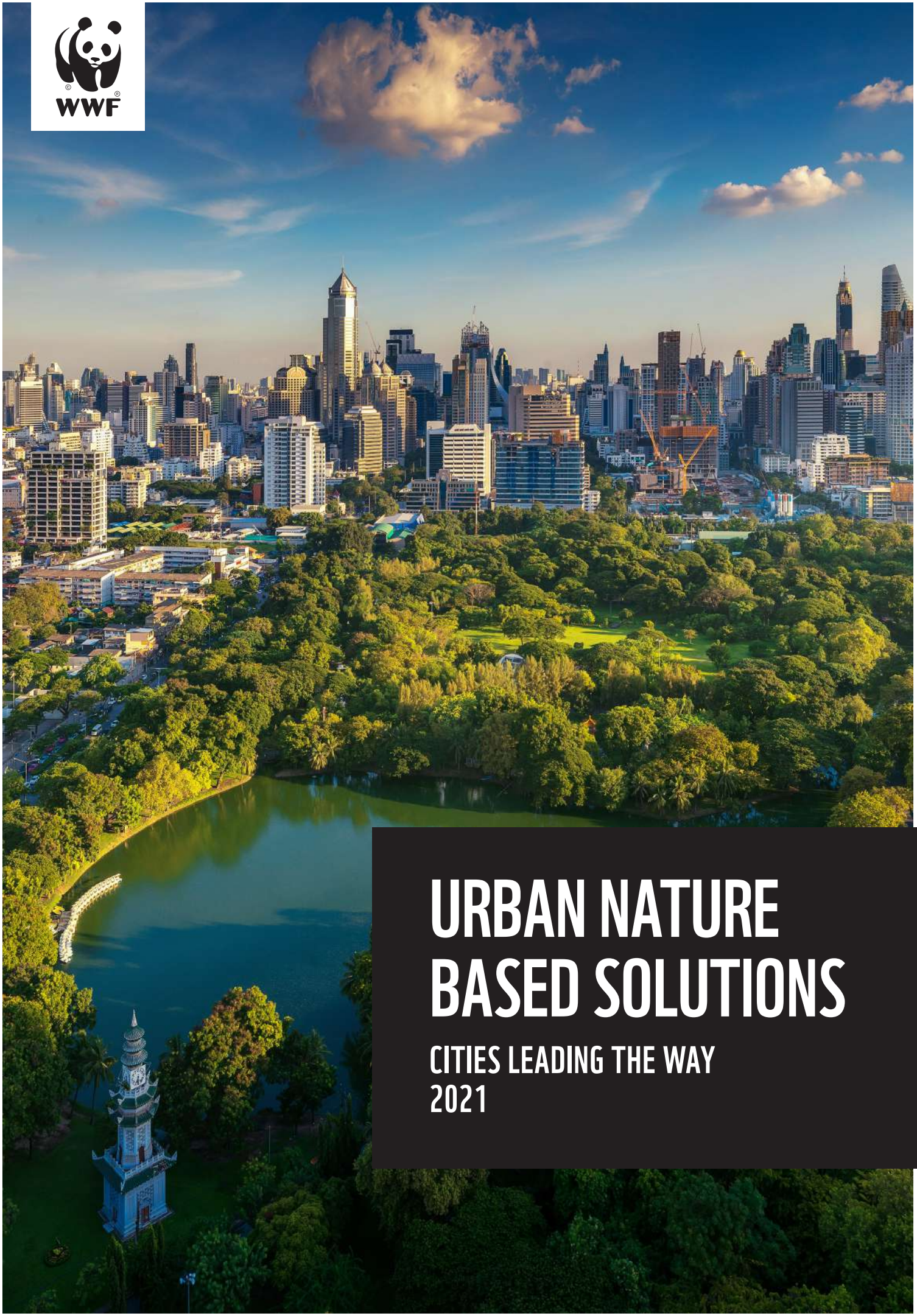


URBAN NATURE BASED SOLUTIONS

CITIES LEADING THE WAY 2021

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction +of pollution and wasteful consumption.

EcoAct, an Atos company, is an international consultancy and project developer, dedicated to helping businesses and organisations succeed in their climate ambitions. We simplify the challenges associated with environmental sustainability, remove complexity and empower individuals and teams to deliver bespoke solutions for a low carbon world.

Our experience tells us that climate action and commercial performance are no longer mutually exclusive. Our mission is to lead the way in delivering sustainable business solutions that deliver true value for both climate and client. EcoAct supported WWF in designing and editing this report.

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BUILD A COLLECTIVE, AMBITIOUS AND MEASURABLE VISION FOR BIODIVERSITY CONSERVATION AND CLIMATE ACTION

The science is frightening and clear: we must transform the way we use energy and natural resources - rapidly and comprehensively - or face catastrophic climate change. The level of global warming we are heading for is already derailing development, costing countless lives, and devastating ecosystems on which people and nature depend, and which WWF has fought so hard to protect. Solving these planetary crises requires systemic thinking.

As the G7Health Ministers' Communiqué pointed out, there are critical links between human and animal health and the environment. Climate-induced mass migrations, more pandemics and conflicts over resources will be inevitable unless urgent action is taken to save the biodiversity on which we all depend. As the Nature Risk Rising report[1] points out, over half of the world's total GDP, $44 trillion USD, involve activities that are moderately or highly dependent on nature. The Economics of Biodiversity: The Dasgupta Review[2] asserts that nature is an asset. It can no longer be treated without value and continue to be degraded, threatening human survival.

Fortunately, global attention and demand for action on climate and nature has never been higher. And the timing is apt, with key global decisions to be taken in 2021 for the recognition of nature-based solutions (NbS) recognition: the first-ever UN Food Systems Summit will be held; the International Union for the Conservation of Nature (IUCN) will host its World Conservation Congress, followed by the Convention on Biological Diversity (COP15) and the UN Climate Conference (COP26). All will require ambitious commitments and actions by governments to reverse the trends of nature loss and address the climate crisis. Equally, governments must ensure broad participation of non-state actors, including cities and subnational governments. They have a critical role to play in delivering ambitious climate and biodiversity outcomes at these meetings and through the global campaigns (Race To Zero and the Nature Action Agenda).

We need governments to heed the call, and to show leadership necessary to build a collective, ambitious and measurable vision for biodiversity conservation, climate action and the sustainable use of natural resources. This should encourage transformational change. This collective vision must incorporate intermediate objectives to measure progress for people's livelihoods and sustainable development and must be effectively mainstreamed into domestic and local policies - including the needed support for cities and local governments to do their part.

If we act now, we can overcome the greatest threats posed by the climate crisis and biodiversity loss, and create a fairer and more sustainable world in which all people can live in harmony with nature. The solutions exist and nature provides many of the answers, including in our cities. Learning from natural systems and processes as a guide for urban policies can help cities and local communities to become more resilient and stable. This includes the incorporation of nature-based solutions in cities and urban areas.

This document showcases eight successful nature-based solutions implemented in cities around the world, demonstrating how NbS can deliver multiple benefits to tackle biodiversity loss and the climate crisis while improving urban quality of life. Cities must include NbS in their local climate plans, which are even more powerful when combined with commitments to end deforestation and habitat conversion.

This publication aims to share the important role of cities adopting nature targets to help restore our relationship with the natural world to realize the promise of the UN Sustainable Development Goals for a net-zero, #NaturePositive world.



Manuel Pulgar Vidal
Global Leader of Climate & Energy, WWF.

1. World Economic Forum's Nature Risk Rising, 2020
2. Economics of Biodiversity: The Dasgupta Review, Partha Dasgupta, 2021

URBAN NATURE-BASED SOLUTIONS
AT THE HEART OF CITIES

Today, more than 55% of the world's population lives in cities. Urbanisation is growing at an unprecedented rate, contributing significantly to the climate crisis and biodiversity loss. Cities also hold many of the solutions to reverse these trends.

As a matter of fact, cities are home to **80% of global GDP**, and are responsible for **70% of CO_2 emissions** and **75% of natural resource consumption**[3]**.** However, when planned well and with ambitious policy, cities can reduce humanity's environmental impacts as they can meet human needs more efficiently (e.g. shared public transport or large-scale energy solutions) and find **synergies between urban development and nature conservation.**

At the same time, the **climate crisis affects people and nature worldwide:** from droughts, fires, flooding and heat waves caused by extreme weather, to the destruction of coral reefs due to changes in ocean temperature. These impacts will worsen if the global temperature continues to rise. Furthermore, climate change and biodiversity loss will especially **impact the most vulnerable populations.** That is why **ensuring cities are resilient** is central.



As population, consumption and solution hubs, cities are where change needs to happen. **Nature-based solutions (NbS) are relevant solutions to enact now in our cities**. The concept of NbS has evolved as an overarching concept aimed to achieve human and ecological benefits, synergistically improving well-being and biodiversity.

The **International Union for Conservation of Nature** (IUCN) defines NbS as "actions to **protect, sustainably manage,** and **restore natural or modified ecosystems**, that address societal challenges effectively and adaptively, simultaneously providing **human well-being and biodiversity benefits**"[4].

According to **WWF**, NbS are specifically designed to address clear societal challenges: **food security, climate change, water security, human health, disaster risk, natural and economic development, whilst protecting nature through monitoring of robust indicators.**

NbS can help to **foster sustainable urban development, while meeting climate adaptation and mitigation** goals. They help biodiversity to thrive and human habitats to become more resilient. Building nature into cities improves their livability, particularly for the economically vulnerable, by reducing temperatures, filtering water and cleaning air.

The urban and peri-urban NbS have shown their efficiency and effectiveness in many cities around the world, in developed and developing countries, in global mega-cities and villages, in inland areas, agricultural, forestry and coastal zones. It reveals that NbS, while varied in terms of what is locally relevant, are universal solutions even if they definitely need to be applied in urban specific contexts.

3. WWF – Urban Nature Based Solutions Initiative – Workshop Report, May 2020

4. IUCN, Nature-based solutions, Definition, 2016

8 URBAN NbS CASE STUDIES TO INSPIRE CITIES

This document aims to **raise awareness of city decision and policymakers, urban planners and developers** about urban nature-based solutions by showcasing **8 existing and successfully implemented programs** in urban and peri-urban contexts.

The selection criteria prioritised robust projects that **can inspire other cities to adapt them locally**. Each case study is presented using the following format:

- **City identity card and profile**
- **Description of the solution**
- **Measured impacts on biodiversity and co-benefits on climate change and society, associated with economic data**
- **Project management and governance**
- **Feasibility analysis: technical, economic and legal**
- **Monitoring**
- **Lessons learned**

Urban NbS were considered at different landscape levels:

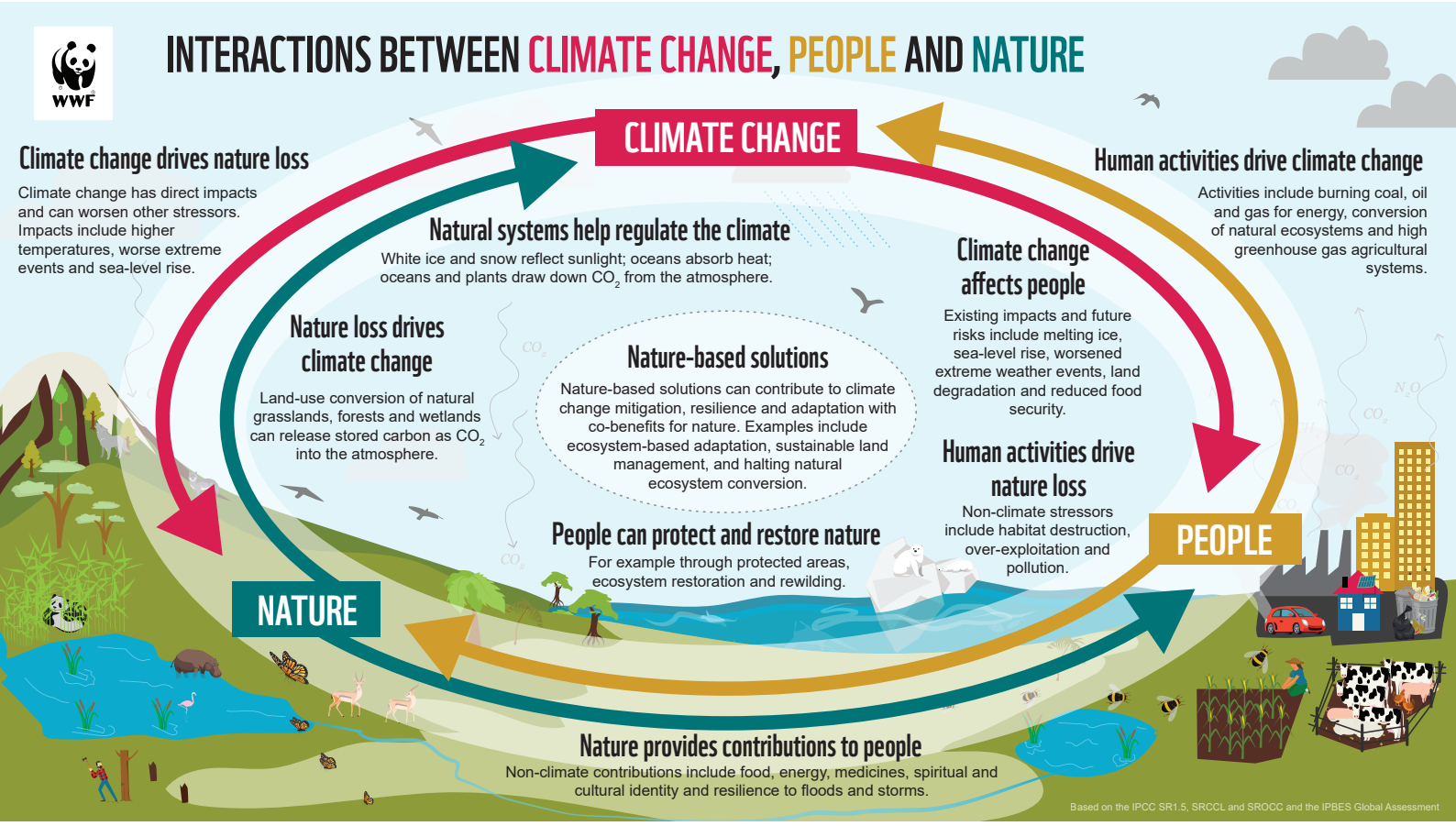
- **Nature-based buildings & neighborhoods**
  Cities are places where humans live and change must occur inside this core function, bringing back nature into the built space.

- **Vegetation, agriculture and forestry**
  A nature-based city guarantees that native vegetation is a priority in all public spaces. Urban parks, agriculture, agroforestry and sustainable forest management are vital for such an urban design.

- **Living rivers**
  Fresh water and rivers need to be put at the center of cities' development for their provision of water, support of natural processes such as flood prevention, their richness in habitats for plants and animals and cooling effect.

- **Living shorelines**
  As 40% of humanity lives on coastal areas[5], coastlines need to build resilience by investing in nature. This perspective involves protecting and restoring shoreline ecosystems.

These international case studies have the ambition to **reflect a broad range of contexts** in terms of **geography, stages of urban, economic development, and landscapes**. Moreover, **several typologies of solutions** are selected presenting **numerous benefits**: climate adaptation and mitigation, food security, health and air quality, well-being, water access and jobs creation.



5. United Nations, Factsheet: People and Oceans, The Ocean Conference, New-York, 2017

SEE WWF RECOMMENDATIONS PAGES 22-23

1 · NATURE-BASED BUILDINGS & NEIGHBOURHOODS

CONTINENT - Europe
TYPE OF LANDSCAPE - Inland
URBAN POPULATION - High (1 million - 10 million)
LEVEL OF ECONOMIC DEVELOPMENT - High income economy



Milan, Italy

BOSCO VERTICALE, A VERTICAL FOREST

> Preserving the integrity and good ecological status of ecosystems
> Restoring degraded ecosystems or creating ecosystems

Bosco Verticale or "vertical forest" consists of two residential towers (80 and 112 metres high) implemented between 2007 and 2014, enveloped by a dense vegetation. It is part of a wider project called the Porta Nova project designed by Boeri Studio. Its objective is to transform a 34-hectare neglected area into a business and residential district integrating NbS.

CO-BENEFITS

- Disaster risk reduction
- Human health & air quality
- Reduction & sequestration of GHG* emissions
- Social benefits and well-being
- Green jobs and economy



*Greenhouse Gas

DATA FOCUS

BENEFITS ON BIODIVERSITY

- 15,000 perennials and ground covering plants present
- 800 trees planted
- 5,000 shrubs seeded

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- -3°C inside buildings in summer
- -7.5% in energy consumption per year
- -30% of particular matter pollution

CLIMATE HAZARDS TACKLED

- Evolution of average temperatures and urban heat island effect
- Heat waves

ECONOMIC DATA

- Around $80 million spent in building costs



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

The project was possible because of an effective and integrated development process between the region which provided guidelines and financial support, and the city of Milan, through its strategic environmental plan. Besides, the city encouraged partnerships with private or semi-private companies and the involvement of local citizens.

TECHNICAL FEASIBILITY

★⯪☆

Strong knowledge is required to choose the best ecosystems to implement and to secure such a building (e.g. avoid falling trees)

ECONOMIC FEASIBILITY

★⯪☆

Concrete terraces sustain the vegetation, increasing costs and embodied carbon. Moreover, maintenance is expensive. However, the project has been a prototype for Trudo Vertical Forest, a social housing building at low cost.

LEGAL FEASIBILITY

★★★

No significant legal obstacle was identified.

MEASUREMENT & MONITORING

- Temperature reduction on average
- Reduction in energy consumption
- Planted trees
- Carbon sequestration

LESSONS LEARNED

- Preparing the maintenance program is highly important to preserve the health, beauty and lifespan of the plants: water management is key and must be sustainable.
- An interdisciplinary approach is required.
- The vertical forest is a project which can be upscaled and has been replicated (e.g. Nanjing, Huanggang, Tirana and Trudo Vertical Forests, all under construction or already built).

TO GO FURTHER

> Oppla, Milan - NBS for urban regeneration, 2017

> Vertical Forest, Stefano Boeri Architetti

> World Green Building Council, It's not that easy being green, 2021

15K
PLANTS ON SITE

-3°
INSIDE BUILDINGS

-30%
OF PARTICULAR MATTER POLLUTION

1 · NATURE-BASED BUILDINGS & NEIGHBOURHOODS

CONTINENT - Europe
TYPE OF LANDSCAPE - Coastal
URBAN POPULATION - Medium (100,000 - 1 million)
LEVEL OF ECONOMIC DEVELOPMENT - High income economy



Malmö, Sweden

AUGUSTENBORG, A GREEN-BLUE NEIGHBORHOOD

> Preserving the integrity and good ecological status of ecosystems
> Restoring degraded ecosystems or creating ecosystems

Since 1998, Ekostaden Augustenborg has been the name for a program to make the 32 ha Augustenborg neighbourhood a more socially, economically and environmentally sustainable place to live. This was thanks to a focus on energy efficiency, a botanical roof garden, pollination preservation, rainwater collection and bioretention basins through open storm water management; all which relied on a committed community. The success of this project has resulted in similar approaches across Malmö and many other cities in Sweden and beyond.

CO-BENEFITS

- Disaster risk reduction
- Water security and access
- Social benefits and well-being
- Green jobs and economy
- Food security & resilience



DATA FOCUS

BENEFITS ON BIODIVERSITY

- +50% biodiversity increase
- +50% of green space extension
- 11,000 m² of green roofs created

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- -20% carbon emissions and waste generation combined with the energy efficiency efforts
- -30% in unemployment
- 10 retention ponds and 6 km of water channels designed for a sustainable urban drainage system
- 90% of stormwater led into the open stormwater system

CLIMATE HAZARDS TACKLED

- Management of average rainfall change
- Storms and floods
- Management of average temperatures change and urban heat island effect
- Heat waves

ECONOMIC DATA

- $24 million invested for physical improvements in Augustenborg and related projects



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

Local stakeholders and residents motivated the project, initiated by the City of Malmö and the MKB housing company. Diverse financing sources helped the project implementation: EU funds, public national budget, public local authority's budget and corporate investments.

TECHNICAL FEASIBILITY

★★★

Augustenborg was a pioneering project in technical NbS and energy solutions. To support similar projects, an education centre was established, technical tours offered, and many written reports to guide other cities.

ECONOMIC FEASIBILITY

★★★

A lot of financial supports (EU, private funds...) facilitated the project's implementation. It is a sustainable investment, relating to costs for managing the challenges in the area before the project.

LEGAL FEASIBILITY

★★★

The Ekostaden Augustenborg project was granted by the government's local investment program.

MEASUREMENT & MONITORING

- Flood events and reduced damages
- Biodiversity increase in percentage
- Increased participation in elections
- New local companies launched
- Heat and hot water reduced consumption

LESSONS LEARNED

- Communicate with the community: workshops, information sessions, festivals, cultural events, community-run cafés.
- Empower the community: support food composting and recycling cooperation between the district and people, support local initiatives to grow food, create leisure and attractive areas for children to play.

TO GO FURTHER

> Ekostaden Augustenborg, World Habitat Awards, 2017

> WWF, Green roofs and innovative water system in Augustenborg , 2012

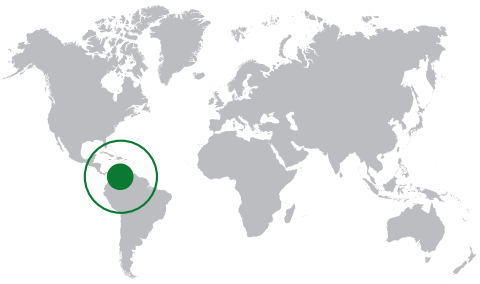
+50%
BIODIVERSITY INCREASE

-20%
CARBON EMISSIONS

-30%
OF UNEMPLOYED PEOPLE

2 · VEGETATION, AGRICULTURE AND FORESTRY

CONTINENT - Latin America & the Caribbean
TYPE OF LANDSCAPE - Inland
URBAN POPULATION - High (1 million - 10 million)
LEVEL OF ECONOMIC DEVELOPMENT - Upper-middle income economy



Medellín, Colombia

GREEN CORRIDORS PROJECT, TREE PITS & RAINGARDENS

> Restoring degraded ecosystems or creating ecosystems

From 2016 to 2019, Medellín's Green Corridors Project created an ecological continuity between several natural areas to restore the green and blue belts, encouraging the movement of species. Urban trees were planted and rain gardens created to support the biodiversity and the well-being of inhabitants.

CO-BENEFITS

- Disaster risk reduction
- Reduction & sequestration of GHG emissions
- Human health & air quality
- Social benefits and well-being
- Green jobs and economy



DATA FOCUS

BENEFITS ON BIODIVERSITY

- 36 green corridors created
- 8,800 trees planted
- 90,000 species of lesser plants seeded
- 65 hectares preserved

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- -2°C on average
- -160,787 kg of CO_2/year
- 678 heart-related deaths averted
- 75 locals from more disadvantaged backgrounds hired as gardeners

CLIMATE HAZARDS TACKLED

- Evolution of average temperatures
- Heat waves
- Heavy rain
- Floods

ECONOMIC DATA

- $16.3 million investment
- $136 million benefits estimated between 2020 and 2030



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

Initiated by the municipality, "A greener Medellín for you" program was launched by the Secretariat of Infrastructure and Environment. It entices citizens to be more environmentally involved. Trainings have been planned to integrate the people since the beginning of the project.

TECHNICAL FEASIBILITY

★★☆

The choice of trees and plants species is decisive for such a project. A true expertise is necessary in terms of urban planning.

ECONOMIC FEASIBILITY

★★☆

Large investments are necessary for a city-based project but expected sustainable returns are high on the long run, for nature & people.

LEGAL FEASIBILITY

★★★

Colombian legislation dedicates a part of cities' budgets in projects where citizens are involved in the selection through a democratic vote. The Green Corridors project was supported by the population.

MEASUREMENT & MONITORING

- Average temperature variations
- Days above thermal thresholds
- Planted species
- Heart-related deaths averted
- Number of community projects

LESSONS LEARNED

- Target busiest areas for greatest impact.
- Make the most of national and local legislation opportunities.
- NbS are profitable.
- NbS are valuable for cities' influence: 2019 Ashden Award for Cooling by Nature, 2019 C40 Cities Bloomberg Philanthropies Award for Resilience.

TO GO FURTHER

> C40 Cities, Heat Resilient Cities Case study, Medellin

> C40 Knowledge Hub, Medellín's interconnected green corridors, 2019

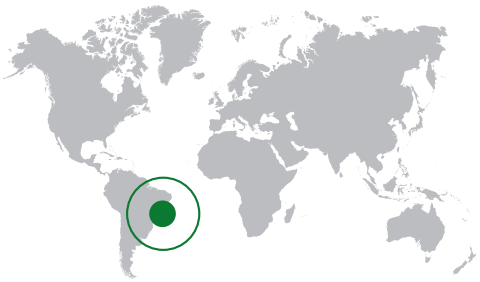
36
GREEN CORRIDORS CREATED

-2°C
ON AVERAGE

75
LOCALS HIRED

2 · VEGETATION, AGRICULTURE AND FORESTRY

CONTINENT - Latin America & the Caribbean
TYPE OF LANDSCAPE - Forest
URBAN POPULATION - High (1 million - 10 million)
LEVEL OF ECONOMIC DEVELOPMENT - Upper-middle income economy



Salvador, Bahia, Brazil

RAINFOREST RECOVERY IN URBAN AREAS

> Preserving the integrity & good ecological status of ecosystems
> Improving sustainable management of ecosystems used by human activities
> Restoring degraded ecosystems or creating ecosystems making a greener & more liveable home for residents

Salvador launched an ambitious urban forest rehabiliation project: "Salvador Capital da Mata Atlântica" to make a greener and more liveable home for residents. 15 integrated ongoing policies aim at transforming public spaces that ensure the sustainable development of the Atlantic Forest. There are initiatives such as the requalification of the existing Botanical Garden, the distribution of tree seedlings, the planting of forest areas, the introduction of birds, butterflies and other insects in parks and squares in the city, among others.

CO-BENEFITS

- Disaster risk reduction
- Reduction & sequestration of GHG emissions
- Water security and access
- Human health & air quality
- Social benefits and well-being



DATA FOCUS

BENEFITS ON BIODIVERSITY

- 39 conservation areas created in the city covering 19 km²
- 75,000 trees planted
- Around 30 m² of green space available per inhabitant

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- 200,000 tonnes of CO_2 captured over 20 years
- Parque das Dunas was recognized by UNESCO with the title of "Posto Avançado de Reserva de Biosfera"
- Improved health for residents

CLIMATE HAZARDS TACKLED

- Heavy Rain
- Floods
- Evolution of average temperatures and urban heat island effect
- Heat waves
- Drought

ECONOMIC DATA

- Low investment and operational costs



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

Fully included in the Atlantic Forest biome, the city of Salvador developed political tools to facilitate the conservation of rainforest in town, integrated in the Urban Development Master Plan. A Master Plan for Urban Afforestation and a technical manual for planting native trees compatible with local infrastructures were produced.

TECHNICAL FEASIBILITY

★★☆

Technical expertise is required to choose the right trees.

ECONOMIC FEASIBILITY

★★☆

Low costs are reported for such measures in literature.

LEGAL FEASIBILITY

★★★

The city of Salvador was actively involved in developing tools to facilitate the implemention of the 15 initiatives.

MEASUREMENT & MONITORING

- Number of planted trees
- Hectares covered by the rainforest recovery
- Number of citizens/local initiatives involved in the restoration
- Tonnes of captured CO_2

LESSONS LEARNED

- Empower the private sector: private companies manage green spaces whom they are responsible for and people benefit from it.
- Involve citizens and use environmental policies as a leverage to strengthen community spirit.
- Evaluate projects on a multi-criteria basis: evaluating social impacts aims to value afforestation and nature conservation.

TO GO FURTHER

> Salvador, Cities 100, pages 108-109, 2019

> Salvador Prefeitura, Salvador & Climate, 2019

> Cities4Forests, Salvador, Case study

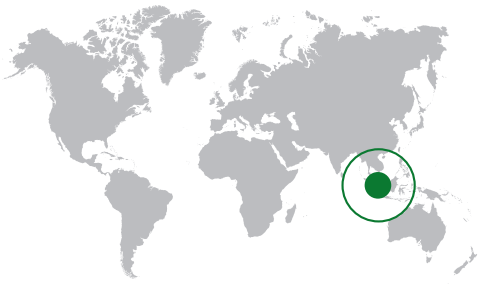
75K
TREES PLANTED

200K
TONNES OF CO_2E CAPTURED OVER 20 YEARS

30 M²
OF GREEN SPACE AVAILABLE PER INHABITANT

3 · LIVING RIVERS

CONTINENT - East Asia and Pacific
TYPE OF LANDSCAPE - Wetlands
URBAN POPULATION - High (1 million-10 million)
LEVEL OF ECONOMIC DEVELOPMENT - High income economy



Singapore

BISHAN-ANG MO KIO PARK AND KALLANG RIVER RESTORATION

> Restoring degraded ecosystems or creating ecosystems

Bishan-AMK Park is one of the largest urban parks in Singapore. Between 2009 and 2012, the project naturalised a concrete storm drain that ran through the park into a 3 kilometers meandering river with lush vegetated banks. Civil engineering techniques were combined with a soil bio-engineering approach and biophilic design principles.

CO-BENEFITS

- Disaster risk reduction
- Reduction & sequestration of GHG emissions
- Human health & air quality
- Water security and access
- Social benefits and well being, recreation and education



DATA FOCUS

BENEFITS ON BIODIVERSITY

- Over 100 species of birds present
- 40 species of dragonflies and damselflies found on site
- Over 50 species of butterflies and moths identified
- More than 10 species of native riverine plants along floodplains listed

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- 4 millions visitors/year on site
- 2.4 to 3.6 times increase in socio-economic value vs baseline option (concrete canal)
- Savings of $57 million in capital expenditure compared to the baseline solution

CLIMATE HAZARDS TACKLED

- Changes in rainfall patterns
- Flood
- Rising temperatures and urban heat island effect
- Drought and erosion

ECONOMIC DATA

- Capital expenditure: $75 million
- Operating expenditure: $4.45 million/year
- SDGs socio-economic benefits: $105 million/year (conservative estimate)



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

The project is a joint collaboration between PUB, Singapore's National Water Agency and the National Parks Board (NParks). Today, NParks continues to operate and maintain the park, runs community programs, and provides informational signage for biodiversity. The floodplain plays a major role in PUB's flood risk mitigation strategy.

TECHNICAL FEASIBILITY

★★★

It took 11 months only to test 10 different bio-engineering techniques before implementation.

ECONOMIC FEASIBILITY

★☆☆

$75 million capital expenditure was necessary but the spending is coupled with high socio-economic returns ($105 million per year).

LEGAL FEASIBILITY

★★★

The use of existing parkland and waterway without additional land-take facilitated the legal concerns.

MEASUREMENT & MONITORING

- Biennial nationwide park usage and satisfaction surveys led by NParks
- Citizen science monitoring programs for birds, butterflies and dragonflies on site
- Studies to assess the cost-benefit balance

LESSONS LEARNED

- NbS may be cheaper than building conventional grey infrastructure. They can improve the local ecosystems and also generate benefits through ecosystems services.
- These solutions not only beautify the landscape but have substantial impact on people's life.
- Pilot tests are essential to ensure the basic requirements are met (e.g. flood control).

TO GO FURTHER

> NParks on Bishan-AMK Park,2021

> Center for Liveable Cities Singapore, Urban Systems Studies, 2017

> National University of Singapore, Cost-benefit Analysis of Bishan-AMK Park, 2015

+100
SPECIES OF BIRDS PRESENT

3KM
MEANDERING RIVER

4M
VISITORS PER YEAR ON SITE

3 · LIVING RIVERS

CONTINENT - East Asia and Pacific
TYPE OF LANDSCAPE - Inland
URBAN POPULATION - High (1 million - 10 million)
LEVEL OF ECONOMIC DEVELOPMENT - High income economy



Seoul, South Korea

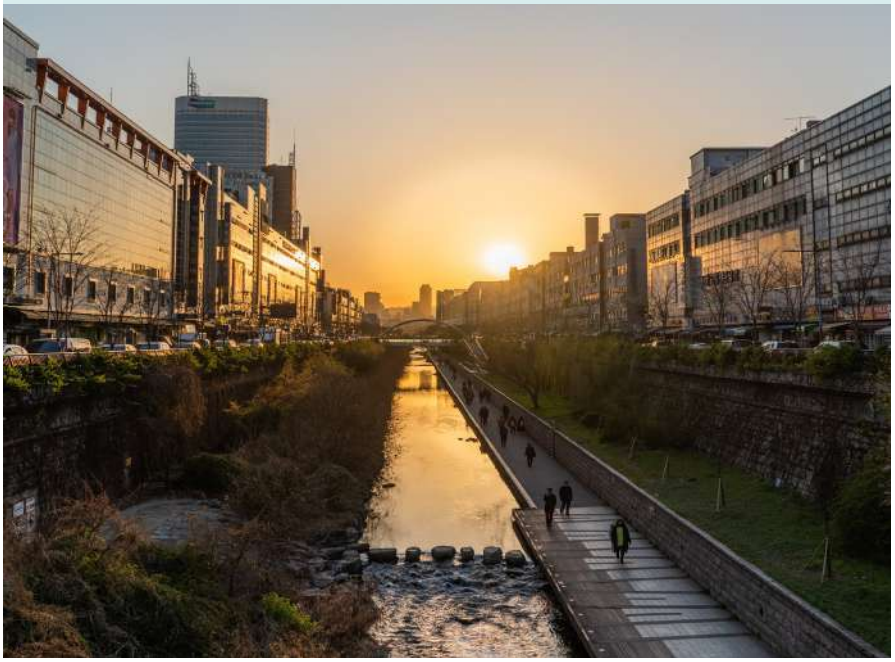
DAYLIGHTING RIVER: REVITALISING THE CHEONGGYECHEON STREAM

> Preserving the integrity and good ecological status of ecosystems
> Restoring degraded ecosystems or creating ecosystems

The Cheonggyecheon Stream had been covered for decades to be used as roads with highway overpasses. From 2002 to 2005, the City of Seoul used its own resources to bring new life to the downtown area by enhancing the urban environment. The stream restoration led to the revitalisation of central Seoul, unleashing the potential for green public spaces.

CO-BENEFITS

- Disaster risk reduction
- Water access
- Human health & air quality
- Social benefits and well being



DATA FOCUS

BENEFITS ON BIODIVERSITY

- 6 km of green corridors and 400 hectares of parks created
- From 6 to 36 bird species indexed
- From 4 to 25 fish species listed
- From 62 to 308 plant species catalogued (2009 data)

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- Up to 3 to 5°C cooling reached
- -160,000 cars/day achieved by limiting traffic in city center and providing bypasses: 35% decrease in small-particle air pollution
- +25-50% land value
- 30,000 people use the riverside park every weekend

CLIMATE HAZARDS TACKLED

- Evolution of average rainfall and heavy rain
- Storms and floods
- Evolution of average temperatures and heat island effect
- Heat waves

ECONOMIC DATA

- $323 million of final budget dedicated for the restoration
- $1.98 billion worth of capital investment



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

The project headquarters office and the City Hall served as the main implementation arm of the project. The Cheonggyecheon Research Group was established with the support of of the Seoul Development Institute to support the restoration project. Citizens were involved in decision-making.

TECHNICAL FEASIBILITY

★⯪☆

In South Korea, it is unusual that the landscape architects manage civil engineering, bridge design and lighting design teams.

ECONOMIC FEASIBILITY

★⯪☆

While the maintenance costs of the highway would have cost less- $260 millions, the project enabled an estimated $1.98 billion worth of capital investment in the area.

LEGAL FEASIBILITY

★★★

The project gathered a citizens' committee, the project headquarters and a research group.

MEASUREMENT & MONITORING

- Number of plants, fishes, insects and birds species
- 200-year flood events
- Biodiversity increase in percentage
- Fine-particle air pollution rate
- Number of visitors
- New businesses in the area

LESSONS LEARNED

- Solutions must integrate the needs of all users from the initial planning and design phase.
- The cost of maintaining grey and old infrastructures is usually high. Computing it can be a convincing tool to advocate for the implementation of NbS.
- Use the less proportion of grey solution in NbS as possible.

TO GO FURTHER

> The World Bank, Case studies, Seoul, 2015

> Landscape Performance Series, Cheonggyecheon Stream Restoration Project, 2011

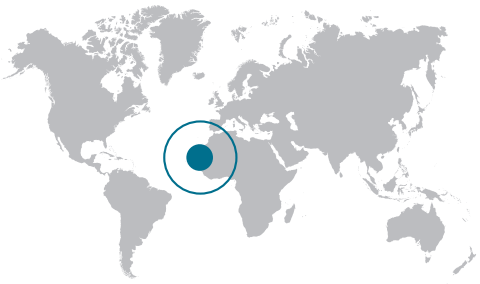
400
HECTARES OF PARKS CREATED

3-5°C
COOLING REACHED

-35%
IN FINE-PARTICLE

4 · LIVING SHORELINES

CONTINENT - Sub-Saharan Africa
TYPE OF LANDSCAPE - Wetlands
URBAN POPULATION - Low (10,000 - 100,000)
LEVEL OF ECONOMIC DEVELOPMENT - Low income economy



Cacheu River Mangroves Natural Park, Guinea-Bissau

CONSERVING & RESTORING MANGROVES FOR BIODIVERISTY, CLIMATE CHANGE & PEOPLE

> Improving sustainable management of ecosystems used by human activities
> Restoring degraded ecosystems or creating ecosystems

The initiative focuses on restoring the mangrove ecosystem and conserving existing mangrove resources while supporting sustainable rice agriculture, fisheries, salt production and wood harvesting. During Phase I (2015-2018), the Cacheu River Mangroves Natural Park established co-management arrangements between local communities and national park authorities. Phase II will end in 2026.

CO-BENEFITS

- Food security & resilience
- Disaster risk reduction
- Reduction & sequestration of GHG emissions
- Social benefits and well-being
- Green jobs and economy



DATA FOCUS

BENEFITS ON BIODIVERSITY

- 88,615 protected hectares of vegetation
- 200 hectares of mangroves restored
- 8,000 hectares of community-based protected forest
- +2,500 ha of protected land in Phase II

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- Rice yield doubled: from 260 to over 500 kilos per hectare per year
- -80% use of mangrove fuelwood
- 7 villages provided with sustainable livelihood alternatives
- 24 committee-members mobilized from the villages and national park authorities

CLIMATE HAZARDS TACKLED

- Floods
- Sea level rise resulting in salt water intrusion and soil acidification

ECONOMIC DATA

- Phase I: Turing foundation as donor
- Phase II: support from Greenchoice/ DOB Ecology/Turing foundation/Waterloo Foundation which donated 1.2 million euros



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

The project was implemented by Wetlands International in collaboration with the Institute for Biodiversity and Protected Areas (IBAP) and local community-based organizations.

TECHNICAL FEASIBILITY

★★★

The Ecological Mangrove Restoration adopted approach provides an alternative to conventional mass planting projects that have demonstrated very low performance.

ECONOMIC FEASIBILITY

★★★

Potential cost reduction of up to 90% are reached compared to conventional planting.

LEGAL FEASIBILITY

★★★

New rules for access and use of natural resources were developed. All the stakeholders were involved in a shared governance process. This approach has been replicated in other protected areas of the country.

MEASUREMENT & MONITORING

- Hectares of mangroves loss reduction
- Surface of protected forest areas
- Families with increased income
- Harvest yields on rice farming
- Number of planted species
- 3-year field monitoring efforts with communities and park authorities

LESSONS LEARNED

- Raising awareness among communities about the importance of conserving and restoring mangroves is efficient.
- Working closely with communities enables direct co-benefits.
- The monitoring results have demonstrated the relevance of Ecological Mangrove Restoration.

TO GO FURTHER

> Wetlands International, Conserving Biodiversity of Cacheu Mangroves National Park at Guinea-Bissau, 2018

> IUCN, African solutions in a rapidly changing world, 2015

89K

PROTECTED HECTARES OF VEGETATION

7

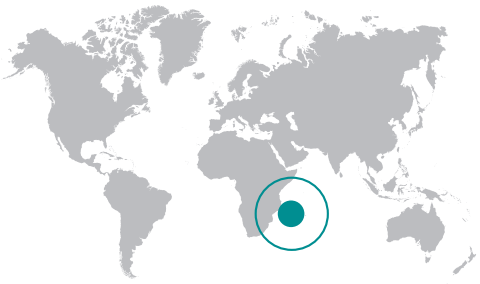
VILLAGES WITH SUSTAINABLE LIVELIHOOD ALTERNATIVES

x2

RICE YIELD DOUBLED

4 · LIVING SHORELINES

CONTINENT - Sub-Saharan Africa
TYPE OF LANDSCAPE - Coastal
URBAN POPULATION - Low (10,000 - 100,000)
LEVEL OF ECONOMIC DEVELOPMENT - Low income economy



Mangaoka and Ampasindava, Madagascar

NOSY HARA, A RESILIENT MARINE PROTECTED AREA

> Preserving the integrity and good ecological status of ecosystems
> Improving sustainable management of ecosystems used by human activities
> Restoring degraded ecosystems or creating ecosystems

Supported by WWF, this project aims to rehabilitate coastal areas in order to protect seagrass beds, coral reefs and mangroves, to restore ecosystem services and to mitigate climate change risks for local populations.It started in 2004 and was finalised in 2007.

CO-BENEFITS

- Food security & resilience
- Disaster risk reduction
- Reduction & sequestration of GHG emissions
- Social benefits and well-being
- Green jobs and economy



DATA FOCUS

BENEFITS ON BIODIVERSITY

125,471 hectares of marine protected area for biodiversity:

- Fauna and marine mammals: corals, turtles, marine birds, fishes
- Flora: seagrass beds, mangroves
- Corals focus: 332 of 340 coral species are found in the Western Indian Ocean

CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- Avoid the depletion of fish resources for local populations subsistence
- Enhance social cohesion thanks to collaborative meetings of reflexion on resilience measures adapted to the local scale

CLIMATE HAZARDS TACKLED

- Storm
- Marine submersion
- Erosion

ECONOMIC DATA

- Low investments required



GOVERNANCE AND MANAGEMENT

GOVERNANCE RATIONALE

The project was led by WWF and Madagascar National Parks which raised funds from the MacArthur Foundation. The solution benefitted from Madagascar's national commitments with regards to Marine Protected Areas and the support from public agencies. The project was also backed by local populations and experts.

TECHNICAL FEASIBILITY

★★☆

The possible obstacles in such a project are the set up of a solid assessment methodology and the gathering of enough data.

ECONOMIC FEASIBILITY

★★★

Management costs are quite low.

LEGAL FEASIBILITY

★★★

There are increasing numbers and types of marine protected areas, which facilitate the legal feasibility. Therefore, it is possible to adapt the legal framework to local legal constraints.

MEASUREMENT & MONITORING

- Socio-economic variables: monitoring for coastal management, e.g. coastal economic activity and trainings
- Coral reefs resilience: benthic coverage, water quality
- Coastal community vulnerability: climate witness assessment tool, e.g. adaptation opportunities

LESSONS LEARNED

- Involving experts is highly recommended: marine life requires a unique expertise.
- Local populations' participation is crucial as their insights are valuable.
- Solid databases and frequent data gathering are key to target the most efficient monitoring possible.

TO GO FURTHER

> WWF & ESSA Forest, Marine protected areas and climate change, Experiences of the Nosy Hara Marine National Park, 2011

> IUCN, Coral Reef Resilience Assessement of the Nosy Hara Marine Protected Area, Northwest Madagascar, 2009

125K

HECTARES OF MARINE PROTECTED AREA

A CLIMATE WITNESS TOOL

A TOOL FOR SOCIO-ECONOMIC MONITORING FOR COASTAL MANAGEMENT

KEY SUCCESS FACTORS FOR NBS IMPLEMENTATION

1. Empower all stakeholders & thrive social development

Ensuring the involvement of all stakeholders

Urban NbS are **local interventions.** Therefore, local stakeholders must be fully involved at all stages, from the identification of the societal challenge to the maintenance of the solution. NbS should especially target **youth, women, people with disabilities** and other **marginalised community** members. Ideally, NbS should ensure responsive, inclusive, and representative decision-making with all stakeholders at different levels. The accessibility, availability, and other aesthetic aspects of NbS need to be equally distributed among the stakeholders.

Achieving sustainable and successful NbS requires the **reliance on scientific principles**. In many cases, **Indigenous and Traditional Knowledge** will be central to sustainable nature-based solutions.

Combining top-down approaches with bottom-up strategies

Projects initiated by local communities and municipalities may ensure they have the support from people and citizens. **Inclusive and participative management** instead of a directive one will facilitate project realisation, solving potential issues. **Co-designed and co-implemented NbS with local stakeholders** are more successful. Participatory approaches involving multiple stakeholders are impactful.

Sharing feedback and identifying best practices also facilitate the implementation of urban NbS. It will help in identifying the best financing sources, from local, regional, national and international opportunities.

2. Increase inter-sectoral policy integration of urban nature-based solutions

NbS should have a **landscape intention** and a **cross-sectoral** and **thematic approach**.

Policy support should explicitly recognise the need for a landscape-based vision involving a diverse portfolio of NbS. **Economic benefits and return on investments must be balanced against societal considerations** such as health and air quality, climate change adaptation and mitigation, job creation, water access and security, food system resilience and biodiversity conservation.

Ecosystem services (i.e. the benefits people obtain from ecosystems) **should be valued in project evaluations**. Eventually, nature can offer protection services and avoided costs, thus increasing economic benefits. Indeed, according to the Center for Research on Energy and Clean Air, "the economic costs of air pollution from fossil fuels are estimated at USD $2.9 trillion in 2018, or 3.3% of global GDP, far exceeding the likely costs of rapid reductions in fossil fuel use"[6].

Besides, **NbS should be cost-effective in relation to other solutions**. While cost-effectiveness of natural solutions is often hard to quantify, the **externalities of hard/grey infrastructures** compared to the sustainably achieved using NbS must also be considered in the assessment. Indeed, nature can provide long-term benefits that need to be properly accounted for.

3. Make sure to improve biodiversity

NbS is a **tool for social development providing biodiversity benefits.** NbS should improve biodiversity and make sure solutions are sustainably managed.

A NbS should be a **place-based** intervention that uses the functioning **power of ecosystems.** It should be designed and implemented according to **scientific** and **conservation principles**.

Conservation work designed to address biodiversity loss is crucial. Not everything must be labeled a nature-based solution to be relevant. While conservation focuses on securing nature and biological diversity, using a range of approaches including protected areas, species conservation, and policy and advocacy to ensure that species and nature can survive, NbS focuses on helping people by addressing societal challenges.

6. Center for Research on Energy and Clean Air (CREA), Quantifying the Economic Costs of Air pollution from Fossil Fuels, 2020.

4. Cover tackling climate change as part of the project

Local governments and cities still need to reduce their carbon emissions as well as implement NbS to **support urban resilience**, while also the co-benefits that they can achieve (e.g. NbS for urban cooling, as opposed to mechanical cooling solutions). Therefore, **NbS should be added to local climate action plans.**

NbS should **identify the climate risks** to people and nature at the outset. They must ensure that **adaptation options** are co-designed by the affected people to address these risks and are appropriate to their needs and contexts.

5. Be context specific

NbS should be **context specific and appropriate.** This refers to both nature as well as to the people living in the area and whose societal challenges will be addressed. A successful NbS intervention in one place cannot necessarily be directly transplanted to other contexts and regions. NbS results will be determined by the **natural, cultural, socio-economic** and **policy contexts** in which they are applied.

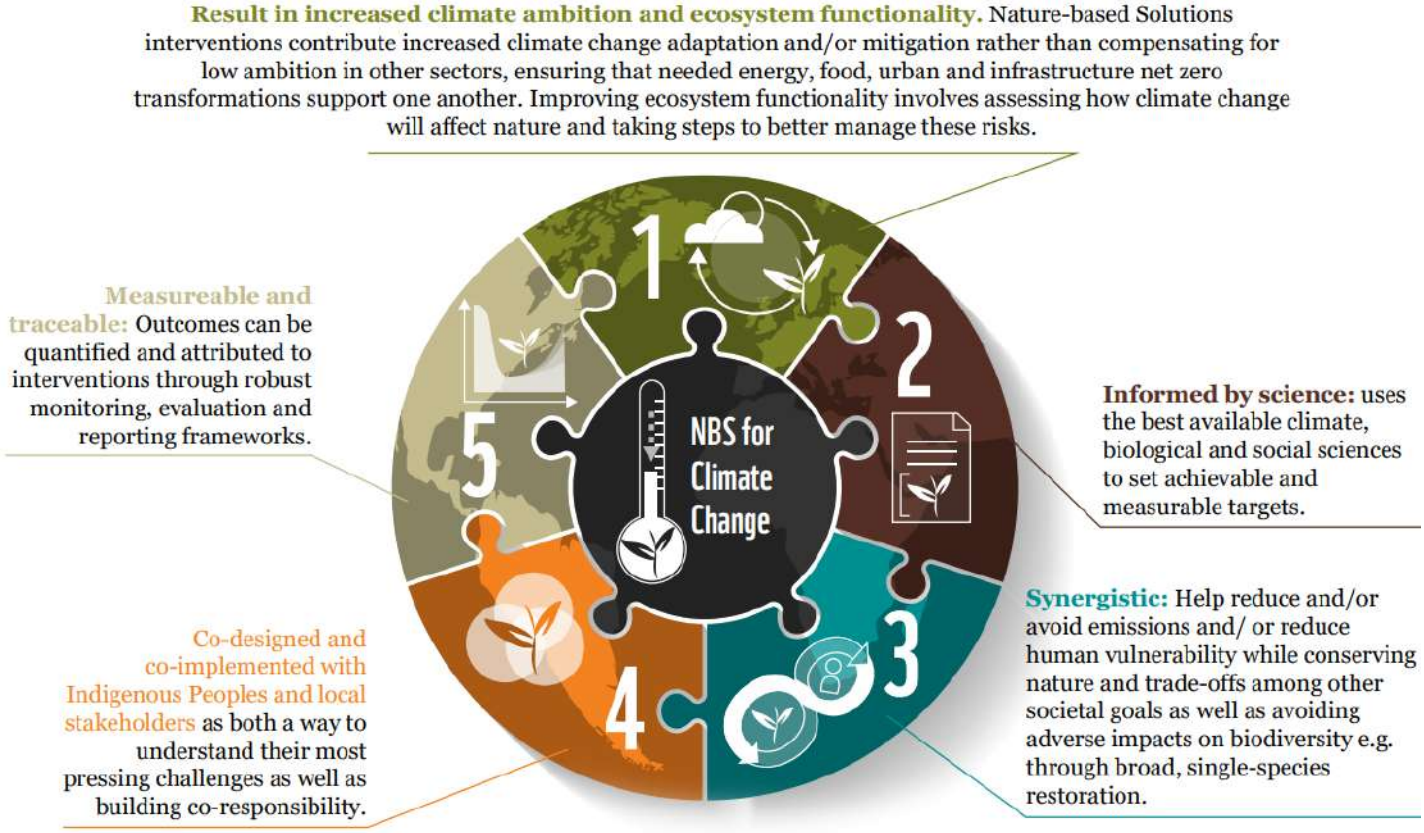
6. Ensure a stable and robust monitoring and measurement system

Nature-based policy should set **well-defined time-bound objectives** and **build capacity** to effectively **monitor** NbS outcomes over the long term. Defining the **key performance indicators** that would provide relevant information of the project impact on the environment and people is a cornerstone (eg. biodiversity increase, jobs created, floods damage, average temperature in the area, energy consumption…). **Co-benefits for human well-being at the local level must be measurable.**

Moreover, **creating or using monitoring tools and identifying the human resources** (pilots and managers) that will enable the reporting clarifies the requirements for project management organisation.

To sum up, even if the **funding** is **short-term**, it is central to have a **long-term perspective** in mind to capitalise on **positive externalities for nature and people.**

5 KEY PRINCIPLES FOR NATURE-BASED SOLUTIONS FOR CLIMATE CHANGE



Source: WWF (2020).



WWF

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