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Urban Climate Resilience and the Law: **Comparative Lessons from Water, Transport,** **and Housing Sectors Across Twelve Countries**

**Brazil, Canada, Chile, Colombia, Denmark, Dominican Republic, Greece,
Kenya, Paraguay, Peru, Philippines and Spain**



Urban Climate Resilience and the Law: Comparative Lessons from Water, Transport, and Housing Sectors Across Twelve Countries: Brazil, Canada, Chile, Colombia, Denmark, Dominican Republic, Greece, Kenya, Paraguay, Peru, Philippines and Spain

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List of Abbreviations

ANA	National Water and Sanitation Agency (Brazil)
DAPSAN	Directorate of Drinking Water and Sanitation (Paraguay)
INTP	Integrated National Transport Policy (Kenya)
MERESE	Mechanisms of Remuneration for Ecosystem Services Law (Peru)
MIDEPLAN	Ministry of National Planning and Economic Policy (Costa Rica)
MRT	Ministry of Roads and Transport (Kenya)
MTC	Ministry of Transport and Communication (Peru)
MVCS	Ministerio de Vivienda, Construcción y Saneamiento (Peru)
NBC	National Building Code (Kenya)
NDC	Nationally Determined Contributions
NTAI	Northern Transportation Adaptation Initiative (Canada)
PDP	Philippines Development Plan
PERTE	Proyectos Estratégicos para la Recuperación y Transformación Económica (Spain)
PNACC	National Adaptation Plan/ Plan Nacional de Adaptación al Cambio Climático (Costa Rica)
PNVU	National Housing and Urban Planning Policy (Peru)
PPPs	Public Private Partnerships
TARA	Transportation Assets Risk Assessment Initiative (Canada)
TARI	Transportation Adaptation and Resilience Initiatives (Canada)
WRMO	Water Resources Management Office (Philippines)

1. Introduction

1.1. Background

To support Costa Rica in developing an effective adaptation construction code, with a particular focus on housing, water and sanitation systems, and road transport infrastructure, UN-Habitat and Fordham University, USA, have prepared this report, which documents relevant and inspiring legal models adapted to the country's legislative, socio-economic, cultural, and institutional context.¹

In Costa Rica, the impacts of climate change, including rising temperatures, increased rainfall, more frequent and extreme weather events, and rising sea levels, will affect all types of infrastructure, from water and sanitation to transportation, roads, and housing. Enhanced efforts to prepare Costa Rica's critical infrastructure for the impacts of climate change can substantially reduce future losses, benefit public health, safety, quality of life, and prosperity.

Infrastructure and climate resilience are deeply connected. Climate change presents both direct risks (for example, a reservoir running dry due to prolonged droughts) and indirect risks (for example, a power plant unable to transmit power because the power transmission lines stopped working). Infrastructure can also amplify climate-related hazards. Heavy rains, for instance, can overwhelm wastewater systems and worsen

urban flooding, while infrastructure in vulnerable areas can heighten exposure to landslides and coastal erosion. Furthermore, a changing climate creates new infrastructure demands, including the need to upgrade water treatment systems and retrofit housing to withstand intensifying storms.

These dynamics underscore the urgent need to adopt climate resilience as standard practice in infrastructure planning and management. Climate-resilient systems must both withstand the impacts of extreme climate events and recover quickly after disruptions. In practice, this means designing, constructing, and operating infrastructure to anticipate, prepare for, and respond to hazardous events or trends. Aging infrastructure may need to be replaced or modified to meet current needs, while existing systems may require new operational strategies to ensure optimal performance throughout their lifespan.

Incorporating climate resilience throughout the infrastructure life cycle requires coordination and collaboration across all levels of government. Such government action must include measures to assess how climate change will create new or alter existing climate-related risks to infrastructure assets, as well as steps to incorporate these findings into planning and

¹ The project is titled *"Increased resilience of urban development and infrastructure in Costa Rica through the development of an adaptation construction code."*

decision-making. This report analyses legal and policy frameworks for climate-resilient infrastructure through twelve country case studies, identifying emerging inspiring practices relevant

to Costa Rica's efforts to develop infrastructure that is resilient to future climatic challenges. Below are some key comparative findings.

1.1.1. Comparative Findings

A. Climate Resilience Is Increasingly Being Mainstreamed into Core Sectoral Laws Rather than Treated as a Standalone Environmental Issue



Perhaps the strongest overarching finding is that the most innovative jurisdictions no longer address climate resilience through isolated sectoral interventions. Instead, they recognize the interdependence of housing, infrastructure, mobility, water security, ecosystem management, and social inclusion, embedding climate resilience into the core legal frameworks that govern these sectors rather than confining it to standalone environmental or climate policy instruments. This shift moves beyond broad national commitments by translating climate adaptation and mitigation objectives into concrete, enforceable requirements within the laws governing water, sanitation, transportation, infrastructure, housing, land use, and construction. Kenya's National Building Code, Chile's Water Code reforms, Canada's National Adaptation Strategy, and Brazil's climate-responsive housing and transport regulations all illustrate this trend. Comparative evidence suggests that the most effective reforms adopt integrated legal and governance frameworks that align land-use planning, resilient infrastructure, environmental protection, housing policy, and social equity objectives, embedding climate resilience into the everyday rules shaping planning, investment, permitting, and service delivery and thereby transforming national climate goals into operational practice.

B. Risk-Based Planning Is Emerging as a Central Regulatory Principle



A second prominent finding is the transition from reactive disaster response towards proactive and anticipatory risk management. Across the jurisdictions reviewed, legal and policy frameworks increasingly require climate risk assessments, vulnerability mapping, hazard forecasting, and the integration of future climate projections into planning, infrastructure design, and investment decisions. This shift reflects a growing recognition that resilience is most effectively achieved by anticipating and reducing risks before disasters occur, rather than focusing solely on post-disaster recovery.

Examples include climate-proofing requirements and climate risk assessments for transport infrastructure in Kenya and Colombia, strategic basin-level water planning in Chile, flood and landslide risk assessments for transport concessions in Brazil, and mandatory regional adaptation planning in Greece and Denmark. Collectively, these approaches demonstrate an emerging regulatory paradigm in which climate risk considerations are becoming a routine and mandatory component of infrastructure governance and development planning.

C. Water Security Has Become a National Resilience Priority

Water security emerged as one of the most consistent and pressing climate resilience priorities across the case studies. Nearly all jurisdictions examined recognize that increasing climate variability, manifested through more frequent droughts, floods, changing precipitation patterns, and growing water stress, poses significant risks to public health, economic productivity, ecosystem integrity, and urban development. In response, countries such as Peru and Spain are undertaking legal and policy reforms that strengthen water conservation, promote water reuse and recycling, protect watersheds and catchment areas, expand strategic storage infrastructure, improve digital monitoring and data systems, and advance integrated water resource management approaches. Examples from Chile, Canada, Kenya, Greece, Brazil, and Paraguay demonstrate a clear shift towards more adaptive and resilient water governance frameworks designed to safeguard long-term water security under increasingly uncertain climatic conditions. The comparative analysis suggests that resilient water management is becoming a foundational pillar of broader climate adaptation strategies and a prerequisite for sustainable urban and economic development.



D. Building Codes Are Becoming a Critical Vehicle for Climate Adaptation

The growing use of building regulations as a key instrument for climate adaptation and resilience, emerged as a key trend. Recognizing that buildings and housing stock are increasingly exposed to climate-related hazards, including floods, heatwaves, storms, droughts, and wildfires, many jurisdictions have updated their regulatory frameworks to improve the resilience and sustainability of the built environment. Examples include Kenya's 2024 National Building Code, Canada's climate-responsive building code reforms, Greece's energy performance and climate adaptation standards, and Brazil's climate-resilient housing requirements. These frameworks increasingly incorporate provisions on energy efficiency, passive cooling and ventilation, water conservation, resilient construction materials, renewable energy integration, and



hazard-responsive design standards. The comparative analysis highlights the growing recognition that building codes represent one of the most effective and scalable legal tools for reducing climate vulnerability, lowering emissions, and ensuring that new development is better prepared for future climate conditions.

E. Climate Resilience and Social Equity are Increasingly Being Addressed Together



Climate resilience and social inclusion are deeply interconnected. Several countries explicitly acknowledge that the impacts of climate change are not experienced equally and that low-income households, residents of informal settlements, Indigenous communities, migrants, and other marginalized groups often face disproportionate exposure to climate risks while possessing the fewest resources to adapt and recover. As a result, climate resilience measures are increasingly being designed to advance broader social equity objectives. Examples include Canada's investments in climate-resilient water infrastructure for Indigenous communities, Colombia's differential water service schemes and migrant housing programmes, the Dominican Republic's informal settlement upgrading initiatives, and Brazil's climate-resilient social housing programmes. These approaches demonstrate an emerging shift towards people-centred resilience frameworks that prioritize vulnerable populations and seek to ensure that climate adaptation efforts contribute to more equitable, inclusive, and socially just development outcomes.

F. Governments are Moving from Grey Infrastructure to Integrated Nature-Based Solutions



One of the key findings is the growing integration of nature-based solutions and ecosystem-based approaches into climate resilience frameworks. Rather than relying exclusively on traditional grey infrastructure, many countries are increasingly recognizing the role of healthy ecosystems in reducing climate risks, enhancing environmental sustainability, and improving the resilience of urban and rural communities. This shift is reflected in legal and policy measures such as Brazil's riparian buffer protection requirements, Denmark's blue-green infrastructure systems, Paraguay's biodiversity-linked sanitation investments, and Kenya's Payment for Ecosystem Services mechanisms. These approaches demonstrate a growing understanding that ecosystems are not merely environmental assets but critical infrastructure that can provide flood regulation, water purification, biodiversity conservation, carbon sequestration, and climate

adaptation benefits. The comparative analysis suggests that integrating ecosystem-based solutions into planning, infrastructure, and resource management frameworks can deliver more sustainable, cost-effective, and multifunctional resilience outcomes than traditional infrastructure approaches alone.

G. Strong Institutions and Multi-Level Governance are Essential for Implementation



Effective climate resilience depends not only on the quality of legal and policy frameworks, but also on the strength of the institutions responsible for implementing them. The most successful jurisdictions are characterized by dedicated institutions, clearly defined mandates, and robust coordination mechanisms across sectors and levels of government. Examples include Philippines Local Climate Change Action Plans, Canada's Water Agency, Chile's strengthened National Water Agency, and Denmark's municipal adaptation planning framework, which provide institutional structures for coordinating climate action, resource management, planning, and implementation. The comparative analysis highlights that legislative reforms are most effective when supported by capable institutions with adequate technical capacity, sustainable financing, and clearly delineated responsibilities. As climate risks increasingly cut across administrative and sectoral boundaries, strong governance arrangements and multi-level coordination emerged as critical enablers of effective and sustained climate resilience outcomes.

H. Financial and Regulatory Incentives are Key for Climate Resilience



A notable cross-cutting trend is the growing use of financial, regulatory, and market-based incentives to complement traditional command-and-control regulations. Rather than relying solely on mandatory standards, many jurisdictions are creating enabling frameworks that encourage public and private investment in climate-resilient infrastructure, housing, and transportation. These include green building certification schemes, resilience-linked housing subsidies, climate-responsive public procurement and concession models, public-private partnership frameworks, and dedicated climate adaptation funds. The experience across countries suggests that combining regulatory requirements with targeted incentives can accelerate implementation, mobilize additional financing, and improve the uptake of resilience measures across sectors.

I. Data, Monitoring, and Digitalization are Becoming Core Components of Climate Governance



A further trend is the growing reliance on digital technologies, geospatial information systems, monitoring platforms, and data-driven decision-making to strengthen implementation, transparency, and accountability. Countries are increasingly embedding digital tools within legal and institutional frameworks to support climate risk assessment, resource management, infrastructure planning, and performance monitoring. Examples include Kenya's centralized water monitoring database, Chile's georeferenced water governance systems, Paraguay's Climate Transparency Platform, and the Dominican Republic's flood-risk geoportal. These initiatives demonstrate that effective climate governance increasingly depends not only on robust legal frameworks, but also on timely, accurate, and accessible data that can inform planning decisions, improve coordination across institutions, support early warning systems, and enable public oversight of resilience and adaptation efforts.

Conclusion

The comparative analysis demonstrates a global shift from sector-specific climate responses toward integrated urban resilience frameworks that combine legal reform, institutional coordination, infrastructure investment, social

inclusion, and ecosystem protection. These integrated approaches appear to offer the strongest foundation for climate-resilient urban development in the coming decades.

1.2. Costa Rica Country Profile



Name
Republic of Costa Rica



Region
Central America



Borders
Nicaragua (north), Panama (south), Caribbean Sea (east), North Pacific Ocean (west)



Population
5.2 million (2024)



Land Area
51,100 km²



Capital
San José (largest city; ~20% of population)



Administrative Structure
Three-tier system

7 Provinces: San José, Alajuela, Cartago, Heredia, Guanacaste, Puntarenas, Limón

81 Cantons

470 Districts

Urbanization

80% of population lives in urban areas

Greater Metropolitan Area (GAM):

Population: **3.1 million**

4 metropolitan areas: San José, Alajuela, Cartago, Heredia



GDP per capita (2026)
USD 34,160 (2nd highest in Central America)



Pre-COVID growth
4.3% annually (1990–2019)

Climate Change Risks



Temperature rise:
+0.2–0.3°C per decade since 1970



Increasing hazards
droughts, floods, extreme precipitation

Exposure

77.9% of population in high-risk areas

80.1% of GDP in high-risk zones



The Republic of Costa Rica (“Costa Rica”) is an upper-middle-income country located in Central America. Costa Rica borders both the Caribbean Sea and the North Pacific Ocean, between Nicaragua and Panama.

According to the United Nations, Costa Rica has an estimated population of 5.2 million people as of 2024 in a land area of approximately 51,100 square kilometres.² Costa Rica’s capital city, San Jose, is the largest in the country and home to approximately one-fifth of the population.



Geography and Administration

Costa Rica is organized into a three-tier administrative system. The country is divided into seven provinces: San José, Alajuela, Cartago, Heredia, Guanacaste, Puntarenas, and Limon. These provinces are further subdivided into eighty-one cantons, and each canton is divided into 470 districts.

Costa Rica is also the most urbanized country in Central America, with eighty per cent of the country living in urban areas.³ More than half of the country’s population (3.1 out of 5.2 million people) resides in the Greater Metropolitan Area (*Gran Área Metropolitana*), which comprises thirty-one cantons and four metropolitan areas: San José, Alajuela, Cartago, and Heredia.



Government

Costa Rica is a presidential republic. Its government is divided into three branches: *Asamblea Legislativa* (legislature), President of the Republic (executive), and the judiciary.



Economy

Costa Rica has the second highest GDP per capita in Central America as of 2026 (34.16 thousand).⁴ Costa Rica has developed a diverse economy that includes tourism, the export of agricultural products (primarily bananas, beef, pineapples, and coffee), and light manufacturing (including microprocessors and pharmaceuticals). Costa Ricans enjoy a high standard of living, with per capita income levels comparable to Uruguay, Chile, and Eastern European countries.⁵ Before the COVID-19 pandemic, Costa Rica’s GDP grew above the Latin American and Caribbean average, at an annual rate of 4.3 per cent between 1990 and 2019.⁶



Climate

Costa Rica’s climate is characterized by consistent annual patterns that vary across the country’s diverse topography. The lowland regions experience tropical and subtropical conditions, while the highlands experience notably colder

² U.N. Department of Economic and Social Affairs, UNdata, <https://data.un.org/>.

³ EBSCO, Central America, <https://www.ebsco.com/research-starters/history/central-america>.

⁴ <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>

⁵ As of 2026, Costa Rica’s GDP per capita (PPP) is approximately USD 34,160, positioning it between the regional benchmarks of Uruguay (USD 39,030) and Chile (USD 37,340) and within the broader average for Eastern Europe (USD 48,450). See IMF <https://www.imf.org/external/datamapper/profile/CRI>.

⁶ Ibid.

climates. The Pacific coast is characterized by a prolonged dry season, which generally extends from November to April, and a wet season that spans from May to November. The Caribbean side of Costa Rica does not have a well-defined dry season, as it experiences rain throughout the year. Costa Rica is also highly vulnerable to the impacts of climate change due to its geographic location between two oceans and its varied topography. As of 2018, Costa Rica ranked 82nd of 193 countries exposed to climate change risks.⁷ In recent decades, Costa Rica has experienced significant changes in temperature and precipitation patterns, as well as in land use and its degradation. Since 1970, the average temperature has increased between 0.2 °C and 0.3 °C per decade. Similarly, episodes of drought, flooding, and extreme precipitation are growing in frequency and intensity. Current estimates indicate that 77.9 per cent of Costa Rica's population and 80.1 per cent of the country's GDP reside in areas at high risk of multiple natural hazards, including floods, landslides, cyclones, storm surges, and sea level rise.⁸

1.3. Relevant Legal and Policy Frameworks in Costa Rica

Costa Rica's legal and policy architecture for climate-resilient infrastructure reflects a country that is normatively committed to sustainable development, yet operationally constrained by institutional fragmentation, technical gaps, and weak enforcement. While numerous laws and decrees address environmental protection, land

use, construction, and disaster risk management, most were not designed initially with climate change in mind. As a result, climate resilience is often implicit, underdeveloped, or non-binding within the country's infrastructure governance framework.

- » At the national level, **Law No. 5525** establishes the Ministry of National Planning and Economic Policy (MIDEPLAN) as the central authority for development planning, requiring that public investments align with national strategies. However, MIDEPLAN does not enforce climate-specific criteria in evaluating infrastructure projects. **Law No. 4240** delegates urban planning to municipalities through local land-use plans (*Planes Reguladores*), but most of these plans are outdated and rarely address climate risk, hindering local adaptation, especially in flood-prone urban areas.
- » **The Environmental Organic Law (No. 7554)** mandates environmental impact assessments (EIAs), yet omits climate resilience from its requirements, limiting its relevance for long-term infrastructure planning. Similarly, **Law No. 7762**, governing public-private infrastructure concessions, does not require climate adaptation clauses, leaving major projects exposed to climate-related hazards.
- » **Costa Rica's National Construction Code** establishes technical standards for building safety but lacks updated provisions for climate-related threats, such as flooding, heatwaves, or hydro-seismic events.

⁷ Notre Dame Global Adaptation Initiative (ND-GAIN). <https://gain.nd.edu/our-work/country-index/>

⁸ World Bank, Costa Rica, <https://www.worldbank.org/ext/en/country/costarica>.

This regulatory gap significantly limits the mainstreaming of climate resilient design. By contrast, **Law No. 8488** establishes the National Emergency Commission (CNE) to coordinate disaster response and early warning systems. While effective for emergencies, it does not focus on long-term adaptation planning.

- » **Recent policy measures aim to improve coordination. Decree No. 41122-MINAE** adopts the national adaptation policy (**PNACC** 2018–2030), and **Decree No. 41187** promotes inter-agency collaboration across environment, housing, and transport ministries. However, both remain non-binding and depend on voluntary compliance. The **INTE/ISO 14090:2020** technical standard supports climate adaptation planning but is also optional, limiting its practical influence on infrastructure design.
- » A significant milestone in Costa Rica’s policy landscape is the **National Adaptation Plan** (*Plan Nacional de Adaptación al Cambio Climático*) 2022–2026, which operationalizes the **PNACC**. The Plan identifies key vulnerabilities in infrastructure, water and sanitation, and housing, setting forth specific adaptation goals and institutional responsibilities. Yet even this forward-looking document acknowledges critical obstacles, including the lack of enforceable technical standards,

fragmented inter-agency coordination, and dependence on international climate finance for implementation. It also highlights the urgent need to build technical capacity at the municipal level, where many adaptation actions must ultimately be implemented.

Overall, these laws and policies reveal a system in transition. Costa Rica has established a robust legal framework for environmental protection and a climate change strategy. Still, the absence of binding, climate-specific requirements in its construction, planning, and investment frameworks undermines the country’s ability to deliver resilient infrastructure at scale. The current policy landscape presents both a challenge and an opportunity to translate strategic commitments into enforceable and binding legal norms and to mainstream adaptive design across the entire infrastructure lifecycle.

The following case studies will examine how selected countries use law and policy to promote climate resilience. This analysis will help Costa Rica identify legal enablers, institutional barriers, and emerging best practices that can guide national and local governments in developing a construction adaptation code. Given the diversity of legal systems, cultures, and socio-economic and political contexts, a comprehensive country selection methodology (below) has been developed to ensure that the countries chosen are sufficiently comparable to Costa Rica.

1.4. Indicators for Country Selection

The selection of countries for the case studies was based on a weighting of the following indicators:



A. Socioeconomic and institutional similarities with Costa Rica: This indicator ensures that selected countries are comparable to the institutional and socioeconomic context of Costa Rica.



B. Thematic relevance (legal and policy frameworks): This indicator guarantees that the selected countries provide inspiring examples of the thematic area, according to each parameter/topic identified.



C. Regional diversity: This indicator aims to achieve regional diversity and balance in the selection of countries. The first two indicators have more weight than the regional diversity indicator. However, based on the results from the socioeconomic and institutional indicator, the highest-scoring country from each region will be awarded an additional point to ensure regional diversity in the pre-selection. To ensure that some of the selected countries are easily comparable with Costa Rica due to their geographical proximity, an additional point was awarded to those countries in Central America.

Table 1 is a summary of what each indicator contains, while **Table 2** shows the parameters and the evaluation grid for each indicator. The minimum requirement for the selection of a country is an overall score of 5/10 and a minimum of 50 per cent in indicators A and B. This result can be interpreted as a viable and relevant case study for Costa Rica. If a country does not achieve at least 50 per cent in indicator A (2 points), it will

not be classified for assessment under indicator B. **Table 3** outlines the socioeconomic and institutional parameters, while **Table 4** presents the evaluation of these parameters. **Table 5** contains the evaluation grid for the relevance indicator, while **Table 6** outlines the assessment of countries according to thematic relevance. **Tables 7** and **8** showcase the final scores and ranking of the countries.

Table 1. Summary of indicators

Indicators	Parameters	Type of assessment	Weighting
A. Socioeconomic & institutional similarities with Costa Rica	Socioeconomic* ▪ Upper-middle-income ▪ Population : 5.37 million. ▪ Diverse economy (tourism, agricultural exports, light manufacturing) ▪ Large urban population (80 per cent) ▪ GDP: USD 95.35 billion	Qualitative	4 3 - 4/4 The country has an institutional and socioeconomic context similar to Costa Rica and is a good comparator. ----- 1.75 - 2.75/4
	Institutional Framework ▪ Form of State: Unitary ▪ Centralization of planning mandates: (national, regional/ provincial, local) *According to the IMF https://data.worldbank.org/indicator/NY.GDP.MKTP.CD		The country has an institutional and socioeconomic context that is moderately similar to Costa Rica and can be comparable. ----- 0 - 1.5/4 The country lacks sufficient elements to be comparable to Costa Rica.

B. Thematic relevance	Effective legal and policy instruments for developing climate-resilient water, housing and infrastructure frameworks based on analysis of the following substantive criteria: ▪ Objectives and content of legal and/or policy framework. ▪ Capacity of institutional stakeholders.	Qualitative	5 4 - 5/5 The country provides excellent models of legal and policy frameworks for climate-resilient water, housing and infrastructure. ----- 2 .5 - 3.5/5 The country has several good examples of legal and policy frameworks for climate-resilient water, housing and infrastructure. ----- 0 - 2/5 The country does not have good examples of legal and policy frameworks for climate-resilient water, housing and infrastructure.
C. Regional Diversity	Geographical region* ▪ Costa Rica geographic region: Latin America and Caribbean (LAC) ▪ Costa Rica geographic sub-region: Central America *According to the UN Statistics Division	Qualitative	1 Based on the results from the first two indicators above, the highest-scoring countries from each geographic subregion are awarded an additional point to ensure regional diversity in the final selection.
Total			10

Table 2. Evaluation grids for the indicators

Indicator	Results
A. Feasibility and Structural Similarity to Costa Rica	/04
B. Thematic Relevance	/05
C. Regional Diversity	/01
Total	/10

1.4.1. Socioeconomic and Institutional Parameters

Table 3. Socioeconomic and Institutional Parameters

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Geographic Region
Costa Rica	Unitary State	3 tiers (national, regional/ provincial, and local)	51,100	100.5	83	1.1	13,198.8	0.678	82.6	Latin America and Caribbean (LAC) - Central America
Brazil	Federal State	3 tiers (national, federal, sub-national/states/ federal district, and local/ municipal)	8,515,767	25.4	88	0.7	8,917.7	0.594	80.5	Latin America and Caribbean (LAC) - South America
Canada	Federal State	3 tiers (national, provincial, local/ municipal)	9,984,670	4.4	81.98	3.1	55,596.8	0.867	94	North America
Chile	Unitary State	4 tiers (national, regional, metropolitan, and local/municipal)	756,102	26.2	88.1	0.7	15,338.2	0.723	90.7	Latin America and Caribbean (LAC) - South America

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Geographic Region
Colombia	Unitary State	3 tiers - decentralized (national, regional, municipal)	1,141,748	47.1	83	1.4	6,630.3	0.593	72.8	Latin America and Caribbean (LAC) - South America
Denmark	Unitary State	3 tiers (national, regional, and local)	42,938	141	89	0.7	68,029.5	0.909	98.8	Europe - Northern Europe
Dominican Republic	Unitary State	3 tiers (national, regional/provincial, and local)	48,671	236.5	85	1.5	10,111.2	0.634	89	Latin America and Caribbean (LAC) - Caribbean
Greece	Unitary State	3 tiers - decentralized (national, regional/district, municipal/local)	131,957	76.8	81	0.2	20,923.1	0.825	83.2	Europe - Southeastern Europe

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Geographic Region
Kenya	Unitary State	2 tiers - decentralized (national and local, but mostly county governments at the local level)	591,958	97.2	30	3.7	2,099.3	0.456	40.8	Africa - East Africa
Paraguay	Unitary State	3 tiers (national, regional, and local)	406,752	17.1	63	1.8	6,153.1	0.599	76.3	Latin America and Caribbean (LAC) - South America
Peru	Unitary State	3 tiers (national, sub-national/ intermunicipal and local)	1,285,216	26.7	79	1.4	7,125.8	0.633	74.7	Latin America and Caribbean (LAC) - South America

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Geographic Region
Spain	Unitary State	3 tiers (national, regional/ provincial, and local)	506,008	95.4	82	1.3	29,771.1	0.891	94.5	Europe - Southern Europe
Philippines	Unitary State	3 tiers (national, provincial/ metropolitan, and local level)	300,000	386.1	49	1.5	3,498.5	0.590	72.3	Asia - South - East Asia

Data Sources: UNData (<https://data.un.org/default.aspx>); UNDRH IHDI Chart (https://hdr.undp.org/sites/default/files/2025_HDR/HDR25_Statistical_Annex_I-HDI_Table.pdf); World Bank DataBank (<https://databank.worldbank.org/reports.aspx?source=2&series=SP.URB.GROW&country=PHL>)

1.4.2. Evaluation of Socioeconomic and Institutional Parameters

Table 4. Evaluation of Socioeconomic and Institutional Parameters

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Final Score /17	Final Score /4 + Regional Diversity /1
	Baseline:	Highly centralized	+/-	+/- 50 =2	+/- 10%	+/- 0.5%	+/-	+/- 0.1= 2	75%-90%		
	Unitary	(1 tier)=0	100,000	+/- 100=1	=2	=2	5,000 =	+/- 0.2 = 1	= 2		
	Unitary= 1 Other=0	Centralized with some degree of autonomy, or decentralized but with control by central government (2 tiers)= 1	km ² =2 +/- 500,000 km ² =1 Other = 0	Other = 0	+/- 20% =1 Other = 0	+/- 1% = 1 Other = 0	2 +/- 10,000 = 1 Other = 0	Other = 0	60-75% or 90-95% = 1 0 = <60% or >95%		
		Highly									
		decentralized									
		(3 tiers)= 2									
		(4 tiers)= 1									
Costa Rica	Unitary State	3 tiers	51,100	100.5	83	1.1	13,198.8	0.678	82.6		

Country	Form of State	Centralization of planning mandates	Surface (km ²)	Population density (people per km ² of land area, 2024)	Urban population (% of total pop., 2024)	Urban population growth (annual %, 2024)	GDP per capita (current US\$, 2024)	Inequality-Adjusted Human Development Index (IHDI) (2023)	Individuals using the Internet (% of total pop., 2024)	Final Score /17	Final Score /4 + Regional Diversity /1
Brazil	0	2	0	0	2	2	2	1	2	11	3+1= 4
Canada	0	2	0	0	2	0	0	0	1	5	1
Chile	1	1	1	0	2	2	2	2	2	13	3+1 = 4
Colombia	1	2	0	1	2	2	1	1	1	11	3+1 = 4
Denmark	1	2	2	2	2	2	0	0	0	11	3
Dominican Republic	1	2	2	0	2	1	2	1	2	13	3+1 = 4
Greece	1	2	1	2	2	1	1	1	2	13	3
Kenya	1	1	1	2	0	0	0	0	0	5	1
Paraguay	1	2	1	0	1	1	1	1	2	10	2.5 + 1 = 3.5
Peru	1	2	0	0	2	2	1	1	1	10	2.5+1 = 3.5
Spain	1	2	1	2	2	2	1	0	1	12	3
Philippines	1	2	1	0	0	1	0	1	1	7	1.75

1.4.3. Evaluation grid for the relevance indicator

Table 5. Evaluation grid for the relevance indicator

Parameter	0	1	2	3	4
Institutional functions and capacity of relevant stakeholders	Several institutions have responsibilities in implementing the legal framework and no coordination mechanism is in place. Human and financial resources are completely inadequate to implement the legislative framework.	Several institutions have responsibilities in implementing the legal framework. Coordination mechanisms exist, but they do not work. Human and financial resources are inadequate to implement the legislative framework but could be improved in several years (+5 years) with capacity development.	Several institutions have responsibilities in implementing the legal framework. Coordination mechanisms exist but they work only occasionally. Human and financial resources are inadequate to implement the legislative framework but could be realistically improved in a few years (2–3 years) with capacity development.	Institutional roles and responsibilities in this legal sector are concentrated in one institution or in several coordinated institutions that do not always work efficiently. Human and financial resources are somewhat adequate.	The definition of the institutions in charge of executing climate resilience objectives are well defined in the legal text, as well as their roles and responsibilities. The legislation contains coordination mechanisms for the different institutions to implement climate resilience policies. This coordination can be horizontal or vertical. Human and financial resources are adequate for the successful implementation of the climate resilience legislative framework.

Parameter	0	1	2	3	4
Objectives and content of legal and/or policy framework.	There are no or very few identifiable laws, policies, or institutional mechanisms that define plans for climate resilience in infrastructure planning or development.	References to climate change or resilience appear in national strategies or sectoral plans, but objectives are vague and not linked to implementation tools or measurable outcomes.	Formal laws or policies on climate resilience have been adopted, but their scope is limited. The legislation defines the objectives as well as the content of plans. Monitoring or evaluation procedures are not clearly established.	Comprehensive legal and policy measures exist across key sectors (e.g., water, housing, transport). Climate resilience objectives are articulated clearly, supported by technical standards, risk assessments, and financing instruments. Implementation and monitoring mechanisms are defined but may still lack consistency or enforcement.	Climate resilience is fully embedded in national, regional, and local laws and policy frameworks guiding infrastructure planning and investment. Objectives are aligned with long-term development and adaptation goals (e.g., Nationally Determined Contributions, National Adaptation Plans). The framework includes clear operational guidelines, measurable targets, and mandatory climate-risk screening for all major infrastructure projects.

1.4.4. Assessment of Countries According to Relevance

Table 6. Assessment of countries according to thematic relevance

Country	Institutional Functions and Capacity of Relevant Stakeholders /4	Objectives And Content of Legal and/or Policy Framework /4	Score / 8	Score /5
Brazil	4	4	8	5
Canada	3.5	3.5	7	4
Chile	3.5	3.5	7	4
Colombia	3.5	3.5	7	4
Denmark	4	4	8	5
Dominican Republic	3.5	3.5	7	4
Greece	3.5	4	7.5	4.5
Kenya	4	4	8	5
Paraguay	3	3	6	3.8
Peru	4	4	8	5
Spain	3.5	3.5	7	4
Philippines	3	3	6	3.8

1.4.5. Final Ranking of Countries

Table 7. Final ranking of countries

Country	Score for the socio-economic and institutional parameters /4	Score for the assessment criteria /5	Final score /10 (9+1 for regional diversity)
Brazil	2.5	5	7.5
Canada	2.2	4	6.2
Chile	4	4	8
Colombia	2.5	4	6.5
Denmark	2.5	5	7.5
Dominican Republic	4	4	8
Greece	4	4.5	8.5
Kenya	2.2	5	7.2
Paraguay	2.4	3.8	6.2
Peru	2.4	5	7.4
Spain	2.8	4	6.8
Philippines	2.65	3.8	6.45

Table 8. Final ranking (highest to lowest score)

Ranking	Final Selection	
1	Greece	
2	Chile	
3	Dominican Republic	
4	Brazil	
5	Denmark	
6	Peru	
7	Kenya	
8	Colombia	
9	Philippines	
10	Spain	
11	Paraguay	
12	Canada	



2. The Country Case Studies



2.1. Brazil



Water & Sanitation

The pressure on Brazil's water resources is set to continue mounting in the coming decades, driven by climate change, rapid urbanization, expanding agriculture, and the degradation of water sources through pollution. Despite holding the largest volume of freshwater of any nation, Brazil faces growing water scarcity in several regions where supplies are compromised by untreated sewage, agricultural runoff, and inadequate distribution infrastructure.

Law No.14,026/2020 which is **Brazil's New Sanitation Legal Framework**, establishes targets for universal access to clean water (99 per cent) and sewage collection and treatment (90 per cent) by 2033 extendable to 2040. The law builds on the **National Policy on Climate Change (Law No. 12,187/2009)**, which identified adaptation in water and sanitation as a national priority, but advances these objectives through enforceable service-delivery standards. It clarified responsibilities among federal, state, and municipal authorities and positioned the National Water and Sanitation Agency (ANA) as the coordinating regulator, tasked with issuing nationwide Reference Standards that set quality benchmarks, tariff methodologies, and performance indicators for subnational regulators and service providers. ANA's most recent instrument, **Reference Standard No. 08/2024**, defines progressive milestones for monitoring water and sanitation access at the municipal and regional levels, ensuring that each jurisdiction has measurable interim targets on the path to universal service.

To receive federal funds, municipalities and their water and sanitation operators must comply with ANA standards and operate under competitively awarded concession contracts, which replaced the previous system of automatic renewals of state-run service agreements. This concession model has opened the sector to private investment through public-private partnerships (PPPs), with the government estimating that more than USD 91 (R\$ 500) billion in combined public and private investment will be needed to meet the 2033 targets. An example of the PPP framework in action is the Vitória Water Reclamation Station in Espírito Santo, the product of Brazil's first public tender for water reuse. Developed by *Águas de Reúso de Vitória*, a partnership between GS INIMA and the Espírito Santo Sanitation Company (CESAN), the facility will process 450 litres per

second of municipal wastewater from Vitória's Camburi basin using membrane bioreactor and reverse osmosis technology. By recycling 85 per cent of that wastewater into industrial-grade supply for major users such as ArcelorMittal and Vale, the project frees up freshwater resources equivalent to the needs of nearly 200,000 people, a significant step in a country where water reuse currently accounts for less than 1 per cent of total consumption.

Regarding the sanitation framework, **Law No. 12,651/2012**, known as the **New Forest Code**, establishes rules governing the protection of vegetation on private land, including mandatory riparian buffer zones along watercourses and around springs, lakes, and reservoirs. These provisions are particularly significant given that diffuse pollution from agricultural runoff, urban stormwater, and deforestation is a leading driver of water quality degradation across Brazil. Conservation buffers, especially riparian buffers, serve as natural filters that slow surface runoff, trap pollutants, stabilize soil, and control erosion. Under Brazil's Forest Code, vegetation within riparian buffer zones must be fully preserved as a no-harvest zone, and if destroyed for any reason, it must be restored using only native species. The required buffer width varies from 30 to 500 meters depending on the width of the adjacent watercourse. However, small landowners who fall under the Code's special regime are permitted to restore smaller areas proportional to their property size, regardless of the size of the water body. Under this special regime, riparian zone protection ranges from 5 to 100 meters. Compliance with the **New Forest Code** is largely regulated by the Rural Environmental Registry (*Cadastro Ambiental Rural*) and the country's Environmental Compliance Program (*Programa de Regularização Ambiental*).



Transportation & Roads

São Paulo's **Municipal Climate Law (Law 14.933/2009)**, reinforced by **Law 16.802/2018**, made the city, the first in Latin America, to set legally binding fleet-wide emission targets for public transport: a 50 per cent reduction in CO₂ emissions by 2028 and complete elimination by 2038. To reach these goals, the city banned the purchase of new diesel buses beginning in 2022, directing public procurement toward electric and hybrid vehicles. São Paulo now operates one of the region's largest e-bus fleets, supported by the municipal climate fund and partnerships with private entities.

At the state and federal level, transportation policy increasingly integrates climate-risk management. The Ministry of Transport's **2024 Green Concessions framework**, which applies to federal concessions, and the **Fourth Road Show Edition (2024)** require private highway operators to conduct flood and landslide risk assessments and invest in reinforced drainage, and slope stabilization works. Also, it requires the allocation of a share of concession revenues

to sustainability and resilience improvements. These initiatives align with the **National Traffic Code (Law 9.503/1997)**, which enshrines safe, environmentally responsible transportation as a public right, linking decarbonization, infrastructure modernization, and disaster risk reduction within Brazil's evolving mobility strategy.



Housing

São Paulo's **Municipal Climate Change Law (Law 14.933/2009)** mandates that new large-scale housing projects integrate energy efficiency, water reuse, and flood-resilience measures. These obligations are enforced through the municipal building permit process and the **Green Seal Certification Program (Selo Verde)**, which rates developments on their climate performance and resource efficiency. The city's **PlanClima SP (2020–2050)** further advances these goals by promoting cool-roof technologies, rainwater infiltration systems, reflective materials, and increased urban tree cover in residential areas to mitigate heat-island effects and extreme rainfall.

At the federal level, the **Minha Casa, Minha Vida (MCMV, "My House, My Life")** social housing program, relaunched in 2023, has begun piloting climate-resilient prototypes in flood- and landslide-prone regions, raising floor levels, reinforcing roofs, and adopting bioclimatic design suited to Brazil's diverse climates. The Ministry of Cities now conditions project financing on compliance with energy-efficiency and passive-cooling standards, aligning public housing with the **National Adaptation Plan** and the **National Policy on Climate Change (Law 12.187/2009)**. Together, São Paulo's local mandates and the federal MCMV pilot illustrate Brazil's evolving approach to climate-smart urbanization, where affordable housing policy also serves as an adaptation strategy, enhancing safety, comfort, and environmental performance for low-income communities.



2.2. Canada



Water & Sanitation

Water governance in Canada is decentralized, with provinces and territories holding primary jurisdiction over water management. Federal frameworks, however, set baseline standards and facilitate coordination across jurisdictions, and are increasingly oriented toward building long-term climate resilience.

Central to this shift is the formal establishment of the **Canada Water Agency** as a standalone entity on October 15, 2024. Pursuant to the **Canada Water Agency Act** (S.C. 2024, c. 15, s. 209), brought into force by Order in Council SI/2024-49, the Agency is mandated to improve freshwater management by strengthening coordination among federal departments and deepening collaboration with provinces, territories, and Indigenous Peoples. The Agency supports the Minister of Environment and Climate Change in carrying out duties under the **Canada Water Act** and is currently leading the modernization of the Act to better address climate-related challenges.

Infrastructure resilience is further reinforced through targeted investments that integrate social equity into federal policy. The **Disaster Mitigation and Adaptation Fund** support municipal upgrades to stormwater, wastewater, and flood protection systems, helping climate-proof essential services against extreme weather. In parallel, the **Safe Drinking Water for First Nations Settlement** (2021) commits at least USD 6 billion by 2030 to bridge longstanding access disparities, recognizing that national resilience depends on closing equity gaps for Indigenous communities through co-developed legislation. Climate change is also accelerating glacier retreat across western Canada, threatening a critical source of regulated water supply for the western provinces. As traditional sources grow less reliable, water recycling has emerged as an important strategy for reducing the volume of freshwater that must be extracted, treated, and transported. Both federal and provincial governments produce guidelines governing water reuse, and the practice was formally incorporated into the **National Plumbing Code** in its 2015 edition, establishing a national technical baseline. Provincial regulation, however, remains uneven. British Columbia is the only province with a dedicated reuse **Municipal Wastewater Regulation** (2018) and **Reclaimed Water Guideline** (2013), though several other provinces have issued non-binding guidelines. At the municipal level, some cities have moved ahead independently. For example, the

City of Guelph, Ontario, introduced a Greywater Rebate Program offering residential homeowners USD 1,000 toward the installation of approved greywater reuse systems, which capture wastewater from baths, showers, and hand basins for non-potable use.



Transportation & Roads

The **National Adaptation Strategy** (2023) mandates the federal government to integrate climate-resilience considerations into national design standards for highways, bridges, and other critical transport assets by 2026. This strategy includes a monitoring and evaluation framework to measure progress. This includes updates to the **Canadian Highway Bridge Design Code**, ensuring new infrastructure can withstand extreme weather, permafrost thaw, and flooding. To operationalize this commitment, Transport Canada oversees the Transportation Adaptation and Resilience Initiatives (TARI), a suite of programs that strengthen climate preparedness across the sector.

TARI encompasses two flagship programs: the **Northern Transportation Adaptation Initiative** (NTAI) and the **Transportation Assets Risk Assessment Initiative** (TARA). NTAI and TARA establish enforcement by conditioning funding eligibility on compliance to climate-resilient standards. NTAI provides funding for research, technology development, and collaborative projects to help northern and remote communities adapt their road, airport, and port infrastructure to climate impacts such as permafrost degradation and shorter winter road seasons. Projects under NTAI include pilot studies on all-weather road design, temperature-resilient construction materials, and new geotechnical monitoring tools. TARA complements this work by supporting climate-risk assessments for federally owned transportation assets, including bridges, airports, and ports. Through data collection, vulnerability mapping, and training programs, TARA enhances institutional capacity to identify risks and implement adaptive design and maintenance strategies.



Housing

The federal government is advancing the integration of climate resilience into the **National Building Code** (NBC) as part of the **National Adaptation Strategy**. While the federal government and the National Research Council of Canada jointly develop updated standards, the NBC serves as a model code that must be formally adopted at the provincial and territorial levels to become legally enforceable.

Such reforms ensure that future housing construction is designed to respond to regional climate and disaster risks, such as flooding, wildfires, permafrost thaw, and extreme heat, by providing a

standardized framework for provinces to implement. By working collaboratively across levels of government, the process aims to harmonize resilient construction across Canada while providing municipalities with the necessary tools to assess and mitigate local climate vulnerabilities.

Complementing this, the **Climate Change Preparedness in the North Program** provides targeted federal funding to strengthen existing housing and community infrastructure especially for Indigenous communities. Projects include vulnerability assessments of aging housing stock, pilot construction of elevated and energy-efficient homes, and design adaptations for shifting permafrost and storm intensity. Collectively, these measures are helping to future-proof Canada's housing sector by integrating climate resilience into building standards, funding mechanisms, and infrastructure investments, thereby ensuring that homes remain safe, efficient, and liveable for generations to come.



2.3. Chile



Water & Sanitation

Chile has recently modernized its water governance framework to incorporate climate resilience, efficiency, and digital oversight. The 2022 reform to the **National Water Code (Law No. 21.435)** introduced climate risk management as a legal priority. It established ten-year Strategic Water Resource Plans to guide basin-level adaptation to droughts and floods. It also established a Fund for Research, Innovation, and Education in Water Resources, administered by the Ministry of Public Works, to support the management of scientific data and sustainable resource planning. These reforms mark a shift toward proactive, science-based governance amid the country's recurring water scarcity.

Further modernization was introduced by **Law No. 21,740 (2025)**, which updated the Water Code's enforcement and administrative procedures. The reform strengthens the authority of the National Water Agency (*Dirección General de Aguas, DGA*), allowing municipalities and other certified bodies to execute enforcement measures and enabling digital notifications and georeferenced communications. It also simplifies sanctioning procedures, expedites responses to unauthorized water use, and prioritizes protection of aquifers and human consumption in

areas of scarcity. Together, these measures reflect Chile's transition from a historically market-driven water regime to a hybrid model that emphasizes climate adaptation, transparency, and environmental accountability.



Transportation & Roads

Chile's transport sector is central to its climate and safety agenda. Nearly 40 per cent of the country's final energy consumption and two-thirds of petroleum use are attributed to transportation, making it critical to achieving national decarbonization goals.⁹ To strengthen climate resilience and reduce emissions, the Ministry of Transport and Telecommunications has introduced economic incentives for public transport operators. Notably, more extended concession contracts are offered to operators deploying electric buses.

This Policy, part of Chile's **National Electromobility Strategy**, has made Santiago's bus fleet one of the largest electric fleets outside China.¹⁰ Complementary measures include upcoming fuel-efficiency standards for light- and heavy-duty vehicles (2024–2028) and legally binding zero-emission vehicle (ZEV) targets aiming for 100 per cent new ZEV sales by 2045 across all segments.

In parallel, Chile's **National Road Safety Policy (2017)**, updated under the Safe System and Vision Zero frameworks, sets a target to reduce road fatalities by 30 per cent by 2030 compared to the average for 2011–2019. The policy's implementation is led by the National Road Safety Commission, which coordinates ten ministries and promotes measures such as automated speed control, safer infrastructure design, and stricter penalties for reckless driving. Despite steady motorization, fatalities per vehicle have fallen by over 30 per cent since 2012.

Together, Chile's transition to electric mobility and its institutional road safety reforms reflect a dual approach to climate resilience and human safety, linking emission reduction, public transport modernization, and safer road infrastructure under a unified national strategy.



Housing

Chile has advanced climate-resilient and transparent housing development. Post-disaster reconstruction programs have piloted elevated social housing in flood- and tsunami-prone areas, raising living spaces above flood levels and reinforcing structures against seismic and hydrological stress. These models now inform national standards for climate-adapted design.

⁹ <https://theicct.org/chile-can-help-pave-the-way-to-clean-transport-in-latin-america-mar25/>

¹⁰ Ibid.

Over the past two decades, Chile's housing subsidy system has reduced the share of households living in inadequate housing from 23 per cent in 1992 to 10 per cent by 2011; however, overcrowding and residential segregation remain significant challenges. The 2024 **Urbanism and Construction Law** (Law No. 21.718) amended the General Law of Urbanism and Construction to expedite real estate projects through streamlined permitting, digital transparency, and stricter professional accountability. The law seeks to accelerate housing and construction delivery by halving permit processing times when a favourable report is issued by an independent reviewer, replacing permits for minor works with affidavits, and enhancing transparency through the monthly publication of construction authorizations by municipalities. It also imposes joint liability on architects and reviewers for violations. This means that a claimant can pursue the full damages from either party. The law also sets deadlines of 10 to 20 days for utilities and property registries to respond, significantly accelerating project delivery.



2.4. Colombia



Water & Sanitation

Colombia recognizes the right to water through constitutional jurisprudence that acknowledges access to drinking water as one of the state's core social objectives. This goal is enforced by policy and legislative frameworks. Colombia's **National Adaptation Plan** integrates climate risk management into sectoral and territorial planning, prioritizing resilient infrastructure and water security. Flagship initiatives like *La Mojana* strengthen flood control, early warning systems, and adaptive water management, benefiting hundreds of thousands of residents in one of the country's most climate-vulnerable regions. At the same time, the COVID-19 pandemic underscored the urgency of universal water access, revealing stark inequalities: while 92 per cent of Colombians have access to drinking water, only 30 per cent of rural residents enjoy comparable service levels. The Constitutional Court has affirmed access to water as a fundamental right, obliging authorities to ensure supply even in underserved areas through emergency measures such as water tankers and temporary installations.¹¹

¹¹ <https://www.corteconstitucional.gov.co/relatoria/2015/t-760-15>

To close persistent service gaps, the government launched the “**Differential Schemes**” (*Esquemas Diferenciales*) framework in 2017, operationalized by the Water and Sanitation Regulatory Commission in 2021. The policy enables utilities to offer flexible, provisional services to marginalized urban and peri-urban communities, while committing to progressive compliance with national standards through annual performance indicators on coverage, quality, and sustainability. Medellín’s utility, *Empresas Públicas de Medellín*, has connected nearly 15,000 low-income households under this model. Looking ahead, the Petro Administration has earmarked USD 1.8 billion until 2026 to modernize drinking water and wastewater infrastructure, attract private investment, and promote innovation in treatment and conservation technologies to achieve universal and climate-resilient access.



Transportation & Roads

Colombia’s transport sector sits at the intersection of climate adaptation, road safety, and decarbonization. With nearly 40 per cent of national energy consumption attributed to transportation, national policy now requires risk assessments and adaptation planning for roads exposed to floods and landslides. The **Julián Esteban Gómez Road Safety Law (Law 2251/2022)** established a unified framework for safer infrastructure design, vehicle standards, and licensing, aligning domestic rules with recommendations from World Health Organization-Pan-American Health Organization.¹² The law sets maximum urban speed limits of 50 km/h (30 km/h in school zones), enshrines the Safe System approach, and requires consistent national crash data collection. The law represents Colombia’s first comprehensive national road safety framework. Developed with support from the WHO and civil society organizations, it seeks to reduce road fatalities by 50 per cent by 2030, from a baseline of more than 5,400 deaths recorded in 2020.

Recent measures also aim to modernize and decarbonize the economy. **Decree 1017/2025** reformed freight transport operations by introducing labour protections, traceability systems, and transparency mechanisms, helping to professionalize the sector, improve regulatory oversight, and support more efficient and sustainable freight movement.



Housing

Colombia’s housing policy is evolving to align sustainability with resilience and inclusion. Under **Resolutions 549 and 149**, all new residential developments must meet mandatory water and

¹² See World Health Organization, Colombia’s Landmark Road Safety Law Could Save Countless Lives (June 20, 2022), <https://www.who.int/news/item/20-06-2022-colombia-s-landmark-road-safety-law-could-save-countless-lives>.

energy efficiency standards to obtain building permits; failure to comply can result in local sanctions. This is enforced by local urban planning offices and regional environmental authorities. Tax incentives, including income tax deductions and VAT exemptions for compliant technologies and materials, are voluntary instruments that support these measures. The government has also issued **Decree 1341/2020**, which integrates the Public Policy for Rural Housing into national regulations, establishing instruments such as the Family Rural Housing Subsidy to improve living conditions in underserved rural areas. The Colombia Resilient and Inclusive Housing Project, co-financed by the World Bank and the Green Climate Fund (GCF), with a total financing of USD 136.7 million, supports the Casa Digna Vida Digna home improvement program and a new rental subsidy for Venezuelan migrants. Eligibility is determined by socioeconomic vulnerability criteria. As of mid-2025, over 2,200 urban and 200 rural households have received resilience-focused improvements.

Moreover, in the Urabá region, initiatives led by Build Change and community-based organizations (CBOs) empower Afro-descendant and displaced populations to retrofit self-built homes through participatory design. These projects strengthen walls, roofs, and flood protection while improving ventilation and access to water and sanitation. By integrating local knowledge with engineering support, the model promotes climate justice and capacity building in communities that have been historically excluded from state housing programs. This “bottom-up resilience” complements Colombia’s regulatory reforms by demonstrating how empowering communities, rather than just financing construction, can strengthen both structural safety and social cohesion, thereby advancing the constitutional right to adequate housing.



2.5. Denmark



Water & Sanitation

Denmark assigns legal responsibility to municipalities for stormwater and wastewater management, a duty reinforced by the 2012 **National Adaptation Plan**. Local utilities must embed future climate projections related to cloudbursts and sea-level rise into drainage and wastewater planning. Copenhagen’s **Cloudburst Management Plan**, launched after the 2011

flood, maps more than 300 projects over two decades, combining underground retention basins and diversion tunnels with blue-green solutions (water plazas, parks, permeable surfaces). The result is lower sewer overflow and contamination risk, along with public amenities that enhance liveability and urban biodiversity.

Economically, Denmark treats water and wastewater as regulated natural monopolies. Under the **Danish Water Sector Act**, the regulator utilizes benchmarking, revenue caps, and efficiency targets to maintain stable prices while ensuring service quality and investment security. The Ministry of Climate, Energy and Utilities oversee economic regulation and consumer payment rules; the Environment Ministry sets environmental and drinking-water standards. Wastewater utilities are explicitly allowed to finance climate-adaptation works within their networks and co-finance dual-purpose cloudburst projects on municipal or private land, aligning tariff frameworks with resilience delivery.

On supply, Denmark relies on protected groundwater and a decentralized network of over 2,600 public water utilities that serve more than 95 per cent of residents, contributing to some of the lowest water-loss rates globally. Persistent water-quality pressures stem mainly from diffuse agricultural nutrients and legacy pesticides, which are addressed through EU-aligned river-basin planning, targeted catchment measures (e.g., wetlands, catch crops), and strengthened monitoring, linking farm policy to the recovery of aquatic ecosystems.



Transportation & Roads

Denmark's **National Adaptation Framework** legally requires municipalities to climate-proof critical infrastructure, including road drainage and stormwater systems. This is directed through legislative mandates and mandatory planning requirements enforced at the municipal level, creating clear accountability. The Capital Region of Denmark has implemented resilience-oriented investments in hospital access roads, metro extensions, and suburban transit lines, which are engineered to remain functional under heavy rainfall. These mandates link health, mobility, and climate safety by ensuring that essential infrastructure can withstand sea-level rise and extreme precipitation. Copenhagen, which aims to become the world's first carbon-neutral capital, has integrated transport resilience into its broader Climate Action Plan through green corridors, low-emission zones, and the expansion of electrified public transport, demonstrating how adaptation planning and emission reduction are mutually reinforcing.

At the national level, the **Green Transition of Road Transport Plan**, under Denmark's **Climate Act (2020)**, advances the country's goal of a 70 per cent reduction in greenhouse gas emissions by 2030 and achieving complete climate neutrality by 2045. In January 2025, Denmark initiated

efforts to replace the Eurovignette with a kilometre-based, CO₂-differentiated road toll for heavy trucks, administered jointly by the Ministries of Transport and Taxation through Sund & Bælt and the Danish Road Directorate. This pricing reform, expected to reduce CO₂ emissions by 0.3 megatonnes by 2025 and 0.4 megatonnes by 2030, internalizes the social costs of freight activity, such as road wear, noise, air pollution, and congestion, while incentivizing the use of cleaner fleets. Together with municipal climate-action plans under DK2020, these national measures illustrate Denmark's cooperative federalism in climate governance, aligning local adaptation with fiscal tools that steer mobility toward a low-carbon, resilient future.



Housing

During its 2025 Presidency of the Council of the European Union, Denmark has placed affordable housing and climate-resilient urban development at the heart of its European agenda. A central initiative is the **European Affordable Housing Plan**, which was launched in December 2025 with a USD 11.5 billion investment platform from the European Investment Bank. Denmark has advanced discussions on affordable and sustainable housing, including financing mechanisms, sustainable construction and renovation, local-level implementation, and the scaling of proven models such as Housing First.



2.6. Dominican Republic



Water & Sanitation

Decree 42-05 establishes the Dominican Republic's legal framework for drinking water, setting national standards for quality, surveillance, and inter-agency coordination. It designates the Ministry of Public Health to oversee water safety.

While reported access to water services are relatively high by regional standards, this metric does not fully capture disparities in service and treatment quality and reliability, which remain uneven across regions. Approximately 79 per cent of the population has access to improved

water sources, and 96 per cent have access to sanitation.¹³ However, intermittent service, limited chlorination, and low treatment coverage leave the systems vulnerable to contamination. Only about 7 per cent of wastewater generated nationwide receives adequate treatment before being discharged.¹⁴

The government, with support from the World Bank and USAID, has introduced reforms to modernize the sector, expanding sewerage networks in coastal cities like San Felipe de Puerto Plata using deep-water submarine outfalls, and strengthening regional utilities to improve financial and operational performance. These projects have benefited over 140,000 people and represent a shift toward decentralized, climate-resilient management of water and sanitation services, aligning national legislation with broader efforts to protect watersheds, reduce pollution, and ensure equitable, reliable access to clean water across the country.



Transportation & Roads

The Ministry of Public Works and Communications, with support from the Inter-American Development Bank, is strengthening climate resilience in transport infrastructure through the use of Blue Spot Analysis and a public geoportal to identify flood-prone road sections and bridges.¹⁵ This risk assessment is integrated into the National Public Investment System, enabling priority investment in projects facing medium to high levels of climate vulnerability. The approach is being implemented through two major initiatives: a USD 140 million road maintenance and rehabilitation programme and a USD 200 million bridge resilience programme. Together, these initiatives are expected to reduce weather-related disruptions by approximately 78 per cent on roads and 70 per cent on bridges, while cutting recurrent repair costs by half. Findings from the risk assessments are also informing updates to design, maintenance, and drainage standards, including larger culverts, elevated approaches, debris-resistant structures, and enhanced slope and riverbank protection, thereby shifting infrastructure management from reactive post-disaster reconstruction to proactive climate-resilient planning and maintenance.

The Blue Spot Analysis is not underpinned by a dedicated legislative instrument. Rather, it is a technical risk-screening and investment-prioritization methodology but integrated into the broader public investment framework established by **Law No. 498-06** on Planning and Public Investment.

¹³ <https://dicf.unepgrid.ch/dominican-republic/water?>

¹⁴ Ibid.

¹⁵ <https://www.iadb.org/es/blog/transporte/innovando-para-resiliencia-en-el-transporte-metologia-blue-spot-analysis-en-republica-dominicana>

Policy alignment runs through the country's Nationally Determined Contributions and the National Development Strategy, linking transport resilience to emission and adaptation goals. Practically, this means embedding hydrometeorological data into planning, budgeting, and procurement; conditioning funding on risk audits; and utilizing performance-based maintenance to keep drainage and stormwater systems functional during extreme precipitation, which is critical given the concentrated exposure along coastal and river corridors.



Housing

Housing resilience in the Dominican Republic is being strengthened through a combination of legal, institutional, and technical measures. **Law 147-02 on Disaster Risk Management** provides the legal foundation for integrating disaster and climate risk reduction into housing and infrastructure planning. This framework enables the Ministry of Housing and local governments to update national building codes and construction guidelines to better withstand hurricanes, floods, and seismic events. Municipal resilience strategies, such as those implemented in Santiago de los Caballeros, have emphasized upgrading informal settlements, relocating families from high-risk zones, and training communities in disaster preparedness.

Institutionally, the government has prioritized mainstreaming resilience across the housing sector. The World Bank's **Technical Assistance on Strengthening Disaster and Climate Change Resilience in the Housing Sector (2021–2023)** supported capacity-building within the Ministry of Housing, the National Office for Seismic Assessment and Vulnerability of Infrastructure and Buildings. The Institute of Aid and Housing aims to promote affordable, green, and climate-resilient housing. Complementary initiatives focus on integrating resilience into post-disaster reconstruction planning and financial mechanisms for private homeowners.

At the local level, the promotion of sustainable housing, including the use of renewable materials such as bamboo and coconut-based products, solar panels, and passive ventilation, reflects a growing effort to align residential construction with environmental and climate goals. Together, these national frameworks and community-driven innovations demonstrate a multi-layered approach to building housing resilience in the Dominican Republic.



2.7. Greece



Water & Sanitation

Greece has moved water to the top of its climate agenda after an emergency cabinet meeting in July 2025 launched a new **National Water Strategy** focused on near-term supply protection and a 30-year adaptation horizon as reservoirs fell to historic lows in Attica. Officials cite Greece's high irrigation share (less than 80 per cent), large non-revenue water (less than 36 per cent), and patchy utility reporting as core weaknesses. The government is combining regulatory reforms aimed at consolidating hundreds of local water providers with strategic investment plans for Athens that include the development of new wells, desalination connections, wastewater reuse systems, and aquifer¹⁶ recharge measures. The flagship medium-term project would partially divert the Krikeliotis and Karpenisiotis rivers to the Evinos reservoir, securing Attica's water supply for decades. These measures are embedded within a binding climate policy architecture (**Law 4936/2022**) and are reinforced by EU-funded digital metering as well as network maintenance. Independent tracking underscores the urgency: Greece ranks 19th globally in terms of water-scarcity risk and has endured multi-year droughts and climate-amplified extremes.¹⁷



Transportation & Roads

Greece's **National Adaptation Strategy** (2016) mandates that all 13 regions prepare **Regional Adaptation Action Plans**, which identify infrastructure priorities, such as upgrading road networks, reinforcing bridges, and protecting coastal highways from sea-level rise and storm surges. Implementation has focused on drainage improvements in flood-prone corridors and protective works in mountainous and landslide-prone areas. Athens' **Resilience Strategy** complements this by integrating shaded, green pedestrian routes and climate-adaptive public transport corridors to mitigate the impacts of extreme heat.

¹⁶ An aquifer is a natural underground layer of water-bearing permeable rock, gravel, sand, or silt that holds groundwater. It functions like an enormous subterranean sponge, storing large amounts of water in its pores and cracks which can be accessed through wells or natural springs.

¹⁷ <https://greekreporter.com/2025/05/18/greece-risk-water-scarcity/>

At the national level, the transport sector, responsible for roughly 35 per cent of Greece's CO₂ emissions, is central to climate and fiscal reform efforts. Under the EU's upcoming Emissions Trading System for buildings and road transport (ETS2), Greece will channel revenues through a USD 5.48 billion Social Climate Fund allocation to support green mobility, low-emission transport, and social protection for vulnerable households. Studies by The Green Tank and Facets suggest that, by leveraging ETS1 and ETS2 revenues, Greece could mobilize up to USD 17.8 billion (2027–2032) to decarbonize transport, upgrade public transit, subsidize electric vehicle leasing, and reduce “transport poverty” affecting up to 14 per cent of households.¹⁸

In parallel, the **National Energy and Climate Plan** and **Law 4936/2022 (Climate Law)** commit Greece to cutting greenhouse gas emissions by 55 per cent by 2030 and achieving net-zero by 2050, embedding transport decarbonization and infrastructure adaptation into the broader transition agenda. Together, these measures represent a dual strategy: climate-proofing the physical transport network while transforming mobility systems toward cleaner, more inclusive, and low-carbon pathways.



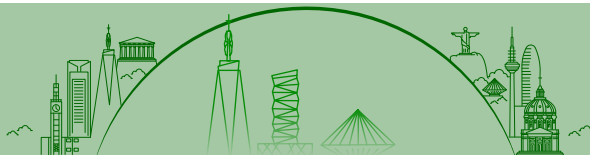
Housing

Greece has embedded climate adaptation and energy efficiency into the housing sector through the **Hellenic Regulation on the Energy Performance of Buildings**, which drives higher insulation standards, efficient HVAC, and solar-ready design in new builds and major renovations. The 2016 **National Adaptation Strategy** requires all 13 regions of the country to plan housing retrofits for extreme heat and other hazards; in practice, programs prioritize shading, thermal upgrades, and flood-resilient detailing for vulnerable neighbourhoods. In Athens, the **Heat Action Plan** operationalizes these goals through reflective and green roofs, district shading, heat-resilient public spaces, and incentives for efficient cooling, directly linking urban housing policy to climate adaptation outcomes.

To fund resilience and post-disaster recovery, Greece replaced the prior stayover tax with a **Climate Crisis Resilience Fee** (in force from 2024, with higher rates from January 2025). The fee is charged per unit, per night, and varies by season and accommodation type or size (for example, from USD 2.29 per night in small rentals to USD 17 per night for large or luxury properties in high season; off-season rates are lower). Collected by hosts at checkout and remitted monthly to the tax authority, proceeds are earmarked for climate-resilience projects and disaster relief, including housing reconstruction and local infrastructure upgrades. Exemptions apply to certain heritage buildings, youth hostels, and campsites. Additionally, separate local Transient Occupancy Tax

¹⁸ <https://thegreentank.gr/en/2025/07/09/ets-impact-report-gt-facets-en/>

and Value-Added Tax rules may also apply, depending on the operator and municipality. Together with EU-backed programs, these national levies create a recurring revenue stream that can be directed to heat-resilient retrofits, seismic and flood-risk upgrades of residential buildings, and targeted support for low-income groups.



2.8. Kenya



Water & Sanitation

Kenya is increasingly exposed to erratic rainfall, prolonged droughts, rising temperatures, and severe flooding.¹⁹ These pressures are compounded by the country's limited capacity to capture and store water during periods of abundance, leaving it without adequate reserves when supply falters. Successive governments have struggled to ensure reliable year-round water availability, largely because of underinvestment in storage infrastructure; dams, pans, reservoirs, and rainwater harvesting systems.

Under **Kenya's 2010 Constitution**, service delivery responsibility shifted to the country's 47 county governments, subject to national oversight. County governments own the majority of Water Service Providers, which are responsible for treating, distributing, and selling water to consumers.

The **Water Act of 2016** established the legal framework for the regulation, management, and development of water resources and sanitation services. It created key institutions to carry out these functions, including the Water Resources Authority for resource management, the Water Regulatory Board for service oversight, and the National Water Harvesting and Storage Authority for water infrastructure development. In 2024, the Act was revised to address escalating challenges including climate change, water scarcity, and the need for digital transformation in water governance. The **Water Service Regulations enacted in 2025** operationalize these revisions, introducing several significant reforms.

¹⁹ African Climate Found., *From Climate Risk to Resilience: Unpacking the Economic Impacts of Climate Change in Kenya*, <https://africanclimatefoundation.org/wp-content/uploads/2023/11/800832-ACF-Kenya-country-note-04.pdf>.

Water Service Providers are now required to develop and implement Climate Change Adaptation Plans as a condition of licensing, detailing how they will sustain service delivery during prolonged droughts or flash floods. The Water Resources Authority, in turn, now integrates climate-risk assessments into the issuance of water abstraction permits, ensuring that allocation remains sustainable even under worst-case modeling scenarios.

The revised framework also mandates a centralized digital database to track national water usage and availability, supporting more accurate early-warning systems for flood and drought management.

To strengthen the resilience of smaller, more vulnerable utilities, the Act encourages the clustering of smaller water providers into larger, more financially viable entities. Greater scale enables investment in resilient infrastructure, such as deep-borehole backup systems, that individual small providers could not afford. The Act also introduces legal mechanisms for Payment for Ecosystem Services, allowing water utilities to direct part of their revenue toward the reforestation and restoration of the upstream catchment areas that feed their systems.



Transportation & Roads

Climate resilience is embedded in Kenya's national transportation planning through the **Integrated National Transport Policy (INTP)**, reviewed and updated by the Ministry of Roads and Transport (MRT) in 2024. The policy elevates climate resilience as a strategic priority across the roads and transport sector, linking it to institutional reform. Among its key provisions is the creation of a Climate Change Coordination Unit within MRT to lead adaptation and mitigation activities and ensure annual reporting on the performance of climate actions. The INTP also directs MRT to develop regulations requiring climate risk assessments for transport infrastructure projects, a practice referred to in the policy as "climate proofing", along with updated engineering standards and design manuals for climate-resilient transport infrastructure. The INTP also introduces a "resilient logistics framework," which focuses on developing secondary road networks in flood-prone regions to ensure supply chains remain open when primary highways are cut off.

Kenya's **Climate Change Act (2016)** established a legal framework for advancing low-carbon development, including the uptake of electric mobility solutions. The preparation of successive five-year **National Climate Change Action Plans** has further provided a structured pathway for promoting sustainable and low-carbon transport alternatives. In addition, Kenya is developing a **National Electric Mobility Policy**, which was drafted in 2024 and has received Cabinet approval. Once adopted, the policy is expected to play a key role in accelerating the deployment and adoption of electric vehicles nationwide.



Housing

The Government of Kenya has made climate-resilient building practices a core component of its national development policy. Through the **Green Economy Strategy Implementation Plan (2016)** and **Kenya Vision 2030**, the government set an ambitious target: 75 per cent of large new or renovated public and private buildings should be green by 2030. These frameworks position sustainable urban development and low-carbon construction as essential elements of Kenya's environmental and economic strategy.

A landmark step toward this goal was the enactment of the **Kenya National Building Code (NBC)** in 2024 under the **National Construction Authority Act**. Published as Legal Notice No. 47 in March and becoming fully operational in March 2025, the NBC replaced the Local Government (Adoptive By-Laws) (Building) Order of 1968. The new Code provides a unified regulatory framework applicable across all 47 counties. Each county serves as the primary approval authority for building projects and is authorized to order building owners to take necessary measures to ensure compliance with the Code. Developed by the Cabinet Secretary for Public Works in consultation with the National Construction Authority, it is notably one of only three building codes in Africa to address sustainability, green building, and climate change.²⁰

The NBC mandates climate-resilient and environmentally sustainable standards across the full lifecycle of construction, from planning and approvals through environmental assessment, design, execution, and ongoing maintenance. Its provisions include standards for energy efficiency, thermal comfort, passive cooling, and renewable energy integration, as well as requirements for rainwater harvesting, wastewater reuse, and sustainable waste management. Structurally, buildings must be designed to withstand multiple hazard types, with materials tested and certified in accordance with Kenya Bureau of Standards guidelines. The Code also encourages development projects to pursue international green building certifications such as LEED, BREEAM, or IFC EDGE, aligning Kenya's construction sector with global environmental standards. There are high penalties for non-compliance or violations to ensure that higher standards are consistently met.

Further regulatory development is anticipated with the proposed **Climate Change (Green and Resilient Buildings) Regulations**, drafted by the State Department for Public Works in 2023 under the **Climate Change Act of 2016**. If enacted, the regulations would establish a dedicated Green and Resilient Building Unit within the State Department for Public Works to coordinate the implementation, monitoring, and promotion of climate-responsive building standards, green construction practices, and resilience measures across the built environment sector.

²⁰ https://www.nca.go.ke:81/media/National_Building_Code_2024_IJ40sQU.pdf



2.9. Paraguay



Water & Sanitation

Paraguay has been historically exposed to floods, droughts, and storms. Between 1965 and 2021, flooding and droughts affected at least 4.2 million people, or 60 per cent of the current population.²¹ The frequency and intensity of such events is projected to increase over the next century, making climate-proofing of water and sanitation infrastructure an urgent priority.

Paraguay's drinking water and sanitation services are publicly owned. **Law No. 1614/2000** on the Regulatory and Tariff Framework of the water and sanitation defines the roles of the service regulator, the promoter of access to services in rural areas, and service providers including the state-owned utility and local sanitation and water supply boards. The Directorate of Drinking Water and Sanitation (DAPSAN), established within the Ministry of Public Works and Communications by **Decree No. 5369/2010**, serves as the lead policy-making body for the sector. DAPSAN is responsible for coordinating national investments in water and sanitation systems and ensuring infrastructure projects align with resilience goals.

DAPSAN issued updated technical manuals in 2026 to improve the ability of water and sanitation infrastructure to withstand climate hazards. Electrical components in pump stations must now be installed at higher elevations to prevent failure during flood events. Deep wells, particularly in the Chaco region, must incorporate more robust casing specifications to prevent structural collapse during thermal shifts and ground movement. It also includes new protocols for integrating solar photovoltaic (PV) backup systems into rural water pumps, ensuring continuity of supply during the grid instability that often accompanies heatwaves. These standards shift the design baseline for new and rehabilitated supply infrastructure from historical conditions to projected climate extremes, reducing the frequency and cost of emergency repairs and service interruptions.

In 2022, the government published **Decree No. 7017** to regulate the **Law 3239/07 on Water Resources of Paraguay**. The decree requires Paraguay's environmental authority, the Ministry of the Environment and Sustainable Development, to formulate and implement a National Water Resource Policy.

²¹ World Bank, Paraguay Country Climate and Development Report, 2024. <https://openknowledge.worldbank.org/entities/publication/f4ffcb9a-a0e4-492a-ab8e-17e86198ab7e>

In October 2025, the Ministry launched the **National Climate Transparency Platform** which allows for the public tracking of adaptation projects. It includes a specific module for tracking the percentage of the population with “climate-resilient” water access, providing a public accountability mechanism for infrastructure adaptation progress.

Paraguay’s **Law No. 5.074/13** on Infrastructure Financing enables the financing of public infrastructure projects, including sanitation systems, through public-private partnerships. The law supports initiatives that contribute to biodiversity promotion, regeneration, and climate change adaptation with a focus on nature-based solutions. A major project under this framework is the Yukyry Sanitation Project, which will construct a wastewater treatment plant and sanitary sewer system to reduce pollution entering Lake Ypacaraí, one of Paraguay’s primary water sources.²²



Transportation & Roads

Paraguay’s road network extends roughly 100,000 km, of which only 32,208 km are classified and administered by the Ministry of Public Works and Communications. An estimated ten per cent of roads are directly exposed to flooding, which can disrupt transportation corridors and isolate rural and indigenous communities. Climate projections have constantly indicated that changes in average rainfall amounts and intensity will increase the frequency of precipitation-induced flooding, landslides, and similar events.²³ In the last five years, Paraguay has taken steps to modernize its legal and policy to embed climate resilience measures in the design, construction, and maintenance of road infrastructure.

The **Public Procurement Law (Law No. 7021/2022)**, fully operationalized by **Decree No. 2263/2024**, replaced the previous lowest-cost bidding model with a “Best Value” evaluation system for public infrastructure projects, including roads. Under this framework, the Ministry of Public Works and Communications can now select construction proposals based on risk management and long-term durability rather than upfront cost alone. In practice, this enables the specification of more resilient materials and construction methods, such as rigid pavement over flexible asphalt in flood-prone corridors; even where these carry higher initial costs.

In 2025, the **Public-Private Partnership (PPP) Law** was updated to mandate that all long-term road concessions include a Climate Risk Assessment. Private partners must incorporate 50-year flood projections in their engineering design. This requirement ensures privately financed

²² <https://www.ferrere.com/en/news/paraguay-first-projects-awarded-under-laws-fostering-infrastructure-development/>

²³ United Nations Framework Convention on Climate Change, Third National Communication of Paraguay to the UNFCCC (2018).

infrastructure is designed to the same forward-looking climate standards as publicly funded projects, preventing the creation of new climate-vulnerable assets through PPP concessions.

The **Environmental and Social Management Framework**, issued by the Ministry of Public Works and Communications in 2025, requires all new road projects to assess how climate change might exacerbate existing environmental risks along transport corridors and to integrate nature-based solutions into infrastructure design.

Law No. 6925/22 on electromobility and the accompanying **Electric Mobility Master Plan** for Urban Public Transport and Logistics establish guidelines for transitioning urban public transport and logistics to electric power. The plan envisions replacing 100 per cent of the public transportation bus fleet, 50 per cent of taxis, and introducing electric bicycles in the country's five largest cities. It also proposes replacing 50 per cent of cargo trucks and delivery vans and 100 per cent of delivery motorcycles with electric vehicles.



Housing

In 2022, the Government of Paraguay launched the Asunción Riverfront Urban Resilience Project to transform the riverfront into a climate-resilient urban district. Asunción, the capital of Paraguay, has a total area of 132.7 km² and an estimated population of 524,184. For decades, the targeted area has been affected by recurrent flooding, inadequate infrastructure, and the growth of informal settlements, particularly in high-risk floodplains along the Paraguay River.

The main deliverable of the project is the construction of a new Eco-Inclusive District on 35 hectares of elevated municipal land owned by the Municipality of Asunción. The district will include 700 climate-resilient housing units designed to relocate families from the flood-prone Parque Caballero area.²⁴ The housing units incorporate passive cooling design and efficient insulation to maintain habitable conditions during extreme heat events without relying heavily on mechanical cooling systems, reducing both energy consumption and vulnerability to power disruptions during storms.

Beyond the housing units, the district's urban infrastructure is also designed with integrated flood management in mind. Bioswales and retention ponds help capture, store, and gradually release stormwater runoff before it enters engineered drainage systems, thereby reducing peak flows as well as alleviating hydraulic pressure on downstream pipes and channels during periods of intense rainfall. Sustainable urban drainage systems will manage surface water across the district, preventing localized flooding. Low-energy public lighting, with weather-resistant fixtures,

²⁴ Please note that UN-Habitat is unsure if tenure security was guaranteed to relocated families for this project.

will reduce both the district's energy footprint and maintenance costs associated with storm damage to exposed electrical infrastructure. The project aligns with Paraguay's **Master Plan for the Coastline of Asunción** and demonstrates an integrated approach to climate adaptation that could serve as a model for similar riverfront infrastructure challenges in other Paraguayan cities.



2.10. Peru



Water & Sanitation

Peru is particularly vulnerable to natural disasters associated with the El Niño phenomenon and the escalating effects of climate change. Extreme rainfall, frequent mudslides, prolonged droughts, and glacial retreat across the Andes compromise water and sanitation service delivery and damage infrastructure.

In Peru, several national and subnational institutions regulate water and sanitation services. The Ministry of Housing, Construction, and Sanitation (*Ministerio de Vivienda, Construcción y Saneamiento*, MVCS) leads national policy development, including prioritizing and allocating public investments. The Technical Organization for the Administration of Water and Sanitation Services (*Organismo Técnico de la Administración de los Servicios de Saneamiento*) operates within the MVCS and provides technical assistance to urban water utilities. The National Superintendence of Sanitation Services (*Superintendencia Nacional de Servicios de Saneamiento*) is an independent entity responsible for economic regulation of water and sanitation services. Regional and local governments are responsible for applying national standards to water and sanitation infrastructure in their jurisdiction. Within this governance framework, several measures have been adopted to strengthen the water and sanitation sector's climate resilience.

The **Sanitation Services Modernization Act of 2013** requires each water and sanitation service company to develop an Optimized Master Plan (*Plan Maestro Optimizado*), which sets out a 30-year capital investment program for the construction, rehabilitation, and expansion of physical assets. The Master Plan must incorporate climate risk assessments and identify investments needed to protect infrastructure against flood, drought, and landslide hazards. Where cost-effective, utilities are directed to also consider nature-based solutions.

The **Mechanisms of Remuneration for Ecosystem Services Law** (*Mecanismos de Retribución por Servicios Ecosistémicos, MERESE*), adopted in 2014, enables water utilities to add a small surcharge to water users' monthly bills (often less than USD 0.3 per household) to fund the conservation and sustainable management of water sources. The **MERESE** is administered by the National Superintendence of Sanitation Services, which works with water utilities to review and update the water tariff structure every five years. The implementation of MERESE tariffs has expanded significantly across Peru, with 43 of the country's 50 water utilities now participating. This has generated an estimated USD 30 million for investments in natural infrastructure and USD 86 million to support climate adaptation and disaster risk reduction measures.²⁵ **MERESE** funds have financed the installation of hydrologic monitoring systems that provide early warning of floods and droughts.

Under the Law on the **Universal Service of Drinking Water and Sanitation (Legislative Decree 1280)**, all water and wastewater utilities are required to prepare Climate Change Mitigation and Adaptation Plans. These plans require utilities to conduct systematic climate risk assessments of their physical assets to identify vulnerabilities such as intake structures exposed to glacial retreat. Based on these assessments, utilities develop mitigation measures to improve infrastructure resilience, which may include relocating assets out of high-risk areas, elevating critical pump stations above flood levels, and installing emergency backup power systems.



Transportation & Roads

Peru's geography and spatial development patterns leave its transport infrastructure vulnerable to natural hazards. Extreme rainfall in the country often triggers flash floods and landslides that damage road surfaces and bridges. The highway system's limited redundancy, particularly the absence of parallel secondary routes along key corridors such as the coastal Pan-American Highway and the Carretera Central connecting Lima to the Andes, further exacerbates these vulnerabilities.

The Ministry of Transport and Communication (*Ministerio de Transportes y Comunicaciones, MTC*) is responsible for national transport policy and coordinates with regional and local governments as well as the private sector on infrastructure projects. Within this framework, MTC has adopted several measures to strengthen the physical resilience of transport infrastructure against climate hazards.

MTC's **Highway Manual on Hydrology, Hydrologic, and Drainage** (*Manual de Hidrología, Hidráulica y Drenaje*) requires engineers to use predictive climate modelling rather than relying solely on

²⁵ <https://www.iwa-network.org/mechanisms-of-rewards-for-ecosystem-services-mrse>

historical rainfall data. Bridges and culverts must now be designed to accommodate water flows with a return period of 100 to 500 years, reflecting the increased intensity and frequency of flash flood events. Separately, MTC's **Highway Manual on Soils, Geology, Geotechnology and Pavements** (*Manual de Carreteras: Suelos, Geología, Geotecnia y Pavimentos*) complements these hydrological requirements by mandating site-specific geotechnical investigations and geological hazard assessments to guide the design of road foundations, embankments, and slopes, thereby reducing the vulnerability of transport infrastructure to landslides, erosion, and other climate-induced ground failures.

The **National Urban Transport Policy**, approved by **Supreme Decree No. 012-2019-MTC**, identifies inadequate and insufficient urban transport infrastructure as a primary concern. The National Program for Sustainable Urban Transport, established within the MTC to implement this national policy, provides technical support to cities developing Sustainable Urban Mobility Plans. As of 2025, MTC requires the mobility plans to include climate vulnerability assessments that map transport infrastructure exposed to floods, mudslides, and other hazards and to prioritize protective investments such as improved drainage, slope stabilization, and structural reinforcement of at-risk assets.²⁶

The **National Infrastructure Plan 2021–2026**, approved by **Supreme Decree No. 039-2026-EF**, elevates climate resilience to a core criterion in transport infrastructure investment decisions. The updated National Infrastructure Plan requires all prioritized urban transport projects, including highways and metro systems, to undergo a “Resilience Scoring” assessment that evaluates the physical vulnerability of proposed infrastructure to seismic, flood, landslide, and drought hazards. Additionally, new public-private partnership contracts for transport infrastructure must include “Climate Risk Allocation” clauses that require private operators to maintain specified resilience standards throughout the concession period, fund ongoing structural maintenance against climate-induced degradation, and carry insurance against damage from extreme weather events. This framework shifts climate risk from a contingent liability managed through emergency response to a planned cost integrated into the infrastructure lifecycle from design through operation.



Housing

Over the last fifty years, Peru has seen a fourfold increase in its urban population, adding 20 million people to its cities. This accelerated urban expansion has occurred largely through informal, unplanned settlement. Almost half of Peru's urban population (45.5 per cent) lives in slums or

²⁶ See SUMP requirements outlined in MTC's *Estratégico Sectorial Multianual 2024–2030: Transport and Communications*.

inadequate housing in areas exposed to several climate hazards, such as hillsides and riverbeds. Thus, climate-proofing Peru's housing and urban infrastructure requires both raising construction standards for new development and addressing deficiencies in the existing housing stock.

The Ministry of Housing, Construction, and Sanitation (*Ministerio de Vivienda, Construcción y Saneamiento*) guides urban expansion and housing construction in coordination with regional and local governments and leads the implementation of Peru's **National Housing and Urban Planning Policy** to 2030. The policy aims to promote sustainable urban-territorial development in cities and human settlements and ensure access to adequate housing and quality living environments

To facilitate the implementation of the Housing and Planning Policy, Peru passed the **Sustainable Urban Development Law (Law No. 31313, *Ley de Desarrollo Urbano Sostenible*)** in 2021. The law establishes principles, instruments, and standards to regulate urban planning and the management of urban land. The law requires climate vulnerability risk analysis to be embedded in all territorial and urban development plans. Critically, the law prohibits construction in “non-mitigable high-risk zones”, areas where floods, landslides, or other climate-related hazards cannot be reduced to acceptable levels. It also provides the legal basis for government-assisted relocation of populations living in these areas. Moreover, the law requires state-subsidized housing to meet specific sustainability and resilience construction standards as a condition of government funding, linking public investment directly to infrastructure quality.

In 2024, the government reformed the **National Building Regulation (*Reglamento Nacional de Edificaciones*)** to address specific climate threats to housing and building infrastructure. Updates to the seismic resistance standard (Norma E.030) now integrate soil liquefaction risks associated with extreme flooding events common during El Niño, requiring foundation designs in vulnerable zones to account for the combined effects of saturated soils and seismic activity, rather than treating these hazards independently. New thermal insulation requirements (Norma EM.110) mandate minimum insulation standards for buildings in Andean and Amazonian

In addition, **Resolución Ministerial N° 0107-2025-VIVIENDA**, issued in 2025, updates the **National Building Regulation's Technical Standard IS.010** on sanitary installations for buildings. The revision introduces climate-differentiated water supply standards for single-family and multi-family housing projects. Under the new guidelines, building projects must ensure a per-capita daily water supply based on the building's climatic zone. For example, in hot climates, the standard may require 169 litres per person per day. Previously, the standard relied on a single flat-rate table based on lot size rather than climate conditions. This change directly affects the sizing of internal plumbing systems, roof tanks, cisterns, and pumping infrastructure in new residential construction. It ensures that building water supply systems are designed for actual demand conditions under different climate scenarios rather than a uniform national average.



2.11. Philippines



Water & Sanitation

In the Philippines, which is an archipelagic nation of more than 7,641 islands, water and sanitation service delivery systems face mounting pressure from climate change. Shifting rainfall patterns, characterized by increased droughts and floods, threaten to outstrip available water supply levels and pose physical risks to existing infrastructure. Compounding this challenge, water and sanitation sector governance in the Philippines is highly fragmented, with over thirty government agencies and units operating under overlapping mandates and functions. While the National Water Resources Board regulates all water resources nationwide, Local Government Units bear the primary responsibility for water and septage service delivery.

To harmonize government efforts and regulatory activities across the sector, the **Executive Order No. 22 in 2023**, created the Water Resources Management Office (WRMO) within the Department of Environment and Natural Resources. The regulation mandates the WRMO to oversee all water-related government agencies and ensure projects, including planned water infrastructure, are resilient to extreme events and address anticipated changes in the availability, accessibility, and affordability of water.

The regulation also requires the WRMO to formulate and implement the **Integrated Water Resources Management Plan**. Published in 2024, the Plan serves as the country's overarching national policy for the sustainable management of water resources. It outlines several action items, such as requiring the National Water Resources Board and the Department of Public Works and Highways to issue guidelines and provide incentives to promote the use of alternative water sources, such as water reuse and rainwater harvesting. Additionally, it requires the local government units to conduct climate vulnerability and risk assessments for infrastructure projects.

The Integrated Water Resources Management Plan operates alongside the **Philippines Water Supply and Sanitation Master Plan**. Approved by the National Economic and Development Authority in 2021, the Water Supply and Sanitation Master Plan serves as the national roadmap for achieving safe, sufficient, affordable, and sustainable water supply, hygiene, and sanitation services by 2030. The master plan is organized around eight Key Reform Agendas, including Building

Climate Resilience (No.5). This agenda focuses on adapting the water and sanitation sector to the effects of climate change. Specifically, the reform agenda No. 5 aims to (1) integrate disaster risk reduction and climate change adaptation strategies to deliver climate-resilient facilities, and (2) enhance the capacities of concerned entities to develop and manage water-related projects. This integrated approach is brought to life through specific priority actions across multiple agencies. For example, the Department of Public Works and Highways is responsible for issuing design standards for climate-resilient hydraulic structures and revising the **National Building Code** to include water-efficiency policies. Furthermore, the National Economic and Development Authority is tasked with coordinating the issuance of administrative guidelines, rules, and regulations that require all local governments to adopt climate-resilient and green technologies.



Transportation & Roads

The Philippines depends on an integrated transportation system spanning road, water, air, and rail networks. The country's transport infrastructure is geographically dispersed and includes roughly 234,000 kilometers of roads, 1,300 public and private ports, and 215 public and private airports. Several government agencies manage the development of transport infrastructure, including the Department of Transportation and the Department of Public Works and Highways. In 2023, estimated hazard-related damages to transportation infrastructure in the Philippines amounted to USD 348 million. Roads are the most vulnerable, accounting for 85 per cent of these projected losses, driven by severe flooding, landslides, heavy rains, and tropical cyclones.²⁷

The **Philippines Development Plan (PDP) 2023-2028** places significant emphasis on climate-proofing, rehabilitation, and improvement of the country's transport infrastructure. The development plan calls for the expansion and modernization of transport networks to facilitate the efficient movement of people and goods, while ensuring that all new and existing assets are resilient to the impacts of climate change and natural disasters through integrated planning. These priorities are operationalized through the **Build Better More program**, which provides funding for major infrastructure projects, including climate-resilient roads, bridges, and rail. For example, the **Samar Pacific Coastal Road Project** was launched in 2022 to improve connectivity among three remote coastal towns in the Philippines. The project incorporates several climate-resilient design features, including elevated road sections in flood-prone areas, enhanced drainage systems, slope protection such as reinforced embankments and retaining structures, and coastal setback measures to reduce exposure to storm surge and erosion.

²⁷ <https://www.gfdrr.org/en/feature-story/protecting-lives-and-property-disaster-risk-philippines>

In addition, the **National Disaster Risk Reduction and Management Law of 2010 (Republic Act No. 10121)** requires the Department of Public Works and Highways to integrate climate risk considerations into the planning and preparation of road and highway infrastructure projects, including exposure to flooding, slope instability, and extreme weather events. Technical guidance is provided through the Design Guidelines, Criteria, and Standards on Highway Design, the Highway Safety Design Standards Manual, and the Social and Environmental Management System. These guidelines collectively embed climate resilience measures into the planning of infrastructure development

Looking ahead, the Department of Transportation is developing the **Philippine Transport System Master Plan 2025–2055**. The transport master plan will provide a 30-year strategic roadmap for the sector, focusing on multi-modal integration, the decarbonization of transport fleets, and the institutionalization of long-term climate adaptation strategies across all transport modes.



Housing

Climate change poses escalating risks to urban and rural housing stock in the Philippines. Approximately sixty per cent of the population lives in coastal areas, where homes are increasingly exposed to sea level rise and storm surges that erode foundations and flood ground floors. Rural dwellings, often located on steep slopes or at the foot of mountains, are frequently vulnerable to landslides and mudslides due to increased rainfall. Further, most homes in the Philippines are not designed to accommodate rising temperatures. Housing structures often lack proper insulation and ventilation which traps heat indoors and drives up energy demand for cooling.

The **National Climate Change Action Plan** positions green building as a key strategy to deliver climate resilient housing and land-use development. In response to the rising demand for adequate housing, the Philippine government has encouraged the construction of safe, resilient, and sustainable communities through various policies and programs.

The **Green Building Code**, introduced in 2015, sets forth regulations designed to increase energy efficiency in building design, construction, and operation. The Green Building Code promotes resilience across the entire development lifecycle, establishing efficient standards for site selection, planning, and materials to long-term occupancy and maintenance. For example, the Code requires the adoption of cool roofs with high solar reflectance to mitigate the urban heat island effect while the **Republic Act No. 11285**, also known as the **Energy Efficiency and Conservation Act** establishes a regulatory framework to enhance energy efficiency in the building sector. Pursuant to the Act's implementing rules and regulations, the Department of Energy adopted the **Guidelines on Energy Conserving Design of Buildings** (Department Circular (DC) DC2020-12-0026) in 2020.

The guidelines set minimum standards on energy efficient building design for new buildings and any expansion or modification of existing buildings with electrical loads of 112.5 kilovolt-ampere (kVa), or a total Gross Floor Area of at least 10,000 square meters. Requirements for buildings covered under the guidelines include the adoption of energy management systems as well as energy efficient appliances such as solar weather heaters and solar-powered lighting.

Under Section 25 of the Act, certified building energy efficiency projects are eligible for fiscal incentives under **Executive Order No. 226** (the “Omnibus Investments Code of 1987”), as amended, as well as other applicable legislation, for a period of ten years from the Act’s effectivity, subject to certification by the DOE. Incentives granted to energy efficiency projects include Income Tax Holidays, enhanced deductions and a preferential special corporate income tax rate of 5 per cent. The Act also establishes non-fiscal incentives (e.g., awards) for buildings that implement energy efficiency projects. Award criteria are described in the Department of Energy’s Department Order No. DO2021-09-0014, entitled the “Guidelines on Energy Efficiency Excellence Awards.”

The Republic Act No. 11201, or the **Department of Human Settlements and Urban Development Act**, directs the Department of Human Settlements and Urban Development to formulate national development policies, strategies, and standards for resilient land use and urban planning. In line with this, the department adopted the Resilient Urban Design and Development Guidelines (Department Circular No. 20205-005) in 2025 to enhance the capacity of local government units and strengthen the integration of climate and disaster risk considerations into local land use planning, urban design, and development decision-making processes.



2.12. Spain



Water & Sanitation

Spain’s predominantly Mediterranean climate produces limited and irregular precipitation. Climate projections for the country further estimate a reduction of approximately 25 per cent in water availability in the coming decades due to rising temperatures and altered rainfall patterns. These pressures directly threaten the physical infrastructure that supplies, treats, and distributes water:

reservoir storage is increasingly insufficient to buffer multi-year droughts, aging distribution networks lose between 15 and 25 per cent of supply through leaks and pipe failures, and treatment facilities face both reduced inflows and more concentrated pollutant loads. Spain's approach to climate-proofing water infrastructure combines upgraded hydrological planning standards, digital modernization of distribution networks, expanded water reuse infrastructure, and flood-resilient design requirements for new facilities.

Water governance in Spain is structured in accordance with the European Union's Water Framework Directive. Spain transposed this framework into national law through the Water Law (**Royal Legislative Decree 1/2001**, *Texto Refundido de la Ley de Aguas*) and its implementing regulations. The law establishes a decentralised management model organized around river basin districts. Under this model, river basin authorities are responsible for preparing and implementing hydrological plans for their respective districts, subject to coordination by the Ministry for the Ecological Transition and the Demographic Challenge.

Spain's **National Climate Change Adaptation Plan** (2021–2030) was adopted pursuant to the 2021 Climate Change and Energy Transition Law (*Ley 7/2021, de 20 de mayo, de cambio climático y transición energética*). Water management represents a critical priority within the plan. **The Royal Legislative Decree 1159/2021** implements water regulations by requiring all hydrological planning, including **River Basin Management Plans**, to incorporate climate change scenarios and adaptation measures. This decree implements aspects of the 2021 Climate Change and Energy Transition law by establishing that water management must prioritize the maintenance of ecological flows and the long-term sustainability of resources over immediate demand.

To modernize aging infrastructure and reduce water loss the government launched the **PERTE** (*Proyectos Estratégicos para la Recuperación y Transformación Económica*) for the digitization of the water cycle in 2022. The project allocates over 3 billion in public and private investment to support the digital transformation of the urban water cycle. These funds support projects using advanced monitoring, AI tools, and predictive systems to detect leaks, improve operations and reduce energy consumption in water supply and treatment. To facilitate this transition, the **PERTE** also includes regulatory measures such as an amendment to Spain's Water Law to incorporate advances in digitalization and an update of the Regulations on the Public Water Domain to encourage remote sensing for monitoring water delivery systems.

Spain accounts for over half of all reclaimed water production in Europe. **Royal Decree: Law 4/2023** introduces measures to improve and expand reclaimed water facilities to increase the country's water supply to 1000 hm³/year of reclaimed water (20 per cent of treated wastewater) by 2027. Quality standards aligned with EU Regulation 2020/741 govern the design and operation

of these facilities, and operators must develop Risk Management Plans for each reuse project, ensuring that reclamation infrastructure meets public health and environmental safety thresholds.

Royal Decree 638/2016 modifies the Public Water Domain Regulations to restrict land use in flood-prone areas. It requires any new sanitation or water infrastructure sited in such zones to incorporate “self-protection” features to ensure continuity of service during catastrophic flooding events. This standard applies to treatment plants, pumping stations, pipelines, and other essential water supply and wastewater infrastructure located within identified flood-risk areas.



Transportation & Roads

Spain lacks a single transport statute setting uniform infrastructure planning rules. Sector-specific laws govern roads (**Law 37/2015**), railways (**Law 38/2015**), and ports (**Royal Legislative Decree 2/2011**), each establishing distinct construction and operational requirements. However, cross-cutting climate resilience obligations apply to all transport infrastructure through **Law 7/2021 on Climate Change and Energy Transition and the National Climate Change Adaptation Plan**. These have been reinforced by **Law 9/2025 on Sustainable Mobility**, enacted in December 2025, which provides the first cohesive national framework linking transport infrastructure investment to low-emission targets and sustainable logistics. Within this framework, several measures address the resilience of transport infrastructure to climate hazards.

Spain's 46 state-owned ports, managed by 28 port authorities under the Spanish Harbor Authority (*Puertos del Estado*), face increasing exposure to extreme weather, sea-level rise, and shifting storm patterns. The **Strategic Framework for the Port System** of General Interest (2030), issued in 2022, requires all state-owned ports to develop and implement climate adaptation plans by 2030. These plans must include vulnerability assessments of physical port infrastructure, risk evaluations covering extreme weather scenarios, including rough seas, heavy rainfall, and heatwaves, and targeted adaptation measures prioritizing critical assets such as quays, breakwaters, terminals, and access roads.

The Ministry of Transport and Sustainable Mobility manages approximately 95 per cent of the national road network. Under the **National Climate Change Adaptation Plan**, the Ministry is required to develop vulnerability maps for national road and rail networks and to update technical standards for materials and construction methods that account for higher temperatures and more intense precipitation. Through the **Safe, Sustainable and Connected Mobility Strategy 2030**, approved in 2021, the Ministry is progressively updating the Road Technical Instructions (*Instrucción de Carreteras*) to address changing conditions. Key updates include redesigning

drainage infrastructure to handle larger flood events and revising pavement specifications to require bitumen mixes capable of resisting heat-island effects and thermal expansion.

Further, in alignment with the **National Climate Change Adaptation Plan**, the Spanish National Roads Authority (*Dirección General de Carreteras*) announced in 2025 the launch of a climate vulnerability study of the entire state road network.²⁸ In line with Spain's **Climate Change Adaptation Plan**, the assessment will evaluate the climate vulnerability of more than 90,000 infrastructure assets, including bridges, tunnels, and drainage systems, to severe climate threats. Based on its findings, the Authority will develop both structural measures (redesigning vulnerable bridge abutments, reinforcing tunnel drainage, upgrading culvert capacity) and non-structural measures (nature-based slope stabilization, early warning systems for road closures) to protect the network.

Law 9/2025 on Sustainable Mobility, enacted in December 2025, introduces a comprehensive national framework to promote sustainable, inclusive, and low-emission transport. The law establishes a State Fund for Contribution to Sustainable Mobility to finance the expansion of urban public transit. Municipalities with over 50,000 inhabitants must adopt Sustainable Urban Mobility Plans that prioritize low-emission zones and public transit. The law also imposes obligations on the private sector. By December 2027, all workplaces with more than 200 employees (or 100 per shift) must implement Sustainable Mobility Plans. These plans are required to facilitate collective and low-emission transport, active mobility (e.g., cycling or walking), teleworking, and the installation of electric vehicle charging stations.



Housing

In Spain, over half of the housing stock is more than fifty years old. Most buildings in Spain were constructed before the first national regulation requiring minimum thermal insulation (the NBE-CT-79 standard of 1979) and suffer from significant energy deficiencies, including inadequate insulation, poor glazing, excessive air infiltration, and thermal bridges. The Spanish government has implemented a series of legislative and regulatory measures to improve building efficiency and reduce the vulnerability of the housing sector to future climate impacts.

Spain's Technical Building Code (*Código Técnico de la Edificación*), substantially updated in 2019 via Royal Decree 732/2019, sets minimum requirements for building design and construction, including safety, habitability, accessibility, and energy efficiency, as well as provisions aimed at improving climate resilience and overall building performance. Key technical requirements

²⁸ See *Record of Proceedings of the Committee on Transport and Sustainable Mobility*, Diario de Sesiones del Senado (Spain), https://www.senado.es/legis15/publicaciones/pdf/senado/ds/DS_C_15_299.PDF.

include the use of sustainable construction materials, decarbonized Heating, Ventilation, and Air Conditioning systems, passive cooling design, and enhanced building envelopes with improved thermal insulation and reduced thermal bridging. These requirements apply equally to new construction and major building renovations, ensuring that any significant intervention raises property toward current performance standards.

The **Quality of Architecture Law (Law 9/2022)** establishes architectural quality as a good of general interest and sets standards for energy efficiency, accessibility, and sustainability in the built environment. The law empowers public authorities to prioritize sustainable retrofitting and urban regeneration of existing building stock over demolition and new construction.

Law 10/2022 introduces financial measures to accelerate the energy retrofitting of the residential building stock. It establishes a tiered system of personal income tax deductions linked to measurable improvements in building performance: a 20 per cent deduction (up to approximately USD 5,500 per year) for works that reduce heating and cooling demand by at least 7 per cent; a 40 per cent deduction (up to approximately USD 8,250 per year) for retrofits achieving a 30 per cent reduction in non-renewable primary energy consumption or upgrading the property to an A or B energy rating; and a 60 per cent deduction (up to approximately USD 16,500) for comprehensive rehabilitation works in predominantly residential buildings that achieve either a 30 per cent reduction in non-renewable primary energy consumption or an overall A or B energy rating.

The law also amends the **Consolidated Text of the Land and Urban Rehabilitation Act** (Royal Decree-Law 7/2015), granting homeowners' associations full legal capacity to enter into credit agreements for building conservation, rehabilitation, and improvement works. In addition, it establishes a state-backed loan guarantee scheme (*líneas de avales*) to provide partial coverage for financing energy efficiency renovations in residential buildings, enabling financial institutions to extend loans with repayment periods of up to fifteen years.

The **Building Energy Retrofit Program**, launched in 2020 and administered by the Institute for Energy Diversification and Saving, provides direct subsidies of 20 to 50 per cent of project costs for energy-efficient renovations in residential and non-residential buildings, with additional support where projects address social vulnerability. The Building Energy Retrofit Program targets four categories of physical building intervention: improvement of the thermal envelope (insulation, glazing, air sealing), thermal system upgrades to reduce fossil fuel dependence (heat pumps, district heating connections), lighting efficiency improvements, and measures to address energy poverty in vulnerable housing.



3. Conclusion



This report demonstrates that achieving climate-resilient infrastructure demands a strategic vision coupled with legal enforceability, institutional coherence, and sustained investment. While Costa Rica has developed a robust normative commitment to sustainability and adaptation, its legal and policy framework remains largely aspirational, fragmented across ministries, and limited by weak enforcement. By comparing the legal and institutional architectures of twelve countries, this report identifies shared global trends, highlights emerging models of excellence, and hints at concrete lessons for Costa Rica as it seeks to operationalize its **National Adaptation Plan** through a **Construction Adaptation Code**.

This report shows that some of the most successful Latin American countries, Brazil, Peru, and Chile, treat climate resilience as a legal and policy obligation that cuts across sectors and levels of government. Brazil's **New Sanitation Legal Framework** (Law 14.026/2020) and **Municipal Climate Law** (14.933/2009) combine clear targets with financial conditions. This helps them ensure that public funds go only to projects that meet adaptation standards. Federal, state, and municipal roles are defined under complementary laws, and compliance is monitored by the National Water and Sanitation Agency.

Together, these mechanisms turn resilience into a national benchmark, supported by transparent regulation and performance-based oversight.

Peru shows how sound fiscal design and environmental protection can reinforce each

other. The **Mechanisms of Remuneration for Ecosystem Services Law** (30215) and **Legislative Decree 1280** of 2024 embed adaptation directly into the financing of utilities and service providers, making resilience a built-in cost of doing business.

Chile has pursued modernization and transparency through legal reform. The **2022 Water Code** elevates climate risk as a national priority, while the **Urbanism and Construction Law** of 2024 strengthens professional accountability. The **National Electromobility Strategy** aligns decarbonization with adaptation. Together, these measures mark Chile's shift from a market-based approach to a coordinated governance model that joins environmental, economic, and social goals.

Taken together, Brazil, Peru, and Chile demonstrate that climate resilience depends on the alignment of law, institutions, and finance. Each has made adaptation part of its development agenda through enforceable rules, measurable objectives, and mechanisms for accountability. Their success shows that strong governance, not national wealth, is what determines whether adaptation goals become lasting outcomes.

For Costa Rica, the main challenge is not ambition but enforcement. The **Environmental Organic Law**, **National Adaptation Policy** (2018–2030), and **National Adaptation Plan** (2022–2026) articulate clear intentions but remain voluntary. Environmental impact assessments do not yet require climate-risk analysis, concession laws omit adaptation clauses, and the **National Construction Code** lacks standards for floods, heat, and seismic threats.

These gaps are structural rather than conceptual: institutions exist, but their authority to enforce is limited.

Closing this gap will require targeted reforms. Costa Rica should adopt a binding law that mandates climate-risk screening and adaptation measures in all publicly funded infrastructure. It should clarify the mandates of the Ministry of National Planning and Economic Policy, the Ministry of Environment and Energy, the National Institute of Housing and Urbanism and local governments, potentially through a Resilient Infrastructure Coordination Unit, to prevent duplication and strengthen accountability. Technical standards in the Construction Code should incorporate climate projections, drawing from Chile's permitting system and Peru's zoning rules. Monitoring and evaluation mechanisms, similar to Brazil's regulatory model, could help track measurable progress. Finally, Costa Rica should develop stable domestic funding for adaptation, such as ecosystem-service fees or a dedicated resilience fund, to reduce reliance on external donors.

This study confirms that resilience is above all a question of governance. Infrastructure, whether roads, water systems, or housing, remains vulnerable unless supported by enforceable law, coordinated institutions, and predictable funding. The difference between planning and achieving adaptation lies in legal clarity and institutional responsibility. By learning from Brazil's regulatory approach, Peru's use of fiscal and legal tools, and Chile's coordinated governance, Costa Rica can strengthen its position as a regional example of climate-resilient development. By implementing binding law and clear institutional responsibility, Costa Rica's infrastructure can shift from reacting to climate impacts to anticipating them. This shift would help protect Costa Rican communities and the national economy while demonstrating that even smaller countries can lead by making resilience a central part of development policy.



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This publication, prepared by UN-Habitat in collaboration with Fordham University, Urban Law Center, US, was developed to support Costa Rica in the development of an adaptation construction code while offering broader insights for policymakers, legislators, urban planners, practitioners, researchers, and development partners seeking to strengthen legal and institutional frameworks for climate-resilient urban development.

The publication draws on comparative case studies from twelve countries across Latin America, Europe, Africa, and Asia, by analysing innovative legal approaches in the water and sanitation, transport, and housing sectors and identifies practical lessons relevant to strengthening climate-resilient infrastructure.

The publication demonstrates a global shift from fragmented, sector-specific responses towards integrated legal frameworks that embed climate resilience into infrastructure planning, investment, governance, and service delivery. It highlights emerging practices including climate-responsive building regulations, risk-informed planning, resilient water governance, nature-based solutions, institutional coordination, and financing mechanisms that support long-term adaptation.

By translating comparative legal experience into practical policy lessons, this publication contributes to advancing resilient, inclusive, and sustainable cities that are better prepared for the climate challenges of the future.



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