

Building a Stronger Nation: A Strategic Framework for Disaster Cost Reduction

Prepared by: BuildStrong America

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Abstract

The United States is facing a sharp increase in costly and deadly disasters, driven by extreme weather and expanding development in high-risk areas. Despite clear evidence that proactive investments in mitigation, resilient infrastructure, and modern building codes yield significant long-term savings, most federal disaster funding remains reactive. This white paper by BuildStrong America proposes a strategic shift toward a comprehensive, proactive national resilience framework. Key recommendations include prioritizing pre-disaster mitigation, standardizing and enforcing building codes, modernizing critical infrastructure with resilient materials, fostering public awareness, and leveraging data and technology. By addressing persistent barriers — such as fragmented governance, aging infrastructure, and inconsistent code adoption — these measures aim to reduce disaster costs, save lives, and strengthen community resilience nationwide.

Introduction: The Growing Imperative for National Resilience

The United States faces a rapidly escalating crisis of disaster frequency, intensity, and cost, driven by both extreme weather and increased development in high-risk areas.¹ Over the past decade (2015–2024), the nation experienced 190 separate billion-dollar disasters, resulting in more than 6,300 deaths and approximately \$1.4 trillion in damages.² In 2023 and 2024 alone, the country experienced over fifty \$1 billion weather and climate disasters,³ resulting in loss of life, property damage, and overwhelmed response systems, underscoring a trend that has seen the annual average of such events more than double in recent years. The financial burden on federal disaster resources continues to grow, while states and local communities across the country face repeated devastation and mounting infrastructure challenges.

The economic rationale for investing in resilience is clear and compelling. Recent studies demonstrate that every \$1 invested in disaster preparedness and resilience yields an average of \$13 in long-term savings through avoided damages, reduced

¹ National Centers for Environmental Information. (2025). *U.S. Billion-Dollar Weather and Climate Disasters*. NOAA. <https://www.ncei.noaa.gov/access/billions/>

² Smith, A. B. (2025, January 10). *2024: An active year of U.S. billion-dollar weather and climate disasters*. NOAA Climate.gov. <https://www.climate.gov/news-features/blogs/beyond-data/2024-active-year-us-billion-dollar-weather-and-climate-disasters>

³ Climate Central. (2024, January 17). *Billion-dollar disaster seasons*. Climate Matters. <https://www.climatecentral.org/climate-matters/billion-dollar-disaster-seasons-2024>

cleanup costs, and preserved economic activity.⁴ Despite this substantial return on investment, most disaster-related funding — over 85% — is still allocated after disasters occur, rather than toward proactive risk reduction and preparedness measures.⁵ This reactive funding model not only increases overall costs but also perpetuates preventable loss of life, injuries, and long-term recovery impacts.

This white paper outlines a proactive, cohesive national resilience strategy that is essential to reduce the growing human and economic costs of disasters in the United States. Policymakers at all levels of government should prioritize pre-disaster investments that safeguard communities, strengthen the built environment and critical lifeline infrastructure, and investments that contribute to long term systemic changes to end the cycle of rebuilding to the same outdated standards.

Community resilience is commonly defined as “the ability to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.”⁶ This comprehensive perspective underscores that resilience is not only about withstanding immediate impacts, but also about adapting systems to function effectively under changing conditions. To be effective, our national approach must fully embrace this broader understanding, integrating adaptation, recovery, and long-term planning into all aspects of disaster policy and investment.

Reducing Risk in the Built Environment

The Foundation of Community Resilience

The built environment, which includes the buildings where we live, work, and occupy as well as the critical infrastructure that supports them, is fundamental to community resilience. While individual preparedness is important, resilience must also encompass the physical structures and infrastructure that enable essential services and daily activities. Buildings and infrastructure are highly interdependent; their capacity to withstand and recover from hazards determines how quickly communities can restore critical functions such as power, water, healthcare, education, commerce, and governance.

⁴ Congressional Budget Office. (2016). Potential increases in hurricane damage in the United States: Implications for the federal budget (Publication No. 51518). <https://www.cbo.gov/publication/51518>; Dixon, L., Tsang, F., & Fitts, M. (2017). Coastal flood risk reduction and economic evaluation of projects: The case of coastal Louisiana. RAND Corporation. https://www.rand.org/pubs/research_reports/RR1992.html; U.S. Government Accountability Office. (2019). Disaster resilience: Actions are underway, but federal fiscal exposure highlights the need for continued attention to longstanding challenges (GAO Publication No. GAO-20-100SP). <https://www.gao.gov/products/gao-20-100sp>; Melecky, M., & Raddatz, C. (2019). The economic effectiveness of disaster risk reduction: A case study from the Philippines. UNU-WIDER Working Paper 2019/7. <https://www.wider.unu.edu/publication/economic-effectiveness-disaster-risk-reduction>.

⁵ U.S. Government Accountability Office. (2015). *Hurricanes Katrina and Sandy: FEMA's Approaches to Distributing Funds Should Be Improved*. GAO-15-515. Retrieved from: <https://www.gao.gov/products/gao-15-515>; Congressional Research Service. (2020). *FEMA's Pre-Disaster Mitigation Program: Overview and Issues*. R45017. Retrieved from: <https://crsreports.congress.gov/product/pdf/R/R45017>; U.S. Government Accountability Office. (2019). *Disaster Resilience: Actions Are Needed to Enhance the Federal Investment*. GAO-20-100SP. Retrieved from: <https://www.gao.gov/products/gao-20-100sp>

⁶ National Institute of Standards and Technology. (2024, October 10). *Community resilience*. U.S. Department of Commerce. <https://www.nist.gov/community-resilience>

A resilient built environment minimizes physical destruction, economic loss, and social disruption, enabling communities to recover more rapidly and maintain their social and economic fabric. When structures are designed or upgraded to remain safe and operational during and after disasters, they help sustain occupancy and reduce interruptions to community life. This proactive approach not only saves lives and protects property but also decreases the resources required for emergency response and long-term recovery.

Investing in resilient buildings and infrastructure is essential for enabling communities to “bounce forward.” In other words, to recover stronger and adapt to future risks, rather than merely returning to pre-disaster conditions. By prioritizing the resilience of the built environment, policymakers can help ensure that the places where people live, work, and play remain safe, functional, and supportive of overall community well-being, even in the face of evolving 21st-century hazards.

Protecting Critical Infrastructure Systems

Critical infrastructure failures act as climate risk multipliers, creating cascading effects that significantly amplify the initial impacts of disasters. For example, the February 2021 Texas power crisis illustrates how extreme cold can cripple critical infrastructure. Record-low temperatures caused nearly half of the state’s power generation to fail, forcing rolling blackouts that left over 4.5 million homes and businesses without electricity. The outages led to at least 246 deaths, primarily from hypothermia, and triggered cascading failures in water systems as treatment plants lost power and pipes burst.⁷ This event exposed significant vulnerabilities in Texas’s electric grid, particularly the lack of winterization and the risks of operating an isolated system, highlighting the urgent need for resilient infrastructure in the face of increasingly frequent extreme weather.

The importance of resilience is well-recognized in the private sector, where organizations are encouraged to safeguard critical business services against potentially disruptive events of any origin. This principle is equally vital for public infrastructure. Business resilience is defined as “an organization’s ability to safeguard its critical business services against the threat of potentially disruptive events, regardless of their nature or origin, by planning and executing a company-wide strategy to reduce their probability as well as their impact.”⁸ Applying this comprehensive approach to public infrastructure is essential for minimizing cascading failures and protecting communities during and after disasters.

A Comprehensive Resilience Strategy

Building a truly comprehensive resilience strategy requires a holistic, forward-looking approach that addresses the full spectrum of risks facing communities today. As

⁷ EBSCO. (n.d.). *2021 Texas power crisis*. EBSCO Research Starters. <https://www.ebsco.com/research-starters/power-and-energy/2021-texas-power-crisis>

⁸ Sam Houston State University. (n.d.). Resilience to High Consequence Cascading Failures of Critical Infrastructure Networks.

disasters become more frequent, severe, and complex, it is essential to move beyond traditional emergency management and invest in solutions that strengthen every layer of society, from individuals and families to critical infrastructure and lifeline systems.⁹ Drawing on its deep expertise and broad coalition of stakeholders, BuildStrong America has identified a set of essential criteria that must be integrated into national resilience efforts: increased resources for mitigation, strong building codes for resilient homes and communities, robust and adaptable lifeline infrastructure, support for individual investments in resilience, the use of safe and sustainable materials, public awareness and education, collaborative research and development, and the empowerment of data and artificial intelligence. By prioritizing these elements, policymakers can help ensure that the nation is prepared not only to withstand future shocks, but also to recover quickly and thrive in the face of growing challenges.

Increased Resources for Mitigation

The financial benefits of pre-disaster mitigation are well-established. Every dollar invested in mitigation saves up to \$14 in future losses, making resilience investment one of the most fiscally responsible actions governments can take on behalf of taxpayers. Despite this compelling evidence, structural barriers in budgeting processes, political incentives, and public perception continue to hinder adequate pre-disaster investment. The result is a financially inefficient cycle of destruction and rebuilding that costs the taxpayer billions of unnecessary dollars.

Every American faces natural hazards, and the risks are growing every day. The pressing challenges posed by extreme climate risks, natural hazards, and other unforeseen events underscore the urgent need for increased mitigation resources. Mitigation efforts play a pivotal role in reducing the severity and impact of such events on communities and individuals. Adequate resources directed toward mitigation initiatives enable the development and implementation of resilient infrastructure, early warning systems, and sustainable practices. In the face of escalating climate-related risks, bolstering mitigation resources becomes paramount to safeguarding lives, protecting property, and preserving the environment. Investing in mitigation not only ensures a proactive response to potential disasters but also yields long-term benefits by curbing the escalating costs associated with emergency response and recovery efforts. By prioritizing and expanding mitigation resources, we take a proactive stance in building a more resilient and sustainable future for generations to come.

While there is an upfront cost associated with mitigation, the long-term economic benefits far outweigh the initial investment. Mitigation measures can substantially decrease the economic impact of disasters by minimizing damage and reducing the need for emergency response and recovery efforts. Allocating resources to mitigation is a fiscally responsible strategy that promotes sustainable development. By investing in mitigation, societies can significantly reduce the human and economic toll of disasters. We must help our communities rebuild and recover while providing them with the

⁹ Federal Emergency Management Agency. (2024, August). *National resilience guidance*. U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/documents/fema_national-resilience-guidance_august2024.pdf

necessary resources to prevent future destruction. It's time to stop the endless cycle of rebuilding to the same, outdated standards after each disaster. Natural hazard mitigation saves \$6 on average for every \$1 spent on federal mitigation grants, according to an analysis by the National Institute of Building Sciences. This number is even higher for "above code" standards, saving \$13 for every \$1. An earlier (2005) study by NIBS found a benefit-cost ratio (BCR) of 4:1.¹⁰

But more importantly, statistics that tend to receive less focus from these studies are that implementing certain mitigation strategies would prevent 600 deaths, 1 million nonfatal injuries, and 4,000 cases of post-traumatic stress disorder (PTSD) in the long term. Furthermore, the act of designing new buildings to surpass the standards set yielded significant economic benefits. This includes the creation of 87,000 new, long-term jobs and an estimated 1% rise in the use of domestically sourced construction materials. Mitigation saves lives, property, taxpayer money, and the environment.

Capacity-building, the process of enhancing an individual's or an organization's ability to perform effectively, stands at the core of resilience. Providing tools and resources for capacity-building is instrumental in fostering self-reliance and empowerment. When individuals and communities are equipped with the necessary skills, knowledge, and tools, they can navigate challenges more adeptly, innovate solutions, and contribute meaningfully to their communities and sectors. This empowerment not only enhances the capabilities of individuals but also serves as a catalyst for overall community resilience.

In addition to more resources for mitigation and communities, both public and private entities need incentives to drive their investments in mitigation. Whether by supporting the creation of federal tax incentives that reward resilient behavior, the development of mitigation tax breaks, or other incentives, individuals and businesses will find it easier to invest in resiliency, including undertaking activities like retrofitting homes and hardening critical infrastructure, if these resources are available. This would also foster private sector investment in mitigation through new financing opportunities. Targeted tax incentives and removing tax penalties will encourage resilient construction techniques to withstand damage from strong winds or flooding and prevent losses from wildfires and seismic events. Through these investments, homeowners and communities ultimately save money through tax savings and avoid recovery costs and losses in the next disaster. Further, federal agencies must reduce the complexity and administrative burden of their programs and allow different programs to come together in flexible and impactful ways.

Overall, the importance of investing in tools and resources for capacity-building cannot be overstated, as it lays the foundation for individual empowerment, economic growth, and community resilience. BuildStrong recommends the promotion and adoption of policies and programs to ensure that state, local, tribal, and regional entities are given the tools and resources to increase capacity and capability to first identify risks and hazards and then mitigate those risks before the crisis occurs.

¹⁰ https://www.nibs.org/files/pdfs/ms_v4_overview.pdf

The Role of Modern Building Codes and Standards

Modern building codes are among the most cost-effective tools for enhancing resilience to disasters such as hurricanes, earthquakes, floods, and wildfires. Structures built to the latest standards consistently experience less damage and require fewer repairs following such events. For example, after the statewide adoption of the modern Florida Building Code (FBC), studies found that windstorm losses were reduced by up to 72% in the decade following implementation.¹¹ During Hurricane Michael in 2018, homes in the Florida Panhandle built up to updated codes, such as those constructed by Habitat for Humanity, sustained only minimal damage, even under extreme wind conditions.¹² Similarly, during Hurricane Ian in 2022, Florida's robust code enforcement is credited with saving between \$1 billion and \$3 billion in structural damage. This demonstrates that modern roofing and structural requirements directly protected families and preserved affordable housing stock.

A discussion of resilience in the United States would be incomplete without highlighting Alabama, a state that has emerged as a national leader through innovative policies, public-private partnerships, and groundbreaking "above code" initiatives that have set new benchmarks for disaster preparedness and recovery. This is credited to Alabama's widespread adoption of the FORTIFIED standard, developed by the Insurance Institute for Business & Home Safety (IBHS). The FORTIFIED program sets engineering and construction benchmarks that help homes withstand severe weather, especially high winds, hurricanes, and heavy rain. Following the devastation of Hurricane Ivan in 2004, Alabama launched a comprehensive effort to promote FORTIFIED construction, combining updated building codes, insurance incentives, and grant programs.

A practical example of this approach is the Strengthen Alabama Homes program, which provides grants of up to \$10,000 for homeowners to upgrade their roofs and other structural elements to meet FORTIFIED standards.¹³ These upgrades have proven highly effective: during Hurricane Sally in 2020, more than 95% of the over 17,000 FORTIFIED homes and 19 commercial structures in coastal Alabama experienced little to no damage, allowing residents to return to normal life much more quickly than those in non-FORTIFIED homes.¹⁴ The benefits extend beyond immediate disaster recovery. Homes built or retrofitted to FORTIFIED standards in Alabama's coastal counties have been shown to command nearly a 7% premium in resale value compared to non-FORTIFIED homes, while also qualifying for insurance discounts of up to 55% on the wind portion of property insurance.¹⁵ Alabama's experience shows that up-to-date, hazard-specific building standards, supported by incentives and strong public-private

¹¹ CBIZ. (n.d.). *The role of building codes in natural disaster resilience: Property & casualty*. CBIZ.

<https://www.cbiz.com/insights/article/the-role-of-building-codes-in-natural-disaster-resilience-property-casualty>

¹² Liberty Mutual Insurance. (2024, April 30). Updated resilient building codes will benefit homeowners and communities.

<https://www.libertymutualgroup.com/about-lm/corporate-information/sustainability/articles/updated-resilient-building-codes-will-benefit-homeowners-and-communities>

¹³ Alabama Department of Insurance. (n.d.). Strengthen Alabama Homes. <https://www.strengthenalabamahomes.com/>

¹⁴ Rabb, W. (2024, September 18). *Alabama's wind-mitigation program celebrates 50,000 fortified homes in the state*. Insurance Journal. <https://www.insurancejournal.com/news/southeast/2024/09/18/793472.htm>

¹⁵ Urban Land Institute. (n.d.). *FORTIFIED Home Building Standards*. Developing Urban Resilience. <https://developingresilience.uli.org/case/fortified-homes/>

partnerships, can dramatically reduce storm damage, stabilize insurance markets, and build more resilient communities.

Despite these clear benefits, the adoption and enforcement of up-to-date building codes remain inconsistent across jurisdictions, resulting in uneven levels of community protection nationwide.¹⁶ This inconsistency stems from several factors. Across the nation, the adoption of building codes is left either to state or local governments, leading to a patchwork where some communities have robust, modern codes while others lag or lack enforcement altogether. For example, FEMA estimates that nearly 65% of counties, cities, and towns have yet to adopt current codes, leaving most buildings more vulnerable to disaster-related damage.¹⁷ The problem is compounded by limited resources for code enforcement, lack of trained staff, and, in some cases, deliberate decisions by local officials to weaken or ignore certain code provisions in favor of short-term economic interests.

Moreover, many consumers remain unaware of the importance of building codes, and the consequences of weak or poorly enforced codes often become apparent only after a disaster strikes.¹⁸ As a result, communities without modern, enforced codes face higher risks of casualties, property loss, and prolonged recovery, while those with up-to-date codes enjoy stronger protection, lower recovery costs, and faster return to normalcy. This disparity highlights the urgent need for more consistent, statewide adoption and enforcement of modern building codes to ensure all communities benefit equally from proven resilience measures.

Resilient Infrastructure and Materials

Policies and initiatives that prioritize the development of safe, sustainable, resilient infrastructure ensure that buildings and communities can withstand and recover from all hazards, whether natural, technological, or man-made both federally and at the state level. A comprehensive national resilience strategy must include the use of safe, sustainable, resilient, American-made products in the construction and retrofit of lifeline infrastructure.

Taking lessons learned from recent disasters, governments and the private sector must endeavor to incentivize actions that improve the resiliency of new construction, particularly through the adoption and enforcement of codes and standards, as well as encourage the identification and implementation of disaster-resistant techniques for retrofitting aged structures. While adoption is important, uniformly enforced codes make the most difference. It must be noted that competition has improved resiliency and efficiency embedded in codes, specifically codes that regulate resilient materials.

¹⁶ Federal Alliance for Safe Homes. (2021, February 9). *No code. No confidence.* <https://flash.org/wp-content/uploads/1/2021/10/2-9-21-Commentary-No-Code.-No-Confidence.-Final.pdf>

¹⁷ Federal Emergency Management Agency. (n.d.). *Building Code Adoption Tracking (BCAT)*. U.S. Department of Homeland Security. <https://www.fema.gov/emergency-managers/risk-management/building-science/bcat>

¹⁸ Federal Alliance for Safe Homes. (2021, February 9). *No code. No confidence.* <https://flash.org/wp-content/uploads/1/2021/10/2-9-21-Commentary-No-Code.-No-Confidence.-Final.pdf>

The growing climate risk is forcing policymakers and emergency management experts to holistically reevaluate our national mitigation approach. The adoption and enforcement of appropriate standards for the use of resilient materials and life safety methods in construction is something that is often overlooked but must be prioritized and incentivized by federal programs and policies. Like with residential construction and development, the enforcement of these standards dramatically increases the resiliency of lifeline infrastructure. Disaster impacts are far-reaching and often present themselves in unforeseen ways following an actual climate event. Encouraging the replacement of vulnerable infrastructure with infrastructure that meets higher standards will result in the avoidance of or reduction in damage, service interruptions, and reconstruction costs.

An example of this dynamic was present in the water infrastructure in Santa Rosa, California in 2017, in which residents were dealt not one, but two crushing post-disaster blows. Following the Tubbs wildfire, Santa Rosa residents were prohibited from returning to their homes to assess damage because of a new threat: sinkholes and landslides. Due to extreme heat from the blazes that destroyed more than 5,000 homes and killed 23 people, plastic storm drains running underground melted, which created the risk of collapses and slides following subsequent heavy rains. Overall, approximately thirty-one locations across Santa Rosa were identified that caused concern for sinkholes because of melted water infrastructure. This slowed recovery in several ways, such as forcing reactivation of the Emergency Operations Center, creating the need for door-to-door alerts, and the deployment of additional resources in an already constrained scenario for the community.¹⁹

In November that same year, Santa Rosa Water received a taste and odor complaint from a resident. In response, department staff took water samples and found contaminants including benzene, a volatile organic compound (VOC) never detected in Santa Rosa's water system previously. Officials conducted a thorough investigation into the cause of the contamination and determined the source present in the water distribution system as the wildfires that burned through the affected area in October. Damage from the fires included a combination of thermal degradation (i.e., melting, burning, and pyrolysis) of plastic pipes and/or entry of ash, soot, and other debris into the piping and ancillary equipment during the fire event. During a loss of water pressure, contamination was back-siphoned into water service lines, where it entered the components of the water infrastructure. Exhaustive attempts to flush these contaminants out have been unsuccessful.²⁰

Taking lessons learned from disasters like the Tubbs wildfire, governments and the private sector must incentivize actions that improve the resilience of new construction, particularly through the adoption of codes and standards, as well as encouraging the identification and implementation of disaster-resistant techniques for retrofitting aged

¹⁹ Enclade, Natalie. (2023, July 21). *USA: Lessons learned from the Tubbs wildfire disaster can help build more climate-resilient infrastructure*. <https://www.preventionweb.net/news/lessons-learned-tubbs-wildfire-disaster-can-help-build-more-climate-resilient-infrastructure>

²⁰ City of Santa Rosa. (2018, March 22). *Post-fire water quality investigation: Analysis of cause of water contamination* [Technical memorandum]. Santa Rosa Water. <https://www.srcity.org/DocumentCenter/View/19837/Post-Fire-Water-Quality-Investigation-Analysis-of-Cause-of-Water-Contamination>

structures. Resilient materials can absorb a shock and still return to their original state, meaning the material remaining in the elastic region of the stress-strain curve. However, for materials to remain resistant to shocks, they must be installed correctly and to technical specifications. It is unclear if the materials used prior to the Tubbs fire in Santa Rosa were installed using these criteria. As we invest tax dollars into rebuilding, Congress and federal programs should require awardees to provide evidence and verify that installation of the products have been done so in accordance with proper standards and in a resilient manner.

Public Awareness and Education

A culture of preparedness is built upon the shared acknowledgment that future disasters are inevitable, and every individual bears the responsibility to prepare themselves and respond effectively to such incidents. The advantages of fostering a preparedness culture are evident: mitigating the human impact of disasters, enhancing the efficiency of emergency response professionals, and expediting recovery efforts. The crucial question is not whether a preparedness culture is necessary but rather how we can instill such a culture.

The cornerstone for establishing a culture of preparedness lies in the presence of a tangible and universally recognized threat. However, the United States currently lacks a cohesive perception of risk. Given the nation's geographical and industrial diversity, citizens in different regions face distinct natural and man-made hazards. While the southwest contends with destructive wildfires, the mid-west plains confront tornadoes and floods, and residents of New York City may prioritize terrorism as their primary safety concern. This diversity of threats complicates the task of fostering a universal perception of risk essential for a culture of preparedness. Moreover, a significant portion of the U.S. population has never personally encountered a significant natural or man-made disaster, making preparedness planning less of a priority for them.

Recent events have underscored the absence of a sense of individual responsibility among Americans, a critical element for cultivating a genuine culture of preparedness. Fifty-eight percent of the United States population does not believe that they will be affected by a disaster. This is concerning given 100% of the U.S. population was recently affected by a global pandemic. Resilience education and communication are essential components of personal, community, and societal well-being, fostering adaptability, and the ability to thrive in the face of challenges. Resilience education fosters a sense of community and connectedness. When individuals within a community are educated about resilience, they can support each other during challenging times, ultimately strengthening the overall fabric of the community.

Collaborative Research and Development

Social behavior research plays a pivotal role in understanding how individuals and communities navigate and cope with challenges. There is a research gap in what drives individuals and communities to take resilience, mitigation, or other preparedness information and put it into action. By delving into the intricate dynamics of social

behavior, researchers can gain insight into what motivates an individual or a community to move from awareness to action. This research not only deepens our comprehension of the interplay between social factors and resilience but also informs the development of targeted interventions and strategies to strengthen resilience on the individual and community level. Ultimately, the importance of social behavior research in resilience lies in its potential to guide the creation of policies and practices that foster supportive environments, empowering individuals and communities to drive down disaster costs by implementing the mitigation strategies they know.

Empower Data and Artificial Intelligence

In recent years, due to an increasing number of extreme hazards and events, the urgent need to use artificial intelligence (AI) in disaster management has emerged. Data and AI are extensively used in forecasting and preparing for disasters, for mitigating and minimizing damage, and in the response phase to effectively help in better and more rapid responses to disasters. Policymakers should seek to identify the uses of AI technologies in reducing the impact of various disasters and investigate the possibility of linking these technologies based on information and communication technology and reducing the effects of disasters.

AI with a focus on machine learning is increasingly assuming a vital role in disaster risk reduction. It encompasses various aspects such as predicting extreme events, developing hazard maps, real-time event detection, providing situational awareness, facilitating decision support, and more. Increased resources spur technological innovation and research in the development of more advanced and effective mitigation strategies. From early warning systems to sustainable building materials, ongoing research fueled by sufficient resources leads to continuous improvement in mitigating the impacts of diverse hazards.

Barriers to a Comprehensive National Resilience Strategy

Despite clear evidence of the benefits of resilience investments, several persistent barriers undermine the development and implementation of a truly comprehensive national resilience strategy. These barriers span governance, economic, social, and infrastructure domains, and their cumulative effect leaves the nation vulnerable to escalating risks from natural hazards, extreme weather, lifeline infrastructure failures, and other disruptive events.

Fragmented Governance and Capacity Constraints

A major barrier is the fragmentation of responsibilities across federal, state, local, tribal, and territorial governments. This leads to inconsistent adoption of mitigation measures, such as modern building codes, and uneven enforcement of standards. Many local governments, especially in small or rural communities, lack the staff, expertise, and resources to proactively plan, apply for funding, or implement resilience initiatives, even

when federal funds are available.²¹ Budgetary structures and political incentives often prioritize short-term recovery over long-term mitigation, perpetuating a costly cycle of destruction and rebuilding. Furthermore, limited incentives for private sector participation and burdensome administrative requirements hinder broader engagement in resilience-building activities. This fragmentation results in a patchwork of preparedness levels, leaving gaps in the nation's overall resilience.

Aging and Vulnerable Infrastructure

Much of the nation's critical infrastructure, including water, energy, and transportation systems, is aging and not built to withstand modern hazards.²² Upgrading or replacing this infrastructure is often delayed until after catastrophic failure, such as those we see in the aftermath of major disasters. The lack of incentives and oversight to ensure resilient materials and proper installation further compounds the problem, increasing recovery times and costs.²³

Lack of a Unified Culture of Preparedness and Public Awareness

There is no cohesive national perception of risk, due in part to the geographic and hazard diversity across the United States.²⁴ Many Americans underestimate their vulnerability, and a significant portion of the population believes they have never experienced a major disaster, reducing motivation to prepare. This lack of awareness and individual responsibility weakens community preparedness and ultimately slows recovery.

Gaps in Data, Research, and Technological Integration

Capacity constraints also extend to data collection, analysis, and the integration of new technologies such as artificial intelligence for disaster prediction and management. Many communities lack the tools and expertise to leverage data-driven approaches, and there is a research gap in understanding how to motivate communities to act on resilience information.²⁵ Without robust data and research, it is difficult to design targeted, effective interventions.

²¹ Pew Charitable Trusts. (2023, January 31). *5 disaster resilience challenges facing state and federal officials*. <https://www.pewtrusts.org/en/research-and-analysis/articles/2023/01/31/5-disaster-resilience-challenges-facing-state-and-federal-officials>

²² American Society of Civil Engineers. (2025). *2025 Report Card for America's Infrastructure: State-by-state infrastructure*. <https://infrastructurereportcard.org/state-by-state-infrastructure/>

²³ City of Santa Rosa. (2018, March 22). *Post-fire water quality investigation: Analysis of cause of water contamination* [Technical memorandum]. Santa Rosa Water. <https://www.srcity.org/DocumentCenter/View/19837/Post-Fire-Water-Quality-Investigation-Analysis-of-Cause-of-Water-Contamination>

²⁴ Federal Emergency Management Agency. (n.d.). National Household Survey on Disaster Preparedness. FEMA OpenFEMA. Retrieved April 25, 2025, from <https://www.fema.gov/about/openfema/data-sets/national-household-survey>

²⁵ Pew Charitable Trusts. (2023, January 31). *5 disaster resilience challenges facing state and federal officials*. <https://www.pewtrusts.org/en/research-and-analysis/articles/2023/01/31/5-disaster-resilience-challenges-facing-state-and-federal-officials>

Recommendations for Policymakers

To overcome these barriers and advance a comprehensive national resilience strategy, policymakers at all levels of government should consider the following actions:

I. Foster Cross-Government Coordination and Capacity Building

- ▶ Establish mechanisms for stronger federal-state-local coordination, including technical assistance and streamlined funding applications, to ensure all communities, especially the most vulnerable, can participate in resilience initiatives.
- ▶ Invest in capacity-building programs to enhance local expertise in planning, data analysis, and project implementation.

II. Prioritize and Incentivize Pre-Disaster Mitigation

- ▶ Reform budgetary practices to prioritize mitigation investments, recognizing their long-term cost savings and societal benefits.
- ▶ Create targeted tax incentives, grants, and public-private partnerships to encourage both individual and business investments in resilience, including retrofitting homes and hardening infrastructure with resilient materials.

III. Standardize and Enforce Modern Building Codes Nationwide

- ▶ Incentivize the nationwide adoption and rigorous enforcement of up-to-date, hazard-specific building codes by conditioning post-disaster federal funding on compliance.
- ▶ Provide resources for code enforcement and public education campaigns to increase awareness of the benefits of resilient construction.

IV. Modernize Critical Infrastructure with Resilient Materials and Practices

- ▶ Direct federal and state investments toward upgrading aging infrastructure using resilient, American-made materials and technologies.
- ▶ Require verification of proper installation and compliance with resilience standards as a condition of federal funding.

V. Build a National Culture of Preparedness

- ▶ Support sustained public education campaigns to increase risk awareness and promote individual responsibility for preparedness.
- ▶ Integrate resilience education into schools and community programs to foster a culture of preparedness from an early age.

VI. Invest in Research, Data, and Technology Integration

- ▶ Expand funding for research on social behavior, risk communication, and the use of AI and data analytics in disaster management.

- ▶ Develop national data-sharing platforms and technical support networks to enable local governments to leverage advanced technologies for risk assessment and mitigation.

By addressing these barriers with coordinated, sustained action, policymakers can move the nation closer to a comprehensive, equitable, and effective resilience strategy that protects all communities and ensures the nation's ability to withstand and recover from future shocks.

