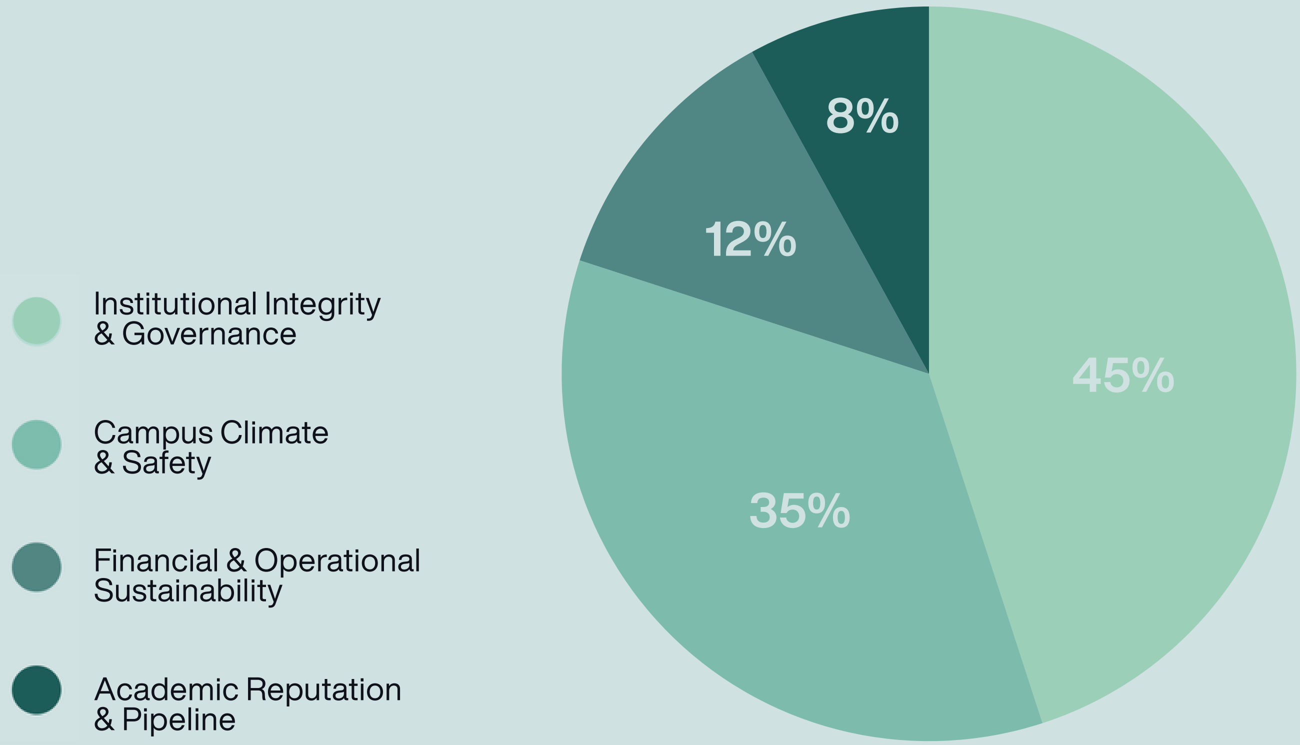


Table 5

Primary Reputational Risk Categories Table

Risk Category	Percentage	Description & Example
Institutional Integrity & Governance	45%	Perceived loss of values, leadership failures, political capitulation (e.g., $220M settlement, President resignation, faculty revolt).
Campus Climate & Safety	35%	Fear, discrimination, lack of inclusion, protest tensions (e.g., ‘scared for Jewish students,’ antisemitism investigations, encampments).
Financial & Operational Sustainability	12%	Direct financial and operational impacts (e.g., 29% donation drop, accreditation threats, cutting international students).
Academic Reputation & Pipeline	8%	Concerns over the value of the degree and future enrollment (e.g., ‘is it worth applying?’, drop in rankings).

Table 6

Reputational Risk Insights from Social Media Analysis (2023–2025)

Category	Finding / Metric	% / Quantitative Data	Relevance to Research
Sentiment	Negative sentiment dominates across Reddit/TikTok/X	~85% Negative, ~10% Neutral, ~5% Positive	Shows reputation crisis is widespread and largely uncontested
Risk Categories	Institutional Integrity issues lead all mentions (lawsuits, faculty resignations)	1st place (40% of coded risks)	Directly tied to trust and values
	Campus Climate & Safety (student fears, protests)	2nd place (25%)	Affects social sustainability & wellbeing
	Governance & Leadership (leadership turnover, discipline)	3rd place (20%)	Undermines stability of Sustainability Plan
	Financial Sustainability (donation drop 29%)	4th place (15%)	Hard financial consequence of reputational crisis
Platform Split	Instagram: prestige, aspirational; Reddit/TikTok: anger/fear; X: political battleground	N/A (distribution by platform)	Shows Columbia controls the least relevant narrative channels

8.3.2. A Latent Opportunity Exists in Bipartisan Sustainability Issues

Research reveals strong, bipartisan public support for the issues, including renewable energy research (80% support) and funding for climate-smart agriculture (88% support), which Columbia University is proactively engaged in (Leiserowitz et al., 2025). This support represents a major, underutilized strategic asset. By emphasizing these trusted, non-partisan issues, Columbia University can strengthen credibility and demonstrate value without entering polarized political discussions.

8.3.3. Recent Events Have Created an Inflection Point for Strategic Repositioning

The intense campus activism of recent years, culminating in events such as the vocal expression of dissatisfaction toward acting leadership during the 2025 commencement season, demonstrates a highly engaged but disillusioned community. With a recent change in campus energy following geopolitical events and leadership transitions, a critical window exists to redirect this latent engagement. The viral nature of past controversies proves the community's ability to mobilize attention. The challenge and opportunity lie in channeling this energy toward a unified, positive narrative about Columbia University's core mission and sustainability leadership, which requires recalibration of its communications strategy and perception.

8.4 Recommendations

1. Build and emphasize a "Resilience and Stewardship" narrative:

The Office of Sustainability should lead the development of a unified messaging framework that reframes Columbia University's sustainability leadership around the core, less polarizing concepts of urban resilience, resource stewardship, and institutional longevity. This aligns with the strategic language trends observed among peers and provides a defensible, counter-narrative to the institutional integrity concerns that currently dominate the public discourse, thereby mitigating political risk.

2. Invest in strategic communications capacity to seize the moment and amplify bipartisan strengths:

The University should strengthen the Office of Sustainability's communications capacity by hiring a dedicated communications or social media manager with experience in impact storytelling. This role should be tasked with proactively developing and disseminating content that highlights Columbia University's research and impact in areas with bipartisan support, like clean energy and climate adaptation, connecting university expertise to tangible public benefits. Prioritizing platforms where negative sentiment is concentrated (e.g., Reddit, X) can leverage strong public support for climate action to rebuild trust. Additionally, a proactive content plan will capitalize on periods of reduced crisis, transforming a reactive communications posture into a proactive one, and strategically redirecting the community's proven capacity for engagement.

3. Enhance international student communications

Columbia University should adapt its existing methods for targeted communications for prospective and current international students, emphasizing the University's unwavering commitment to their safety, academic success, and legal status security amidst recent geopolitical controversies. Messaging should proactively highlight the stability and exceptional value of the Columbia academic experience. This action has the potential to directly mitigate a key financial and reputational vulnerability identified by social monitoring and the broader risk assessment, ensuring Columbia University's standing as a top institution for attracting global talent.

9 Financial Risks

9. Financial Risks

Risk Register with Financial Impact and Likelihood

9.1 Summary

As noted above, Columbia University is exposed to considerable risks spanning social, reputational, operational, regulatory, and climate-related areas. Accordingly, a financial lens was applied to assess both the likelihood of occurrence and the potential monetary impact of these risks. Based on this assessment, the risks identified below represent the top risks. These risks have both a high probability of occurrence and a high potential cost. For each risk, the minimum and maximum estimated costs of inaction were quantified to illustrate the potential financial impact.

Top risks identified:

Data Security

$31M–$187M annually

International Enrollment & Visa Vulnerability

$85M-$170M per event

Business Ethics & Compliance

$19M–$34M per event

Floods and Rainfall

$2.8B per event

9.2 Methodology

9.2.1 Identification of Risks

For the financial impact analysis, risks were first consolidated using multiple methodologies.

Consolidation of Risks identified under Social, Physical and Climate

The social, climate, and physical risks identified in the previous sections were consolidated into a unified set of overlapping risks to assess their financial impact and likelihood of occurrence.

Peer Benchmarking Scorecard

The peer benchmarking scorecard mentioned in Section 3 of this report was used to identify several key risks, including GHG emissions, data security, and energy management.

SASB Standards

SASB standards were reviewed to determine the most relevant industry classification, and the SASB Education standard was selected. This informed the identification of business ethics, data security, international enrollment dependence, and donor and endowment-related risks.

ROSI Framework

The Return on Sustainable Investment (ROSI) framework from New York University, which quantifies the financial value created by sustainability initiatives, was then applied, highlighting additional risks such as business ethics, GHG emissions, data security, and energy management.

These risks were subsequently quantified to assess their financial impact, using the ROSI framework where applicable and customized methodologies as necessary.

In the order of most material risks as per the risk register, the consolidated risks are:

Risk	Risk Description
Data Security	Cybersecurity vulnerabilities or data breaches affecting confidential academic, health, or financial data expose Columbia University to significant litigation risk, regulatory compliance failures, expensive IT recovery and notification requirements, operational disruption to teaching and research, and diminished stakeholder confidence in the University's information governance.
Business Ethics	Failure to uphold campus safety, discrimination compliance, and ethical standards exposes Columbia University to intensified federal enforcement actions that could lead to substantial regulatory penalties, restrictions on federal funding, costly corrective measures, and reputational damage that undermines trust among students, faculty, government partners, and the broader public.
Extreme Precipitation / Stormwater	More intense rainfall events overwhelm stormwater systems, leading to localized flooding that restricts building access, disrupts classes and research activities, and increases maintenance, remediation, and continuity-of-operations planning demands.
Sea-Level Rise / Coastal Erosion	Progressive sea-level rise increases shoreline erosion and facility vulnerability at coastal sites such as Lamont-Doherty and Nevis Laboratories (Columbia University's physics research facility), driving physical infrastructure damage, reduced logistics and access reliability, and long-term capital planning pressures.

Risk	Risk Description
International Student Enrollment Decline and Immigration Policy	Shifts in U.S. immigration rules and concerns about campus stability reduce the attractiveness of Columbia University for international students, which threatens tuition revenue growth, academic program viability, and the University's strategic commitment to global diversity and research excellence.
Environmental Justice and Local Community Trust Risk	Large-scale campus expansion into Harlem and Manhattanville exacerbates local environmental justice concerns, where construction nuisances, displacement pressures, and historical community mistrust elevate the likelihood of organized resistance, project delays, regulatory scrutiny, and reputational harm to Columbia University's civic relationships.
Energy Volatility	Increasing extreme heat events driven by climate change and NYC peak demand lead to overload cooling, electrical, and data-center infrastructure, elevating risks of equipment overheating, power outages, research loss, and disrupted learning environments that carry substantial operational and financial consequences.
GHG Emissions	Aging HVAC and heating systems increase the likelihood of non-compliance with New York City's Local Law 97 emissions requirements, generating exposure to escalating fines, major retrofit costs, project reprioritization, and stakeholder concerns over Columbia University's climate leadership credibility.

Risk	Risk Description
Heat Waves / Extreme Heat	Higher baseline temperatures and repeated extreme-heat exposures diminish indoor comfort, increase heat-related health issues, and threaten continuous operations in teaching, residential, and laboratory spaces, resulting in operational interruptions and elevated energy and maintenance costs.
Riverine / Coastal Flooding -Sea Level Rise	Storm surge and Hudson River flooding amplify risks to lower-elevation facilities, especially mechanical rooms, research buildings, and energy hubs, which cause asset damage, expensive emergency response requirements, and service disruptions that could affect mission-critical activities in health care and science.
Campus Climate Deterioration (Belonging, Discrimination, Safety)	Campus tensions related to external geopolitical conflicts increase safety concerns, stress, and feelings of exclusion among students, raising risks of operational disruptions, reputational impacts, and increased oversight of how the university manages discrimination and harassment responsibilities (including exposure to business ethics and federal funding compliance risks).
Long-Term Heat Increase & Urban Heat Island Effect	Chronic warming and increased cooling loads degrade building performance and raise operational energy spending while creating thermal-comfort and health challenges that impact student performance, workforce productivity, and research continuity.

Risk	Risk Description
Donor Sentiment risk	Declining alumni and donor confidence in University governance and social climate responses creates the risk of reduced philanthropic giving, which could constrain funding for student financial aid, faculty recruitment, research advancement, and long-term institutional priorities.
Local Economic Equity & Inclusion risk	Limited integration of minority-owned, women-owned, and locally-owned businesses into construction and procurement may generate community resistance, negative media attention, and challenges to project approvals, undermining Columbia's social license to operate in surrounding neighborhoods.
Winter Storms & Extreme Cold	Winter storms and prolonged freezing conditions increase heating demand, hamper campus mobility, and elevate chances of energy failures in laboratories and health care buildings that depend on uninterrupted environmental control for safety and research integrity.
Stormwater Management Stress	Surface flooding caused by inadequate stormwater drainage disrupts campus transportation, affects essential utilities, elevates property-damage risk, and requires increased investment in water-management infrastructure to ensure safe campus functioning.

Risk	Risk Description
Biodiversity	Ongoing loss of urban green and blue spaces around campus weakens natural cooling and stormwater mitigation functions while elevating reputational risks if Columbia is perceived as insufficiently addressing biodiversity and ecosystem stewardship in its planning and development.
Earthquake	Seismic shocks from regional intraplate fault lines could damage older buildings and key utilities not designed for earthquake resilience, endangering life safety, displacing campus communities, and necessitating costly emergency repairs and recovery.
Groundwater Rising	Rising groundwater levels increase seepage and corrosion in basements, tunnels, and utility corridors, accelerating infrastructure deterioration, limiting usable space, and driving major rehabilitation needs to safeguard research assets and building functionality.
Air Quality	More frequent regional wildfire smoke events deteriorate air quality and create health risks for sensitive populations, forcing operational modifications such as indoor restrictions or class cancellations that disrupt student experience and campus activity.

9.2.2 Quantifying the Financial Impact of Identified Material Risks

This table summarizes Columbia University's material ESG and climate risks, in order of financial impact, that were quantified using ROSI or custom quantification methods. Each risk includes a brief description, the monetization approach applied, and the estimated financial impact to support decision making.

Table 7

ESG and Climate Risk Quantification Using ROSI and Custom Monetization Approaches

Material Issue	Monetization method	Custom or ROSI	Impact (USD)
Riverine & Coastal Flooding	Overlay campus assets with projected flood depths; apply damage ratios or repair cost per ft^2 to estimate asset-specific losses and total event-loss range.	Custom	$2.8B
International Enrollment Dependence & Visa Vulnerability	Model tuition revenue at risk by applying % enrollment declines across optimistic, moderate, and aggressive scenarios.	Custom	$85M - $170M annually
Data Security	Assess the probability and severity of a data breach and calculate the avoided loss by multiplying the likelihood by the potential impact.	ROSI	$31M - $187M annually
Business Ethics	Identify penalties for non-compliance and estimate avoided costs based on the % risk reduction achieved.	ROSI	$19M to $34M per event (Columbia University paid $9M in 2025)
Energy Management	Compare historical vs. projected energy price volatility and estimate savings by multiplying reduced volatility by average energy consumption.	ROSI	$7M - $28M annually

Material Issue	Monetization method	Custom or ROSI	Impact (USD)
Donor & Endowment Sentiment Risk	Estimate revenue at risk by applying % reductions in donor contributions across scenarios and multiplying expected decline by total giving.	Custom	$4.2M - $10.5M annually
Long Term Heat Increase/Heat Island Effect	Estimate increased cooling load between baseline and future periods; convert added load to kWh and multiply by projected electricity prices to get additional annual cost.	Custom	$5.28M
GHG Emissions	Estimate penalties for failing to meet emission limits or commitments and prorate avoided costs based on progress toward renewable energy or transition targets.	ROSI	$1.7M annually

9.2.3 Building the Risk Register

This risk register is grounded primarily in the ISO 31000: 2018 Risk Management standard, with additional structure and terminology drawn from the Committee of Sponsoring Organizations (of the Treadway Commission) (COSO) Enterprise Risk Management (ERM) framework. ISO 31000 provides principles and a process for systematically identifying, analyzing, and evaluating risk across an organization, while COSO ERM emphasizes how risks connect to strategy, objectives, governance, and performance (COSO, 2017; ISO, 2018).

To align the approach with sector practices in higher education, the team benchmarked methods and scoring systems from four university climate-risk assessments: Royal Melbourne Institute of Technology (RMIT University), Australia (2013), McGill University, Canada (2024), the University of Queensland, Australia (2022), and the University of Strathclyde, Scotland (2022) to define likelihood scales, categorize severity, and structure climate-related risk registers (McGill University, 2024; RMIT University, 2013; University of Queensland, 2022; University of Strathclyde, 2022).

Building on this benchmarking, the team defined ‘likelihood’ as the probability that a given risk event will occur within the relevant time horizon. This is expressed using hybrid qualitative and quantitative categories (e.g., ‘rare,’ ‘possible,’ ‘likely,’ ‘almost certain’) and is anchored to a combination of historical occurrence patterns, scientific projections of climate hazards, and regulatory or operational exposure to transition risks. The likelihood scale is therefore derived from the above mentioned universities, and ISO and COSO principles, providing a defensible and sector-consistent basis for comparing risks (COSO, 2017; ISO, 2018; McGill University, 2024; RMIT University, 2013).

On the other axis of the risk register, to convert severity scores to monetary figures that are relevant to Columbia University, the team calibrated financial impact bands as percentage ranges of the university’s FY 2025 expense budget of approximately $6.6 billion. Each risk is therefore assigned a severity score based on its estimated financial impact as a share of this budget, and a likelihood score based on the calibrated likelihood scale. Multiplying these two scores yields an overall risk rating, which enables prioritization and comparison across transition, physical, social, governance, and operational risks.

9.3 Findings

Figure 37

Climate & Sustainability Risk Register: Likelihood vs. Financial Impact

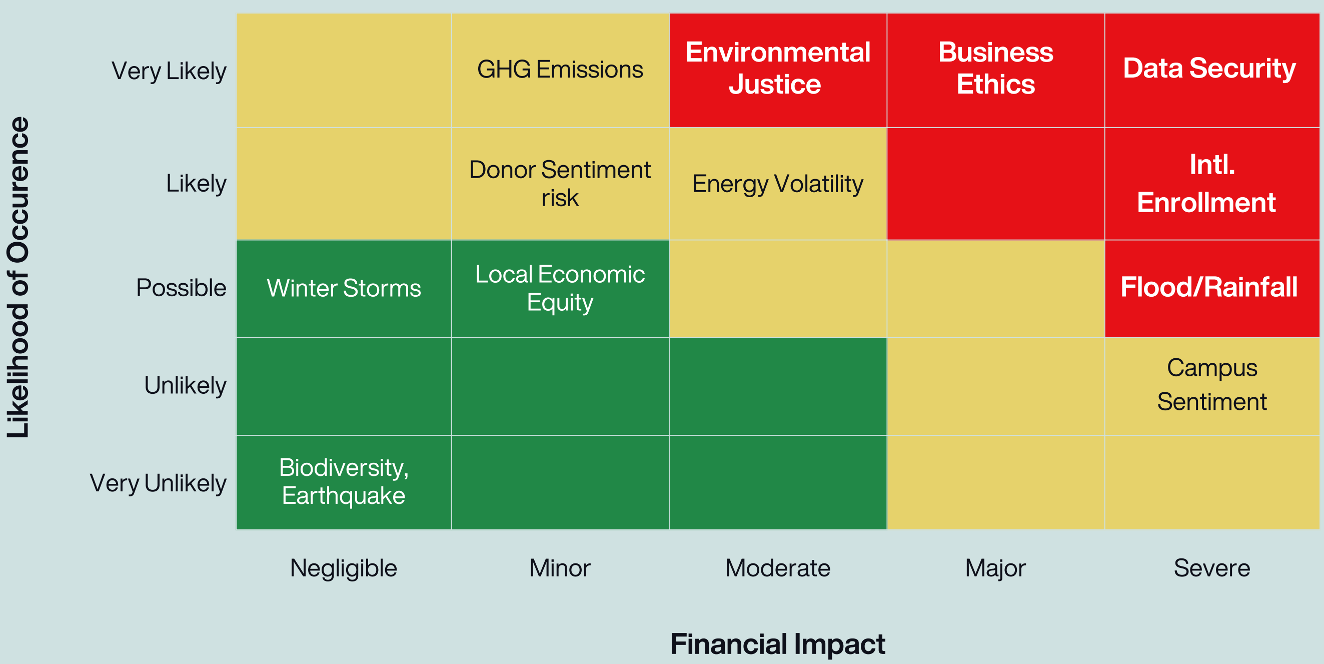


Table 8

Comprehensive Risk Register Across Social, Physical, Financial & Climate Domains (ISO - Based). For more details on the financial quantification refer Appendix C:

#	Risk Category	Risk Title	Financial Impact	Financial Impact Level	Likelihood Level	Risk Level
1	Data Security	Data Security	**$31M - $187M annually**	5	5	**25**
2	Social	Business Ethics	**$19 - $34M (Columbia University paid $200M in 2024 and $9M in 2025)**	4	5	**20**
3	Physical	Extreme Precipitation / Stormwater	**~$2.8B** per event *	5	3	**15**
4	Physical	Sea-Level Rise / Coastal Erosion		5	3	**15**
5	Social	International Student Enrollment Decline and Immigration Policy	**$85M - $170M**	5	3	**15**
6	Social	Environmental Justice and Local Community Trust Risk	**$6.3M-$10.5M**	3	5	**15**
7	Energy	Energy Volatility	**$7M - $28M annually**	3	4	**12**
8	GHG Emissions	GHG Emissions	**$1.76M per year**	2	5	**10**
9	Physical	Heat Waves / Extreme Heat	**$5.28M per event** for any risk related to Heat	2	5	**10**
10	Physical	Riverine / Coastal Flooding -Sea Level Rise	**~$2.8B** per event *	5	2	**10**

Note: *Reflecting structure and contents-related damages across facilities affected by pluvial, coastal, or storm-surge flooding

#	Risk Category	Risk Title	Financial Impact	Financial Impact Level	Likelihood Level	Risk Level
11	Social	Campus Climate Deterioration (Belonging, Discrimination, Safety)	Difficult to quantify but impact exists due to legal exposure, and reputational harm	2	5	**10**
12	Physical	Long-Term Heat Increase / Urban Heat Island Effect	**$5.28m per event for any risk related to Heat**	2	4	**8**
13	Social	Donor Sentiment risk	**$4.2M - $10M annually**	2	4	**8**
14	Social	Local Economic Equity & Inclusion risk	Difficult to quantify but impact exists due to legal exposure, and reputational harm	2	3	**6**
15	Physical	Winter Storms / Extreme Cold	$0.7M	1	3	**3**
16	Physical	Stormwater Management Stress	Qualitatively low impact (no quantification warranted)	**1**	**3**	**3**
17	Biodiversity	Biodiversity		**1**	**1**	**1**
18	Physical	Earthquake	Qualitatively low impact (no quantification warranted)	**1**	**1**	**1**
19	Physical	Groundwater Rising	Qualitatively low impact (no quantification warranted)	**1**	**1**	**1**
20	Physical	Air Quality	Qualitatively low impact (no quantification warranted)	**1**	**1**	**1**

Note: *Reflecting structure and contents-related damages across facilities affected by pluvial, coastal, or storm-surge flooding

9.4 Recommendations

Based on this register, several risks stand out and pose a great potential impact on institutional operations, regulatory standing, and revenue stability. To manage these risks effectively, Columbia should adopt a coordinated, framework-aligned approach:

1. Prioritize highest exposure risks

Focus institutional resources on the top-tier risks identified in the risk matrix, those with both high likelihood and high severity, ensuring they receive early intervention, dedicated funding, and senior leadership oversight. This includes data security, business ethics and compliance, international enrollment vulnerability, environmental justice and community trust, and flooding-related physical risks

2. Strengthen enterprise level risk governance

Integrate physical, climate, social, regulatory, reputational, and operational risks into a unified enterprise risk management framework guided by ISO 31000 and COSO ERM. Establish clear risk owners, decision rights, and escalation procedures tied to strategic objectives and the university's financial planning cycle.

3. Implement continuous monitoring and reporting

Develop dashboard-based quarterly monitoring for high-priority risks, using consistent likelihood and severity scoring derived from the ISO 31000 and COSO ERM methodology above. Metrics should include leading indicators (e.g., enrollment signals, infrastructure stress markers, regulatory exposure) to support proactive intervention.

10 Internal Interviews

10. Internal Interviews

After the midterm, apart from the interviews with peer universities, conversations were also held with professors on campus to include their insights and feedback into our risk assessment, validate our methodology, assumptions, and strengthen our overall risk assessment and analysis.

The team spoke to two professors, Michael Gerrard and Satyajit Bose, in order to dive deeper into risks and opportunities for Columbia University (M. Gerrard, personal communication, Oct 24, 2025; S. Bose, personal communication, Nov 17, 2025). Both professors discussed key risks that Columbia University faces, especially extreme heat, flooding, and electrification, which allowed the team to dive deeper into the associated challenges and implications (as expanded upon in Section 5):

Michael Gerrard
Andrew Sabin Professor of Professional Practice

Areas of Speciality:
- Environmental Law
- Climate Change Law and Policy
- Energy Regulation

Satyajit Bose, Ph.D.
Professor of Practice; Associate Director, M.S. in Sustainability Management Program

Areas of Speciality:
- Sustainable Investing
- Cost Benefit Analysis
- Automated Weather Risk Management

Heat Risk

With increasing temperatures, NYC has been facing more frequent, more intense, and longer heatwaves over the last few years. This impacts Columbia University due to the high building density and impervious cover of its campuses. Apart from the health impacts associated with increased heat on students and staff (such as heatstroke, exhaustion, dehydration, dizziness, and more), it must be noted that there are several old dormitory buildings that are not installed with air conditioners.

Flood Risk

While the main Morningside Heights campus is situated at a higher elevation and faces a lower risk of flooding, flooding remains a significant concern for the Manhattanville campus due to its lower elevation and basement classrooms. It also poses a risk to the 1-line subway serving both campuses, which has experienced disruptions during heavy rain events and impacts commuters, such as students, faculty, and staff.

Electrification Risk

With several academic, corporate, and residential buildings, LL97 is highly consequential for the University. Although Columbia University has already begun its electrification journey, any Net Zero electricity claims must clearly disclose the extent to which they rely on RECs and offsets to avoid scrutiny as definitions become more refined and stringent. An additional emerging factor is the University's expanding use of AI and other computationally intensive research tools, which not only require substantial energy and place added strain on the local grid, but also contribute to higher emissions as cloud-computing demand grows. Furthermore, the use of AI results in large amounts of additional water use for cooling the systems. These impacts must be considered when planning for Columbia University's long-term energy infrastructure, sustainability, and resilience planning.

Other risks were also discussed (M. Gerrard, personal communication, Oct 24, 2025; S. Bose, personal communication, Nov 17, 2025) but were not elaborated upon, such as:

Earthquake Risk

Given the uncontrollable nature of earthquake events, their occurrence, magnitude, and frequency, it is still an important risk to keep in mind due to the fault line near campus on 125th Street. Furthermore, the magnitude of its impact could have serious consequences unless the current adaptation strategy and action plans are up to date and insurance plans are in place. Earthquakes in New York City are considered low-probability but high-impact events, defined as infrequent occurrences that can cause significant operational, safety, and financial disruptions. While property value and damage can be covered by insurance, business interruptions and productivity losses (including, but not limited to, research labs and medical school operations) should also be kept in mind. Most importantly, intangible assets such as human capital are also at risk through potential injuries, illnesses, and death.

Toxic Risk

Asbestos, lead, and mold are also important considerations. It must be ensured that these risks are mitigated through monitoring and remediation to avoid any human health impacts on the students, faculty, staff, and laborers working in the impacted buildings.

Construction Risk

While there are fewer regulations for existing buildings, newer builders have stronger energy efficiency requirements, and there is potential for regulations with respect to low-carbon cement and solar roof-based tax exemptions.

Property Tax Risk

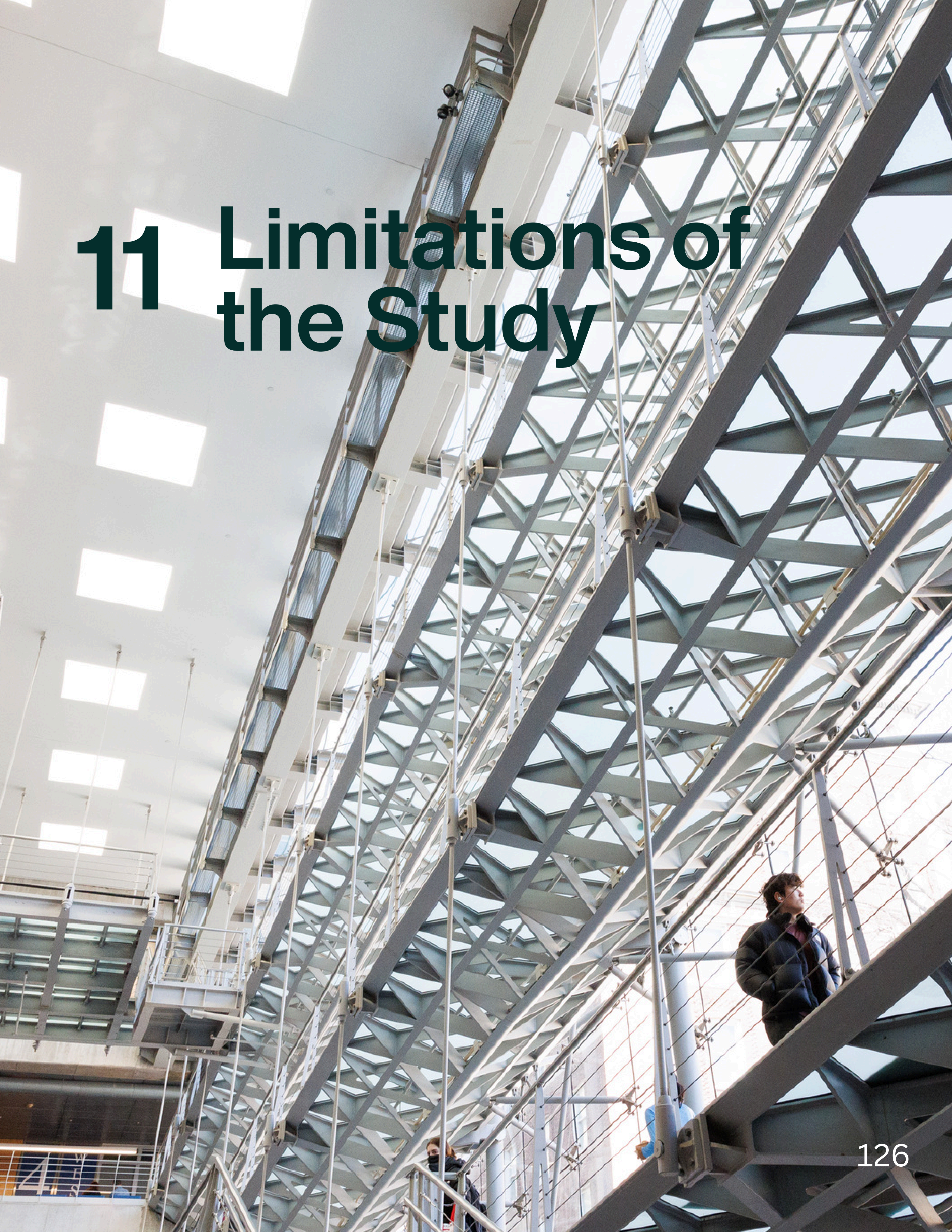
This risk reflects Columbia University's unique landownership profile. The discussions noted that Columbia University owns more than 300+ buildings and is currently exempt from property tax (Haag & Kolodner, 2023). If this exemption were removed, it would imply a huge financial risk for Columbia University, as it would have to choose between either paying a huge amount of taxes or selling a lot of properties at depressing prices.

Wildfire Risk

Air quality risks were also discussed, specifically frequent wildfires from Canadian forests, resulting in intense smoke and fine dust, soot, and ash particles that impact numerous communities across New York (Zhuang, 2025). It was highlighted that it might impact Lamont-Doherty Earth Observatory more than the Morningside Heights and Manhattanville campus due to its proximity to forests and woodland. The associated impact on air quality does not have financial implications in the short term, but it does affect stakeholders (M. Gerrard, personal communication, Oct 24, 2025; S. Bose, personal communication, Nov 17, 2025).

Overall, these interviews were important in helping us dive deeper into the different types of risks and their impacts, providing nuanced insights and feedback that would not have been captured through desktop research alone. Attempts were also made to speak with someone from Columbia University's Enterprise Risk Management (ERM) Department, Columbia Business School (CBS) and Columbia Center on Sustainable Investment (CCSI).

11 Limitations of the Study



11. Limitations of the Study

This study has several important limitations that should be kept in mind when interpreting the results. First, the peer scorecard uses equal weighting across all 56 indicators, followed by the average taken across the environmental, social, and governance pillars. In practice, this means that strengths in one area do not outweigh the weaknesses in another. For instance, a university that excels in climate disclosures but performs poorly in social or governance reporting will not necessarily achieve a higher overall score than another university that has moderate performance across all areas. This design avoids making normative claims about which issues should matter most, but it also means the work does not provide a hierarchy of materiality across risks or categories.

The scorecard and comparative analysis are disclosure-based rather than performance-based. Indicators are scored on whether a university reports on a topic rather than the underlying performance. For example, a school that publishes a detailed GHG inventory showing that it is currently off track on its emissions targets still receives credit for that transparency. In contrast, a school that is quietly performing well but does not publish comparable data will appear weaker in this framework. That choice was made to allow consistent, documentable, and reproducible comparison across institutions with very different internal data and target frameworks, but it might blur important distinctions in actual risk exposure, progress, and impact.

Since only publicly available information was used, the capstone is limited in providing internal insights. It should therefore be interpreted as a structured snapshot of what can be observed from an outside perspective. For example, inaccessibility to Columbia University's GHG inventory data limits the ability to conduct a complete comparison with peers and assess performance related to climate risks (Refer Section 6).

The analysis is intentionally restricted to calculations that are publicly available data from roughly 2022 onward. This cutoff was chosen to ensure that Columbia University and its peers are evaluated using recent, relevant, and broadly comparable documentation and to avoid mixing legacy commitments with current plans. It does not mean that earlier work or internal initiatives are unimportant, only that they fall outside the evidentiary base used for some indicators.

While the risk assessments do include Morningside Heights, Manhattanville, and CUIMC campuses, the scope of the Capstone still does not fully incorporate all of Columbia University's institutional complexity. Certain activities, such as affiliated hospital systems, specific real estate holdings, and specialized research facilities, remain outside the scope of the scorecard and other analyses conducted.

Across individual physical risk topics, the analysis often depends on regional projections and qualitative judgment rather than high-resolution modeling.

For instance, flood-related risks are a critical concern for the Manhattanville campus currently. However, as Columbia University's footprint expands through construction activities and infrastructure changes near the Hudson River, flood risk may extend beyond the Manhattanville campus and create indirect vulnerabilities that could affect other campuses, including Morningside Heights.

The hazard screening used by the team includes open-access tools and regional datasets (NPCC4, FEMA NRI, PlaNYC, and more), and are also capable of further analysis but not yet calibrated with building-level inputs due to a lack of access to precise elevations and other spatial data. Columbia University would need high-resolution elevation data, on-site surveys, and hydrological modeling to estimate damage under specific scenarios. In addition, online platforms offer broad hazard layers, such as flood maps or heat indices, but they cannot incorporate Columbia-specific factors like building structure, drainage design, or localized microclimates. Due to these gaps, insurance companies may treat parts of the campus as higher-risk. Without more precise building-level information, Columbia University could face elevated or overly conservative flood-insurance premiums.

Columbia University's social risk assessment also faced several limitations that are important to acknowledge. Student survey responses, for example, capture a snapshot of feelings around belonging and safety but may not fully reflect longer-term trends or the experiences of underrepresented groups. Community trust and environmental justice issues are also complex and deeply contextual, shaped by historical dynamics and ongoing institutional relationships that cannot be fully captured through publicly available information or short-term engagement.

Food security and accessibility emerged as an important socio-environmental theme. Although Columbia Dining has undertaken pilot sustainability efforts, such as composting and participating in carbon-reduction challenges, this assessment was limited by the lack of comprehensive, system-wide data on food procurement sources, supply chain emissions, and the affordability and accessibility of food options for the campus community.

Disruptions to food systems due to climate change or supply chain volatility could have significant social and operational impacts, yet these complexities remain challenging to quantify rigorously without more detailed internal data and ongoing monitoring. Finally, with a large student population with diverse backgrounds and needs, it is essential to continue expanding offerings that cater to different dietary requirements and restrictions.

Another limitation is in the reputational section, where there is a lack of comparability against other peer universities, as the study only looked at metrics for Columbia University's reputational trends. This narrow focus restricts our ability to contextualize Columbia University's performance, assess whether similar institutions face comparable reputational shifts, or determine whether observed trends are unique to Columbia University or part of broader patterns across higher education.

The financial risk quantification focuses on selected hazards and social risks where defensible methodologies and data were available, leaving other risks treated qualitatively or with conservative assumptions that likely understate expected annual loss. Most importantly, our most material risks according to the Risk Register (likelihood and financial impact) (Refer Section 9) are Data Security, Business Ethics, and International Enrollment. However, due to the scope of the capstone and lack of data accessibility, these risks were not analyzed beyond financial quantification. As a result, no recommendations were proposed to mitigate these gaps.

Looking at regulatory risk, there are two main caveats that must be acknowledged. First, the section primarily focuses on NYC Local Laws, rather than on state and federal legislation. Secondly, these Local Laws tend to focus on environmental initiatives and impact; there is a need to look deeper into the socio-economic regulations that might hold relevance for Columbia University. This limits the analysis from achieving a complete understanding of the broader regulatory landscape to support institutional compliance and long-term climate action planning.

Altogether, these limitations are fundamental not just to understanding the scope and reliability of the analysis but also to interpreting the analysis before moving on to the recommendations.

12 Next Steps & Recommendations

12. Next Steps & Overall Recommendations

Columbia University is currently positioned slightly above average in terms of its total average across the three ESG performance pillars, compared to the 17 other U.S. peer universities. This progress is realized as a result of Columbia University's implementation of multiple sustainability initiatives and efforts in the previous years.

However, there are a number of indicators that require dedication over the next five years and beyond, while also considering Plan 2030 and evolving regulatory expectations. Following the identification and analysis of key risks, these recommendations have been built to improve Columbia University's approach towards climate and sustainability risk management in the short, medium, and long term; these proposed suggestions can and should be implemented in conjunction with Plan 2030 to strengthen operational and financial resilience.

In the near term, Columbia University should prioritize establishing a unified governance structure that integrates the sustainability team with the Enterprise Risk Management Team, Legal Team, and Insurance Team. This would allow them to fill current data gaps, such as with waste and water data.

Additionally, Columbia University should build upon its existing Plan 2030 to include relevant social and governance metrics for a more complete and comprehensive sustainability report. Our team recommends using the International Sustainability Standards Board (ISSB) since it is being adopted globally and incorporates two existing frameworks that were consistently referenced throughout this report: the Sustainability Accounting Standards Board (SASB) and the Task Force on Climate-related Financial Disclosures (TCFD).

In the medium term, feedback from peer interviews suggests that Columbia University needs to improve food systems. This includes areas such as supply chain and vendor audits, more low-carbon food options (with respect to local sourcing, foods that consume less energy during storage, and increased plant-based alternatives), and composting initiatives.

Finally, the long-term goal is full institutional integration, in which sustainability becomes strategically embedded in resilient business operations. This includes establishing accountability across all schools and departments, closing gaps with top peer performers, and strengthening stakeholder engagement through peer, community, and student partnerships.

Table 9. Columbia University Sustainability & Climate Risk Implementation Roadmap (2025-2030)

No.	Aspect	Short Term (0-24 months)	Medium Term (2-3 years)	Long Term (3-5+ years)
1	Governance Structure & Placement of the Sustainability Office	Establish a unified sustainability governance structure with Columbia Finance, Insurance, and Risk Management teams, that formally embeds the Office of Sustainability within Columbia University's enterprise risk architecture, clarifies risk controls across its primary goals, provides a direct reporting line and regular access to the Provost and a designated Board committee.	Deploy school-level sustainability and risk committees that include deans, finance and facilities to develop an implementation plan that translates university-wide targets (GHG, water, waste, equity) into school-specific actions, KPIs, and budget lines.	Achieve full integration of sustainability and climate risk into university-level strategic planning, capital allocation, and core business operations.
2	Peer Benchmarking	Consult the peer benchmarking scorecard to target and improve areas where Columbia performs below its peers.	Launch improvement programs in lagging areas using peer best practices. For example, a catch-all-environmental-metric improvement program can be a student pitch competition to reduce waste and water usage within Columbia University's food system. Additionally, update the peer scorecard every 3-5 years to track progress and inform workplans and budgets.	Use peer benchmarking to inform and update long-term targets for Scope 1-3 emissions, energy efficiency, climate resilience, and circularity, ensuring targets remain aligned with best-in-class institutions and evolving global standards. Additionally, formalize a sustainability benchmarking consortium with peer institutions to exchange data, share best practices, and co-develop climate resilience and decarbonization strategies.

No.	Aspect	Short Term (0-24 months)	Medium Term (2-3 years)	Long Term (3-5+ years)
3	Risk Frameworks & Management	Develop customized risk frameworks using COSO/ISO and use tools (NPCC/ FEMA/ NOAA, etc.) to map climate and social hazards across campuses and communities. Document vulnerable assets and key concerns (e.g., data security, business ethics, physical hazards, international student enrollment) and establish baseline financial exposure.	Update financial impact models annually to measure avoided losses and return on investment. Also integrate the sustainability/climate risk assessment with Enterprise Risk Management.	Harden critical infrastructure and climate resilience programs. Incorporate financial implications into investment decisions
4	Regulatory Compliance	Map all climate and operational regulations by outlining what is applicable to Columbia University, identify compliance gaps, and create an implementation roadmap.	Set up compliance tracking at the local, state, and federal level. Start phased implementation of priority requirements which would be co-led by legal and sustainability departments.	Advance unified university-wide regulatory and compliance system where all schools and major units follow consistent processes and tools for tracking, documenting, and evidencing compliance, with escalation pathways.

No.	Aspect	Short Term (0-24 months)	Medium Term (2-3 years)	Long Term (3-5+ years)
5	Food Systems	Document current food and waste systems, assess baseline emissions and establish core infrastructure for composting and waste tracking.	Develop a low-carbon food plan in line with Plan 2030 goals, expand inclusive and sustainable sourcing, enhance dining access and composting/food-rescue programs, and conduct annual supply-chain audits.	Transition to a circular food system with on-campus growing capacity, zero food waste to landfill, and 100% sustainably and equitably sourced food.
6	Sustainability Reporting	Begin aligning disclosures with the SASB Education Standard and TCFD, while noting that additional material topics may need to be included for Columbia University (e.g., endowment-related topics, environmental justice, campus climate, etc.)	Either follow a recognized reporting framework (e.g SASB/TCFD) or build an internal sustainability reporting framework to ensure each ESG pillar's metrics are being met. Build a dashboard for university and school leadership that show progress on key performance indicators.	Transition to reporting in line with ISSB (which incorporates SASB & TCFD) by integrating financial materiality, climate resilience, and broader sustainability topics.

Note.

1. University-level: Central coordination, standardized data, audits, strategic integration
2. School-level: Local implementation, budget control, quarterly reporting to central oversight

13 Conclusion

13. Conclusion

This capstone integrates three components: peer benchmarking, sustainability risk assessment, along with financial quantification and recommendations for Columbia University's Office of Sustainability.

The benchmarking exercise provided an external view of Columbia University's ESG disclosures, highlighting strengths in social and governance aspects but improvements needed in environmental initiatives and disclosures. Learning from peers such as Stanford University, the University of Pennsylvania, and the University of California, Berkeley can also help Columbia mitigate future risks more effectively. Moreover, data gaps identified emphasize the need to better integrate data and governance to strengthen Columbia University's ability to quantify and manage risks effectively. This aligns with our recommendation for a unified governance structure for the sustainability office, as discussed in our recommendations.

Columbia University faces significant interconnected risks across physical, climate, social, regulatory, and financial areas that demand coordinated action to protect its mission, stakeholders, and long-term competitiveness. Addressing these challenges proactively through enhanced governance, improved data transparency, and targeted investments is crucial for advancing Plan 2030 goals and building institutional resilience amid an increasingly complex regulatory and climate landscape.

Material risks were identified and quantified using ROSI and custom methodologies tied to Columbia University's ~$6.6B FY2025 expense base. Risks compatible with ROSI showed potential for avoided losses or value-at-risk in areas such as Cybersecurity and Data Privacy Failures, Business Ethics, International Enrollment, and Physical Risks. These risks are deeply intertwined, showing that physical, social, and financial challenges cannot be managed in isolation but require integrated solutions, linking mitigation strategies directly to planning and budgeting.

To achieve this, the university should embed the sustainability risk assessment into ongoing governance and capital planning processes and commit to closing disclosure and performance gaps through more granular data and sustainability integration into routine reviews. Taking these steps will not only reduce vulnerabilities but also position Columbia University as a resilient leader demonstrating sustainable operations and community responsibility within higher education, with a clear path forward for enhanced sustainability and resilience.

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Glossary of Terms

Acronym	Full Term
AC	Air Conditioning / Air Conditioner
BE-Ex	Building Energy Exchange
BREEAM	Building Research Establishment Environmental Assessment Method
CLCPA	Climate Leadership and Community Protection Act of 2019
CO_2	Carbon Dioxide
COP16	16th Conference of the Parties (Cancun Agreements under the UNFCCC)
COSO	Committee of Sponsoring Organizations (of the Treadway Commission)
CRA	Climate Risk Assessment
CSAP	Climate and Sustainability Action Plan (University of Pennsylvania)
CSO	Combined Sewer Overflow
CU	Columbia University
CU Grow	Columbia University Grow Vendor Development Program
CUIMC	Columbia University Irving Medical Center
CY	Calendar Year
DEI	Diversity, Equity, and Inclusion
DER	Distributed Energy Resource
DOE	Department of Energy
DOHMH	Department of Health and Mental Hygiene (New York City)
DOJ	Department of Justice

EAL	Expected Annual Loss
ED	Department of Education
EHP	Exterior and Historic Preservation
EEOC	(U.S.) Equal Employment Opportunity Commission
EIA	Energy Information Administration
EJ	Environmental Justice
EPA	Environmental Protection Agency
ERM	Enterprise Risk Management
ESG	Environmental, Social, and Governance
EV	Electric Vehicle
FCA	False Claims Act
FEMA	Federal Emergency Management Agency (United States)
F-1	U.S. Student (Academic) Visa Category
GHCN-D	Global Historical Climatology Network – Daily; category from the New York City Panel on Climate Change (NPCC)
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GRESB	Global Real Estate Sustainability Benchmark
GSA	General Services Administration
GWP	Global Warming Potential
HHS	Department of Health and Human Services
HMP	Hazard Mitigation Plan

IDT	Identical Standard (ISO designation)
IFRS	International Financial Reporting Standards
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
Ivy+	Extended Ivy League peer group
JHU	Johns Hopkins University
kWh	Kilowatt-hour
LDEO	Lamont-Doherty Earth Observatory
LEED	Leadership in Energy and Environmental Design
LL33	New York Local Law 33 Related to Energy Grading
LL55	New York City Local Law 55, Otherwise Known as the Asthma-Free Housing Act
LL84	New York City Local Law 84 Related to Benchmarking and Energy Efficiency Rating
LL87	New York City Local Law 87 Related to Energy Audits and Retro-commissioning
LL97	New York City Local Law 97 Related to Building Emissions
MIT	Massachusetts Institute of Technology
MS	Master of Science
MW	Megawatt
MWh	Megawatt-hour
MWBE	Minority- and Women-owned Business Enterprise

NCA5	Fifth National Climate Assessment (United States)
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration (United States)
NPCC4	New York City Panel on Climate Change, Fourth Assessment
NRI	National Risk Index
NSHM	National Seismic Hazard Model
NYU	New York University
NYC	New York City
NYCEM	New York City Emergency Management
NYS	New York State
OPEX	Operating Expenditures
p.a.	Per Annum
REC	Renewable Energy Certificate
ROSI	Return on Sustainable Investment
SASB	Sustainability Accounting Standards Board
SSP	Shared Socioeconomic Pathway
STARS	Sustainability Tracking, Assessment & Rating System
SUMA	Sustainability Management (Graduate Degree Program at Columbia University)
SUSCi	Sustainability Science (Graduate Degree Program at Columbia University)
SusDev	Sustainable Development (Undergraduate Degree Program at Columbia University)
UHI	Urban Heat Island

Appendices

Appendix A

Table A1 Peer University

Benchmarking List

Name of University	Reasoning
Harvard University	Harvard University is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks.
University of Pennsylvania	University of Pennsylvania is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks.
Cornell University	Cornell University is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks. It is also located in New York State and hence, needs to comply with the same state regulations.
Brown University	Brown University is also an Ivy League research university with similar weather conditions and hence, similar reputational, financial and physical climate risks.
Princeton University	Princeton University is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks.
Yale University	Yale University is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks.
Dartmouth College	Dartmouth College is also an Ivy League research university with similar weather conditions and hence, faces similar reputational, financial and physical climate risks.
California Institute of Technology	Like Columbia University, they are global leaders in research and innovation and renowned for their academic rigor, admission standards, and prestige in the United States, resulting in similar reputational and financial risks. Despite different physical climate risks and reputational risks, their research output and sustainability initiatives are admirable and to be learnt from.

Name of University	Reasoning
New York University	Like Columbia University, New York University is also located in New York City and hence, needs to comply with the same state regulations and local laws. Due to the geographical location, it has similar weather conditions and hence, faces similar physical climate risks.
Fordham University	Like Columbia University, Fordham University is also located in New York City and hence, needs to comply with the same state regulations and local laws. Due to the geographical location, it has similar weather conditions and hence, faces similar physical climate risks.
Johns Hopkins University	Considered to be one of the Ivy+ Universities, Johns Hopkins University is included due to its academic rigor, admission standards, prestige and geographical location within the United States, resulting in similar reputational, financial and physical climate risks.
Massachusetts Institute of Technology	Considered to be one of the Ivy+ Universities, Massachusetts Institute of Technology University is included due to its academic rigor, admission standards, prestige and geographical location within the United States, resulting in similar reputational, financial and physical climate risks.
University of Chicago	Considered to be one of the Ivy+ Universities, University of Chicago is included due to its academic rigor, admission standards, prestige and geographical location within the United States, resulting in similar reputational, financial and physical climate risks.
Northwestern University	Considered to be one of the Ivy+ Universities, Northwestern University is included due to its academic rigor, admission standards, prestige and geographical location within the United States, resulting in similar reputational, financial and physical climate risks.
Duke University	Considered to be one of the Ivy+ Universities, Duke University is included due to its academic rigor, admission standards, prestige and geographical location within the United States, resulting in similar reputational, financial and physical climate risks.
Stanford University	Considered to be one of the Ivy+ Universities, Stanford University is included due to its academic rigor, admission standards, and prestige in the United States, resulting in similar reputational and financial risks.
University of California, Berkeley	Like Columbia University, they are global leaders in research and innovation and renowned for their academic rigor, admission standards, and prestige in the United States, resulting in similar reputational and financial risks. Despite different physical climate risks and reputational risks, their research output and sustainability initiatives are admirable and to be learnt from.

Table A2

Indicator Scoring Criteria for Benchmarking Analysis

Indicators	Indicator Criteria
GHG Carbon Emissions of CO2 Scope 1 & 2	Complete calculations of greenhouse gas emissions from sources that are owned or controlled by the organization & greenhouse gas (GHG) emissions that result from the generation of purchased or acquired electricity, heating, cooling, and steam consumed by the organization (2022 or after).
GHG Carbon Emissions of CO2 Scope 3	Calculations of indirect greenhouse gas (GHG) emissions not included in Scope 1 & 2 calculations (2022 or after).
Energy Consumption (kWh / MWh)	Complete Calculations of the amount of energy used or needed to carry out processes or tasks.
Renewable Energy Percentage	Calculations of the proportion of total energy or electricity that come from naturally replenished sources like solar, wind, and geothermal.
Carbon Intensity (Ratio)	Calculations of the amount of carbon dioxide and other greenhouse gases generated over total energy used per unit activity.

Indicators	Indicator Criteria
Net Zero Targets	Setting targets to reduce carbon emissions to a small amount of residual emissions that can be absorbed and durably stored by nature and other carbon dioxide removal measures, leaving zero in the atmosphere.
Building Energy Intensity	Calculations of the quantity of energy required in a building per unit output or activity, so that using less energy to produce a product reduces the intensity.
Electrification efforts	Actively working towards the process of converting an energy-consuming device, system, or sector from non-electric sources of energy to electricity-based (such as EVs or electric stoves).
Total Waste Generated	Calculations of the total weight of all discarded materials produced by an organization encompassing all types of waste like hazardous, non-hazardous, industrial and municipal solid waste.
Waste Diversion Rate	Calculations of the percentage of waste kept out of landfills or incineration through methods like recycling, composting, and reuse.
Hazardous Waste Percentage	Calculations of the percentage of a company's total waste that is classified as hazardous.

Indicators	Indicator Criteria
Packaging Material Recycled	Calculations of the packaging made from materials that were previously used and then reprocessed into new products, diverting from the waste stream.
Circularity Metrics	Actively using tools to measure an organization's transition from a linear take-make-dispose model to a circular one where waste is minimized and resources are kept in use for as long as possible.
Total Water Withdrawal	Calculations of the sum of all water drawn from surface water, groundwater, seawater, or a third party for any type of use over the course of the reporting period.
Water Recycling Rate	Calculations of the percentage of wastewater that is treated and reused for beneficial purposes, such as irrigation, industrial processes, or groundwater recharge.
Biodiversity Impact Assessments (High Stress Areas)	A systematic process to evaluate the potential effects of a project, investment, or development on biodiversity.
Land Use and Ecological Sensitivity	Addresses how the land is used by humans, such as for agriculture, housing, or industry and ecological sensitivity describes how susceptible an ecosystem is to disturbance and its capacity to recover from it.
Water Waste	Calculations of used water that cannot be recycled or re-used, not the same as total water withdrawal.

Indicators	Indicator Criteria
Employee Wellbeing	Programs and resources that support the overall mental, physical, emotional, and economic health of an organization's employees, faculty and other staff.
Working Hours	Actively encouraging employees to have healthy working hours during a day and having policies in place to prevent unreasonable working hours.
Training and Development Resources	Active efforts towards increasing the time employees spend on learning activities to improve job performance and career growth.
Employee Turnover Rate	Calculates the number of employees who leave the organization voluntarily or due to dismissal, retirement, or death in service over the total number of employees in an organization.
Environmental Health and Safety (EHS) Policy & Practices	Public statement of the EHS standards, policies, and practices an organization uses to ensure their operations don't harm people or the environment.
Community Rights & Engagement (including Investments)	The process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people which can also include community engagement (e.g. local food sourcing).
Local Hiring	Highlights the share of jobs or work hours that must be performed by residents of a particular geographic area on a project

Indicators	Indicator Criteria
Socio-Economic Impact Assessments (DEI)	Acknowledgement of socio-economic variables, including diversity in student acceptances and staff/faculty hiring process as well as mentions of equity, disability and inclusion on the university website.
Public Transit Access	Convenient access to one or more public transport systems including, but not limited to, subway, buses, regional trains, etc.
Student Wellbeing	Programs and resources that support students' mental, physical, and emotional health and well-being.
Supplier Diversity	Inclusion of businesses owned by minorities, women, or underrepresented groups in procurement.
Fair Labor Practices Compliance	Adherence to labor laws ensuring fair wages, safe conditions, and worker rights.
Grievance Mechanism Effectiveness	The systems/processes/policies implemented that allow any internal and external stakeholders to report and resolve complaints in a clear, fast and effective manner.
Socio-Economic Impact Assessments (DEI)	Acknowledgement of socio-economic variables, including diversity in student acceptances and staff/faculty hiring process as well as mentions of equity, disability and inclusion on the university website.

Indicators	Indicator Criteria
Public Transit Access	Convenient access to one or more public transport systems including, but not limited to, subway, buses, regional trains, etc.
Student Wellbeing	Programs and resources that support students' mental, physical, and emotional health and well-being.
Supplier Diversity	Inclusion of businesses owned by minorities, women, or underrepresented groups in procurement.
Fair Labor Practices Compliance	Adherence to labor laws ensuring fair wages, safe conditions, and worker rights.
Grievance Mechanism Effectiveness	The systems/processes/policies implemented that allow any internal and external stakeholders to report and resolve complaints in a clear, fast and effective manner.
Code of Conduct Compliance	Conformance with institutional ethical behavior standards.
Anti-Corruption and Bribery	Presence and clarity of policies/frameworks addressing corruption, bribery, and related misconduct.

Indicators	Indicator Criteria
Shareholder Rights and Engagement	Mechanisms enabling shareholders to actively influence governance and decision-making.
Sustainability Reporting Standards	The use of one or more frameworks (like GRI, SASB, CDP, TCFD, etc.) to self-disclose environmental, social and governance initiatives, performance and future plans.
Sustainability Course Offerings	Academic courses integrating sustainability concepts across disciplines, not limited to Environmental or SusDev Programs. (e.g. sustainability courses in non-sustainability degrees like environmental design in an architectural program because some programs have courses about the environment but no actual sustainability degrees.)
Research Output	Volume and impact of scholarly publications or projects on sustainability-related topics.
Sustainability Clubs	Existence of more than one student organization that hosts sustainability-related events and community building (e.g. For Columbia University, this includes Sustainability Management Student Association (SUMASA), Electric Vehicles Organization (EVO), Women & Sustainability (W&S), Circular Economy Club, etc.).

Indicators	Indicator Criteria
Third-Party ESG Ratings	External evaluations of an institution’s environmental, social, and governance performance.
Board Evaluation & Reviews	Regular assessments of board effectiveness, accountability and honor code.
Lobbying	Advocacy efforts aimed at influencing public policy or regulation.
Materiality Assessment Disclosure	Transparency about key ESG issues most relevant to stakeholders and operations.
Partnerships with respect to Sustainability	Collaborations with organizations advancing shared sustainability goals, at any level or department of the institution.

Note. Adapted from What are the Ivy Plus colleges? (n.d.), The Ivy Institute. https://theivyinst.org/blog/what-are-the-ivy-plus-colleges

Appendix A3 Interview with Johns Hopkins University

Details of the interview
Interviewee - Julian Goresko, Director of Climate & Sustainability
Date: Thu Oct 23, 2025 1:30pm - 2pm

Summary of the meeting

1. Governance Structure
    a. Chief Risk Officer and other executives are held accountable for the Risk planning and decision making.
    b. Office of Climate and Sustainability isn't responsible for success alone, everyone is (just like safety at a job site)
    c. The risk-time horizon is important, not just the 5-10 years of imminent risk, but longer time horizons beyond 2050. It is important to not lose the urgency. Strategic value alignment with change management is key
2. Climate Action Planning & Key Physical Climate Risks
    a. Johns Hopkins University integrates sustainability into its institutional risk framework,
        i. Extreme weather and climate resilience is central in their risk assessment, supported by environmental modeling, consultant input, and alignment with Maryland's fossil fuel regulations.
        ii. Executive engagement ensures risks are framed around operational, financial and reputational impacts.
    b. No external tools or scenario are used for reporting and disclosure, JHU has their own framework built through benchmarking and studying a multitude of frameworks, combines operations and academics into a single cohesive framework
    c. Financial, carbon or energy model can only be directional, but it can make people feel comfortable about work and setting goals; confidence that their work is leading somewhere important
    d. Building guidelines and directives to operationalize it - integrate it directly into the built and natural environment, investments - ESG, diversity, climate.
        i. To show up on balance sheets
        ii. $ in resilience = $ in savings

3. Additional Focus Areas
    a. Risk and health, faculty involved could exert leadership at the campus and local level
        i. LANSET - environmental health to physical assets and communities, this was folded into the deliverables

Note: This interview does not impact peer benchmarking scorecard and analysis.

Appendix A4 Interview with University of Pennsylvania

Details of the interview
Interviewee - Nina Morris, Director of Sustainability
Date: Tue Nov 18, 2025 4pm – 4:45pm

Summary of the meeting

1. Lessons Learned and Evolving Approach: UPenn has developed a collaborative, integrated approach to sustainability and climate risk. The university leverages existing structures, such as faculty-led advisory committees and partnerships with non-profits and local schools, to embed resilience and sustainability across operations. Small, incremental interventions ("little wins") are prioritized alongside high-impact projects, balancing climate goals with cost-effectiveness. Longstanding commitments, such as the 2007 President's Climate Commitment (Second Nature), and annual planning cycles help maintain accountability and continuous improvement.
2. Governance Structure
    a. Sustainability and climate risk oversight sits under Facilities and Real Estate Services, coordinated with Risk Management, Insurance, and operational units.
    b. Key advisory bodies include the Environmental Sustainability Advisory Committee, with ~160 faculty, staff and students and Resiliency Working Groups that integrate , operational staff from all schools and centers.
    c. Accountability is distributed: implementation is a shared responsibility across schools, departments, and operational teams, with central coordination for strategy, reporting, and data management.

3. Key Physical Climate Risks
    a. Extreme heat and urban heat island effects
    b. Flooding and stormwater management
    c. Freeze/thaw cycles affecting infrastructure
    d. Human health impacts, including air quality and campus well-being
    e. Tree canopy management and urban greenery are considered critical for resilience.

Risk assessments are informed by insurance reports, external consultants, and internal research. Physical risks are evaluated building by building, with mitigation strategies linked to operational priorities.

4. Measurement, Frameworks, and Reporting
    a. UPenn uses internal risk and sustainability frameworks and aligns with external reporting standards like Second Nature commitments.
    b. Certain Scope 3 emissions are managed efficiently due to integration with procurement and faculty/staff advisory committees.
    c. Progress is tracked via annual plans and reports, with coordination across decentralized units.
    d. Financial impact considerations (energy, emissions, regulatory compliance) inform project prioritization and cost-benefit decisions.
5. Additional Focus Areas
    a. Focus on equity and community partnerships, leveraging local schools and non-profits.
    b. Supply chain impacts, particularly food, are assessed and mitigated.
    c. Projects balance climate impact with short payback investments, optimizing both environmental and operational outcomes.

Appendix A5 Interview with Massachusetts Institute of Technology

Details of the interview
Interviewee - Brian Goldberg, Associate Director at the MIT Office of Sustainability
Date: Wed Nov 19, 2025 2pm – 2:45pm

Summary of the meeting

1. Governance Structure: MIT's Office of Sustainability operates within Campus Services (VPCSS), advising Facilities, Planning, and EHS while these units manage compliance. The office provides strategy, data, and coordination, linking operations with academic teams to use the campus as a "living lab." Climate risk governance is shared with many offices including VPCSS, Risk Management, Insurance and Office of Emergency Management.
2. Climate Action Planning: MIT's Climate Action Plan covers mitigation (energy, waste, Scope 3, electrification) and resilience (flooding, heat, storms). Targets include net zero by 2026 and zero emissions by 2050. Implementation depends on distributed leadership across schools and departments.
3. Key Physical Risks
    a. Flooding: Most urgent risk due to extensive below-grade space and vulnerable research assets. Modeling guides resilient building design.
    b. Extreme Heat: Increasingly significant long-term risk; MIT monitors indoor/outdoor conditions with the city.
    c. Storm surge is a risk emerging over next 20 years, and freeze risks are relevant but less emphasized.
4. Risk Tools & Data
    a. MIT uses embedded risk processes rather than one framework. Key tools include ICM2D flood modeling, a Sustainability Data Pool with Scope 3 and climate dashboards, STARS reporting, selective consultant support and regular convenings of committees
5. Waste & Food Systems
    a. Food waste (30–40% of campus trash) is a major climate and cost issue; MIT uses audits and engagement to drive reductions.
6. Low-Carbon & Energy Strategy: Investments align with city/state policy, prioritize collective action (e.g., joint PPAs), and focus on solar, electrification, and EV charging (challenging due to system constraints).
7. Peer collaboration: MIT collaborates with Harvard, Ivy+, Stanford, government partners at city, regional and state scales; and supply chain actors to accelerate learning and alignment

Note: This interview does not impact peer benchmarking scorecard and analysis.

Appendix A6 Interview with New York University

Details of the interview

Interviewee - Cecil Scheib, Chief Sustainability Officer
Date: Thu Nov 20, 2025 11:30am - 12pm

Summary of the meeting

1. Governance Structure:
    a. Sustainability sits under Office of President to ensure collaborate with all university schools and partners to support a strategic view of overall interests and not just facilities
2. Climate Action Planning & Key Physical Climate Risks
    a. Data collection is important. NYU has a risk assessment and response model, with various categories and classifies risks into level 1,2,3
        i. Data Gaps: A lot of the information is more qualitative than quantitative.
    b. The main goal discussed: "To reduce building emissions intensity by 50 percent by 2025" is ambitious - what was most impactful and what were the challenges??
        i. NYU is a signatory to NYC carbon challenge 2007, committed to 30% by 2017 and then signed up to 50% by 2025.
        ii. One of NYU's goals for climate neutrality includes complete campus electrification. Currently, a few buildings have already achieved this. It was stressed upon that it was key to get there as much as possible without offsets and/or RECs; reducing energy consumption and increasing energy efficiency is much more important. Also, a cleaner grid will probably bring lower energy supply prices and is necessary for emissions to actually fall over time. A combination of energy reduction, fuel switching to electricity, and a lower-cost grid is required for long-term financial stability.
        iii. Climate reset and affordability -> false dichotomy, efficiency and electrification in the long run are complementary. Reducing price volatility.
        iv. Sea level rise and/or precipitation based flooding are less of a risk due to lack of coastal properties and elevation of current properties
3. Additional Focus Areas
    a. Regulations are also a financial risk, especially Local Law 97.
    b. Apart from electrification, looking at food is really crucial to reduce emissions. Working with food, in terms of sustainability, is very achievable and has a bigger impact than one would anticipate. This includes looking at supply chain volatility and waste management but also the type of food being sourced. For example, a pack of beans uses less energy over refrigerated cans and is a more secure food source during energy outages.

Note: This interview does not impact peer benchmarking scorecard and analysis.

Appendix A7

Interview with Yale University

Details of the interview
Interviewee - Lindsay Crum, Associate Director at the Yale Office of Sustainability
Date: Thu Nov 20, 2025 2pm – 2:45pm

Summary of the meeting

1. Lessons Learned and Evolving Approach
Yale's sustainability planning has become increasingly tailored and collaborative. The university developed a sustainability action planning model that allowed each school and unit to set context-specific goals, informed by extensive community feedback and close coordination with operational partners like libraries and athletics. These lessons will shape the next Sustainability Plan .

2. Governance Structure
Sustainability is embedded within Facilities, with the Director reporting to the VP for Facilities, Campus Development, and Sustainability. Accountability for delivering the plan sits with this operational leadership, with regular performance reporting through the VP Operations structure.

3. Key Physical Climate Risks
Yale focuses on risks tied to its coastal location, sea-level rise, hurricanes, heavy rainfall, and stormwater management with particular concern for libraries, museums, HVAC, and flood-prone basements. Freeze events, extreme heat, and the resilience of IT/data centers are also major considerations due to energy and continuity demands.

4. Measurement, Frameworks, and Reporting
Yale's measurement approach is built around internal operational priorities rather than a single external framework. In addition to issuing annual progress reports for its sustainability goals and verifying its GHG inventory through The Climate Registry, Yale reports through AASHE STARS (since 2018, on a two-year cycle), collaborates with Ivy+ peers for benchmarking, and submits to various other reporting and benchmarking mechanisms. Scope 3 work is expanding although Yale does not explicitly use COSO, ISO 31000, or TCFD.

5. Additional Focus Areas
Food systems, especially waste reduction and composting have become a growing priority, driven by strong student interest and alignment with Yale's Scope 3 and community well-being goals.

Note: This interview does not impact peer benchmarking scorecard and analysis.

Appendix A8

Interview with Harvard University

Details of the interview

Interviewee - Heather Henriksen, Chief Sustainability Officer & David Havelick, Associate Director at the Office of Sustainability
Date: Fri Nov 21, 2025 9:15am – 10am

Summary of the meeting (Links shared by Harvard University)

1. Lessons Learned and Evolving Approach

Harvard's sustainability strategy has become increasingly coordinated and data-driven. A decentralized University made up of 12 schools is supported by a collaborative model that includes strong staff partnership, clear governance, faculty expertise, and engagement with students and the broader community. Longstanding commitments to a University-wide Sustainability Action Plan, rigorous standards and data including greenhouse gas (GHG) accounting, transparent disclosures, and pilot testing through the living-lab model align priorities and strengthen campus-wide adoption.

2. Governance Structure

Sustainability sits under the Executive Vice President within Campus Services alongside Environmental Health and Safety (EHS), transportation, dining, and other departments. Accountability is shared across the Presidential Committee on Sustainability, the Sustainability Management Council, and the Council of Student Sustainability Leaders, which advise the Office for Sustainability (OFS) and senior leadership and guide progress. Implementation is distributed: the central sustainability office works with senior leadership to set strategy and data-driven standards, while schools and operational units deliver results in partnership with OFS.

3. Key Physical Climate Risks:

As part of a broader region within Cambridge, Allston and Longwood, physical climate-related risks have been identified regionally with varying timelines and locations:

- Extreme precipitation and flooding
- Air quality impacts, including wildfire smoke
- Freeze–thaw cycles affecting infrastructure
- Increasing extreme heat

Boston/Cambridge and state regulations on adaptation priorities are evolving. Harvard continues to evaluate and work to mitigate risks and vulnerabilities associated with future climate changes such as extreme heat, stormwater surge from increased rainfall events, and sea-level rise.

This work is closely coordinated with local, state, and federal agencies. Harvard's most significant regional physical climate risks across Cambridge, Allston, and Longwood include extreme precipitation and flooding, air quality impacts such as wildfire smoke, freeze–thaw damage to infrastructure, and increasing extreme heat, stormwater surge, and sea-level rise. Risk Management and Insurance jointly assess these exposures as local and state regulations evolve, and Harvard's Sustainable Building Standards embed climate resilience into new construction and major renovations in coordination with government partners.

4. Measurement, Frameworks, and Reporting

Harvard follows the WRI GHG Operational Control Protocol and uses third-party verification via The Climate Registry. The university does not rely on a single risk framework; instead, risk assessment is embedded across operational units. Scope 3 emissions reduction and data collection advances in several categories (more info here), with targets to reduce emissions related to food and embodied carbon in construction.

5. Additional Focus Areas

Harvard is expanding metrics beyond carbon to include health, wellbeing, and the supply chain, including purchasing healthier, more sustainable building materials, and supporting community. Standards such as the Sustainable Building Standards and the Harvard Healthier Building Academy were institutionalized through faculty advisors working with OFS to create a research-backed strategy, which allowed OFS to partner with cross-campus project teams to pilot and scale progress.

6. Most Impactful Strategies

Key emissions reductions have come from lighting retrofits, monitoring-based commissioning, electrification, and heat recovery. Consistent data, shared methodologies, and the Green Revolving Fund (0% interest, 10-year payback) have enabled schools and units to coordinate investments in energy efficiency and decarbonization projects.

7. Peer Collaboration and Engagement

Harvard works closely with Ivy+ peers, city/state partners, and internal research teams. Students and faculty remain central through grants, committees, and the living-lab model, ensuring pilots inform university-wide standards and long-term climate action.

Note: This interview does not impact peer benchmarking scorecard and analysis.

Appendix B

Climate and Physical Risk Assessment for Columbia University

This appendix contains the full Climate and Physical Risk Assessment used in the analysis. The assessment evaluates thirteen risk topics (A4–A16): (1) Heat Waves / Extreme Heat, (2) Riverine / Coastal Flooding (Hudson / Harlem River) – Sea Level Rise, (3) Extreme Precipitation / Stormwater, (4) Winter Storms / Extreme Cold, (5) Long-Term Heat Increase / Urban Heat Island Effect, (6) Sea-Level Rise & Coastal Erosion, (7) Groundwater Rising, (8) Stormwater Management Stress, (9) Air Quality, (10) Building / Construction, (11) Clean & Reliable Energy, (12) Earthquake, and (13) Biodiversity.

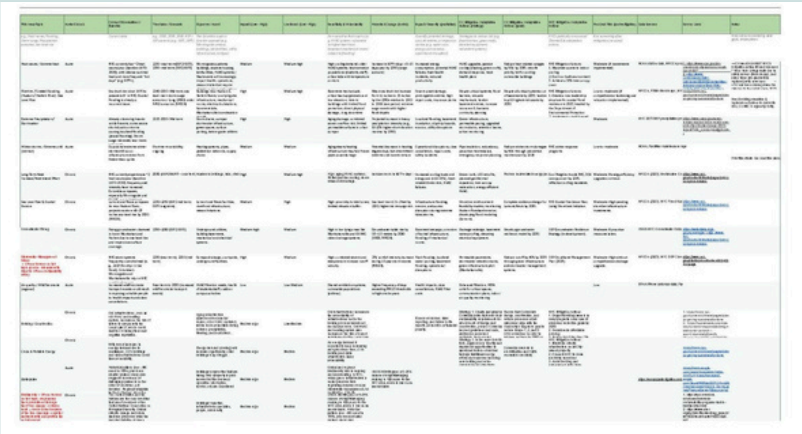
Heat waves - NPCC4 includes dedicated chapters on extreme heat, "Tail risk, climate drivers of extreme heat," identifying heat waves as a leading climate related cause of morbidity and mortality in NYC (Mayor's Office of Climate & Environmental Justice, n.d.; EPA, 2025; Matte et al., 2024)

To provide a comprehensive evaluation, the matrix includes criteria shown in B2–Q2: Acute/Chronic, Current Observations/Baseline, Exposure/Asset, Impact (Low–High), Likelihood (Low–High), Projected Change, Columbia University's Mitigation/Adaptation Actions (Strategy), Columbia University's Mitigation/Adaptation Actions (Goals), NYC's Mitigation/Adaptation Actions (Goals/Strategy), and Residual Risk (post-mitigation).

Because the full table cannot be displayed within this document due to its size, the complete matrix is available here:

Full Climate and Physical Risk Matrix:
https://docs.google.com/spreadsheets/d/1haJ7jbzdV_1Gb_M1TX-AMVveAqt9JEeK/edit?gid=40609978#gid=40609978

CU Climate Risk Assessment (Google Doc Overview):



Note. The full matrix and supporting document are provided externally because of formatting and size limitations in the main report. All analysis, interpretation, and references in the report are based on these materials.

Scenario Analysis

For the severe rainfall scenario, the analysis examined recent subway flooding incidents and reviewed Columbia University's current emergency communication systems and operational practices. For heat-related risks, the assessment used findings from NPCC4 climate projections and research conducted by the Columbia Climate School on local heat-island conditions.

Acute Scenario: Severe Rainfall and Transit Disruption

Heavy rainfall has become one of the most immediate climate-related threats to New York City's transportation network. The subway system is particularly vulnerable because many stations sit below street level and depend on drainage systems that cannot always handle sudden heavy rain. Several events in recent years illustrate this pattern. In July 2025, riders recorded floodwater rushing across platforms as storms soaked the region (Prussin, 2025). On August 1, 2025, additional news showed water pouring down stairwells and filling station halls during a torrential downpour (Lenthang, 2025). These incidents demonstrate how quickly service can shut down when rainfall exceeds pumping capacity.

A similar dynamic occurred in late October 2025, when a storm caused severe flooding across multiple subway lines. One widely shared clip showed water cascading into a Brooklyn station on October 30, forming waterfalls onto the platform (Deliso et al., 2025). Although this event occurred outside Manhattan, it highlighted the type of disruption that can also strike the 1 subway line, the primary subway route serving Columbia University's Morningside Heights and Manhattanville campuses.

If the 1 subway line becomes unusable and inoperative, a large number of students, faculty, and research staff may be unable to travel to campus. Past events show that Columbia University typically relies on CCAlert to send rapid updates, while CUIMC maintains essential operations with on-site personnel. However, a prolonged transit shutdown would raise more complex challenges. Laboratory work involving temperature-sensitive materials may require constant oversight, and some clinical rotations cannot pause without consequence. At present, Columbia University does not publish detailed procedures for multi-day commuting disruptions, nor does it list contingency transportation options outside regular MTA service. These gaps indicate that a major transit failure during a storm could lead to academic delays, research interruptions, and uneven access to essential spaces.

Chronic Scenario: Long-Term Heat Increase and Urban Heat Island Intensification

New York City is projected to experience continued warming, including more days above 90°F and hotter nights. Regional assessments show that the city's average summer temperatures have already trended upward, with a significant increase expected under both moderate and high-emission scenarios (NPCC4, 2024). Columbia University's campuses sit in dense neighborhoods where heat tends to collect and dissipate slowly. Research from the Columbia Climate School identified several heat-island "hot spots" near Morningside Heights and Manhattanville, where surface temperatures remain elevated for long periods (Hinsdale, 2021).

These trends have direct implications for building performance and campus operations. Older residence halls and academic buildings rely on cooling systems that were designed for milder summers. During heat waves, these systems must work harder to maintain safe indoor temperatures, increasing the risk of mechanical failure. The Environmental Protection Agency (2022) notes that heat-island conditions can amplify electricity demand and contribute to local outages. If this occurs during peak usage, critical facilities such as research laboratories and medical buildings may experience unsafe temperature fluctuations.

Heat also affects outdoor spaces. The removal of several aging trees from College Walk in 2023, although necessary for safety reasons, temporarily reduced natural shade during peak summer months (Towfighi, 2023). Replanting efforts take time to produce cooling benefits. Without a coordinated plan to increase canopy coverage and implement passive cooling measures, such as reflective roofs or vegetated surfaces, Columbia University will face growing pressure on its energy systems and higher health risks for heat-sensitive community members.

Appendix C

Financial Risk

1. Data Security

Table C1

Data Security Risk – Annualized Loss by Scenario

Scenario	Annual cost
Minor	3.75
Moderate	28.5
Severe	76

Table C2

Data Breach Cost Components – Fines, Settlements, and Reputational Impact

Severity Level	Records (A)	Cost per record (Cost typically company pays for) - (B)	Cost Estimate - (A*B) ($ Millions)
Minor	250,000	$250	$31.25
Moderate	350,000	$250	$87.50
Severe	750,000	$250	$187.50
Range	$31M - $187M p.a		

Cost per record includes fine, penalties, class action settlement, and reputational damage. Source: Molnar, M. (2015, June 2). Data breaches cost education companies $300 per record, study finds. Education Week.

2. International Student Enrollment Decline and Immigration Policy

Table C3

International Student Enrollment – Baseline Metrics & Sources

Metric	Value	Source
International students (% of total)	39% (3rd nationally, 2.9x national average)	ET
International student headcount	13,745 from 145 countries	Shiksha
International tuition revenue	~$850M	Politico
Drop in enrollments in 2025	20%	NYT

Table C4

International Enrollment Decline – Scenario-Based Revenue Impact

Scenario	Enrollment Decline %	Revenue Loss p.a (In Million)	Drivers of enrollment decline
Minor	0.05	$42.50	Modest visa constraints; limited policy change
Moderate	0.1	$85	Current trajectory (NAFSA baseline + partial recovery)
Severe	0.2	$170	Significant policy hardening; China
Range	$42M - $170M p.a		

Table C5

Donor & Endowment Sentiment – Scenario-Based Revenue Impact (Gifts Decline)

Scenario	Gifts Decline %	Revenue Loss p.a (In M)
Minor	20%	$4.20
Moderate	30%	$6.30
Severe	50%	$10.50
Range	$4.2M - $10.5M p.a	

Table C6

Regulatory Fine Severity Tiers – Impact Range Calibration

Severity Tier	Range
Low Impact	<$5M
Moderate Impact	$5M–$25M
High Impact	$25M–$75M
Very High Impact	$75M–$200M
Extreme / Tail Impact	>$200M potentially into

Table C7

Business Ethics Regulatory Fines – Case-Based Severity Benchmarking

Entities	Regulations	Amount	Year	Source
University of Maryland	Title IX	$4,140,000	2024	U.S. Department of Justice (2024)
Liberty University	Clery Act	$14,000,000	2024	Inside Higher Ed (2024)
Stanford University	False Claims Act – FCA	$19,000,000	2023	U.S. Department of Justice (2023)
Duke University	False Claims Act – FCA	$112,500,000	2019	U.S. Department of Justice (2019)
Columbia University	Anti Discriminatory law	$200,000,000	2025	Columbia University Office of the President (2025)
Brown University	Antitrust / financial-aid collusion	$19,500,000	2024	Berger Montague (2025)
Columbia University	Antitrust / financial-aid collusion	$24,000,000	2024	Berger Montague (2025)
Duke University	Antitrust / financial-aid collusion	$24,000,000	2024	Berger Montague (2025)

Entities	Regulations	Amount	Year	Source
Yale University	Antitrust / financial-aid collusion	$18,500,000	2024	Berger Montague (2025)
Dartmouth College	Antitrust / financial-aid collusion	$33,750,000	2024	Berger Montague (2025)
Rice University	Antitrust / financial-aid collusion	$33,750,000	2024	Berger Montague (2025)
Northwestern University	Antitrust / financial-aid collusion	$43,500,000	2024	Berger Montague (2025)
Vanderbilt University	Antitrust / financial-aid collusion	$55,000,000	2024	Berger Montague (2025)
University of Chicago	Antitrust / financial-aid collusion	$13,500,000	2024	Berger Montague (2025)
Emory University	Antitrust / financial-aid collusion	$18,500,000	2024	Berger Montague (2025)
California Institute of Technology	Antitrust / financial-aid collusion	$16,700,000	2024	Berger Montague (2025)

Entities	Regulations	Amount	Year	Source
Columbia University	New York General Business Law	$9,000,000	2025	Nietzel (2025)
Johns Hopkins University	Antitrust / financial-aid collusion	$18,500,000	2024	Berger Montague (2025)
Harvard University	False Claims Act – FCA	$1,300,000	2020	U.S. Attorney's Office, District of Massachusetts (2023)

5. GHG Emissions

To estimate potential Local Law 97 (LL97) compliance exposure, we used the Building Energy Exchange (BE-Ex) LL97 Carbon Emissions Calculator (https://www.be-exchange.org/calculator/) as our primary tool. For each Columbia asset, the calculator requires building-level inputs including the building address/property ID and property type, gross floor area (ft^2), and annual energy consumption by fuel (electricity in kWh, steam, natural gas, fuel oil, and other delivered fuels). The tool converts reported energy use into annual GHG emissions (tCO_2e/year) using LL97 emission factors. It then applies the statutory emissions-intensity caps for the relevant compliance period (based on building type and floor area) to calculate the allowed emissions threshold. Excess emissions are computed as Emissions – Threshold, and the calculator multiplies this excess by the statutory $268 per tCO_2e to derive an estimated annual LL97 penalty.

For the 2030–2034 compliance period, we ran the calculator for three major Columbia sites: the Morningside Heights/Main Campus, Teachers College, and the Manhattanville campus. The resulting annual emissions, thresholds, and penalty estimates are summarized below:

- Columbia University Main Campus: 53,748 tCO_2e/year versus a threshold of 50,233 tCO_2e/year, implying excess emissions of 3,515 tCO_2e and an estimated LL97 penalty of $942,020 per year.
- Teachers College: 5,577 tCO_2e/year versus a threshold of 2,680 tCO_2e/year, implying excess emissions of 2,897 tCO_2e and an estimated penalty of $776,396 per year.
- Manhattanville Campus: 12,081 tCO_2e/year versus a threshold of 11,922 tCO_2e/year, implying excess emissions of 159 tCO_2e and an estimated penalty of $42,612 per year.

Aggregating these buildings yields a combined baseline LL97 exposure of approximately $1.76 million per year for the 2030–2034 period, assuming no further mitigation actions beyond current performance levels.

Assumptions & Limitations:

- Estimates are based on the BE-Ex LL97 Carbon Emissions Calculator and publicly available building-level energy data; results may differ from Columbia's internal metered or audited data.
- Calculations assume no new retrofits, electrification projects, efficiency upgrades, or renewable procurement beyond what is already reflected in the baseline inputs.
- LL97 emission factors, building-type classifications, and compliance thresholds used by the calculator reflect current regulatory guidance and may change in future rulemaking cycles.

- Actual penalties may vary due to operational changes, updated occupancy patterns, weather variability, and shifts in building energy mix (e.g., increases in steam vs. electricity).
- Estimates represent gross exposure only and do not account for potential mitigation strategies such as RECs, DERs, building improvements, load management, or compliance flexibilities.
- The analysis excludes capital costs, projected OPEX changes, and any timing-related impacts (e.g., phased retrofits before 2030).
- Penalties are modeled on a per-year basis for the 2030–2034 period; actual compliance outcomes will depend on year-to-year performance and updates to LL97 implementation rules.
- These results are intended solely for internal academic analysis and are not validated for operational decision-making by Columbia Facilities & Operations.

6. Energy Volatility

To estimate Columbia's exposure to electricity price volatility, we first establish the university's baseline electricity-related emissions and consumption. Columbia reports that approximately 72,000 tCO_2e of its total footprint comes from purchased electricity (Columbia University, n.d.-b). Using the New York State grid emission factor of 0.17157 $kgCO_2e/kWh$ (CarbonFootprint.com, 2022), we convert emissions to electricity consumption:

Electricity Use (MWh)=0.17157 tCO_2e/MWh72,000 tCO_2e≈419,654 MWh
This yields an estimated baseline electricity consumption of 419,653,786 kWh per year.

Baseline electricity expenditures are calculated using the average commercial delivered electricity price (0.1275 $/kWh), as reported by the U.S. Energy Information Administration's *Electricity Annual* (EIA, 2024). Multiplying price by total consumption gives a baseline spend of: **53,505,858 USD/year**

To model volatility, we compiled a 30-year time series of commercial electricity prices from the U.S. Energy Information Administration's *Electric Power Monthly* and *Electric Power Annual* datasets (EIA, 2024). Using this long-run dataset, we calculated the standard deviation (σ) of annual price changes, consistent with risk-management practices in finance where 1σ represents typical annual variation around the mean price, and higher multiples (2σ, 4σ) reflect increasingly extreme but plausible shocks (Investopedia, 2023). We then apply these shocks to Columbia's baseline annual electricity expenditure to estimate potential financial impacts under low-, medium-, and high-volatility scenarios.

Table C8

Electricity Price Volatility – Scenario-Based Fluctuation Impact on Annual Spend

Volatility Scenario	Standard Deviation	Source	Fluctuation Impact
Low	0.0165	1σ shock	$6,918,075
Medium	0.033	2σ shock	$13,836,150
High	0.0659	4σ shock (extreme tail)	$27,672,301

Assumptions and Limitations:

- Electricity consumption is derived from reported GHG emissions using a uniform emission factor; does not reflect potential building-level variance or metering improvements.
- Commercial electricity price data are historical averages and do not represent forecasted prices or utility-specific contract rates.
- Volatility is modeled using standard deviation of historical values, which captures statistical variation but not structural changes (e.g., grid decarbonization, fuel switching, renewable penetration).
- Analysis assumes no long-term purchasing strategy, hedging, RECs, PPAs, or demand-response measures that could materially reduce exposure.
- Columbia's operational and capital planning decisions (e.g., electrification, heat pump deployment) could significantly change future load profiles.
- Calculation reflects gross volatility exposure only, not incremental cost net of avoided emissions or efficiency improvements.
- All results should be interpreted as illustrative scenario ranges, not predictive financial forecasts.
- This analysis is intended for internal academic use and should be further validated before application to operational planning.

7. Flood Related

Table C9

Flood Damage Inputs & Assumptions – Structure and Contents

Variables	Figures	Unit	Source
Columbia University Building Area	16,000,000	sq ft	Columbia University (n.d.)
Construction Cost	$596.00	$ per square foot	Autodesk (n.d.)
Total Structure Value	$9,536,000,000		
Content to Structure Value Ratio	1.5	Constant	U.S. Army Corps of Engineers (2022)
Total Content Value	$14,304,000,000	$	
Total Structure + Content Value	$23,840,000,000	$	
Structure Damage	15%	Percentage	Federal Emergency Management Agency (2025)
Content Damage	10%	Percentage	
Columbia University Exposed Building Area	4,000,000	sq ft	

Table C10

Flood Event Loss Estimation – Modeled Structure and Contents Damage

Structure Loss Estimation	$1,430,400,000
Content Loss Estimation	$1,430,400,000
Total Loss Estimation	$2,860,800,000
Total Loss Estimation per square ft	$179

Assumptions & Limitations:

- Losses estimated using FEMA/HAZUS depth-damage functions for ~1–2 ft of standing water (lower-floor impacts only).
- Calculation focuses on structural + contents damage; does not include business interruption, research delays, relocation costs, or loss of critical equipment functionality.
- Exposure area simplified to 4M sq ft based on assumed vulnerable lower-level space; actual at-risk area may differ by building elevation, floodproofing, and utility configuration.
- Uniform damage ratios applied across asset classes for simplicity; real losses vary by building type, age, and contents.
- No adjustments included for emergency response, insurance coverage, or recovery rebates, meaning losses represent gross physical damage, not net financial loss.
- Event frequency and recurrence not modeled and this represents a “per-event” order-of-magnitude scenario rather than yearly expected loss.
- All data used (e.g., replacement cost per sq ft, content-to-structure ratio) reflects industry averages and may not fully represent Columbia-specific retail, lab, or medical use cases.
- Estimates are illustrative, intended for internal academic analysis and preliminary physical-risk screening.

8. Heat Related

Table C11

Heat-Related Event – Cooling Energy Demand and Financial Impact

Variables	Figures	Unit	Source
Baseline Cooling Load (a)	3	KWh/sqft per year	Budderfly (n.d.)
Columbia University Building Area (b)	16,000,000	sq ft	Columbia University (n.d.)
Baseline cooling energy needed	48,000,000	KWh per year	Calculation (a x b)
Increase in cooling needed	24,000,000	KWh	EPA: The number of days over 90°F could triple from an average baseline of 18 days to 57 days by 2050.Adjust to 50% for conservative assumptions. U.S. Environmental Protection Agency (2023)
Cost of power	$0.22	$/KWh	NYSERDA (n.d.)
Estimated Financial Impact	$5,280,000	$ per year	

Assumptions & Limitations:

- Baseline cooling energy use estimated at 3 kWh/sq ft/yr applied uniformly across ~16M sq ft of building area; real loads vary by building type, HVAC system, and occupancy.
- Increase in cooling demand derived from EPA projections of extreme heat day frequency (~50% increase used as a conservative mid-range assumption).
- Electricity pricing based on current commercial rates; model does not incorporate volatility, contract pricing, future tariffs, or potential electrification incentives.
- Estimate represents incremental operating cost and does not include capital expenditures for system upgrades, emergency response, or resilience retrofits.
- Cost impacts shown as annualized exposure, not a single event; actual costs will vary year-to-year with weather patterns.
- Calculations assume no major efficiency improvements or demand-response measures beyond the status quo.
- Does not include health, productivity, or research disruption costs linked to indoor temperature stress in labs/classrooms.
- Figures are illustrative order-of-magnitude estimates, intended for internal academic analysis only.

9. Winter Storms/Extreme Cold Related Event

Table C12

Winter Storm / Extreme Cold Event – Heating Energy Demand and Financial Impact

Variables	Figures	Unit	Source
Baseline Heating Load (a)	2	KWh/sqft per year	Budderfly (n.d.)
Columbia University Building Area (b)	16,000,000	sq ft	Columbia University (n.d.)
Baseline cooling energy needed	32,000,000	KWh per year	Calculation (a x b)

Variables	Figures	Unit	Source
Increase in heating needed	3,200,000	KWh	Assume a 10% increase in heating needed in an extreme-cold winter as a stress-test shock. This is conservative because long-term projections show overall heating demand declining: the NYC Hazard Mitigation Plan (NPCC4) projects roughly 50% fewer days at or below freezing by the 2030s, and the NY State Climate Impacts Assessment notes that the number of cold days is expected to decrease. NYC Climate Impacts (n.d.) NYSERDA (n.d.)
Cost of power	$0.22	$/KWh	NYSERDA (n.d.)
Estimated Financial Impact	$704,000	$ per year	

Assumptions & Limitations:

- Baseline heating load (2 kWh/sq ft/yr) is taken from a generalized commercial building benchmark; actual heating intensity varies widely across Columbia's diverse building portfolio (labs, residence halls, academic buildings).
- Total building area (16M sq ft) is applied uniformly; real heating loads depend on building age, envelope performance, HVAC systems, and occupancy patterns.
- The 10% increase in heating demand is a stress-test shock, not a forecast. It intentionally overstates risk because long-term climate projections for NYC (NPCC4, NYS Climate Impacts Assessment) indicate declining heating degree days and fewer cold days by the 2030s.
- Electricity price of $0.22/kWh is based on current New York commercial averages; actual heating energy costs may differ depending on fuel mix (electricity, steam, natural gas) and future tariff changes.
- Calculation assumes heating energy is fully electricity-based; buildings using steam or gas may experience different cost dynamics.
- Estimate represents annual incremental cost in an extreme-cold scenario; does not include capital improvements, boiler upgrades, insulation retrofits, or emergency response costs.
- Scenario excludes operational flexibility (setpoint adjustments, demand response, energy management) that could mitigate additional load.
- Results are illustrative, intended for preliminary physical-risk screening and academic analysis—not a predictive financial forecast.

Thank You