Resilient Housing

A Report for Latin America and the Caribbean

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ABSTRACT

A resilient home is understood as infrastructure designed to withstand, recover from, and adapt to conditions such as climate change and natural disasters. This type of construction protects people's lives and material belongings. This article outlines the conceptual elements that connect resilient housing with benefits for people's health, education, and economic development. It also presents how investing in these solutions reduces recovery costs. Finally, it lists a series of strategies for implementing the concept of resilient housing in programs, activities, or advocacy efforts.

Keywords: resilience, resilient housing, health, education, economic development.

RESUMEN

Se considera vivienda resiliente a la infraestructura diseñada para resistir, recuperarse y adaptarse ante la incidencia de condiciones como el cambio climático y los desastres naturales. Esta edificación protege la vida y los bienes materiales de las personas. Este artículo expone los elementos conceptuales que conectan la vivienda resiliente con beneficios a la salud, la educación y el desarrollo económico de las personas. Asimismo, presenta cómo la inversión en estas soluciones reduce los gastos de recuperación. Finalmente, enumera una serie de estrategias para implementar el concepto de vivienda resiliente en programas, actividades o esfuerzos de incidencia.

Palabras clave: resiliencia, vivienda resiliente, salud, educación, desarrollo económico.

Versión en español: https://www.habitat.org/lac-es/impacto/publicaciones/informe-vivienda-resiliente

1. INTRODUCTION

This report outlines the concepts, theoretical foundations, and practical strategies for implementing resilient housing in Latin

America and the Caribbean (LAC). It draws on a literature review mainly from the past ten years. At a historical juncture marked by the convergence of the climate crisis, accelerated urbanization, and persistent structural inequality, the region ranks as the second most vulnerable on the planet. This document addresses the urgent need to transform the current housing paradigm by shifting from a reactive approach – historically focused on humanitarian response and post-disaster reconstruction – to a preventive, systemic, and comprehensive model that mainstreams resilience across urban and social development.

The document emphasizes that resilient housing is a key safeguard against disasters, helping reduce the financial strain on governments and protecting the assets of vulnerable families. It also offers recommendations for incorporating this strategy into social housing initiatives.

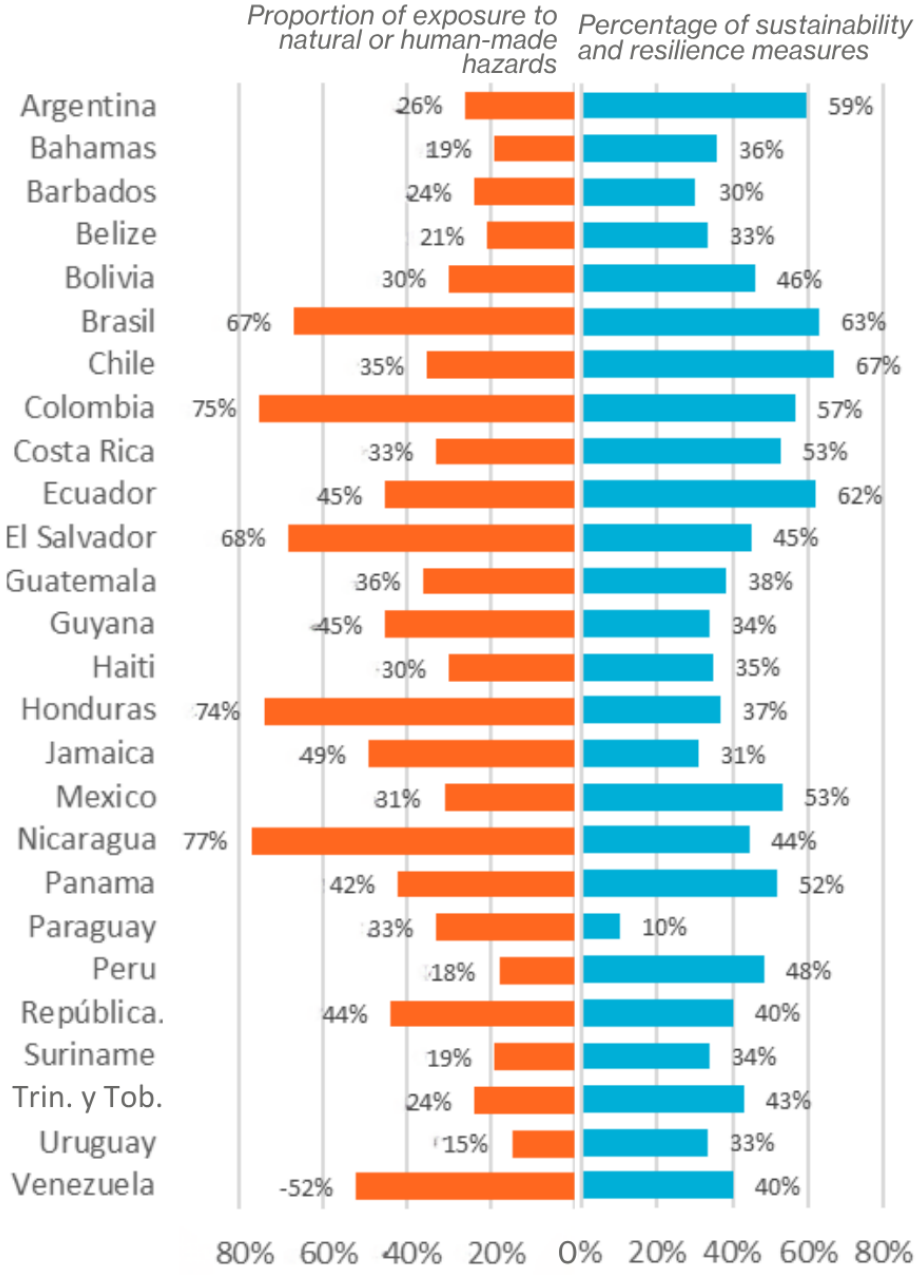
2. THE RELEVANCE OF CLIMATE CHANGE IN THE LAC REGION

LAC is the second most disaster-prone region globally, a fact that shapes its development profile (IDB, 2024). The impact is both human and economic. In human terms, more than 277 million people have been directly affected by disasters in recent decades (IPCC, 2022), while in economic terms, direct losses in 2023 amounted to US$21 billion, equivalent to 0.3% of regional GDP (UNDRR, 2025). Cities account for approximately 70% of greenhouse gas (GHG) emissions and nearly 80% of economic losses from extreme events (IDB, 2024).

The fiscal disparity is striking. Annual disaster losses in the region are three times the total yearly budget of Chile's Ministry of Housing (~6,352 million USD) and over twenty times Argentina's housing investment (~816 million USD) (Library of the National Congress of Chile, 2024; Ministry of Economy of Argentina, 2023). This evidence shows that the cost of inaction far exceeds the cost of preventive investment. Furthermore, the housing sector is the “ground zero” of this impact: in the Caribbean, as much as 46% of post-disaster economic damage results from housing destruction (IDB, 2024). This issue is worsened by the fact that 20% of the regional population resides in highly vulnerable informal settlements.

The chart on the right illustrates the hazard exposure levels of LAC countries alongside their progress in incorporating sustainability and resilience measures into building codes. An analysis of averages based on the ratio of measures included to hazard risk indicates that countries most vulnerable to hazards generally have the fewest resilience and sustainability measures in their building codes. This results in a paradox, since it would be expected that the most exposed countries are also those that have advanced the most in adopting resilience and sustainability measures.

Comparison chart showing the percentage of exposure to natural and human-made hazards, along with the proportion of sustainability and resilience measures included in building codes by country in LAC.



Source: Own elaboration based on INFORM, 2025, EU, and IDB Technical Notes No. 2854: “Resiliencia y sostenibilidad en los códigos de construcción de LAC.”

3. KEY DEFINITIONS

To operate effectively and to structure the rest of this report, it is essential to clearly distinguish and relate the key concepts that are frequently used interchangeably.

First, resilience refers to the systemic ability of households and communities to prevent, resist, absorb, adapt to, and recover from hazards effectively, all while maintaining their core functions and structure (UN, 2020). It encompasses more than just physical resistance ("not falling down"); it also includes the capacity to recover functionally.

Resilient housing units are designed to withstand, recover from, and adapt to adverse conditions resulting from climate change or natural disasters, ensuring occupant safety and protecting assets (IDB, 2022a).

In turn, there are two key components or strategies for approaching resilience. The first is climate change adaptation, which involves modifications to human or natural systems to respond to current or anticipated climate stimuli and minimize damage (UNFCCC, n.d.) – for instance, elevating a house on stilts to cope with increasing flood levels.

The second is climate change mitigation, which involves human actions to reduce greenhouse gas emissions or enhance sinks (UNDRR, 2017), such as using low-carbon materials or improving energy efficiency.

Adequate versus resilient housing?

For a housing unit to be resilient, it must first be adequate; however, not all adequate units are inherently resilient. Although related, these concepts need different strategies.

A housing unit may be adequate in peacetime but may fail during a crisis if it is not resilient.

The table on the next page compares the key characteristics of adequate housing with those of resilient housing.

Element	Adequate Housing	Resilient Housing
Secure tenure	**Legal** Property titles	**Physical** Location outside non-mitigable risk zones
Basic services	**Reliable formal access** Drinking water, sanitation, energy, etc.	**Alternative access** Ability to access water /energy when the central grid fails (e.g., rainwater harvesting)
Habitability	**Stable performance** Durability and protection under "normal" conditions or absence of crises	**Critical performance** Ability to dissipate seismic energy, withstand extreme wind loads, heatwaves, etc.
Affordability	**Reasonable access and maintenance cost** Up to 30% of household income	**Life-cycle cost** Lower post-disaster recovery costs (avoids total asset loss)
Location	**Access to opportunities, services, and infrastructure**	**Site management** Drainage, slope stabilization, etc., to mitigate environmental hazards
Accessibility	**Specific groups' needs** The elderly, people with disabilities, children, etc.	**Evacuation capacity** Clear escape routes and a design that allows the quick movement of vulnerable people during emergencies
Cultural adequacy	**Identity and ways of life**	**Vernacular architecture** Revisiting traditional techniques (e.g., stilt houses, intermediate spaces) that have historically been better adapted to the local climate than industrialized models

4. CONCEPTUAL FRAMEWORK

Resilient housing not only mitigates physical damage caused by climate hazards but also serves as a fundamental pillar of the health, education, and economic prosperity of vulnerable households and states.

4.1 Health: Biopsychosocial Protection and Well-being

First, resilient housing protects life and physical integrity by resisting collapse during events such as earthquakes and floods, thereby greatly reducing the risk of injury and death (UNDRR, 2021; World Bank, 2017). Similarly, it reduces respiratory diseases and heat stroke by using adequate materials, ventilation, and thermal insulation, which prevents exposure to polluted air and extreme temperatures. This is critical in childhood because it prevents damage to organ development that could cause chronic diseases in adulthood (Etzel et al., 2024).

Resilient housing also prevents the spread of pathogens and infectious diseases by ensuring continuous water and sanitation services. This prevents outbreaks of cholera, hepatitis A, and other diarrheal diseases, which together cause thousands of deaths during emergencies (WHO, 2019, 2023; PAHO, 2022). Besides lowering specific disease rates, resilient housing promotes long-term health by preventing families from entering a “survival mode,' where preventive healthcare is deferred in favor of reconstruction.

Research in Guatemala indicates that the impact of a disaster, such as the 1976 earthquake, can last for many decades, as evidenced by lower adult height and body mass (Hermida, 2011).

Finally, regarding mental health, resilient housing alleviates stress, anxiety, and depression by preventing homelessness and forced displacement, thus safeguarding emotional well-being and support systems (Walinski et al., 2023).

4.2 Education: Continuity and Cognitive Development

Resilient housing provides a secure environment with access to services and connectivity, supporting remote education and fundamental activities such as play and rest under proper conditions (PAHO, 2022). It also helps reduce school absenteeism and child labor by safeguarding children's educational paths from disruptions caused by housing collapse. Following Storm Stan in Guatemala, child labor increased by over 7%. Similarly, after Storm Agatha, school attendance declined by 2.2 percentage points, and child labor rose by more than 3 percentage points (Baez et al., 2017).

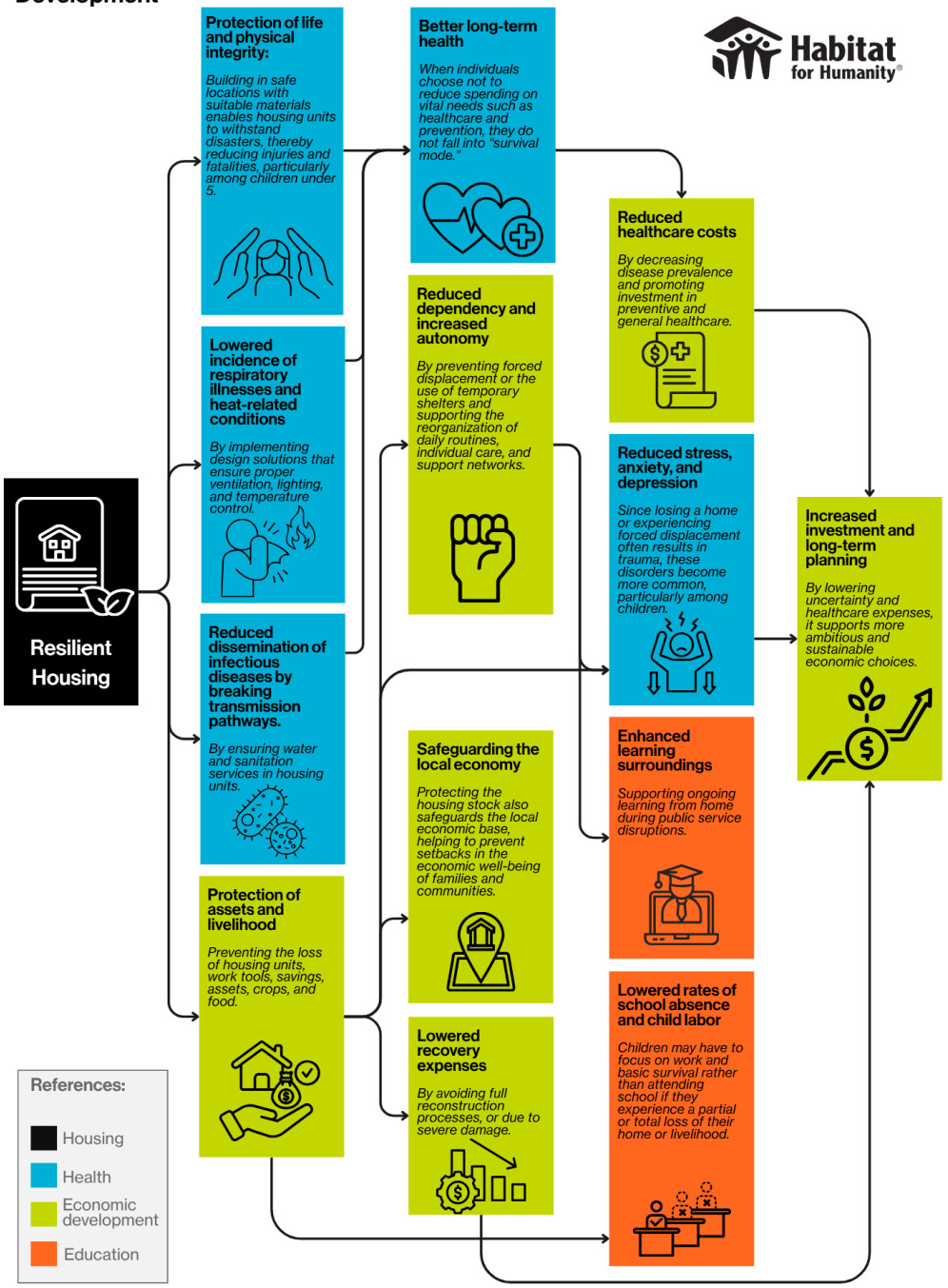
4.3 Economic Development: Asset Protection and Planning

Resilient housing reduces losses in housing units, which serve as families' main financial asset and can account for up to 90% of their savings (World Bank, 2022). Furthermore, it safeguards the home as a space for productivity and income generation. Additionally, it supports the local economy by maintaining the housing stock and avoiding overall economic decline in the community. It reduces reliance on external aid and boosts independence by preventing forced displacement to shelters and by simplifying daily restructuring and support-network upkeep.

Resilient housing contributes to lowering recovery expenses. Reinforcing a house may add 15% to 30% to the cost. However, neglecting reinforcement can result in repeated repairs that, over five years, might double the original construction expenses (Huy, 2002; Tran et al., 2012). In Puerto Rico, 65% of the roofs destroyed by Hurricane Maria were makeshift structures needing full rebuilding. Regarding cost savings, as disease prevalence drops, health costs decrease and collateral economic impacts are minimized, helping families preserve their budgets for preventive health and general care.

Ultimately, resilient housing encourages families to invest more and plan for the long term by reducing uncertainty. This shift causes families to move away from conservative economic choices, such as opting for low-risk, low-yield crops, and instead focus on investing in productive improvements and sustainable ventures (World Bank, 2017).

The Connection Between Resilient Housing and Health, Education, and Economic Development



Generally, resilient housing at the household and community levels yields two direct benefits: safeguarding health and preventing property and financial losses. These benefits subsequently enhance mental health and educational outcomes. These factors enable families and communities to access more long-term prosperity opportunities by decreasing uncertainty and lessening the impacts of stresses and shocks, whether natural or human-made. This blend of increased certainty, independence, and the potential for a gradual yet consistent buildup of health and assets supports the creation of a medium- and long-term cycle of family and community growth.

4.4 Contributions at the Public Scale: 5.

Implementing resilient housing greatly enhances the state's fiscal efficiency and supports macroeconomic stability. Investing in disaster-resilient infrastructure significantly reduces public costs for shelters and rebuilding after disasters. It is much more economical to proactively invest in “building better sooner” (World Bank, 2017, 2018, 2022; IDB, 2022). The economic impact is significant, with disaster losses exceeding USD 2.3 trillion each year globally (UNDRR, 2025). In this context, resilient housing serves as a safeguard to maintain local productivity and to prevent climate change from pushing 77 million people into poverty by 2030 (World Bank, 2016). Furthermore, adding resilience increases investment costs by just 3%, but it yields a return of US$4 for every US$1 invested, resulting in benefits of up to US$4.2 trillion in developing countries (World Bank, 2019).

Evidence indicates that insufficient resilience damages assets and results in multi-million-dollar losses from displacement and reduced productivity, such as in the Philippines in 2023, with losses reaching USD 114 million (UNDRR, 2025). Likewise, government backing for preventive structural upgrades is essential for early recovery. In places like New Orleans, sufficient investments could have reduced flood damage by 90% and shortened recovery time from 3 years to 1 year (Zavareh & Winder, 2022). This approach enables the state to help prevent humanitarian crises and lessen future burdens on social assistance programs and contingency funds (World Bank, 2017, 2022).

In the end, promoting resilient housing enables the government to strategically achieve its sustainable development objectives and fulfill its international obligations. Updating cadastral records, building codes, and territorial planning to steer clear of risk-prone areas helps the public sector support the Sendai Framework, the New Urban Agenda, and the Sustainable Development Goals, especially SDG 11 and target 1.5 (UN, 2015, 2015b; UN-Habitat, 2016, 2020; World Bank, 2022).

Every dollar

spent on resilient housing saves 4 dollars in recovery costs.

This support involves raising risk awareness and subsidizing adaptation measures in existing housing, making it easier to access climate finance and participate in multilateral partnerships (UN, 2021). Under the "Build Back Better" vision, these policies not only define protection mandates but also outline a pathway for integrated governance that connects housing to climate security and fiscal stability (World Bank, 2016, 2018, 2022; IDB, 2022).

6. IMPLEMENTATION STRATEGIES

To ensure that resilient housing units can withstand, adapt to, and recover from climate hazards, a comprehensive set of strategies that cover design and construction, territorial planning, risk management, and community participation is necessary. Most of these strategies are derived from IDB recommendations and backed by technical evidence from the World Bank and recent academic research. These strategies are categorized into four interconnected dimensions: constructive, organizational, institutional-territorial (advocacy), and financial.

6.1 Constructive Strategies

These strategies involve technical interventions in design and construction to enhance the building's physical resilience and minimize its vulnerability to climate-related hazards. They are structured around the essential elements of adequate housing units, as outlined by the UN, to support integration with current programs.

Materials and solutions should be adapted to the environment, as there is no universal standard; instead, they must be customized for each territory (IDB, 2022a). It is advisable to use local techniques with low embodied energy, such as the *Mi Abrigo* program in Peru, which employed natural fibers (ichu and cabuya), wood (eucalyptus and cane), and earth coverings to guard against frost (IDB, 2021a). In hot climates, passive solutions like cross-ventilation and white paint are emphasized to enhance reflectivity (IDB, 2022a). In certain settings, like coastal communities in Cuba, solutions such as elevating on piles, mobile enclosures, and amphibious structures are suggested (Abreu et al., 2023). Some cost-effective measures that incorporate cultural adequacy include

- Low incremental cost: The revival of traditional construction and design techniques, such as those in the *Mi abrigo* project and in the design of portals and verandas that reflect the social dynamics of LAC, promotes natural ventilation and community living, embodying vernacular bioclimatic architecture.
- Moderate incremental cost: Use methods like bahareque or reinforced *quincha*, integrating traditional materials (cane, wood, earth) with modern connectors to enhance seismic and thermal performance. It is also crucial to design housing units that fit local family structures and to use certified wood or stabilized earth (BTC) to lower the carbon footprint, all while maintaining regional aesthetics.

BASIC SERVICES

- **Water and energy efficiency:** It includes rainwater harvesting and solar panels to enhance household autonomy (IDB, 2022a). Similarly, implementing green infrastructure such as rain gardens and green roofs helps regulate temperatures and prevent flooding, as demonstrated in the San Salvador Metropolitan Area (IDB, 2022b). As outlined in the guidelines for adapting social housing units (IDB, 2023), these measures differ in their economic and environmental effects.

  - Low incremental cost: Cross-ventilation is achieved through manual windows, complemented by solar protection (e.g., eaves or louvers), LED lighting, and eco-friendly materials.

- Average incremental cost: Reflectance combined with thermal insulation, water efficiency measures (such as water-saving faucets and rainwater harvesting), and the use of structural reinforcement anchors. Alongside reducing emissions via solar heaters and bioclimatic design (IDB, 2013), these measures improve comfort and housing health while reducing operating expenses (IDB, 2022d).

LOCATION AND ACCESSIBILITY

2. **Site management, location planning, and accessible pathways:** These measures enhance the safety of the housing unit, even when urban regulations are lacking or under review, by focusing on physical changes to the immediate surroundings. They are also categorized into low and medium-cost groups:

   - Low incremental cost: Runoff control involves building perimeter infiltration trenches and constructing slopes of 2% to 5% to divert water away from the foundation (IFRC, 2020) and keep roads near the housing unit dry. Additionally, deep-rooted plants like vetiver help stabilize soil on slopes and prevent surface erosion that could threaten structures or access points (UN-Habitat, 2018).

   - Average incremental cost: Building platforms or piles to elevate the house at least 30 cm above the site's historical flood level (Habitat for Humanity, 2021). Implement soil containment using small gravity walls or gabions equipped with "weeps" (drains) to reduce water pressure and prevent landslides on sloped ground (IFRC, 2020). Also, make sure to install access ramps with proper pedestrian slopes and non-slip surfaces.

6.2 Organizational and Community Management Strategies

This dimension covers maintenance, monitoring, and protective systems that enhance residents' ability to respond. Developing preventive maintenance plans with social support for families is crucial for identifying and addressing vulnerable components, such as gutters or leaks, before extreme events occur (IDB, 2022a). This support not only guarantees the project's sustainability but also enhances the community's organizational capacity (IDB, 2021b). Additionally, early warning systems should utilize sirens, radios, or cell phones to deliver prompt alerts (IDB, 2022a). An effective system depends on the participation of local governments and residents (IDB, 2022c), as well as on well-defined evacuation procedures and participatory drills.

To cope with complete or partial household losses, it is advised to adopt financial protection schemes (IDB, 2022a). This gap due to informality can be bridged using microinsurance, community funds, or public asset protection programs (World Bank, 2022). Community training is essential for incorporating local understanding of safe zones and evacuation routes (IDB, 2022a; IDB, 2021b). The most effective programs include awareness and education initiatives, facilitating successful improvements, and enhancing disaster preparedness (World Bank, 2022).

5.3 Institutional and Territorial Strategies (advocacy)

1. Land-use plans: It is recommended that they align with climate risk scenarios to prevent new development in flood-prone zones (IDB, 2022).
2. Diagnostics and evidence generation: Evaluating a household's disaster risk in its geographic area through qualitative or quantitative approaches to understand the risk's nature and magnitude. This involves examining potential hazards and evaluating current exposure and vulnerability that could harm people, property, services, livelihoods, and the environment (UNDDR, 2017: 15). Creating a disaster risk assessment facilitates informed decision-making, which helps in reducing risk scenarios. By using georeferenced platforms, governments can pinpoint the most vulnerable housing units, enabling them to develop targeted subsidy and relocation strategies (World Bank, 2022). Investment should also focus on disaster risk and climate change research that examines natural hazards and population vulnerability (IDB, 2019a). The application of modern methods – like drones, satellite imagery, and machine learning – is recommended for precise estimation of dwelling exposure (World Bank, 2022). These early diagnoses enable the assessment, through technical evidence, of whether a house needs reinforcement or relocation, ensuring that mitigation resources are allocated effectively.

3. Building regulations: Updated building codes and energy-efficiency labels (IDB, 2022a). To reduce vulnerability in self-built housing, it is recommended to link compliance with technical standards to financing, improvements, and technical assistance programs (World Bank, 2022).

6.3 Financing Strategies

Implementing resilient housing involves securing targeted funding to integrate adaptation standards into new constructions and upgrade existing buildings. Several multilateral agencies have established mechanisms to mobilize resources for these types of projects, particularly in vulnerable urban environments.

This section categorizes the main financing mechanisms identified by the IDB (2022a) and the World Bank (2016), dividing them into two groups according to the IDB's classification: (1) climate finance funds and (2) innovative financial instruments. A brief explanation of certain World Bank instruments used to implement these mechanisms at the national or local level is also provided.

Climate Finance Funds

As defined by the United Nations Framework Convention on Climate Change, climate finance includes public, private, or alternative resources at the local, national, or international levels that fund efforts to adapt to and mitigate climate change (IDB, 2022a). As stated by the IDB (2022a), the main climate finance funds include:

- Green Climate Fund
- Special Climate Change Fund of the Global Environment Facility (GEF Global Environment Facility)
- Bilateral and multilateral funds from the IDB Group and the World Bank include climate credit lines, direct subsidies, technical assistance, and co-financing for public or public-private projects. For the World Bank, these funds are provided via three different modalities.
    - Investment Project Financing (IPF): Loans designated for particular projects with specified eligible costs.
    - Development Policy Loans (DPLs): Financial support tied to the successful implementation of institutional reforms.
    - Program-for-Results (PforR): Payments are made only when there is verifiable compliance with targets set by the country.

Innovative Financial Instruments

Along with climate funds, the IDB (2022a) highlights various financial instruments that help secure extra resources and broaden financing options. The key points for resilient housing include the following:

Green bonds: Debt instruments issued by public or private entities, with resources designated solely for projects that have environmental or climate benefits. They can be used to construct resilient housing units, improve energy efficiency, or develop sustainable urban infrastructure.

- Debt-for-climate action swaps: Agreements where a country agrees to reduce some of its external debt in exchange for commitments to invest in mitigation or adaptation projects.
- Climate guarantees: Mechanisms that address financial, contractual, or regulatory risks of projects, thereby enabling access to commercial or private financing.
- Concessional loans: Loans provided with preferential terms – such as lower interest rates or longer repayment periods – to encourage investment in resilient housing units.
- Green mortgages: Mortgage loans offered with favorable terms for purchasing or upgrading homes that meet sustainability and resilience standards.

7. Conclusions

Climate change requires us to remain vigilant and to promote resilient housing as a containment measure. A resilient housing unit is a structure designed to withstand adverse conditions, such as climate change and natural disasters, safeguarding lives and property while supporting recovery and adaptation. While adequate housing provides a foundation for well-being, transitioning to resilient housing enhances the ability to withstand the hazards faced by populations in Latin America and the Caribbean.

Resilient housing plays a crucial role in health, education, and economic growth by offering advantages like lowering illness and heat stress, safeguarding assets and livelihoods, promoting school attendance, and alleviating stress. Furthermore, savings in recovery costs contribute to social benefits.

To incorporate resilient housing into housing programs, construction strategies focus on aspects like habitability, cultural relevance, basic services, location, and accessibility. Similarly, organizational and communication management, along with institutional, territorial, and financial strategies, are considered.

At Habitat for Humanity, we advocate for resilient housing as part of climate change and disaster response efforts because ensuring people's safety starts with a secure home.

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