Mitigating Damage from Natural Disasters: Requiring the Retrofitting of Pre-Existing Buildings to Meet Safety Standards

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Over the last several decades, the frequency and severity of natural disasters and extreme weather events have been increasing due to climate change. As a result, these extreme weather events have had, OR are having, a greater effect on communities and infrastructure than before. Although there are ways of constructing buildings to mitigate damage and economic loss from natural disasters, many jurisdictions have not adopted these standards or have not implemented them in all respects. Following natural disasters, state and local governments often respond by updating their building codes to provide some level of resiliency for the next natural disaster. However, the codes often only require new buildings to meet these construction standards. Pre-existing buildings are often left untouched, even though in many cases they could be retrofitted to be more resistant to natural hazards as well. This especially impacts low-income and minority communities, as they are already more affected by natural disasters and often do not have the capability to move out of high-risk areas and into buildings that fit the new, resilient standards. This Note discusses the policy and legislative changes that can be made in order to require pre-existing buildings to meet the updated building code standards and become hazard-resistant.

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I. INTRODUCTION

In 2008, Hurricane Ike landed on the coast of Texas, causing a total of $29.5 billion in damages and the need to rehabilitate over 10,000 homes and 11,000 rental units.[1] In the aftermath, on Bolivar Peninsula of Gilchrist, Texas, one yellow house remained standing while the rest were destroyed.[2] This single house survived due to engineering specifically designed to withstand hurricanes. The house was built in 2006, after Hurricane Rita had already struck the area the year prior and demolished homes. The builder of the yellow house purposefully

1. *Hurricanes Ike & Dolly Action Plan*, TEX. GEN. LAND OFF., https://www.glo.texas.gov/disaster-recovery/action-plans/hurricanes-ike-dolly-action-plan (last visited Nov. 13, 2023).
2. Christine Dobbyn, *House vs.. Hurricane Ike: Yellow structure a symbol of resilience in Bolivar Peninsula*, ABC13 (Sept. 14, 2018), https://abc13.com/gilchrist-texas-yellow-house-hurricane-bolivar-ike-swedes-real-estate/4235787/ [On File with the Columbia Journal of Environmental Law].

constructed the pitch of the roof to withstand hurricane winds and placed the buildings on stilts to avoid the flood of water from the ocean when hurricanes hit.[3]

The house in Gilchrist is a success story of what can happen when houses and buildings are properly designed to withstand natural disasters and other extreme events. As climate change worsens, the probability of natural disasters and extreme weather events occurring is increasing. Across the Northeastern U.S., annual total precipitation is projected to double by the end of the century.[4] This increase in rain will contribute to increased flooding and may be related to more frequent hurricanes. However, rain and tropical storms are not the only weather events that are projected to escalate with climate change. For example, a study funded by the National Integrated Drought Information System (NIDIS) found that anthropogenic climate change contributed to a 320% increase in burned areas in California from 1996 to 2021.[5] Worldwide, the economic losses from natural disasters have risen 60% over the last thirty years.[6] Thus, to protect people and buildings, it is necessary to ensure that buildings are kept to a certain standard to protect against the ever-increasing danger of natural disasters.

This Note will argue that state and local governments should change building codes to require that existing buildings be retrofitted in a timely manner to be able to withstand future natural disasters. Part II will present background information on historical and current damage mitigation from natural disasters, as well as the current model building codes promulgated by the International Code Council. Part III will discuss the issues with current building codes and regulations—which mandate changes only to new buildings and not existing buildings—using case studies from various cities and states. Part IV will propose policy and legislative solutions to require all buildings, including existing buildings, to be constructed to withstand natural disasters and extreme weather events, regardless of the age of the buildings.

3. *In Ike's Wake: Last House Standing*, ABC NEWS (Sept. 21, 2008, 7:05 PM), https://abcnews.go.com/WN/Weather/story?id=5852406&page=1 [https://perma.cc/M9YM-XU9H].

4. Christopher J. Picard, et al. *Twenty-first century increases in total and extreme precipitation across the Northeastern US*, 176 CLIMATIC CHANGE 72, 72 (2023).

5. Marco Turco ET AL. *Anthropogenic climate change impacts exacerbate forest fires in California*, 120 PROC. NAT'L ACAD. SCIS., 1, 5 (2023).

6. Patrick W. Baylis & Judson Boomhower, *Mandated vs. Voluntary Adaptation to Natural Disasters: The Case of US Wildfires* 1 (Nat'l Bureau of Econ. Rsch., Working Paper No. 29621, 2021).

II. CLIMATE CHANGE AND HAZARD-RESISTANT BUILDING CODES

Before discussing the ways that jurisdictions can create codes that require existing buildings to be retrofit to mitigate damage from natural disasters, it is important to understand the current trend of climate change and increasing natural disasters as well as the historical underpinnings of hazard-resistant building codes. Part II(A) defines climate change and discusses its relation to the worsening of natural disasters and extreme weather events. Part II(B) describes the historical ways that governments have tried to prevent damage from natural disasters. Part II(C) discusses the development of hazard-resistant building codes over time. Part II(D) examines the model codes presented by the International Code Council and their application to retrofitting existing buildings to meet safety standards. Part II(E) analyzes the historical interpretation of the Takings Doctrine, whether it would apply to regulating the retrofitting of buildings, and how it might be possible to avoid a confrontation with the Takings Clause.

A. Climate Change and Increasing Natural Disasters

Climate change refers to long-term changes in the conditions of weather and temperature over time.[7] While climate change has historically happened naturally, evidenced by periods such as the Ice Age, human actions are currently contributing to the earth warming at a rate much faster than before.[8] In turn, the rising temperature of the Earth causes a multitude of problems that affect humans, plants, animals, and ecosystems.

One of the biggest contributors to climate change is the emission of greenhouse gases.[9] From 1990 to 2015, the net emissions of greenhouse gases across the world increased by 43%.[10] Even if natural fluctuations are accounted for, the atmospheric concentration of carbon dioxide has increased at an unprecedented rate. This has caused the Earth's surface to be more than 1.1°C warmer than it was before the Industrial Revolution, and it appears that the current policies and actions by humans will cause it to increase by 3°C by the end of the

7. *What is Climate Change,?* UNITED NATIONS, https://www.un.org/en/climatechange/what-is-climate-change [https://perma.cc/ELD9-BM8B] (last visited Jan. 4, 2024).
8. *How Do We Know Climate Change Is Real?,* NASA, https://climate.nasa.gov/evidence/ [https://perma.cc/CLE2-LD9B] (last visited Mar. 2, 2024).
9. *Climate Change Indicators: Greenhouse Gases*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/climate-indicators/greenhouse-gases [https://perma.cc/Z258-A69U] (last visited Jan. 4, 2024).
10. *Id.*

century.[11] It is clear that climate change and global warming will continue to increase, as most countries are not taking adequate steps to mitigate or begin reversing the problem.[12]

With increasing global warming and climate change comes an increase of natural disasters and extreme weather events, as well as the damage resulting from them. Examples of this are rising sea levels leading to greater economic loss and loss of lives from tropical storms and hurricanes. Since 1880, the average sea level has risen eight to nine inches.[13] This is due to ice and glaciers melting because of the increased global temperature as well as thermal expansion of the ocean. As the ocean warms, its volume expands, causing the sea levels to rise and encroach further on coastal areas. This has an extremely detrimental impact on coastal communities and infrastructure because higher sea levels mean that storm surges and hurricanes will reach further inland than they did before. As around 30% of the population in the U.S. lives in high population-density coastal areas, this places a large proportion of the population at risk for flooding and other hazards from tropical storms.[14] By 2100, it is expected that global sea level will rise at least one foot above 2000 levels, but it could rise as much as 6.6 feet higher.[15] Thus, it is important to begin installing some kind of protection in these coastal areas to prevent loss of human life and homes.

Besides tropical storms reaching further inland due to rising ocean levels, climate change and global warming are also increasing the severity of tropical storms and cyclones. As the surface temperature of the ocean rises, storms over the ocean can strengthen.[16] This means that a greater proportion of tropical storms and hurricanes will be stronger and higher category storms when they reach the land. The severity of tropical storms is also affected by the temperature of the atmosphere. Warmer atmospheres can hold more moisture which means that the rainfall will be heavier and cause more flooding.[17]

11. UNITED NATIONS, *supra* note 7.
12. Max Bearak and Nadja Popovich, *The World Is Falling Short of Its Climate Goals. Four Big Emitters Show Why.,* N.Y. TIMES (Nov. 8, 2022), https://www.nytimes.com/interactive/2022/11/08/climate/cop27-emissions-country-compare.html [On File with the Columbia Journal of Environmental Law].
13. Rebecca Lindsey, *Climate Change: Global Sea Level*, CLIMATE.GOV (Apr. 19, 2022), https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level [https://perma.cc/43AD-8VGW].
14. *Id.*
15. *Id.*
16. Michael Burger et al., *The Law and Science of Climate Change Attribution*, 45 COLUM. J. ENV'T L. 57, 109 (2020).
17. *Id.*

Anthropogenic forcing[18] has caused 37% more precipitation over land from tropical storms and cyclones.[19]

Climate change has also led to an increase in wildfires.[20] When spring and summer temperatures are hotter, there is a greater incidence of wildfires in the western U.S. Higher temperatures in spring and summer are also associated with reduced winter precipitation in the western U.S., which causes the ground to be dryer and thus more prone to catching fire.[21] The annual length of the wildfire season has increased since the 1980s; the average season length has increased by 64%.[22] As discussed above, the temperature of the Earth is expected to continue to increase, which will lead to an increase in warmer springs and summers, which will contribute to a greater incidence of wildfires and longer fire seasons.

Given the increasing prevalence of natural disasters as well as the increase in harm that they cause, it is more important than ever to figure out how to mitigate their damage.

B. Attempts to Prevent Damage from Natural Disasters

Natural disasters and extreme weather events have always been a danger to society, even before the expansion of the built environment into danger zones and high-risk areas and the fact that climate change has increased their occurrence.[23] The government and federal agencies have historically tried to protect high-risk areas through projects that are designed to prevent the natural disaster from reaching homes and buildings in the first place. Unfortunately, these prevention methods often do not work as well as they should to truly protect the homes and people within them.

One example of a failed prevention strategy is seawalls, designed to act as a barrier to prevent rising sea levels or storms from flooding the

18. Anthropogenic forcing is defined as the human activity that causes the climate to vary and change. *Introduction to Climate Change Forcing*, CLIMATE DATA INFO., http://www.climatedata.info/forcing/introduction/ [https://perma.cc/GK4J-JTMR] (last visited Mar. 2, 2024).
19. Burger, *supra* note 16, at 109.
20. A study by Westerling et al. found that "interannual variability in wildlife frequency is strongly associated with regional spring and summer temperature. A.L. Westerling et al., *Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity*, 313 SCIENCE 940, 940 (2006).
21. *Id.* at 942.
22. *Id.* at 941.
23. *5 Natural Disasters that Beg for Climate Action*, OXFAM INT'L, https://www.oxfam.org/en/5-natural-disasters-beg-climate-action [https://perma.cc/6WTN-JNQW] (last visited Mar. 2, 2024).

inhabited area behind it. The oldest recorded seawall is 7,000 years old and located off the coast of Israel in the settlement of Tel Hreiz.[24] Compared to other ancient walls that resembled seawalls, this wall is notable because it was actually on the coast, making it more likely that it was built for flood protection. However, it appears that the sea wall did not provide adequate protection, as Tel Hreiz is now underwater and it appears that the community was inhabited for less than 250 years.[25]

Structures that have been built to protect against natural disasters and extreme weather events on a large scale have also often caused more harm than good. Seawalls can cause erosion, which can lead to greater instances of flooding later, and levees built in one area to provide flood protection can exacerbate flooding downstream.[26] Furthermore, if levees break, they can cause more damage than if they had never been built, as it makes the flood more difficult to control since water levels are higher and flowing faster when the levees are in place.[27] Louisiana had levees that were supposed to protect New Orleans from floods and hurricanes, but the levees broke during Hurricane Katrina and 80% of the city was flooded in response.[28]

In addition, many dams in America, which were built to prevent downstream flooding, were constructed without adequate spillways.[29] These are supposed to release water away from the dam when rain is too heavy. However, when a dam lacks a spillway the water runs over the top, and this causes floods downstream. Therefore, merely creating structures resistant to extreme weather events does not solve the problem of protecting the communities behind them, particularly as natural disasters are ever-increasing with climate change. This is why many locations have turned to making their buildings and houses resilient to natural disasters instead of merely trying to prohibit the natural disaster from reaching the community.

24. Megan Gannon, *Oldest Known Seawall Discovered Along Submerged Mediterranean Villages*, SMITHSONIAN MAG. (Dec. 18, 2019) [On File with the Columbia Journal of Environmental Law].
25. *Id.*
26. Anna K. Schwab & David J. Brower, *Increasing Resilience to Natural Hazards: Obstacles and Opportunities for Local Governments Under the Disaster Mitigation Act of 2000*, 38 ENVTL. L. REP. NEWS & ANALYSIS 10171, 10172 (2008).
27. Hilary Costa, et al., *Levee*, NAT'L GEOGRAPHIC (Oct 19, 2023). https://education.nationalgeographic.org/resource/levee/ [https://perma.cc/CRN3-9FCA] (last visited Nov. 20, 2023).
28. *Id.*
29. David Etkin, *Risk Transference And Related Trends: Driving Forces Towards More Mega-Disasters*, 1 ENV'T. HAZARDS 69, 72 (1999).

C. Development of Hazard-Resistant Building Codes

Although the easiest practice would be to simply prohibit living in areas that are highly prone to extreme weather events, population increase and rising sea levels make this practice impossible, as there would not be enough low-risk land area to inhabit.[30] The most vulnerable areas, such as wooded areas and the coast, are often also some of the most desirable areas due to their natural beauty. Thus, if construction in these areas cannot be avoided, then the best strategy is to practice property protection in order to strengthen buildings so that they can withstand the hazards.[31]

CoreLogic performed a study on over 100 million residential buildings across the United States and determined their risk score for the average annual loss for earthquakes, wildfires, floods, storms, hurricanes, and tropical storm coastal surges.[32] The study determined that not only does almost every property in the United States have exposure to some kind of risk from natural disaster, but almost one-third of houses are exposed to high risk from natural disasters.[33] Given this vulnerability, it is especially important for local and state governments to formulate and enforce building codes that will mitigate the damage and lower the risk in these areas.

One of the earliest examples of a Western government developing natural hazard-resistant building codes dates back to London in 1667. After the Great Fire of London in 1666 destroyed over 13,300 buildings, the British Parliament passed the Act for the Rebuilding of the City of London.[34] The Act was created to mitigate damages from future fires in the city. While previously the buildings had largely been made of timber, the Act required that all new buildings must be made

30. Although this Note pertains to American building codes, this is not just an issue in America, as "the number of the world's settlements in the riskiest flood zones has increased 122%, compared to 80% for the safest areas" in the last thirty years. Seth Borenstein, *Study Finds More People Are Moving Into High Flood Zones, Increasing Risk Of Water Disasters,* APNEWS.COM (Oct. 4, 2023), https://apnews.com/article/flooding-population-development-climate-change-disaster-cfee396af85763e69c1527d4c95652f1 [https://perma.cc/E9DK-P6TA].
31. Schwab & Brower, *supra* note 26, at 10174.
32. *Risk Redefined: CoreLogic Climate Change Catastrophe Report Emphasizes Need to Address Increasing Frequency of Hazard Events*, CORELOGIC (Jan. 27, 2021), https://www.corelogic.com/press-releases/risk-redefined-corelogic-climate-change-catastrophe-report-emphasizes-need-to-address-increasing-frequency-of-hazard-events/ [https://perma.cc/YZA2-9NDL].
33. *Id.*
34. *An Act for rebuilding the city of London, 1666*, UK PARLIAMENT, https://www.parliament.uk/about/living-heritage/transformingsociety/towncountry/towns/collections/collections-great-fire-1666/1666-act-to-rebuild-the-city-of-london/ [On File with the Columbia Journal of Environmental Law] (last visited Dec. 26, 2023).

of either brick or stone instead.[35] It also required party walls between houses and banned jettying upper stories to prevent fire from spreading as quickly between houses.[36] The building codes in London continued to evolve over the following centuries, often focusing on fire protection and damage mitigation from these fires.

Over time, governments have increased the sophistication of their building codes to reflect greater understanding of natural risks and to protect against more types of harm. For the last few decades in the United States, the Mitigation Assessment Teams (MATs) of the Federal Emergency Management Agency (FEMA) has been investigating buildings after natural disasters and providing recommendations for stronger construction methods to withstand natural disasters.[37] In 2000, the first set of hazard-resistant building codes was published by the International Code Council (ICC).[38] The International Codes (I-Codes) were developed to be used as the base for state and local jurisdictions to create their own building codes, for which the purpose is "to establish minimum requirements to protect life safety and reduce property damage."[39] In 2015 and 2018, the I-Codes were amended to what is referred to as "the modern code" to provide recommendations for buildings to be even more resistant to floods and high hurricane winds.[40]

Many studies have been performed on buildings and houses that have withstood natural disasters and those that have not. Architects and engineers have determined measures that help make buildings more resilient to certain hazards. These include "elevation, flood proofing, nonstructural mitigation, seismic retrofitting, and enforcement of rigorous building codes".[41] The most efficient way to ensure that homeowners and business industry professionals will actually implement these strategies is for state and local governments to write

35. *Id.*
36. Jake Bransgrove, *London After the Great Fire of 1666*, HISTORIC UK, https://www.historic-uk.com/HistoryUK/HistoryofEngland/London-After-The-Great-Fire/ [https://perma.cc/KPY6-6BS2] (last visited Dec. 26, 2023). Jettying was a popular architectural style during the Tudor Era in England in which "the second story protrude[d] beyond the walls of the first story floorspace below." *Jettying – a Unique Architectural Style*, CLASSIC HISTORY, http://www.classichistory.net/archives/jettying [https://perma.cc/9S8V-5WV4] (last visited Mar. 2, 2024).
37. FED. EMERGENCY MGMT. AGENCY, COMPASS PTS JV, BUILDING CODES SAVE: A NATIONWIDE STUDY – LOSSES AVOIDED AS A RESULT OF ADOPTING HAZARD-RESISTANT BUILDING CODES (2020), at ES-2.
38. *Id.* at 1-1.
39. *Id.* at 1-3.
40. *Id.* at 1-6.
41. Schwab & Brower, *supra* note 26, at 10177.

and enforce strict building codes that regulate these hazard-resistant standards.[42]

In 1998, The American Society of Civil Engineers (ASCE) created a standard, revised several times since,[43] with the minimum requirements for buildings that are in flood hazard areas.[44] The ASCE-24 states that buildings in Coastal High Hazard Areas must be elevated on piles or deep foundations.[45] ASCE-24 sets out the minimum elevation requirements which—as demonstrated in the case of the yellow house remaining after Hurricane Ike—help mitigate damage from floods and hurricanes.

Unfortunately, one of the issues with the development of these hazard-resistant building codes is that they do not accurately incorporate increasing climate risk. Typically, the organizations such as the ICC who develop the model codes look at historical data instead of long-term projections for the future of climate change.[46] This is a problem as climate change is constantly worsening and the rate at which natural disasters or threats that could lead to more damage from natural disasters—such as sea levels rising—are rapidly increasing.[47] The ICC and jurisdictions that rely on the ICC standards for their own building codes thus need to update their codes to include forward-looking climate information in order to truly be hazard-resistant.

D. Retrofitting Buildings to Meet Hazard-Resistant Building Codes

Generally, existing buildings have been covered under a grandfather exception that exempts them from being required to meet new standards of building codes. There are several reasons why governments have not required existing buildings to fit current standards. These include issues under the Takings Clause, as discussed below; infeasibility; and economic inefficiency. Also, it can be expensive to require alterations to existing buildings, especially if the changes

42. *Id.* at 10178.
43. John L. Ingargiola, Christopher P. Jones, and Rebecca C, Quinn, *ASCE 24: Improving the Performance of Buildings and Structures in Flood Hazard Areas*, ADVANCES IN HURRICANE ENG'G: LEARNING FROM OUR PAST (2013), https://www.fema.gov/sites/default/files/2020-07/improving-performance-buildings-flood-hazard-areas.pdf [On File with the Columbia Journal of Environmental Law].
44. *Highlights of ASCE 24-14 Flood Resistant Design and Construction*, FEMA.GOV (July 20, 2015), at 1 https://www.fema.gov/sites/default/files/2020-07/asce24-14_highlights_jan2015.pdf [On File with the Columbia Journal of Environmental Law].
45. *Id.* at 2.
46. DIANE P. HORN & ERICA A. LEE, CONG. RSCH. SERV., R47612, BUILDING RESILIENCE: FEMA'S BUILDING CODES POLICIES AND CONSIDERATIONS FOR CONGRESS 6 (2023).
47. *5 Natural Disasters that Beg for Climate Action, supra* note 23.

would go beyond the existing value of the building.[48] Requiring retrofits would likely also lead to political resistance—possibly from both sides of the aisle—because of the high cost of retrofits and downstream concerns regarding housing affordability, as market and rental prices might increase to combat the initial expense of retrofitting the residences.

As an important example of a grandfather exception, Section 102.6 of the 2021 International Building Code (IBC) states that "the legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as otherwise specifically provided in this code, the International Existing Building Code, the International Property Maintenance Code or the International Fire Code."[49] The IBC only requires for existing buildings to meet new standards of building codes if an existing building applies to make improvements to the building that constitute substantial improvement or repair of substantial damage.[50] If a building does not make substantial repairs or improvements, it will not be required to retrofit to meet the new standards. Many state and local governments model their building codes off of the IBC. Since the IBC does not require existing buildings to be updated, it is then not likely that states or municipalities will require this either.

Meanwhile, the International Existing Building Code (IEBC) is a model code designed to regulate alterations that are made on existing buildings.[51] Section 301 of the IEBC provides three options for a designer when alterations are being made on an existing building: alterations can follow the Prescriptive Compliance Method, the Work Area Compliance Method, or the Performance Compliance Method.[52] The differences between these three compliance methods are laid out in the table below.

Figure 1. Three Methods of Compliance in the IEBC[53]

Prescriptive Compliance Method	**Work-Area Compliance Method**	**Performance Compliance Method**

48. INT'L EXISTING BLDG. CODE, Preface (Int'l Code Council 2021).
49. INT'L BLDG. CODE, § 102.6 (Int'l Code Council 2021).
50. *Id.* at § 104.2.1.
51. INT'L EXISTING BLDG. CODE, Preface (Int'l Code Council 2021). As of 2016, more than half of U.S. states had adopted the IEBC. *See* Chris Kimball, *How Familiar Are You with the IEBC?* STRUCTUREMAG.ORG (Nov. 2016), https://www.structuremag.org/?p=10665 [On File with the Columbia Journal of Environmental Law].
52. INT'L EXISTING BLDG. CODE, Preface (Int'l Code Council 2021).
53. INT'L EXISTING BLDG. CODE, Preface (Int'l Code Council 2021).

Does not require the retrofitting of existing buildings to meet current standards *unless substantial improvement is made*[54]	Defines three levels of alterations; each level must comply with certain chapters of the IEBC respectively[55]	Used when one aspect of proposed work cannot comply with the other methods, but the rest of the building complies
Any additions must comply with the requirements of the IBC for new construction[56]	**Level 1 Alterations**: replacement of existing materials or elements with new materials for same purpose as they were previously used[57]	Allows alteration and additions onto existing buildings without requiring them to meet full compliance of Chapters 6–12 of the IBC[58]
Alterations must be made to ensure that the existing building combined with the new addition is not less compliant with the IBC than it was before[59]	**Level 2 Alterations:** includes changes that affect up to 50% of the building[60]	Requires evaluation of building systems (such as means of egress, fire protection systems, and height/area) which must meet a mandatory safety score[61]
	Level 3 Alterations: alterations where work area consists of greater than 50% of the total building area[62]	Compliance is only required when substantial improvements have been made[63]

The IBC and IEBC do not require existing buildings to meet new safety standards unless substantial improvements are made.

54. *Id.* at § S503.2.
55. *Id.* at Chapter 6.
56. *Id.* at § 502.1.
57. *Id.* at Chapter 7.
58. *Id.* at § 1301.1
59. INT'L EXISTING BLDG. CODE, § 502.1 (Int'l Code Council 2021).
60. *Id.* at Chapter 8.
61. *Id.* at § 1301.7 and § 1301.8.
62. *Id.* at § 604.1.
63. *Id.* at § 1301.3.3.

However, there are jurisdictions where codes and regulations have required existing buildings not otherwise undergoing extensive work to be updated to meet certain standards.

One example of this is a fire safety provision in Rhode Island. In 2003, the Station nightclub in Rhode Island caught fire, killing 100 people.[64] The National Institute of Standards and Technology (NIST) published an investigative report regarding the fire, and determined that if the nightclub had implemented the building codes that had been available at the time of the fire, many lives would have been saved.[65] The reason the nightclub was not adhering to these codes was because the codes had only been applied to new buildings that were constructed after the codes were passed. Since the Station was already in existence, these codes were not implemented. In response to this deadly fire, Rhode Island passed the Comprehensive Fire Safety Act of 2003, which required that all standards promulgated in the Act applied to existing buildings.[66]

This demonstrates that building codes can require existing buildings to be retrofitted to adhere to new safety standards. However, many local and state governments model their building codes off the IBC and IEBC.67 Since these codes do not require the retrofitting of existing buildings to meet new safety standards, the majority of state and local jurisdictions unfortunately do not either.[68]

E. The Takings Clause

The Takings Clause is a potential barrier against updating building codes to require the retrofit of pre-existing buildings and homes to meet safety standards for natural disasters.

This Section presents an argument prohibiting the government from requiring the retrofit of existing buildings under the modern interpretation of the Takings Clause, but this argument likely would not succeed.

64. *R.I. Passes Fire Sprinkler Retrofit Law*, CONTRACTOR (July 1, 2003), https://www.contractormag.com/piping/fire-sprinklers/article/20877861/ri-passes-fire-sprinkler-retrofit-law [https://perma.cc/NRD5-FV2H].
65. WILLIAM GROSSHANDLER, ET AL., NAT'L. INST. STANDARDS & TECH., REPORT OF THE TECHNICAL INVESTIGATION OF THE STATION NIGHTCLUB FIRE 8–9 (NIST NCSTAR 2, 2005).
66. 23 R.I. GEN. LAWS § 28.3 (2003).
67. Carl Smith, *More Resilient Buildings Will Save Lives and Money*, GOVERNING (Jan. 5, 2024), https://www.governing.com/urban/more-resilient-buildings-will-save-lives-and-money [https://perma.cc/PQU4-FDD8].
68. *Id.*

1. Historical Interpretation of the Takings Clause

The Fifth Amendment states that private property shall not "be taken for public use, without just compensation."[69] Historically, this meant that the government was prohibited from physically seizing property from landowners without providing them just compensation.[70] Under this erstwhile view, the clause only applied to property that was physically seized. It did not apply when the government was merely regulating property. It was not until *Pennsylvania Coal Co. v. Mahon* that the Supreme Court extended the takings doctrine to include instances of mere government regulation as opposed to the actual seizure of property.[71] *Pennsylvania Coal* held that "while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking."[72] The Court noted that there are exceptional cases where regulation would be permitted without being considered a taking, and that a desire to improve safety is a question of degree which would likely have to be considered on a case-by-case basis.[73]

Seventy years later, another Supreme Court case appeared to extend the reach of the Takings Clause even further, especially with regards to climate change and natural disaster issues.[74] The Supreme Court defined two categories of regulatory action that would require compensation by the government so as to not violate the Fifth Amendment: regulations that require the property owner to experience a physical invasion of property (such as requiring landlords to install cable facilities in the buildings they own) and regulations that prevent all economically beneficial use of land.[75] The Court in *Lucas v. South Carolina Coastal Council* struck down a law targeting beach erosion which made many municipalities and states reluctant to enact laws

69. U.S. CONST. amend. V.
70. William Michael Treanor, *The Original Understanding of the Takings Clause and the Political Process*, 95 COLUM. L. REV. 782, 782 (1995).
71. *See* Pa. Coal Co. v. Mahon, 260 U.S. 393 (1922). The Supreme Court granted certiorari in this case to determine the constitutionality of a statute that forbade the mining of anthracite coal in a way that caused subsidence of structures used for human habitation. The Court held that this violated property owners' constitutionally protected rights without a sufficient public interest to justify it.
72. *Id.* at 415.
73. *Id.* at 415–16.
74. *See* Lucas v. S.C. Coastal Council, 505 U.S. 1003 (1992). Lucas bought two lots on an island with the purpose of building homes on the land. Two years later, the state passed an act in order to combat erosion on the island which prohibited him from building permanent habitable structures on the land. Lucas claimed this violated his Fifth Amendment rights because the ban deprived him of all economically viable use of the property.
75. *Id.* at 1015.

challenging similar climate change issues.[76] This could present a problem for the retrofitting policies suggested in this Note, as property owners could argue that retrofitting their existing buildings to meet building codes for natural disasters under a mandate would be over-regulation and constitute a taking.

Although the Court in *Lucas* seemingly wrote a strict opinion setting out this second category of regulation subject to the Takings Doctrine, it frequently referred to "regulation that deprives land of *all* economically beneficial use."[77] This appears to permit regulation that does not deprive the property owner of *all* their economically beneficial use without implicating the Takings Clause.

2. The Doctrine of Necessity

While the Fifth Amendment provides protection for property owners, there is still an exception to their rights under the doctrine of necessity takings. In order to invoke the doctrine of necessity, two requirements must be met: "there must be a public necessity or emergency . . . [and] the violation of property rights must be reasonably necessary to address that emergency".[78] The doctrine of necessity can be applied in order to prevent an imminent public catastrophe that threatens the community.[79] While it would be hard to argue during the actual occurrence of said disaster that it was not an imminent, threatening public catastrophe, some courts have been hesitant about using the doctrine of necessity for preventive efforts.[80] If a policy of requiring retrofits to existing buildings is considered a Takings issue, the necessity doctrine is a possible, though not surefire, argument to avoid it.

III. RETROFITTING BUILDINGS THROUGH DIFFERENT LENSES

Currently, the building codes in various states and cities that focus on mitigating damage from natural disasters typically share two characteristics. First, they are only created and implemented *after* a

76. Mark Nevitt, *As We Adapt to Climate Change, Legal Doctrine Must Also Adapt*, WHARTON SCH., UNIV. P.A.: ENV'T, SOC. & GOVERNANCE (ESG) INITIATIVE (Aug. 8, 2019), https://esg.wharton.upenn.edu/climate-center/as-we-adapt-to-climate-change-legal-doctrine-must-also-adapt/ [https://perma.cc/7EF8-X6GK].
77. *Lucas*, 505 U.S. at 1018–19, 1027 (emphasis added).
78. *Necessity Takings in the Era of Climate Change*, 136 HARV. L. REV. 952, 957 (2023).
79. Robin Kundis Craig, *Adapting Water Law to Public Necessity: Reframing Climate Change Adaptation as Emergency Response and Preparedness*, 11 VT. J. ENV'T L. 709, 739 (2010).
80. *Id.* at 741.

natural disaster or extreme weather event strikes. This means that they are not effective in preventing damage from all future events. Second, they only require the changes to be made to new construction—houses that are built after the code is implemented—and do not mandate any changes to be made to pre-existing homes. This leads to pre-existing homes suffering more damage in future disasters. Part III(A) analyzes the existence of three building codes aimed to prevent damage from natural disasters—those of Florida, New York City, and California—and discusses the results of the code changes and how pre-existing buildings are left behind. Part III(B) analyzes this issue through an environmental justice lens. Part III(C) presents the costs of retrofitting buildings and the problems with homeowners bearing this cost upfront.

A. Case Studies

This Section will explore the building codes of three different cities and states—Florida, New York City, and California. Each of these case studies represents a jurisdiction where changes to the building code were made after a natural disaster struck the area, damaging and destroying buildings. However, each jurisdiction only required their updated codes to apply to new construction, which left behind the pre-existing homes. This Section will demonstrate the importance of applying new building code standards to pre-existing homes and buildings.

1. Florida Building Codes after Hurricanes Andrew and Charley

In 1992, Hurricane Andrew struck southern Florida and caused $26 billion—adjusted for inflation—in damages, destroyed more than 25,000 homes, and damaged 100,000 more.[81] In response, the South Florida Building Code (SFBC) was updated by the Florida Building Commission in 1994 in order to maximize hurricane protection.[82] Several Florida counties then adopted the updated version of the SFBC. In 1995, many coastal counties adopted high-wind design provisions for residential codes, including the Southern Building Code

[81]. Kevin M. Simmons et al., *Economic Effectiveness of Implementing a Statewide Building Code: The Case of Florida*, 94 LAND ECON. 155, 156 (2018).
[82]. *Id*. at 156.

Congress International's[83] Standard for Hurricane Resistant Construction SSTD-10.[84]

Given the catastrophic amount of damage from Hurricane Andrew, the Florida Building Code Commission performed a study on inferior construction practices in southern Florida and presented recommended changes to the building code to maximize hurricane protection. The Florida Legislature authorized these changes statewide and the Florida Building Code (FBC) was adopted in 2002. The FBC was based on the International Code Council's model codes and was implemented statewide.[85] The 2002 FBC required that new buildings and residential homes must be able to withstand hurricane-force winds.[86] To achieve this, the code states that all openings have either shutters or impact-resistant glass to minimize damage from the hurricane. Data from the Insurance Services Office and the Florida Department of Emergency Management on wind-related claims and losses between 2001 and 2010 demonstrates that 86% of the claims and losses were incurred by homes built before 2000.[87] This percentage is slightly skewed because a larger proportion of homes in the area were built before 2000. However, the underlying point is also proven by the rate of claims and losses. On a per-home basis, owners of pre-2000 homes had almost twice the number of claims and triple the average loss payment as compared to owners of post-2000 homes.[88] This exemplifies the importance of updating building codes—the designs they require successfully mitigate damage.

In 2004, after Hurricane Charley hit Florida, the Institute for Business and Home Safety (IBHS) performed a study in Charlotte County, which was one of the coastal counties that had adopted the SSTD-10 in 1995. The study compared the damage done to houses built before and after the 1996 code's implementation. The IBHS found that, for

[83]. The Southern Building Code Congress International (SBCCI) is now the International Code Council (ICC). The SBCCI consolidated with Building Officials and Code Administrators International, Inc. and the International Conference of Building Officials in 1994. The purpose of the ICC is to develop a single set of model building and construction codes throughout the United States. *About the International Code Council*, INT'L CODE COUNCIL, https://www.iccsafe.org/about/who-we-are/ [https://perma.cc/EM9P-V79H] (last visited Jan. 3, 2024).
[84]. INST. FOR BUS. & HOME SAFETY, HURRICANE CHARLEY: NATURE'S FORCE VS. STRUCTURAL STRENGTH 2 (2004), https://ibhs.org/wp-content/uploads/member_do cs/Hurricane-Charley-Natures-Force-vs-Structural-Strength-Executive-Summary_IBHS.pdf [https://perma.cc/Q4K9-G7ZC].
[85]. Simmons et al., *supra* note 81, at 156.
[86]. Joshua Huff, *30 Years Later: Hurricane Andrew Redesigned Modern Building Codes*, US GLASS NEWS NETWORK (Aug. 25, 2022), https://usglassmag.com/2022/08/30-years-later-hurricane-andrew-redesigned-modern-building-codes/ [https://perma.cc/E792-DVY2].
[87]. Simmons et al., *supra* note 81, at 159.
[88]. *Id.* at 159.

homes constructed after the 1996 code changes, insurance claim frequency after Hurricane Charley was reduced by 60% compared to the older homes.[89] The severity of these claims was also significantly reduced by 42% for homes post-1996.[90]

These findings demonstrate the importance of municipalities implementing building codes that require existing buildings to retrofit to the new standards alongside new buildings, since the updated code design requirements successfully prevented and mitigated losses. While the 2002 FBC did provide a break on insurance rates to homeowners who retrofitted their homes to meet the standards, it only mandated that *new* homes were built fully according to the code.[91] If the code had required the retrofitting of the existing homes to meet the higher standards established in the 2002 FBC to protect against wind and hurricane damages, thousands of homes and possibly millions of dollars could have been saved.

This demonstrates that homes built before safety standards are implemented will forever be at a disadvantage unless cities require preexisting buildings to be retrofitted to meet these updated standards.

2. New York City Codes after Hurricane Sandy

In the aftermath of the 2012 Hurricane Sandy, which destroyed around 300 homes in New York City, damaged over 69,000 residential units, and caused $19 billion in damages, New York City established new building codes to try to mitigate the damage from future hurricanes.[92] On January 31, 2013, New York City implemented a new rule regarding design flood elevations for buildings in Structural Occupancy Category I and II which would require a design flood elevation of at least one to two feet higher—depending on the dwelling type—than previous levels.[93] The code specifically stated that these increased elevations were mandatory for projects that had either not obtained a permit yet, had obtained a permit but had not yet started construction work after 180 or more days, or where the construction

89. INST. FOR BUS. & HOME SAFETY, *supra* note 84.
90. *Id.* at 3.
91. Adrian Sainz, *Fla. Building Codes, Revamped Since Andrew, Still Being Worked*, INS. J. (May 18, 2007), https://www.insurancejournal.com/news/southeast/2007/05/18/79827.htm [https://perma.cc/7GDX-RFEX].
92. *Hurricane Sandy*, NYC RECOVERY, https://www.nyc.gov/site/cdbgdr/hurricane-sandy/hurricane-sandy.page [https://perma.cc/AC24-WCUV] (last visited Nov. 13, 2023).
93. NYC BLDGS., REBUILDING NYC AFTER HURRICANE SANDY: A GUIDE TO NEW CODE AND ZONING STANDARDS FOR INDUSTRY PROFESSIONALS 4 (Feb. 2015).

work had been abandoned for at least 180 days.[94] The code does *not* call for pre-existing buildings to be retrofitted to meet these standards.

Existing buildings must be updated only if they are classified as substantially damaged or in need of substantial improvement; i.e. if the cost to restore or improve the building is equal to or exceeds 50% of the market value of the building.[95] If a building falls in one of these two categories, it must comply with the regulations for new buildings when it is reconstructed.[96] Pre-existing buildings that are not classified as substantially damaged or substantially improved are not required to meet any of the new standards outlined in the code to protect against flood and hurricane damage.

However, some requirements do apply to existing buildings. The New York City Council approved requirements that are aimed at making buildings more sustainable for their residents during emergencies. For example, higher floors tend to lose water during blackouts because the electric pumps stop working, a problem exacerbated by hurricanes. The Council thus required residential buildings that are five stories or higher to add faucets in common areas so that people living on higher floors would still be able to access water in the case of an emergency.[97] New buildings were required to immediately implement this during construction, but the Council also required existing buildings to retrofit their buildings to add the faucets. While existing buildings were not required to add these faucets immediately, as new construction was, they were required to update their buildings within eight years.[98] Although this is not quite the same as building code standards designed to minimize damage from hurricanes, this legislation demonstrates that it is possible to require existing buildings to retrofit to meet certain new standards.

In October of 2014, two years after Hurricane Sandy, the Department of City Planning published a report for landlords and property owners guiding them on how to retrofit their existing structures to be

94. *Id.*
95. *Id.* at 11.
96. *Id.* at 10.
97. Mireya Navarro, *New Building Codes Passed After Lessons From Hurricane Sandy*, N.Y. TIMES (Nov. 14, 2013), https://www.nytimes.com/2013/11/15/nyregion/new-building-codes-passed-after-lessons-from-hurricane-sandy.html [On File with the Columbia Journal of Environmental Law].
98. *Id.*

more resilient in future disasters.[99] This report demonstrates that there are recommended methods to lower the risk of damage from hurricanes and floods in pre-existing buildings, which would mitigate future damage and economic losses. However, as stated above, no retrofits were mandated. Instead, the report merely guides property owners who wish to retrofit their property of their own accord.[100] As will be discussed further in Part IV of this Note, voluntary building construction programs hardly ever prove to be effective or might never be implemented at all. Thus, although it is theoretically helpful that the Department of City Planning produced the report, it is unlikely that much change in existing buildings resulted from the publication. In the current 100-year floodplain, 96.5% of buildings are under no obligation to implement the resiliency measures.[101]

The updated building codes in New York City after Hurricane Sandy exemplify the fact that, not only do municipalities wait to change their building codes until after a disaster has struck, but also that the current standard is to exclude existing buildings from updated building code mandates. However, the Council legislation regarding faucets as well as the Department of City Planning report demonstrate that it is possible to mandate existing buildings be retrofitted to meet updated safety standards that would mitigate damages from natural disasters and other extreme weather events.

3. California Codes after Wildfires

Fifteen of the twenty most destructive wildfires in California's recorded history have occurred since the year 2000.[102] This demonstrates not only the increase in the occurrence of wildfires due to global warming but also the increase in destruction that the wildfires cause, as more homes are being destroyed, and the economic and environmental damages are increasing as well. Currently, there are around 49 million homes in the wildland-urban interface (WUI) in the United States,[103] which refers to areas where human development is

99. NYC DEP'T OF CITY PLAN., COASTAL CLIMATE RESILIENCY: RETROFITTING BUILDINGS FOR FLOOD RISK (2014), https://www.nyc.gov/assets/planning/download/pdf/plans-studies/retrofitting-buildings/retrofitting_complete.pdf [https://perma.cc/39BP-DGZM].
100. *Id.*
101. *Ten Years After Sandy: Barriers to Resilience*, N.Y. CITY COMPTROLLER (Oct. 13, 2022), https://comptroller.nyc.gov/reports/ten-years-after-sandy/ [https://perma.cc/HL5Z-JN9D].
102. Eric Biber & Moira O'Neil, *Building to Burn? Permitting Exurban Housing Development in High Fire Hazard Zones*, 48 ECOLOGY L.Q. 943, 945 (2021).
103. *Id.* at 946.

adjacent to undeveloped wildland or heavily forested areas.[104] This can make buildings more vulnerable to wildfires. Given this, it is especially important that the homes in these areas are as protected against fires as much as possible.

Similar to how Florida and New York City amended their building codes due to extreme weather events, parts of California amended their codes to be more fire-resistant after the Oakland Hills fire in 1991, which caused $1.5 billion in property damage and killed twenty-five people.[105] Assembly Bill 3819 of 1994 increased roofing requirements in high-risk areas.[106] Again, this requirement only applied to new construction. In October of 2007, multiple fires burned in Southern California and destroyed over 1,750 homes and over 368,000 acres of land.[107] This led to California strengthening its wildfire building code in 2008, which again applied only to new homes. Chapter 7A, the new amendment to the building code, included several changes: it required roofs to be rated class A or B, for eaves and exterior siding to be fire resistant, for decks to be built of non-combustible materials, and for vents, windows, and doors, to be as fire-resistant as possible as well.[108]

Following the 2008 changes to Chapter 7A of the wildfire building code, the National Bureau of Economic Research performed a study comparing property damage for homes built after 2008 and before. They found that a home built in 2008 or after, which was required to follow the new Chapter 7A building requirements, was 40% less likely to be destroyed than a home built in 1990 in the same wildfire.[109] This shows that both the 1991 and the 2008 code changes played a large role in the resistance of homes to wildfires, and also exhibits that building codes can reduce damage and economic loss from wildfires. However, this also shows the importance of requiring existing buildings to be retrofitted to these standards as well. Only the newer homes were less likely to have reduced damage. Pre-existing homes were still destroyed in these wildfires.

104. *What is the WUI?*, U.S. FIRE ADMIN., https://www.usfa.fema.gov/wui/what-is-the-wui.html [https://perma.cc/6TQV-RATX] (last visited Mar. 1, 2024).
105. Baylis & Boomhower, *supra* note 6, at 7.
106. *Id.* at 8.
107. ARCELA NÚÑEZ-ALVAREZ ET AL., NAT'L LATINO RSCH. CTR. AT CAL. STATE UNIV., SAN DIEGO FIRESTORM 2007 REPORT 23 (2007), https://www.csusm.edu/nlrc/documents/report_archives/nlrc-wildfires-report-2007-rev.pdf [https://perma.cc/U8LL-BDWC].
108. *Id.* at 8–9.
109. Baylis & Boomhower, *supra* note 6, at 3.

California again amended their Building Code following the Butte fire of 2015 in California, which destroyed over 500 homes.[110] The California Building Code, enacted in 2016 and modeled after the 2015 International Building Code (IBC),[111] specifically states that "new buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this chapter."[112] Again, the state only amended the code *after* a wildfire had happened and only applied it to *new* construction.

The 2015 Amendment to Chapter 7A further increased the standards required for wildfire-resistant homes. It mandates fire-retardant-treated wood and shingles.[113] It also requires that materials for exterior windows and sidings undergo a fire resistance test standard, as well as a heat release combustion test for the deck.[114] These are valuable changes that will further mitigate the damage caused by wildfires in California. However, as Chapter 7A only refers to new construction, homes that existed before 2015—and even before 1991—will be disadvantaged and will be more likely to be destroyed in a wildfire.

B. Environmental Justice Framework

The case studies above depict the legal problem currently at issue: although natural disasters are increasing, municipalities are not changing their building codes to require existing buildings to be retrofitted to mitigate damage. The case studies demonstrate that the codes *are* changed with regard to new construction, and that these new standards do prevent some damage. As the study performed by the IBHS in Florida exemplifies, when retrofitting is not required and does not happen, homes experience much greater levels of damage. This presents a problem of environmental injustice.

The goal of environmental justice is "to ensure that all people, regardless of race, national origin, or income, are protected from

110. Samantha Fields, *California's wildfire building codes make newer homes less likely to burn*, MARKETPLACE (Apr. 1, 2022), https://www.marketplace.org/2022/04/01/californias-wildfire-building-codes-make-newer-homes-less-likely-to-burn/ [https://perma.cc/6AL7-RX23].
111. *History of the California Building Code*, CAL. BLDG. STANDARDS COMM'N, https://www.dgs.ca.gov/BSC/About/History-of-the-California-Building-Code--Title-24-Part-2 [https://perma.cc/6WS5-JVDY] (last visited Nov. 20, 2023).
112. CAL. CODE. REGS., tit. 24, § 701A.3 (2016).
113. CAL. CODE. REGS., tit. 24, § 703A.5.2 (2016).
114. CAL. CODE. REGS., tit. 24, § 703A.7 (2016).

disproportionate impacts of environmental hazards."[115] Historically, climate change and natural disasters affect communities of color and lower-income communities at a greater rate than White and affluent communities. One year after Hurricane Harvey hit Texas, the percentage of homes that were still unsafe to live in was higher for Hispanics and Blacks as compared to Whites.[116] The same was true for lower-income residents as opposed to higher-income. When Hurricane Katrina hit New Orleans in 2005, four of the seven zip codes that suffered the most flood damage consisted of populations that were at least 75% Black.[117]

U.S. News analyzed figures from FEMA's National Risk Index and determined which communities are the most at risk from natural hazards in the United States. Unsurprisingly, they found that communities of color are at a greater risk than White communities. The U.S. News analysis determined that Alaskan Natives and Native Americans have the highest overall risk for natural disasters while Black communities are at the highest risk for negative impacts from hurricanes, tornadoes, heat waves, and flooding.[118]

There are two factors responsible for communities of color having a higher risk of negative impacts from natural disasters than White communities. The first is a community's pre-existing vulnerability.[119] Lower-income communities and communities of color are more likely than White or affluent communities to live in low-lying areas or floodplains.[120] These areas also tend to have fragile housing and less climate infrastructure.[121] This means that they are more affected by a natural disaster when it hits, as their neighborhood and houses are less prepared than their White counterparts. Outside of the actual homes, the infrastructure of the neighborhoods that people of color live in is often less climate-resilient as well. Parks and permeable

115. Brie Sherwin, *After the Storm: The Importance of Acknowledging Environmental Justice in Sustainable Development and Disaster Preparedness*, 29 DUKE ENV'T L. & POL'Y 273, 280 (2019).
116. *Id.* at 275.
117. E&E News & Thomas Frank, *Flooding Disproportionately Harms Black Neighborhoods*, SCI. AM. (June 2, 2020), https://www.scientificamerican.com/article/flooding-disproportionately-harms-black-neighborhoods/ [https://perma.cc/68T9-ZFE7].
118. Steven Ross Johnson, *The Demographics of Disaster*, U.S. NEWS (June 22, 2022), https://www.usnews.com/news/health-news/articles/2022-06-22/disaster-disparities-natural-hazards-climate-change-threaten-underserved-communities [On File with the Columbia Journal of Environmental Law].
119. *Id.*
120. E&E News & Thomas Frank, *supra* note 117.
121. Jeremy Ney, *Natural disasters cause havoc for low-income Americans*, AM. INEQUALITY (Mar. 8, 2023), https://americaninequality.substack.com/p/natural-disasters-cause-havoc-for [On File with the Columbia Journal of Environmental Law].

surfaces can help to mitigate flood risk and damage—two things that are more likely to be found in a White neighborhood than a neighborhood of color.[122] Since communities of color tend to be located in more vulnerable areas and have less climate infrastructure than White neighborhoods, they are more impacted by natural disasters.

The second factor contributing to their higher risk is the lack of response, funding, and investment made in these communities after a natural disaster occurs.[123] Socially-vulnerable populations are less equipped to respond when a natural disaster strikes, as they might not have the money to rebuild their houses, especially to reconstruct them in a way that would prevent future damage from natural disasters.[124] This lack of ability to reconstruct in a way that mitigates damages directly impacts them in future natural disasters. As the IBHS study in Charlotte County, Florida, found, residents of homes built before codes were changed required additional living expenditures after disasters and over longer periods—and that is if updated homes even experienced any damage at all.[125] Low-income communities are less likely to be able to afford these additional living expenses after a natural disaster.[126] People with a lower socio-economic status are also less likely to be able to afford to move out of the danger zone after a natural disaster strikes, in part because there is a limited supply of affordable housing in lower-risk areas.[127] Taken together, this makes low-income and minority communities more vulnerable to both economic loss as well as repeated damage and danger from natural disasters.

The issue of environmental justice in relation to natural disaster-prone areas presents a striking problem within the building codes and regulations that are currently in place. Since existing regulations only require new buildings to be built to the hazard-resistant standards, and provide no funding for pre-existing homes to be retrofitted to fit these standards themselves, lower-income communities and communities of color will continue to suffer at a disproportionate rate from extreme weather events compared to richer and White communities that live in newer homes or can afford to proactively retrofit them. Since these aforementioned communities are often unable to afford to move out of the risk-prone areas, they are not constructing or

122. Johnson, *supra* note 118.
123. *Id.*
124. E&E News & Thomas Frank, *supra* note 117.
125. INST. FOR BUS. & HOME SAFETY, *supra* note 84, at 5.
126. Ney, *supra* note 121.
127. Sherwin, *supra* note 115, at 296.

purchasing houses that are hazard-resistant.[128] In instances when homes do not experience substantial damage but still suffered some damage, these communities merely restore their homes to the code they were at before the disaster struck, since they do not have the ability to afford to retrofit them to meet the new standards and the government is not giving them funding to do so either. When a home is substantially damaged and thus must conform to the new building requirements, the lack of funding given to meet the new standards can lead to families losing their houses altogether.[129] This demonstrates the problem of requiring only new buildings to fit the codes—affluent, White communities are disproportionately able to take advantage of the safety and design requirements of the new codes. Communities of color and lower-income communities are being left behind to be the victims of the next natural disaster, which will inevitably strike soon as climate change continues to worsen. A change needs to be made to the current system in order to correct this injustice.

C. The Economic Cost of Requiring Retrofitting

While it is clear that building codes need to be changed in order to require existing buildings to be retrofitted to meet safety standards, particularly given the issue of environmental injustice, the largest barrier to doing so is the cost. If homeowners are forced to bear the costs of compliance and retrofitting themselves, it would pose a greater issue for communities of color and low-income communities, which would merely serve to exacerbate the problem of environmental injustice. While minorities are less likely than Whites to own their own homes, as 72.7% of White Americans are homeowners while only 44% of Black Americans are, it is likely that renters would also bear the costs of retrofits. Landlords would simply pass on the costs of the retrofits to their tenants in the form of higher rent.[130] This would again disadvantage low-income communities and people of color as they might be unable to afford the higher rents.

128. Eleanor Krause & Richard V. Reeves, *Hurricanes hit the poor the hardest,* BROOKINGS INST. (Sept. 8, 2017), https://www.brookings.edu/articles/hurricanes-hit-the-poor-the-hardest/ [https://perma.cc/56ZC-7UHT].
129. In 2010, five years after Hurricane Katrina hit New Orleans, there were around 6,000 families in Louisiana who were still unable to afford to rebuild their home. Seth Fiegerman, *Five Years After Katrina, Still Homeless*, UNITY OF GREATER NEW ORLEANS (Aug. 23, 2010), https://unitygno.org/newsweek-five-years-after-katrina-still-homeless/. [https://perma.cc/JE3B-5RRP].
130. Lauren Cozzi, *More Americans Own Their Homes, but Black-White Homeownership Rate Gap is Biggest in a Decade, NAR Report Finds,* NAT'L ASS'N OF REALTORS (Mar. 2, 2023), https://www.nar.realtor/newsroom/more-americans-own-their-homes-but-black-white-homeownership-rate-gap-is-biggest-in-a-decade-nar [https://perma.cc/JJN9-GJ62].

IBHS and Headwater Economics, a nonprofit research group, conducted a study in California to compare the costs of constructing different types of wildfire-resistant homes. They divided the homes into three different styles; i) Baseline, which meets only the minimum requirements of Chapter 7A, ii) Enhanced, which includes the Chapter 7A requirements as well as a noncombustible perimeter around the home and deck and iii) Optimum, which are homes constructed in the most fire-resistant way possible, beyond what is required by the code.[131] On average, building an Enhanced home cost $2,800 more than building a Baseline home and building an Optimum home increased the cost anywhere from $18,000 to $27,080, depending on which part of California the home was built in.[132] The high upfront cost of safety creates a vicious cycle, as people who cannot afford to make their home more wildfire-resistant will have to pay more later when it is actually destroyed by a wildfire, while their wealthier neighbors who were able to afford to build their house at the Enhanced or Optimum levels will save money in the long-run.

Of the different ways to retrofit homes to prevent flood damage, each of them will cost the homeowners a great deal of money if they are required to cover the cost of retrofitting themselves. The most common kind of retrofit to prevent flood damage is elevating the house, which consists of separating the foundation from the living space of the house and lifting it higher to construct a new foundation below, as discussed in the Introduction with the house in Gilchrist.[133] On average, for a wood-framed house, this costs around $70 per square foot of living space.[134] The average square foot of a home in the U.S. (although it varies by location) is 1,600 square feet,[135] meaning that elevating a single-family home could cost as much as $112,000, or even more for a larger home. As the average American family only has about $62,000 in savings,[136] it is likely that many people who are living in high flood-risk areas would not be able to afford the cost of this kind of retrofitting.

131. KIMIKO BARRETT, ET AL., HEADWATERS ECON. & INS. INST. FOR BUS. & HOME SAFETY, CONSTRUCTION COSTS FOR A WILDFIRE-RESISTANT HOME: CALIFORNIA EDITION 4 (2022).
132. *Id.* at 6.
133. MULTI-HAZARD MITIGATION COUNCIL, NATURAL HAZARD MITIGATION SAVES: 2019 REPORT, NAT'L INST. OF BLDG. SCI. 87 (2019).
134. *Id.* at 89.
135. Joe Pinsker, *Why Are American Homes So Big?*, ATLANTIC (Sept. 12, 2019), https://www.theatlantic.com/family/archive/2019/09/american-houses-big/597811/ [https://perma.cc/YA5G-GCJK].
136. Liz Kneuven and Sophia Acevedo, *Average American savings balance by age, household size, and education level*, BUS. INSIDER (Oct. 19, 2023), https://www.businessinsider.com/personal-finance/average-american-savings [https://perma.cc/ME2V-GMZX].

Instead of retrofitting, one policy that has been suggested is for the federal government to buy out homes in high-risk areas and pay for the relocation of previous inhabitants to areas that are not at high-risk for a natural disaster. However, this is incredibly expensive for the government. In one study, relocating one million homes from areas especially prone to flooding would cost the government $180 billion.[137] It would cost less for the federal government to single-handedly fund the retrofit of one million houses by increasing their elevation as discussed above. It is also not feasible for the owners of all of these homes to relocate. As discussed in Part II(C), inhabitable areas of land are decreasing due to rising sea levels, and population is increasing, leaving a dearth of space for these homeowners to live if they all move out of high-risk areas. Thus, buying out homes and completely vacating high-risk areas is not a practical solution, as it is likely less cost-effective and would ultimately lead to overcrowding in other areas.

Unless homes are in an area excessively prone to highly destructive future natural disasters,[138] it is better to retrofit houses in ways that will mitigate the damage from natural disasters rather than buy them out. However, as it can be difficult or even impossible for individual homeowners to cover the upfront cost of these changes—furthering environmental injustice—it is necessary to find a solution that both requires the retrofitting of houses to mitigate damage and provides funding for homeowners.

IV. POLICY AND LEGISLATIVE CHANGES TO BUILDING CODES

Parts II and III demonstrated the need for retrofitting existing buildings to meet safety standards for extreme weather events as well as the limited number of codes currently in place that require these changes. Part IV proposes suggestions regarding the implementation of building codes for retrofitting existing buildings. Part IV(A) discusses California's policy for seismic retrofits for earthquake safety as a possible model for the mandate of retrofits. Part IV(B) discusses how the government can provide subsidies and grants as funding for

137. NAT'L INST. OF BLDG. SCIS., 2020 ANNUAL REPORT TO THE PRESIDENT 24 (2020).

138. Even if the home is in an area that is excessively prone to future natural disasters, it might still not be worth it to buy-out the home and mark it as unusable land. Given the increasing prevalence of natural disasters and rising sea levels combined with the increasing population of America, the land might be necessary to remain zoned for residential purposes until it is too dangerous to live in that area. This again demonstrates the importance of living in hazard-resistant homes.

property owners to retrofit their buildings and homes, drawing from funds currently earmarked for disaster-relief. Part IV(C) presents policy and legislative suggestions for state and local jurisdictions to require property owners to retrofit their pre-existing buildings to meet safety standards for natural disaster-resistant buildings.

A. California Earthquake Law

Although earthquakes are not an extreme weather event and will not increase in frequency with the worsening of climate change, they do still destroy hundreds of thousands of houses across the United States and the world. The California Geological Survey estimated that the annual earthquake loss for California would be around $3.7 billion of damage.[139] Buildings in California were historically constructed of unreinforced masonry (URM). During earthquakes, this can cause walls to collapse, walls and floors to break apart from each other, and architectural ornaments to fall into the street.[140] Given this, URM buildings are considered to be the most threatening to life during an earthquake, as the buildings can collapse on the people within them.[141]

This led to California passing Senate Bill 547 in 1971, also known as the Unreinforced Masonry Building Law (URM Law), in response to the damage done to buildings from earthquakes.[142] The main purpose of the bill was to identify, strengthen, and retrofit existing and historic buildings.[143] The URM Law serves as a case study to demonstrate the various ways that governments can approach the issues of extreme weather events and update building codes to require the retrofitting of existing buildings to meet new safety standards and be more resistant to extreme weather events.

The URM Law applies to all locations within seismic zone four[144]—the areas with the highest earthquake risk—and requires the local governments of these areas to perform three tasks.[145] The first task

139. *Earthquake Loss Estimation,* CAL. DEP'T OF CONSERVATION, https://www.conservation.ca.gov/cgs/earthquake-loss-estimation [https://perma.cc/X3DB-HVF3] (last visited Jan. 3, 2024).
140. Ronald B. Reiss, *California's S.B. 547: Local Government Balancing of Public Safety and Historic Preservation*, 26 URB. LAW. 347, 349 (1994).
141. *Id.* at 349.
142. *Id.* at 351.
143. *Id.*
144. The United States is divided into Seismic Zones 0 through 4. Zone 4 has the strongest earthquake ground motion. S.K. Ghosh, *Seismic Design Considerations in Model Codes*, MASONRY TODAY (Oct. 2000), [On File with the Columbia Journal of Environmental Law].
145. Reiss, *supra* note 140, at 352.

is to identify all potentially hazardous URM buildings: those built prior to the adoption of local codes that required earthquake-resistant design.[146] The second task is to develop a mitigation program, which must include notification to the owner of the building that it has been identified as a potentially hazardous building.[147] This program can also include measures to strengthen or demolish buildings, incentive programs, and permissive code requirements, among other measures. The third task is that the government create an inventory of the identified buildings and submit this, along with their mitigation programs, to the Seismic Safety Commission.[148]

The URM Law leaves the decision of how to fix the safety issue that URM buildings pose to public safety up to local governments. Different governments have adopted different ordinances or requirements, which creates a valuable contrast to determine which methods work well and which do not. The jurisdictions that implemented only the most basic requirements of the URM Law—notification to building owners only without mandating any additional changes to be made—have been ineffective in reducing the hazards that URM buildings pose during earthquakes, as there is no incentive for building owners to consider hazard reduction.[149]

In contrast, other jurisdictions have implemented either mandatory strengthening laws or provided economic incentives for building owners to comply with hazard reduction processes. The mandatory strengthening programs typically followed model building codes for earthquake resistance.[150] These programs require building owners to retrofit their buildings to reduce the potential for collapse and damage during an earthquake. Ninety-two percent of URM buildings in seismic zone four are within a jurisdiction which implemented a mandatory strengthening ordinance.[151] For jurisdictions that did not require mandatory strengthening of the buildings, several of them relied on various different forms of economic incentives to encourage owners to retrofit their buildings. While some jurisdictions merely paid for engineers to complete structural analyses of the URM buildings, other jurisdictions went a step further and either paid for the cost of retrofitting buildings up-front or established reimbursement programs for building owners who retrofit their buildings. For

146. *Id.* at 353.
147. *Id.*
148. *Id.*
149. *Id.* at 357.
150. *Id.* at 358.
151. Reiss, *supra* note 140, at 362.

example, San Jose provides reimbursement for design work from their redevelopment funds and the City of San Leandro pays for all retrofitting costs directly from its General Fund and then allows the building owners to make deferred payments back to the city over time.[152]

In addition to the URM Law, the California legislature also created the California Earthquake Authority (CEA) in 1996.[153] This was in response to the San Fernando earthquake of 1994 that caused around $20 billion in residential damage.[154] Although the CEA was created by the legislature, it is a non-profit entity that provides two-thirds of the residential earthquake insurance policies in California.[155] While the CEA provides insurance to all residences that purchase it, it provides a premium discount for houses that were retrofitted to be more resistant to earthquakes.[156] This works as an incentive to owners of older homes to encourage them to retrofit their homes—even if they do not belong to one of the jurisdictions that require mandatory retrofits or provide the greatest incentives to do so. Combined, the URM Law and the CEA insurance premiums are examples of legislative and policy practices that can encourage the retrofitting of homes to be hazard-resistant.

The URM Law demonstrates that it is possible for governments to require the retrofitting of existing buildings. It is also an example of a law that aims to prevent future damages and harm—it is well-known that another earthquake will hit these areas in California—since it calls for the strengthening of buildings that are usually left out of hazard-resistant building codes. Since the URM law allowed local jurisdictions to decide how to implement the broad legislative standards, it shows clearly which programs actually work in regards to encouraging the retrofitting of existing buildings—notification programs are ineffective and the strongest measure is a mandatory requirement.[157] The success of the jurisdictions that established mandatory strengthening laws or economic incentives can be applied to the creation of

152. *Id.* at 359–60.
153. *History of the California Earthquake Authority (CEA)*, CAL. EARTHQUAKE AUTH., https://www.earthquakeauthority.com/about-cea/cea-history [https://perma.cc/4M8Y-F9WZa] (last visited Mar. 1, 2024).
154. *Id.*
155. *Id.*
156. *How to Qualify for an Earthquake Insurance Premium*, CAL. EARTHQUAKE AUTH., https://www.earthquakeauthority.com/california-earthquake-insurance-policies/earthquake-insurance-policy-premium-discounts [https://perma.cc/SX35-HMB8] (last visited Mar. 1, 2024).
157. Reiss, *supra* note 140, at 365.

laws in other states to mitigate harms from other natural disasters and extreme weather events.

B. Savings Lead to Subsidization

One argument against requiring the update of pre-existing buildings to fit disaster-resistant codes is the economic cost, as retrofitting buildings can be expensive. Homeowners would likely either not want to shoulder the entire cost of these changes or, in many cases, would not be able to afford the cost of the construction and updates. Thus, legislators might not pass the requirement as a matter of economic policy or, if they do, homeowners might simply not comply.

In order to solve this problem, the federal government could provide grants to aid with retrofits or subsidize the cost of retrofit construction. One example of this is FEMA's Hazard Mitigation Grant Program (HMGP). This program provides funding to local, state, and tribal governments to develop hazard mitigation plans and rebuild their communities to mitigate and prevent damage from future natural disasters.[158] Local communities can request aid on behalf of the homeowners in their community.[159]

Additionally, the Disaster Relief Fund (DRF) is a source of government-funded federal assistance to aid homeowners after natural disasters.[160] The purpose of this funding is to help repair and replace damaged infrastructure, cover the cost of home repair, and clear out the area of debris. In 2020, FEMA spent $47 billion from the DRF while the average since 2005 was $12.5 billion a year (excluding money that was spent on the pandemic).[161] In contrast, from 1992-2004, annual DRF spending was only $5 billion.[162] As climate change worsens and natural disasters increase in severity, this number is likely to stay elevated. The money from the DRF is typically allocated in three ways: i) emergency response activities such as food and medical aid, which typically end within six months of the disasters; ii) recovery activities such as the repair and reconstruction of buildings and houses, which typically take three years or more; and iii)

158. *Hazard Mitigation Grant Program (HGMP)*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/grants/mitigation/hazard-mitigation [https://perma.cc/Y5RW-CTG3] (last visited Mar. 2, 2024).
159. *Id.*
160. *FEMA's Disaster Relief Fund: Budgetary History and Projections*, CONG. BUDGET OFF. (Nov. 2022), https://www.cbo.gov/publication/58840 [https://perma.cc/UU3G-PED9].
161. *Id.*
162. *Id.*

mitigation projects, which can last for more than a decade after the disaster happens.[163]

Each year, Congress appropriates billions of dollars for disaster-relief spending. If Congress did not need to spend money to repair homes and entire communities after a disaster, this same money could be reallocated as grants to homeowners to help fund the cost of retrofitting. After Hurricane Sandy, FEMA spent $10 billion in the first three years, which was over 50% of the amount FEMA spent on Sandy in total.[164] If the houses had already been retrofitted to withstand natural disasters and mitigate damage, less money would have been spent after the disaster.

While the DRF is an incredibly important fund to help provide aid and funding after natural disasters, Congress could reallocate some of these funds to provide grants to homeowners for pre-disaster mitigation. Over time, this would likely save the government millions if not billions of dollars as they would have to provide less aid after natural disasters because—as noted by the Florida studies discussed in Part III(A)[165]—there is a lower chance of retrofitted homes being destroyed or severely damaged which reduces disaster-relief spending. Providing grants to homeowners will also reduce the problem of environmental injustice, where homeowners living in wealthy neighborhoods are able to retrofit their homes, and those who live in lower-income communities are not.

1. Government Subsidies Combat the Takings Problem

As discussed in Part II(E) of this Note, under the historical view of the Takings Clause—which applied only when the government confiscated property without just compensation—there would be no constitutional issue with the government requiring the retrofitting of older homes. However, under the modern interpretation—in which the Takings Clause also applies to government regulation that prevents all economically beneficial use of land—an argument could be made that it would prevent local governments from implementing the retrofitting legislation suggested in this Note if just compensation was not given.

While it is likely that the Takings Clause would not be implicated at all, as the regulations would not prevent *all* economically beneficial

163. *Id.*
164. *Id.*
165. *See* INST. FOR BUS. & HOME SAFETY, *supra* note 84; Simmons et al., *supra* note 81.

use of the land, implementing government grants and subsidies would ensure that the Takings Clause would not be a barrier to mandating retrofits. The Takings Doctrine only prohibits the taking or regulating of private property without just compensation. If the government provided grants and funding to property owners to retrofit their homes, they would be providing just compensation and thus the Takings Doctrine would not be implicated.

C. Mandated Retrofitting Laws

The URM Law in California provides a valuable insight into how policies on retrofitting can be structured and how they are implemented in practice. The URM Law requires local governments to develop a mitigation program but does not set any further standards. Thus, each local government developed different programs with different requirements, which serve to demonstrate the success of these programs. Governments that instituted voluntary retrofitting—where they simply notified the building owners of the hazards but did not require them to make any changes to their code—found this implementation to be ineffective and almost no owners adopted new code changes to mitigate seismic damage to their buildings, as seen in Part IV(A).

Learning from this, local municipalities should require homeowners to implement the code changes on their pre-existing buildings. This will create the greatest success in compliance, which will also lead to the greatest mitigation of damages. While the current codes and standards, based off the IBC, only require buildings to be retrofitted when substantial improvements or alterations are made, local governments should instead implement codes that require existing buildings to be retrofitted immediately. Otherwise, it could take years for buildings to undergo substantial alterations that would meet the requirements for forcing them to update their code, or—in the case of individual homes—they might never perform such improvements and the house might never be retrofitted to mitigate damage from natural disasters.

While it might be difficult to require immediate compliance with the new codes, local governments can still pass legislation requiring property owners to implement updates even if they are not doing substantial improvements or alterations to their property. Local governments could introduce legislation with a similar timeline for retrofits as New York City did after Hurricane Sandy. In that case, New York City required new construction to implement the changes

immediately and required existing buildings to meet the new code standards within eight years.[166] This gave property owners time to find the money to make the changes and hire workers while still providing a set deadline so that the city could easily determine which buildings had made the proper changes within the set time.

Although the URM Law was highly successful in encouraging the retrofitting of pre-existing buildings in order to be better withstand seismic events, this Note suggests that legislation regarding natural disaster-resistant building codes should go one step further. In California, the URM Law required local governments to at least designate and notify all building owners of the buildings that were identified as risk-prone. However, it left everything else up to the local governments. There was no statewide requirement for any changes to actually be made. The effectiveness of the different approaches of the municipalities is evident in the data compiled once the governments each instituted their different policies. The varied success of the different jurisdictions' approaches suggests that incentive programs are superior to notification programs, but mandates are still the most effective.

Therefore, state governments should either pass state-wide legislation with regard to natural disaster-resistant building codes, or pass legislation requiring local governments to implement more concrete legislation in their own jurisdictions that require property owners to retrofit their buildings to mitigate damage from natural disasters. These laws should set a deadline, such as five to ten years, within which the property owners must properly retrofit their homes or buildings so that they are up to code to mitigate damage from disasters. The state and local governments should also pass this legislation now, instead of waiting for more natural disasters to strike before they implement new legislation, which has been the previous pattern. This will provide the greatest protection for life and property.

V. CONCLUSION

It is vital that local governments and municipalities require property owners to retrofit their homes and buildings to comply with safety standards designed to mitigate damage from natural hazards. The current legislation in place, which only requires these changes to be made when substantial improvements or damages are done to the building or home, does not do enough to protect from the loss of

166. Navarro, *supra* note 97.

property and human life. This is especially true as climate change is causing natural disasters to increase in severity and number.

As evidenced by the case studies of California and Florida, there are clear and proven benefits to adopting codes and updating homes to meet these codes to mitigate damage from natural disasters. Homes that are constructed without meeting natural disaster-resistant standards are more likely to suffer damage or complete destruction when natural disasters strike. As this Note discussed, this can present an environmental injustice issue as people of color and people with a lower income are less likely to be able to afford the newer homes that did meet the disaster-resistant standards or to be able to fix their homes when they are damaged in a natural disaster.

This Note has analyzed historical examples of mitigating property loss and damage from natural disasters and case studies where building codes have been implemented to try and further reduce property damage. This Note concludes that new policies and legislation must be adopted in order to provide the greatest protection to property and life. Following the example of local governments in California with regards to retrofits for seismic damage, this Note suggests state and local governments institute legislation that requires property owners to retrofit their homes to be natural disaster-resistant, which will be the most effective way of preventing damage and economic loss from future natural disasters, which are ever-worsening with climate change.