WORLD GREEN BUILDING COUNCIL

CLIMATE CHANGE RESILIENCE IN THE BUILT ENVIRONMENT

Principles for adapting to a changing climate

BETTER PLACES FOR PEOPLE

RACE TO RESILIENCE

ABOUT THE WORLD GREEN BUILDING COUNCIL

The World Green Building Council (WorldGBC) catalyses the uptake of sustainable built environments for everyone, everywhere.

Transforming the building and construction sector across three strategic areas — climate action, health & wellbeing, and resources & circularity — we are a global action network of over 70 Green Building Councils around the world.

As members of the UN Global Compact, we work with businesses, organisations and governments to drive the ambitions of the Paris Agreement and UN Global Goals for Sustainable Development. Through a systems change approach, our network is leading the industry towards net zero carbon, healthy, equitable and resilient built environments.

GREEN BUILDING COUNCILS

Green Building Councils (GBCs) are independent, non-profit organisations accelerating the uptake of sustainable buildings.

As members of WorldGBC, they convene businesses and governments to collectively drive environmental, economic and social impact within the built environment on a national, regional and global scale.

BETTER PLACES FOR PEOPLE

The Better Places for People (BPFP) is a global programme of the WorldGBC dedicated to supporting GBCs, partners, and the global network to transition towards a healthy and sustainable built environment, creating substantial improvements to human health, wellbeing and quality of life for everyone, everywhere.

The work of Better Places For People is aligned to WorldGBC's North Star Goal, "a built environment that delivers healthy, equitable and resilient buildings, communities and cities", while underpinning the six core principles of the Health & Wellbeing Framework, catalysing social and environmental impact across the entire built environment value chain.

Cristina Gamboa
CEO
World Green Building Council

The Race to Resilience campaign, delivered by the UN High-Level Climate Champions, calls on all of us to act in solidarity with the +4 billion people suffering from the impacts of our changing climate.

To support this ongoing call to action, WorldGBC is proud to share this practical guide, inspiring the much-needed transition towards people-centric resilience and adaptation at different urban scales.

It's time to enable the capacity of the built environment to deliver social value and ensure the resilient solutions we need are implemented in our disrupted world. It's time to get resourceful and listen, learn, and respond to the needs of our communities. And it's time for impactful policy responses from local and regional leaders, to enable this much needed transformation.

We invite all stakeholders with a responsibility of infrastructure assets to take ambitious climate action in alignment with the Race to Resilience. It's time to embrace and scale low carbon, highly resilient and equitable built environments for everyone, everywhere.

THE WORK OF WORLDGBC'S 'BETTER PLACES FOR PEOPLE' GLOBAL PROGRAMME IS KINDLY SUPPORTED BY:

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FOREWORD

Nigel Topping
UN High-Level Climate Action Champion for UK COP26

Dr. Mahmoud Mohieldin
UN High-Level Climate Action Champion for Egypt COP27

In the past 20 years, natural disasters have affected 4.4 billion people, claimed 1.3 million lives, and caused $2 trillion USD in economic losses (**World Bank**, **UN**). By 2050, over 970 cities could be subjected to extreme heat, with over 570 cities impacted by sea level rise, to name just two impacts of our changing climate (**C40**).

Far too few cities are prepared for these changes. The extreme heat, floods, droughts and wildfires seen in urban hubs around the world in recent years has shown how unbearable, and unliveable, our cities could become – unless we act to build resilience while mitigating further changes.

Our built environment is continually growing to meet the demands of changing, urban-centric populations. Two-thirds of the world's population will live in cities by 2060, yet half of the urban fabric to accommodate them has not yet been built. It is critical that design and investment decisions taken today consider the scale, scope and severity of climate change impacts that will affect these built assets. Coupled with ageing infrastructure and under-investment, these challenges are already having devastating consequences for communities around the globe. Regardless of where you live or where you do business, we all need to build resilience to climate change. The built environment sector has the opportunity to lead the resilience agenda, placing adaptation on par with mitigation through how we design, manage and occupy buildings and infrastructure for the worlds' people.

As part of the UN High Level Climate Champions' Race To Resilience, initiatives are catalysing action by non-state actors to build the resilience of 4 billion people vulnerable to climate risks. Initiatives that train people with the skills to build homes resilient to extreme weather, design policies with governments at all levels to make the infrastructure systems we all rely on resilient to climate shocks and share best practices, so knowledge is available to all.

In this guide, World Green Building Council (WorldGBC) collates effective and practical steps that can be taken on a building, community, and city scale in order to adapt and build resilience. We encourage the broad range of built environment stakeholders set out in this guide to engage with their role, to exert their influence and to implement change. Under the inevitable impacts of climate change, resilience action is essential to build community capacity to survive and thrive in our built environments.

CLIMATE RESILIENCE IN CONTEXT

More people are at risk today from the impacts of climate change than ever before.

Changing climate patterns, and increased frequency and severity of weather events is impacting every geography in the world.

Vulnerability is heightening in the context of global population growth. As construction on flood plains, storm-prone areas and other high-risk areas increases, the likelihood of a major catastrophe consequently increases too. Decarbonising our society, restoring nature and ecosystem services and tackling our production and consumption of materials and products are essential for us to mitigate further climate change.

However, the impacts of climate change are already being felt, and are locked in for decades to come. The buildings and infrastructure of our cities can continue to contribute to these problems - or they can be part of the solution. Resilience is about embedding solutions and adaptability into the core purpose of the built environment.

'Resilience' is the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions."
United Nations Office for Disaster Risk Reduction, 2022

We need to put **people and nature first** in pursuit of a **world resilient to climate change** - where we don't just survive climate shocks and stresses, but thrive in spite of them. It is fundamental to consider resilience, adaptation, hazard and climate mitigation of our built environment as part of our transition to an equitable and sustainable future.

This paper focuses on resilience within the built environment to natural disasters and weather conditions that are expected to increase in severity due to the impacts of climate change. These include extremes of temperature, both heat and cold, drought, storms and flooding. Wider natural disasters, including earthquakes, volcanic eruptions and extreme weather events such as wildfires or flash floods are also critical to consider, however these events can rarely be mitigated or lessened in severity with resilience measures.

A RESILIENT VALUE PROPOSITION

There is a clear value proposition for a resilient and adaptable built environment at regulatory, organisational and owner/occupier scale, which includes drivers and benefits alongside the cost of inaction:

DRIVERS AND BENEFITS

For national and local government

- Build relationships with partners and communities by cooperating on resilience measures.
  - Align with international guidance and and regulations on climate adaptation and financing regulations.
  - Enhance long-term growth prospects by protecting livelihoods of local people and businesses from climate change-related damage.

For private sector organisations

- Protect human capital, business operations and supply chains from physical effects of climate change.
- Stay ahead of regulatory requirements to meet net zero emissions and climate regulations.
- Enhance brand and reputation with climate conscious customers and other stakeholders.
- Opportunity to respond to consumer's higher market value of environmentally-minded brands with higher pricing and yields.
- Incorporate climate and nature related financial disclosures resulting in improved ESG performance, such as:
  - Alignment with targets of the Taskforce for Climate Related Financial Disclosure **(TCFD),** a private-sector oriented framework that requires businesses to undertake future-scenario aligned analysis of climate risks and opportunities, that is becoming increasingly mandated.
  - Alignment with tools such as Physical Climate Risk Assessment Methodology (**PCRAM**) - which provides guidelines for integrating physical climate risks in infrastructure investment appraisal.
- Demonstrate ethical choices and provide social value by supporting natural capital and the prevention of environmental destruction, optimising ESG and corporate reputation.

For building owners and occupiers

- Strengthen community and social cohesion by cooperating on resilience measures.
  - Reduced risk of damage to personal property, businesses or necessary supporting infrastructure.
  - Heightened wellbeing, comfort and reassurance at community level, particularly during weather events.

COST OF INACTION

The cost of inaction to responding to current and future climate change impacts will be felt financially as well as socially. The difference between inaction on climate change and a rapid transition to resilience is reportedly worth $221 trillion USD to the global economy **(Deloitte Center for Sustainable Progress)**.

- At a built environment level, delayed action on climate resilience and adaptation will see reduced building performance, resulting in sub-optimal living and working environments. This could spiral to a global decline in health and wellbeing, heightening inequalities and injustice between regions.
- The increasing quantity of severity of extreme weather events will likely lead to damage of buildings and infrastructure, with heightened risk of stranded assets and higher insurance premiums for owners.

Estimates suggest a $1.8 trillion USD investment by 2030 in early resilience measures (warning systems, resilient infrastructure, dryland agricultural crop production, mangroves, and water resource management) would yield more than $7 trillion USD of benefits in avoided costs from climate change effects **(Bank of America)**. Whereas the delay in implementing mitigation and resilience strategies is costing the global economy an additional $0.3-0.9 trillion USD a year **(World Health Organisation)**.

For more information about the value proposition for a sustainable built environment please visit **worldgbc.org/business-case**

WHAT ARE THE **CORE CONSIDERATIONS** FOR TACKLING CLIMATE RESILIENCE IN THE BUILT ENVIRONMENT?

The impacts of climate change and damage from extreme and gradual weather events will occur at building, community, city and even national scale, therefore measures to mitigate damage and ensure recoverability must be implemented at systemic level. To incorporate climate resilience strategies across a series of complex systems, all built environment stakeholders and decision makers will have to engage and take responsibility. Leadership from local and national government is essential to activate meaningful resilience and adaptation solutions.

KEY STAKEHOLDERS IN THE TRANSITION TO A RESILIENT BUILT ENVIRONMENT

CITY	COMMUNITY & NEIGHBOURHOOD	BUILDING
Academic Institutions	Architects	Consultants
Governments	Contractors	Contractors
Local communities	Designers	Developers
NGOs	Engineers	Investors
Policymakers	Investors	Local communities
Professional Associations	Landscape Architects	Manufacturers
Public entities	Owners/Occupiers	Owners/Occupiers
Urban planners	Urban planners	Suppliers

The following sections present principles of built environment management for changes to weather related climate change impacts such as: storms, high winds, droughts, floods, severe temperature change, and wildfires. These principles are focused on measures of mitigation and damage protection from continual or gradual climate impacts and in some cases, extreme weather events.

However, large scale natural disasters from extreme weather events are outside the opportunity window for design or policy interventions. Most sudden and extreme weather events cannot be mitigated or lessened in severity with even the most conscientious design or planning interventions. Ultimately, building in areas with known risk of extreme weather events should be avoided at all costs, such as flood plains or locations at high risk of wildfire. Unfortunately, as millions of people worldwide live in high-risk locations, measures of safety (such as evacuation of population during dangerous weather events) and efficient bounce-back and recovery after periods of damage must also be considered as important climate resilience considerations.

For more information on this, please see the resource list on **page 19**.

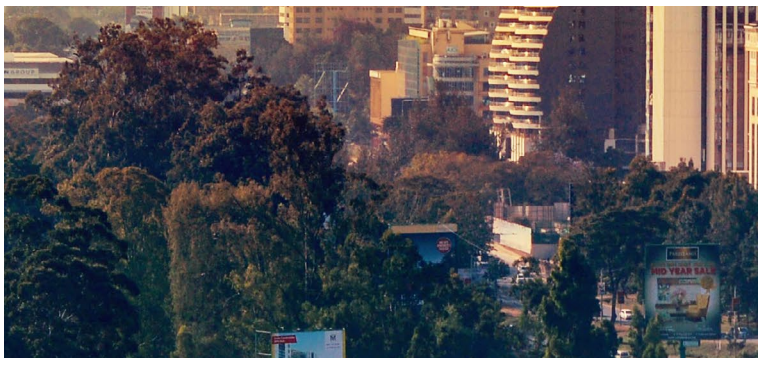
CITY SCALE PRINCIPLES
for a resilient and adaptable built environment

LEARN

- **Gather environmental and demographic data associated with climate change** - collect appropriate data to develop and facilitate adoption of sustainability frameworks and milestone agendas that enhance resilience, such as Sendai Framework for Disaster Risk Reduction.
- **Assess most vulnerable locations to focus priority interventions** - attention to vulnerable locations, particularly informal settlements, and aspire to transform slums into healthy, clean and safe communities.
- **Audit accessibility to vital natural resources,** such as fresh water, and invest in improvements to infrastructure system structures.
- **Assess the risk of climate change on physical assets and infrastructure** and system stressors through future scenario modelling and risk assessments that consider the lifespan of an asset, including risk of stranded assets.
- **Integrate indegenous knowledge and resources to help monitor key components of biodiversity**, support sustainable use of environmental resources and enforce conservation management through indegenous value system.

ADOPT

- **Create responsive regulatory toolbox for gradual and extreme weather change events** that enables adaptation activities across different scales and levels. Put in place early warning systems - command and control spaces - and emergency response plan for extreme climate events.
- **Set building regulations or guidelines to target specific climate risk,** eg. guidelines for better buildings can reduce storm damage. New building standards should be able to be resilient to changing extreme weather conditions.
- **Adopt land use policies and regulations to reduce/prevent development in high risk areas,** and incentivise development in lower risk ones.
- **Institute policies and financial incentives/penalties to increase resource efficiency**, such as water conservation, and to avoid unnecessary risks - such as regulation for woodburning, campfires, and behaviour around flammable substances to reduce fire risk.
- **Advocate for shift towards sustainable behaviours** through campaigns and initiatives.
- **Support sustainable and circular economy activities** through public procurement and regulation of building and construction services.
- **Plan resilient and decentralised systems to improve data reconciliation,** reduce points of weakness, and optimise resource distribution.



ACT

- **Protect natural capital and resources with investment infrastructure** - e.g. Prioritise greening infrastructure and urban area, including wildlife corridors. Integrate blue and green infrastructure into municipal urban planning. Manage water operations to rescue the depletion of available freshwater from building wastewater, including maintenance of existing water infrastructure.
- **Implement strategic protection measures** - such as flood prevention measures, including dams and seawalls (favouring nature-based solutions as preferable solutions). Create more public and open green and blue spaces for both nature and people within cities, reducing urban heat island effect.
- **Prioritise social cohesion as essential resilience strategy** - enhance collaboration between local government, community and industry to tackle local climate change threats.
- **Invest in maintenance and enhancing existing systems to prevent avoidable damage from small - medium scale weather events,** for example implementing sustainable infrastructure drainage and storm-water runoff solutions at city scale, maintaining sewerage and water systems and improving river catchment management to prevent flooding. Build infrastructure, pavements and roads with materials that are durable and withstand temperature change.
- **Provide guidance to retrofit existing building stock** to encourage populations to make manageable changes to their properties, such as passive shading, additional insulation, or storm proofing.
- **Build transport routes that will allow a rapid response** from the supply chain to transport critical goods and components in emergency situations.

COMMUNITY & NEIGHBOURHOOD SCALE PRINCIPLES

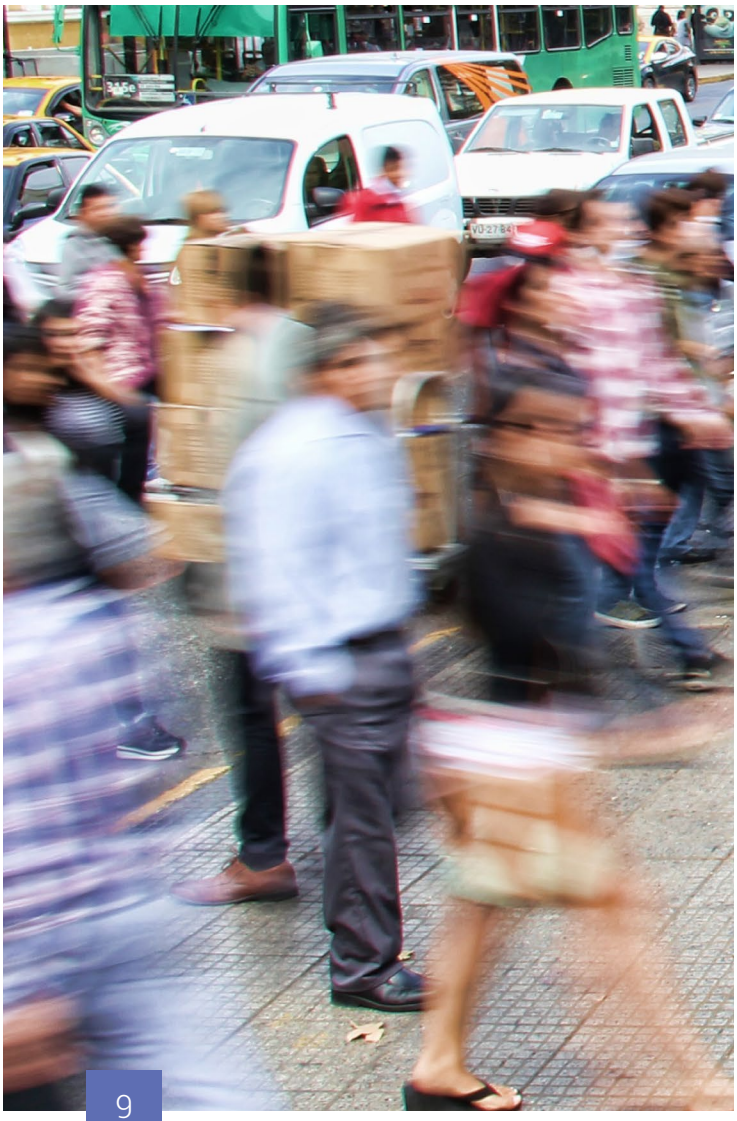
for a resilient and adaptable built environment

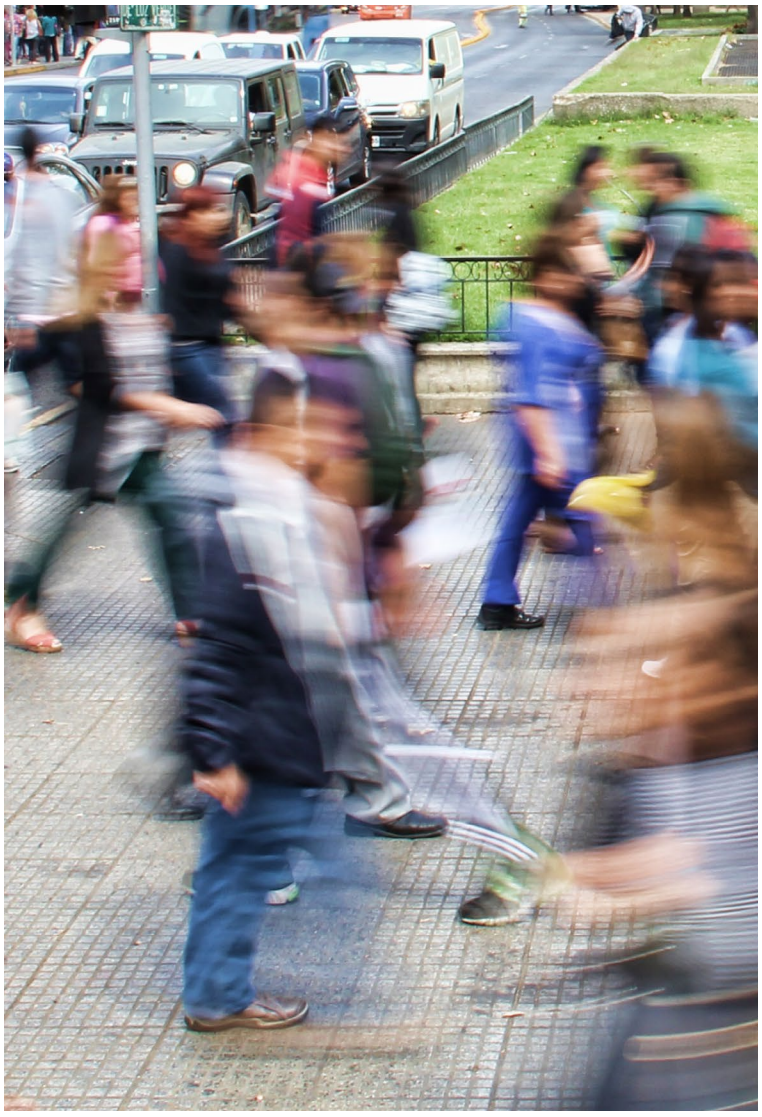
LEARN

- **Undertake assessments of localised risks and opportunities** (such as natural capital) to recognise the areas of vulnerability in the area including risks to infrastructure.
- **Conduct detailed assesment of ecological health** in the area to keep an eye on climate risks.
- **Integrate indegenous knowledge and resources to help monitor key components of biodiversity,** support sustainable use of environmental resources and enforce conservation management through indegenous value system.

ADOPT

- **Collaborate with multi-disciplinary and public entities,** enabling faster and more efficient resilience and adaptation activities across the community and neighbourhood.
- **Put in place early warning systems** - command and control spaces - and emergency response plan for extreme climate events.
- **Adopt sustainable strategies and frameworks** that focus on commuinty scale planning, such as adopting natural capital based financial reporting to encourage nature-based solutions.





ACT

- **Protect and invest in natural resources,** such as protecting ponds, lakes, and rivers nearby from over-extraction and pollution, and investing in water storage for emergency situations. Sustainable drainage solutions and green infrastructure techniques, such as planting moisture-loving plants and trees and installing permeable hard surfacing to absorb excess water that can support resource management, for example by allowing infiltration to support groundwater levels.
- **Consider community scale built asset upgrades and retrofit** to improve resilience of community assets in case of severe climate events, such as community level master-planning to implement passive shading techniques, including narrow streets to create shade, expanding urban tree cover to combat urban heat island impacts and fire breaks to act as a buffer between natural and residential zones.
- **Increase availability of vegetation that is resilient to climate change impacts** to allow for nature-based co-benefits, such as temperature-durable trees to provide shading and reduce urban heat island effect, as well as deep rooted trees resistant to floods and storms.
- **Plan community emergency hubs** that will provide access to safe space and services during extreme weather events, and prioritise establishing community protocols and maintaining evacuation pathways.

BUILDING SCALE PRINCIPLES

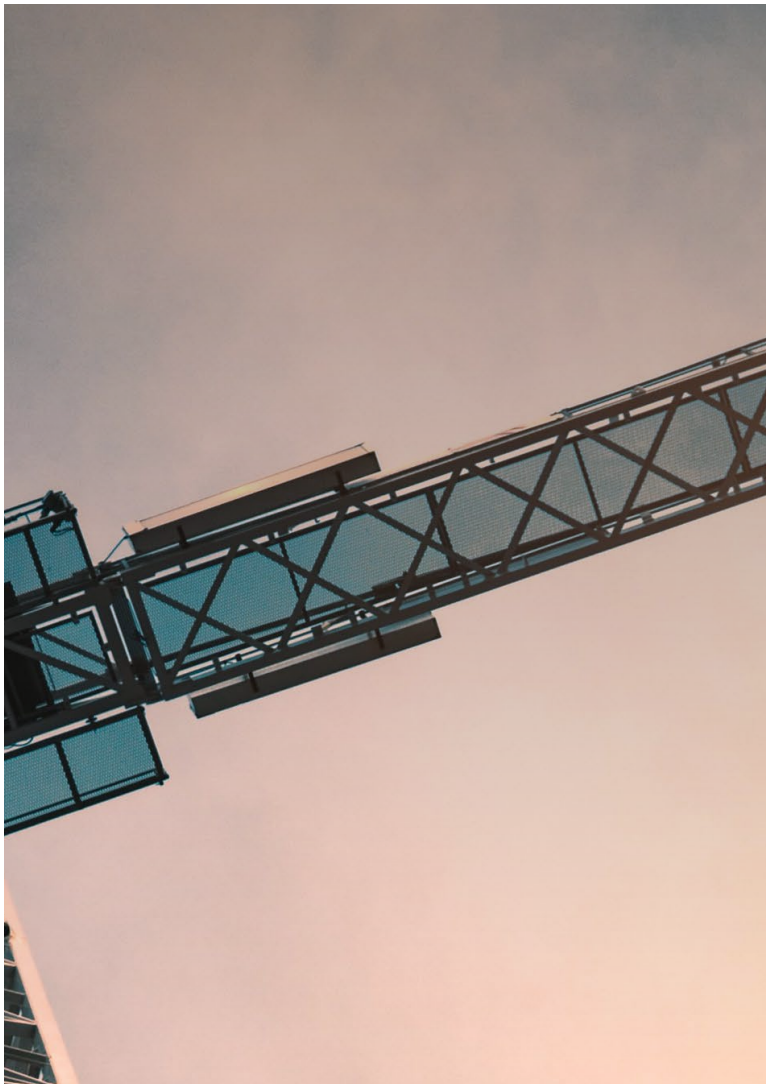
for a resilient and adaptable built environment

LEARN

- **Prepare to undertake adaptation measures** to changing environmental conditions, by ensuring awareness of passive and active retrofit measures for buildings of all typologies to a range of climate impacts.
- **Be aware of sustainable sources of investment** and financing to invest in building upgrades and retrofits for increased resilience and durability against climate impacts and severe weather conditions.
- **Assess the risk of climate change** on physical assets, infrastructure and system stressors through future scenario modelling and risk assessments that consider the lifespan of an asset, including risk of stranded assets.

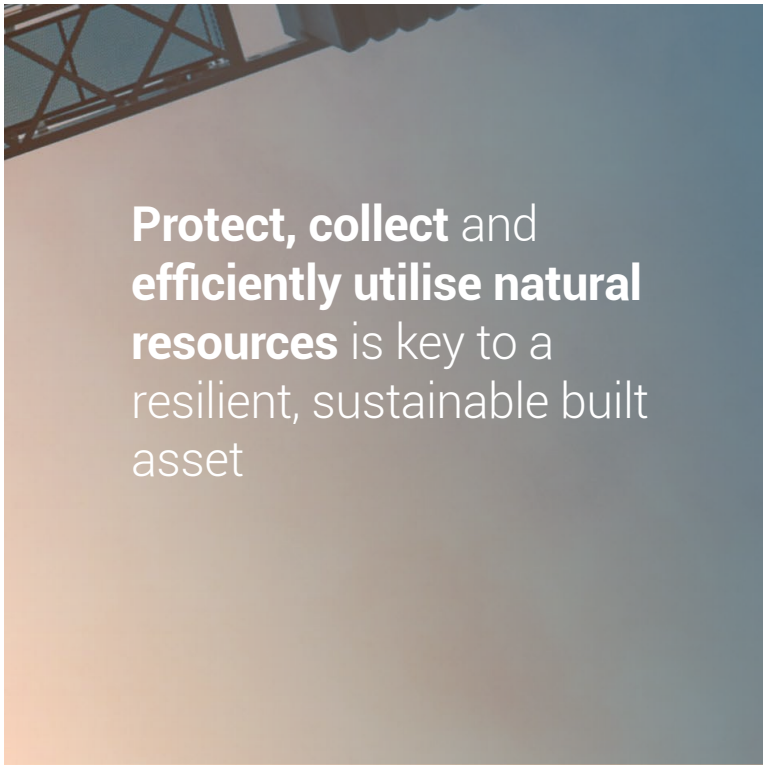
ADOPT

- **Utilise resilience-based measurement frameworks and reporting standards,** calling for users to assess climate risk and adopt resilient and adaptive business strategies based on future scenario modelling of likely climate impacts.
- **Select materials for appropriateness to likely future weather events,** prioritising circularity and low embodied carbon materials.
- **Adopt backup strategies at building scale** in case of extreme weather events such as off-grid, decentralised and resilient energy supply.



ACT

- **Design to protect, collect and efficiently utilise natural resources,** such as rainwater collection apparatus (eg. water wells and tanks, accurately sized to provide enough storage space in drought periods), grey-water reuse systems, low-flow amenities and water-saving devices, building green and blue roofs, or installing rain gardens to manage rainwater runoff with adaptive and native vegetation.
- **Implement passive design and retrofit techniques** - to mitigate extreme heat - northerly orientations, building or adding semi-permanent shading devices, deciduous tree shading, shutters, light colour roofs, overhangs and utilising thermal mass, and avoid large volumes of glazing (on south or north-facing aspects and facades depending on the global north or south regions), or to mitigate extreme cold - capture residual heat with thermoelectric generators and heat exchangers, install passive systems including rooflights and reflective surfaces to increase solar gain, or increase air tightness or wall cladding and glazing insulation and quality to reduce heat loss.
- **Design for durability, disassembly and maintenance,** such as planning for climate appropriate structures and urban layouts to prevent damage, considering techniques in which the building can withstand floods, fire, storms, heat waves, and other climate change events.
- **Guide environmentally-conscious user behaviour,** such as prevention of litter overflow to avoid clogging of storm water systems, placing low retaining walls made from stones or logs to avoid erosion and topsoil, utilise vegetation as windbreaks to avoid topsoil erosion, or install fans instead of air conditioning systems for low-energy cooling.

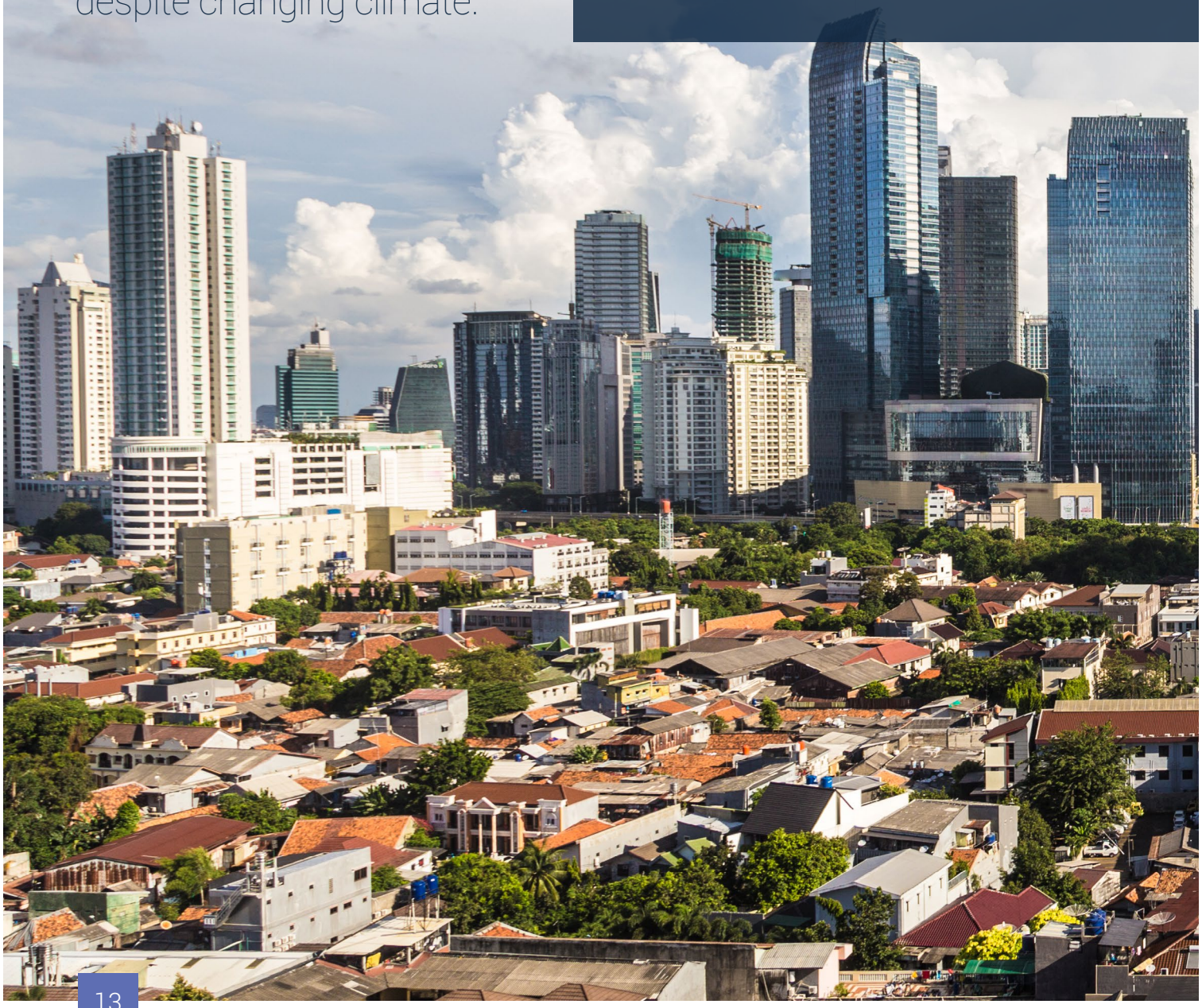


PRINCIPLES IN ACTION

Applying **adaptation solutions** to our cities will ensure that the built environment **continues to protect**, provide for and connect urban citizens, despite changing climate.

Sachin Bhoite
Director of Climate Resilience,
Climate Solutions and Networks
C40 Cities

A VISION FOR RESILIENT CITIES

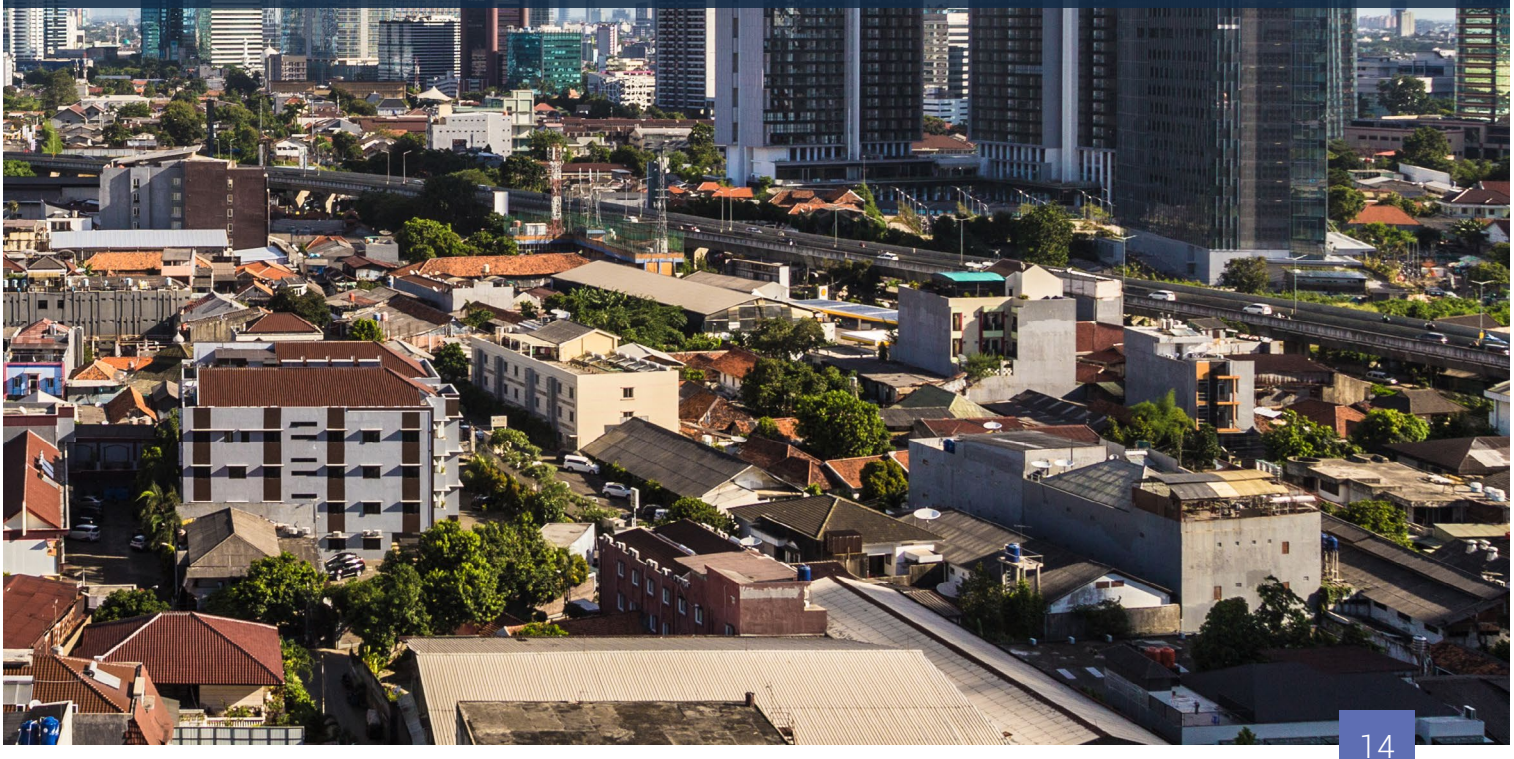


The dangerous consequences of climate change such as more frequent and worsening droughts, flooding and heat waves are already posing an existential threat worldwide.

This is felt acutely in our largest cities. Cities are important in this regard, not only because it is where a majority of people live, but also where the most impactful solutions could be implemented. Applying adaptation solutions to our cities will ensure that the built environment continues to protect, provide for and connect urban citizens, despite a changing climate. Proactive climate adaptation can also deliver transformative health, societal and economic benefits. Most adaptation investments serve multiple purposes and quickly provide everyday benefits for better functioning cities and resilient communities. For instance, strengthened river embankments can be used as pedestrian walkways, cycle lanes or parks; nature-based or 'green' adaptation solutions that use vegetation to reduce heat, drought and flood risk also help to improve air quality, environmental conservation and citizens' wellbeing, as well as absorbing greenhouse gases. Reducing the risks of disasters also improves political security and helps reduce civil unrest, hunger and disease, contributing to a stable environment for social and economic development.

These benefits outweigh the costs of potential losses by a factor of four, on average some leading cities are already taking innovative action. Wuhan is promoting ecologically friendly alternatives to traditional flood defences and drainage systems city-wide called sponge city features. These features will not only work on principles of nature-based solutions to flooding (70% of flood water retention), but also bring multiple benefits to the city including creating cooler environments and creating amenity spaces. The 15-minutes city concept is being applied through urban planning globally, from Bogota to Paris. This is not only due to its positive impacts to local economy and life, but also improving resilience to climate shocks. Cities are also implementing various local solutions to tackle increasing Urban Heat Island (UHI) effect by Los Angeles installing cool paving, Melbourne planting urban forests and Cape Town introducing water sprays in public parks.

Adaptation is needed in cities now. Policy makers, industry and wider stakeholders can ensure a safe and healthy future in cities by taking firm steps, adaptation is embedded in how we plan new and retrofit existing cities. This needs better planning, improved political will and financing adaptation solutions that can make our society more resilient to climate change.



CASE STUDY:
THE COLLECTIVE FOR CLIMATE, PARIS, FRANCE

C40 Reinventing Cities is an innovative, global competition that aims to deliver carbon-neutral and climate-resilient urban regeneration projects. The case study is one of the 33 winners of the project which presents best practice for climate resilience and adaptation in the built environment.

The first zero-carbon neighbourhood of Paris, the Collective for Climate, is situated along the eastern belt of Paris and spans over 35 hectares. The project aims to reduce operational and embodied carbon emissions by 85% through multiple innovative approaches and offset the project's mobility-related emissions through a 'carbon fund'. 80% of the superstructure is built in timber or stone, and 100% of the façades are composed of bio-sourced materials such as terra cotta bricks and hemp. Interestingly 100% of the spaces will be reversible allowing the program to change over time and adapt to changing needs.

Adapting to Extreme Heat

Ambitious target to reduce ambient temperature by 3°C (In comparison to the same building excluding vegetation/ shading). This is achieved mainly through the use of bio-solar roofs.

7,000 m^2 of dedicated green vegetation space of which the majority (5,350 m^2) is a combination of green space on rooftops or on balconies to reduce the heat island effect and the remainder is green public space. The project's vegetation is chosen to maximize the evapotranspiration of the surroundings to limit the heat island effect:

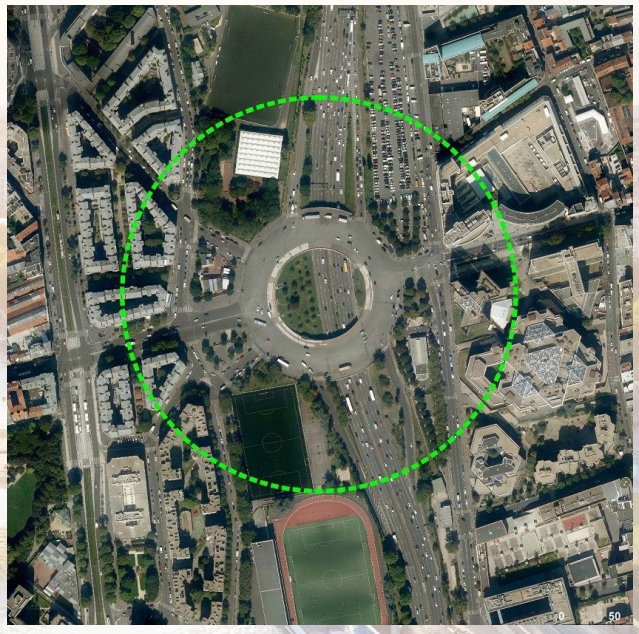
- 80% of the plants chosen are native to France.
- 314 trees are grown in and around the site doubling the number of trees on the site.
- Bioclimatic design to model the quality of the outdoor and indoor air, optimising the choice of location of the air intakes.

Adapting to Drought & Water Scarcity

Excess rainwater is used to water plants leading to reduced potable water demand for irrigation purposes. Improvement of water security through the creation of four cooling oases to complement the public space.

Adapting to Flooding

Semi-permeable coverings over 100% of the catchment area allow rainwater to collect and passively permeate into the underground water table instead of straining the sewage system.



CASE STUDY:
CORREDORES VERDES, MEDELLÍN, COLOMBIA

Medellín, the second largest city in Colombia, has created 30 'Corredores Verdes' (Green Corridors) - an interconnected network of greenery across the city - since 2016. This ambitious initiative provides strong climate resilience benefits, alongside improving urban biodiversity, reducing the city's urban heat island effect, absorbing air pollutants, and sequestering a significant amount of carbon dioxide.

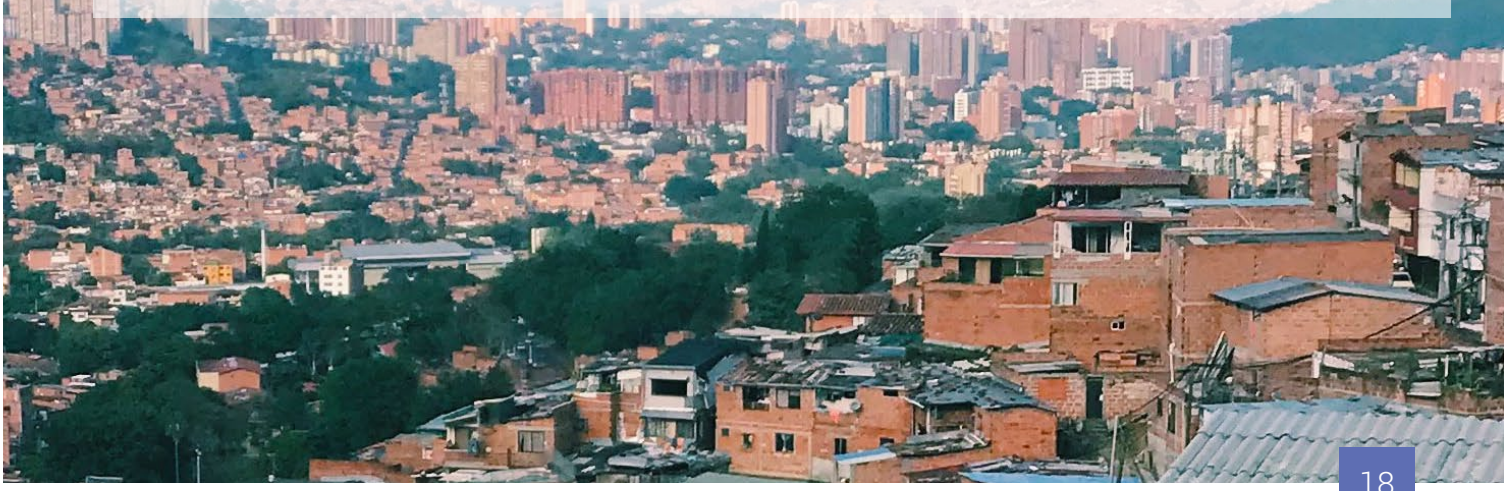
Corredores Verdes is an excellent example of integrating nature-based solutions into the city's existing masterplan, and demonstrates how integrated, nature-based policies can have a far-reaching impact on the local and global environment. Alongside the environmental benefits, the Green Corridors are significantly improving citizens' lives and wellbeing as well as providing social value to the community, specifically jobs for local citizens from disadvantaged backgrounds.

$16.3 million USD has been invested in this ecosystem services project. 8,800 trees and palms have been planted in the 30 corridors that cover 65 hectares, as well as more than 90,000 species of lesser plants. A bioclimatic study estimated that in just one corridor, the new vegetation growth would absorb > 160,000kg of CO_2 per year for the initial phase of the plants' lives. The study's 100-year projection is that over 2.3 million kg of CO_2 would be taken up in the plants' biomass.

Adapting to Extreme Heat and Flooding

Trees and vegetation provide evapotranspiration and shade, which both result in localised cooling. Linear parks and green corridors also help to improve urban ventilation. Vegetation also helps to reduce the risk of flooding. These Green Corridors provide Medellín with a host of ecosystem services: they help to reduce average city temperatures by 2°C, enable carbon uptake via plant growth, capture particulate matter (PM2.5) to improve air quality, and increase urban biodiversity thanks to creation of more wildlife-friendly habitats.

Three years after the programme's beginning, Medellín's urban heat island effect has been reduced by 2°C. In spite of climate change, city officials expect a further decrease of 4-5°C in 28 years' time. This reverses the previous trend that saw the city's average temperatures in 2010, 6°C above what should have been Medellín's average temperature.



RESOURCES TO ENHANCE ACTION

WORLDGBC NETWORK RESOURCES

GBCA: Resilience in the built environment - Understanding the topic

GBCA: Green Star - Rating system setting the standard for healthy, resilient, positive buildings and places

GBC France: Framework for defining resilience and adaptation for the built environment

UKGBC: Climate resilience actor and resource map

UKGBC: Climate resilience and embracing nature: An ambition for the built environment

UKGBC: Making the Case for Green Infrastructure: Lessons from Best Practice

UKGBC: A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets

WorldGBC: Health and Wellbeing Framework - A comprehensive educational tool for healthy and equitable built environment

WorldGBC: Beyond the Business Case Report - Encouraging decision makers to accelerate sustainability transformation through economic opportunities, risk mitigation and social value

WorldGBC: Building Resilience - How a hollistic approach to building resilience is accelerating the SDGs and sustainble buildings

WorldGBC: Sustainable Reconstruction & Recovery Framework - helping communities build back better across the Middle East and North Africa

INDUSTRY RESOURCES

ARUP: City resilience index providing a holistic, practical and evidence-based definition of urban resilience

ASHRAE BC: Building Sustainability & Resilience Guide

Better Buildings Partnership: A guide for commercial real estate companies on climate resilience

BuildChange: A guide to resilient housing

C40: C40 Urban Nature Accelerator

C40: Focused Adaptation: A strategic approach to climate adaptation in cities

GlobalABC: Adaptation of the buildings sector to climate change - 10 principles for effective action

GlobalABC: Roadmap for Buildings and Construction 2020-2050

HBN: Product guidance for sustainable and resilient building materials and concepts

ICC: Building safety solutions and resilience tool-kits

ICLEI: A report on resilient cities, thriving cities - The evolution of urban resilience

Institute for Sustainable Infrastructure: Envision - Sustainable Infrastructure Framework

IWBI: Defining Resilience: A people-first approach to protecting places

Resilience Rising Global: Making systemic resilience the norm as society transforms towards a net-zero future

SIWI: City water resilience approach - A step-by-step guide for resilient water system management

UNDRR: Sendai Framework for Disaster Risk Reduction 2015-2030

UNFCCC: Race to Resilience - Catalysing a step-change for climate resilience, putting people and nature first

WEF : BiodiverCities by 2030 - A report on transforming cities' relationship with nature

Under the inevitable impacts of climate change, **resilience action is essential to build community capacity to survive and thrive in our built environments**. Join us in working towards a resilient, adaptable and sustainable built environment for everyone, everywhere.

ACKNOWLEDGEMENTS

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GBCCR (Costa Rica)
GBCSA (South Africa)
GBC Italia
GGBC (Guatemala)
Jordan GBC
Philippine GBC
UKGBC

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