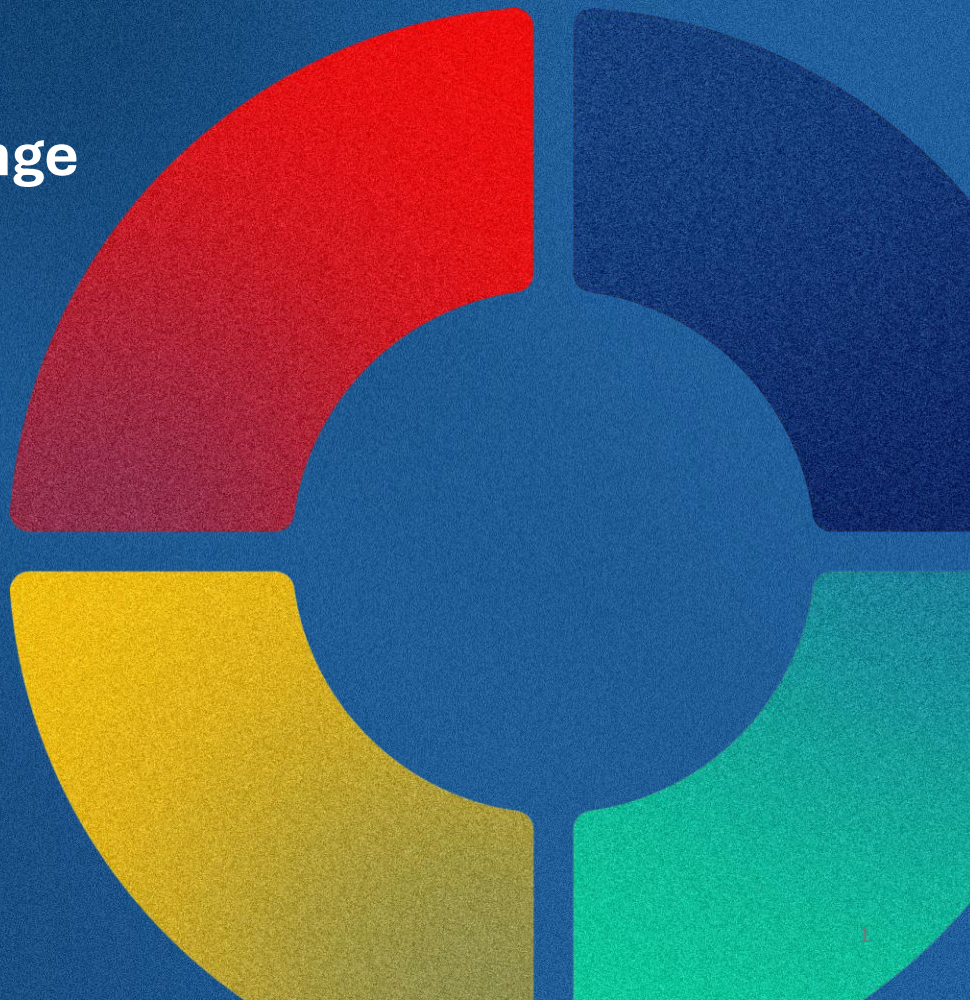


Architecture and Climate Change Adaptation

Resilient Cities in a Changing Climate



Urbanization is one of the most powerful forces shaping global development.

4.4B

people live in cities today — and urban populations continue to grow

70%

of the global population will live in urban areas by 2050

80%

of global GDP is generated by cities

70%

of global GHG emissions are produced by cities, which consume 75% of energy

This concentration of population, infrastructure, and economic activity makes cities both highly vulnerable to climate impacts and central to climate solutions.

Cities in National Climate Strategies (NDCs)

81% of submitted NDCs 3.0 include well-developed urban measures — up from 49% in NDCs 2.0

Sectoral priorities are emerging

104 out of 128 NDCs include mitigation

Focus on transport & mobility, energy and the built environment

104 out of 128 NDCs include adaptation

Focus on ecosystems & biodiversity, infrastructure, water management

Means of implementation are being defined

77% mention multilevel governance

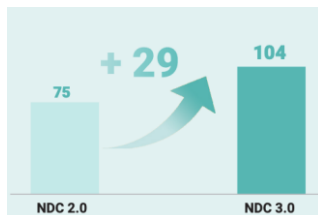
37% mention urban climate finance

81% include well-developed urban measures

Majority of NDCs include cities in their mitigation and adaptation strategies

Mitigation

104 NDCs 3.0 include urban mitigation



Record number of mitigation responses in NDCs 3.0, with top performers including **transport and mobility**, **energy**, and the **built environment** in cities.

70%

of NDCs 3.0 mention mitigations in **transport and mobility**

53%

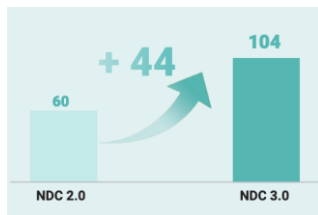
of NDCs 3.0 mention mitigations in **energy**

51%

of NDCs 3.0 mention mitigations in the **built environment**

Adaptation

104 NDCs 3.0 include urban adaptation



Record number of adaptation responses in NDC 3.0, with top performers including **ecosystems and biodiversity**, **infrastructure**, and **water management** in cities.

69%

of NDCs 3.0 mention adaptations for **ecosystems and biodiversity**

58%

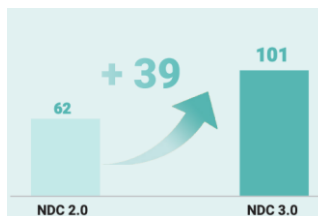
of NDCs 3.0 mention adaptations for **infrastructure**

46%

of NDCs 3.0 mention adaptations for **water management**

Means of implementation

101 NDCs 3.0 include enablers



Means of implementation are also being strengthened, with increased reference to enablers such as **multilevel governance**, **capacity-building**, and **finance** in cities.

77%

of NDCs 3.0 mention **multilevel governance**

44%

of NDCs 3.0 mention **capacity-building**

37%

of NDCs 3.0 mention **finance**

Cities at the Frontline of Climate Impacts

Climate change is intensifying a range of risks that directly affect urban environments.


Key climate hazards affecting cities include:

 **Extreme heat & heat waves**

 **Flooding & extreme rainfall**

 **Sea-level rise & coastal flooding**

 **Water scarcity & drought**

 **Infrastructure failures & service disruptions**

Urban areas concentrate exposure to these hazards. As a result, urban adaptation is becoming a critical priority in climate policy and planning.

The Built Environment: A Key Adaptation Sector

The built environment is the physical interface between climate hazards and human vulnerability — and a primary delivery mechanism for adaptation at scale.

THE EXPOSURE — Why the Sector is Critical

Urban concentration of risk

55% of the world lives in cities today — rising to 70% by 2050. Climate risk is most dense where people and assets are most concentrated.

Asset and emissions weight

Buildings = 38% of global CO₂ (UNEP, 2022) and ~\$326 trillion in global built asset value — both a major driver of climate change and its most financially exposed victim.

Vulnerability at scale

1 billion people in informal settlements with no building regulation. 800 million urban residents in low-elevation coastal zones facing sea-level rise.

The urban heat island effect

Dense cities are already 4–8°C hotter than surrounding areas. Under a warming climate, this becomes a direct public health emergency.

THE RESPONSE — What Adaptation Looks Like

Hazard-specific design

Every major climate hazard has a direct architectural response — flood-resilient construction, passive cooling, wind-resistant structures, drought-adapted water systems.

Building codes as climate policy

The single most powerful adaptation instrument at scale. A code mandating flood resilience, thermal comfort, and stormwater retention shapes every building for decades.

Nature-based solutions

Green roofs, urban forests, wetlands, and mangroves simultaneously reduce heat, manage flooding, store carbon, and improve liveability — at lower cost than hard engineering.

NDC and Sendai alignment

The built environment sits at the intersection of both frameworks. Sendai Priority 3 — investing in DRR — is delivered primarily through resilient construction and land-use planning.

Urban Climate Risks Affecting Architecture

Six major hazards · how they affect the built environment · design responses

Extreme Heat

Urban Heat Island Effect

+8°C hotter than rural areas

Heat-absorbing surfaces and dense buildings trap warmth. Architecture without passive cooling, shading, or green cover becomes a health hazard — especially for the elderly and low-income residents.

Cool roofs · Passive ventilation · Green roofs · Shaded public space

Drought & Water Stress

Prolonged Dry Periods

40% of world faces scarcity by 2050

Buildings that waste water intensify urban water stress. Drought also drives soil shrinkage, causing foundation movement and structural damage to buildings.

Rainwater harvesting · Greywater recycling · Permeable paving · Low-flow systems

Flooding & Storm Surge

Extreme Precipitation & Sea-Level Rise

2x flood events since 2000

Impermeable surfaces, floodplain development, and inadequate drainage amplify flood damage. Poor site selection and construction below flood level turn rain events into disasters.

Elevated foundations · Permeable surfaces · Amphibious design · Setback regulations

Wildfire

Urban–Wildland Interface Risk

3x land burned since the 1980s

As climate dries landscapes, the urban–wildland interface expands. Combustible cladding and inadequate ember-resistant design make buildings highly vulnerable to ignition.

Non-combustible cladding · Ember-proof vents · Defensible space · Firebreaks

Cyclones & High Winds

Intensifying Tropical Storms

40% rise in Cat 4–5 storm intensity

Roof failures, façade collapse, and flying debris are primary causes of structural damage. Informal construction with weak roof-to-wall connections is catastrophically vulnerable.

Hip roof geometry · Metal strap connections · Ring beams · Wind-resistant cladding

Sea-Level Rise

Coastal Infrastructure Threat

1m rise projected by 2100

Coastal cities face permanent inundation of low-lying infrastructure, saltwater intrusion into foundations, and increased storm surge reach beyond current design lifetimes.

Coastal setbacks · Managed retreat · Elevated construction · Mangrove buffers

Solutions: Designing for Climate Resilience

How architecture, urban design, and construction practice respond to each major hazard



Passive Cooling & Heat Resilience

30% cooling energy reduction via passive design

- Cool & green roofs — reflect solar radiation, reduce urban heat
- Passive ventilation — cross-ventilation, stack effect, operable facades
- Thermal mass — heavyweight materials absorb and release heat slowly
- Shading systems — overhangs, louvres, pergolas, street canopies
- Urban greening — trees and water features lower local temps by 4–8°C

NDC sectors: Energy efficiency · Urban heat · Public health



Flood & Storm Surge Resilience

60% damage reduction with flood-resilient construction

- Elevated foundations & plinths — raise living areas above flood level
- Wet-proofing — ground floors built to flood and dry quickly
- Amphibious design — structures that rise with water on buoyant foundations
- Permeable surfaces — paving, gravel, green cover absorb runoff
- Stormwater retention — on-site ponds, swales, underground cisterns

NDC sectors: Water · Coastal zones · Urban infrastructure



Wind, Cyclone & Seismic Resilience

5x lower damage with resilient roof connections

- Hip roof geometry — sheds wind more effectively than gable roofs
- Metal strap connections — secure roof to wall, preventing uplift
- Concrete ring beams — tie walls for wind and seismic loads
- Non-combustible cladding — fire and ember resistance
- Confined masonry — cost-effective seismic resistance for low-rise

Sendai target: Reduce housing damage from disasters



Water Resilience & Adaptive Reuse

50% water demand reduction via harvesting & recycling

- Rainwater harvesting — collection, storage, filtration at building scale
- Greywater recycling — reuse of sink and shower water for irrigation
- Modular design — buildings upgradeable as climate conditions shift
- Adaptive reuse — retrofitting existing buildings saves embodied carbon
- Climate scenario planning — design for 2050 climate, not today's

NDC sectors: Water · Housing · Infrastructure retrofit

Solutions: Nature, Policy & Finance

Working with ecosystems · Embedding resilience in regulation · Mobilising climate finance

NATURE-BASED SOLUTIONS (NbS)

Mangroves & Coastal Wetlands

Provide coastal protection equivalent to engineered sea walls at a fraction of the cost — while storing carbon and supporting fisheries. Featured in NDCs of 70+ countries.

Urban Forests & Tree Canopy

Reduce surface temps by up to 8°C, absorb stormwater, improve air quality. Cities with >30% canopy cover show measurable reductions in heat-related mortality.

Green Roofs & Living Walls

Reduce stormwater runoff by up to 80%, lower cooling loads by 25%, extend roof lifespan, and provide biodiversity habitat in dense urban areas.

Sponge City Infrastructure

Integrated networks of permeable pavements, rain gardens, and bioswales that manage up to 70% of urban rainfall on-site — reducing flood risk city-wide.

Restored River Corridors

Daylighting culverted streams and restoring floodplain vegetation provides natural flood storage, cools surrounding areas, and creates green corridors.

POLICY & REGULATORY INSTRUMENTS

Climate-Responsive Building Codes

Mandatory thermal performance, flood resilience, wind resistance, and water efficiency standards embedded in national building regulations — the most scalable policy lever.

NDC Adaptation Targets

Quantified, time-bound, and monitored targets for climate-resilient housing and urban infrastructure within NDC frameworks — currently the weakest part of most NDCs.

Land-Use Planning & Zoning

Restricting development in high-risk zones (flood plains, coastal strips, wildfire interfaces) and directing growth to climate-safe locations.

Green Building Certification

EDGE, LEED, BREEAM, and national equivalents create market incentives for resilient design and measurable benchmarks for NDC monitoring.

Managed Retreat Frameworks

Policy frameworks enabling planned relocation of communities from high-risk coastal and flood zones — sometimes the only viable long-term strategy.

FINANCE MECHANISMS

Green Climate Fund (GCF)

The primary multilateral fund for climate adaptation in developing countries. Finances resilient housing, urban infrastructure, and NbS projects. Gap: \$260B/year.

Adaptation Fund (AF)

Direct access fund supporting community-level adaptation in vulnerable countries. Prioritises small island states and least developed countries.

Resilience Bonds & Green Mortgages

Private finance instruments that price climate risk into property lending — incentivising resilient construction through lower interest rates for verified resilient buildings.

Catastrophe Risk Insurance Pools

Sovereign mechanisms (CCRIF, ARC, PCRAFI) providing rapid post-disaster finance for reconstruction — ideally linked to build-back-better standards.

Blended Finance for Informal Settlements

Combining grants, concessional loans, and community savings to finance resilient upgrading where market finance will not reach.



**Thank you for your
attention!**