

# NATURE BASED SOLUTIONS

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# NATURE BASED SOLUTIONS REPORT

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# THE ANTHROPOCENE

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Human beings have existed for just 200,000 years, yet our impact on the planet is so great that scientists around the world are calling for our period in the Earth's history to be named the 'Anthropocene' – the age of humans. The changes we are now making have exacted a heavy toll on the natural world around us. It's vital that people understand the impact we have.

Since the agricultural revolution some 12,000 years ago (when we started building cities and accumulating goods), human enterprise has steadily grown. However, our impact has surged dramatically over the past couple of centuries. This surge has since transformed into exponential growth, particularly since 1950. Now, the materials used by humans now weigh more than all life on Earth – here's four graphs that reveal our staggering impact on the planet



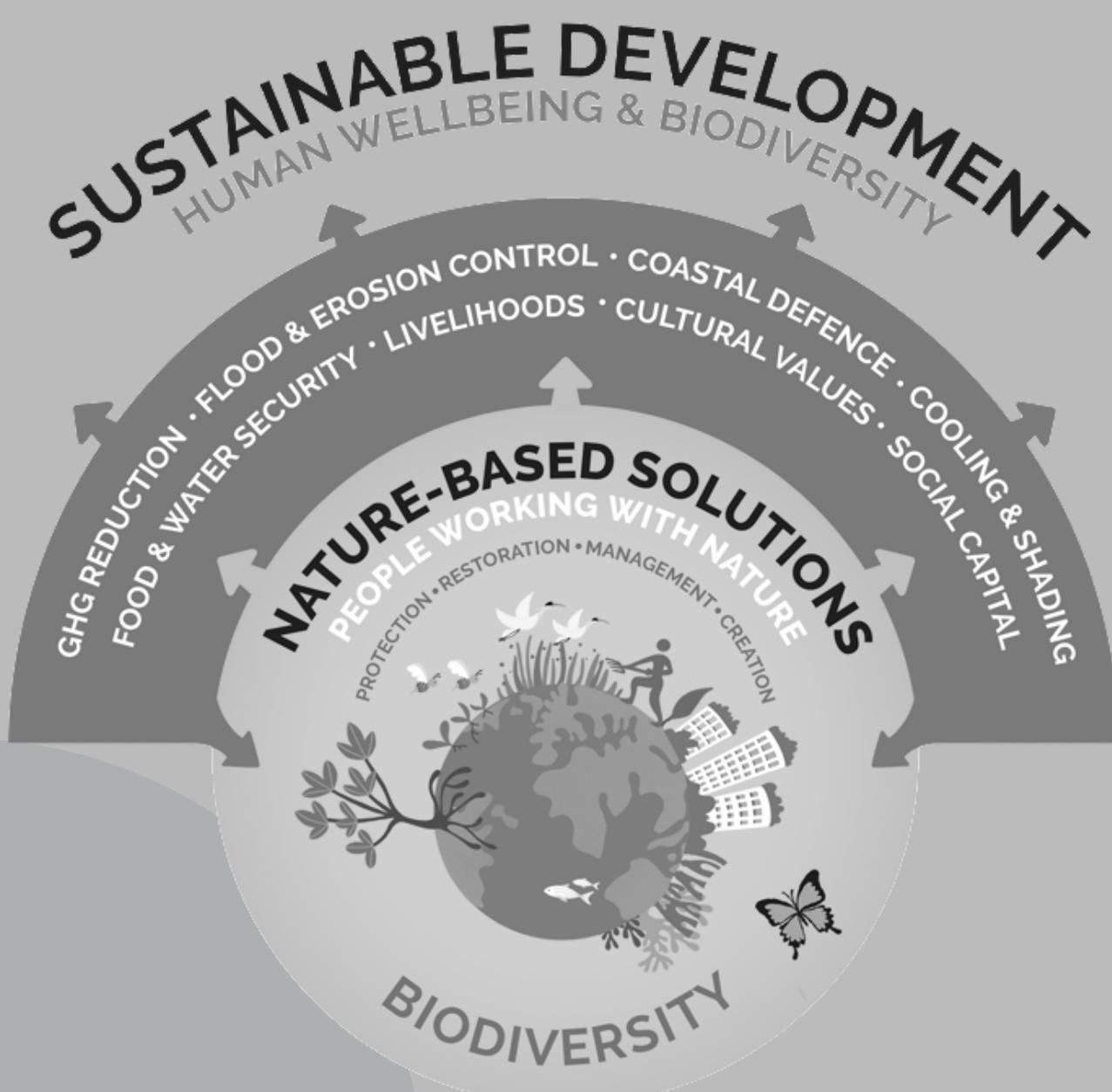
## THE SIXTH MASS EXTINCTION

- **According to recent estimates, species are becoming extinct at least 1,000 times faster than they would without human impacts.**
- **Populations of wild animals have declined by more than two-thirds since 1970, while the human population has more than doubled.**
- **Only five times before in our planet's history have so many species and so much biodiversity been lost so quickly. The fifth was when the dinosaurs were wiped out. That is why scientists and conservationists call what is happening now the Sixth Mass Extinction. Some have even described the loss of biodiversity today as 'biological annihilation'.**



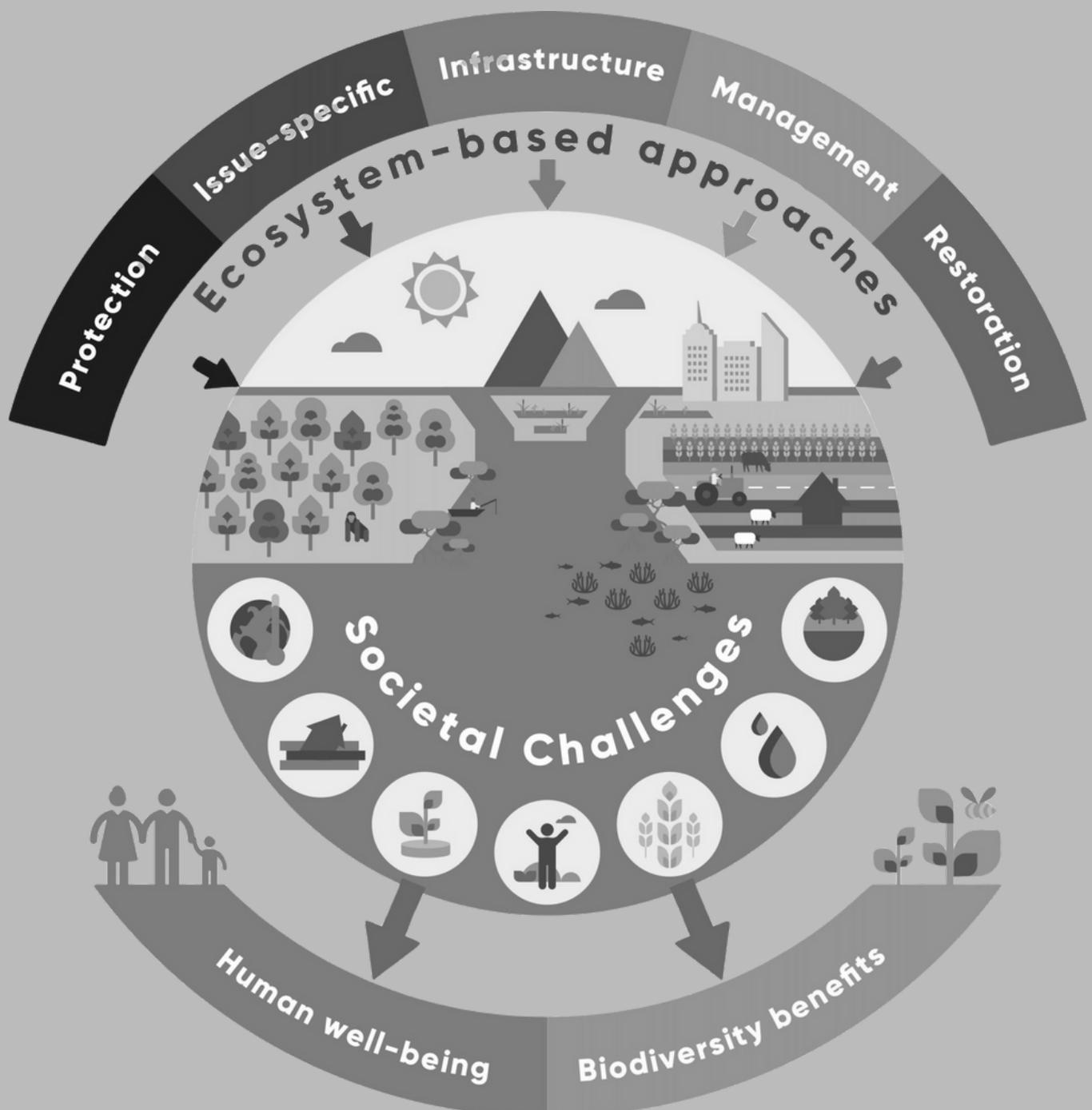
# NATURE BASED SOLUTIONS

Since we are living in an ecological crisis because of the Anthropocene age, we need nature-based solutions (NBS). Nature-based Solutions are actions addressing key societal challenges through the protection, sustainable management and restoration of both natural and modified ecosystems, benefiting both biodiversity and human well-being. NBS have significant, but currently underutilised potential to help address global challenges such as climate change, human health, food and water security, natural disasters and biodiversity loss. An IUCN report found that NBS projects were not large enough in scale, that the NBS approach was insufficiently integrated into policy, and that more collaborative NBS projects were needed for increased efficiency.



## We Need for a Standardised Approach

The IUCN Global Standard for Nature-based Solutions, launched in July 2020, addresses this need. It consists of eight criteria and their associated indicators, which address the pillars of sustainable development (biodiversity, economy and society) and resilient project management. These criteria directly respond to the existing gaps found in the 2019 IUCN report: scale, policy and complementarity to other interventions. The governance structure of the IUCN Global Standard will be responsible for revising the criteria every four years, enabling improvement and incentivising engagement with the Nbs approach across sectors.



# The Potential of Nature Based Solutions

While ecological engineering are often valued in terms of immediate benefits to human well-being and economy, NBS focuses on the benefits to people and the environment itself to allow for sustainable solutions that can respond to environmental change and hazards in the long-term. NBS goes beyond the traditional biodiversity conservation and management principles by “re-focusing” the debate on humans and specifically integrating societal factors such as human well-being and poverty alleviation, socio-economic development, and governance principles.

System	Extent of Modification	Nature-based solution	Societal benefit
Forest		Preservation	Carbon sequestration in biomass in vegetation and soils; biodiversity protection; flooding, drought, and erosion protection, recreation and tourism, water infiltration and storage
		Restoration	
		Enhanced management for woodfuel harvest	Carbon sequestration in biomass in vegetation and soils; provision of fuel and forest products to local users; flooding, drought, and erosion protection
		Production	Carbon sequestration in standing biomass and harvested products; sustainable income; water infiltration and storage; reduced pressure on natural forests
Grassland / Savanna		Preservation	Carbon sequestration in biomass in vegetation and soils; biodiversity protection; slope stabilization
		Restoration	
		Grazing management	Carbon sequestration in biomass in vegetation and soils; slope stabilization
Coastal/ riparian		Preservation	Protecting lives and property from storms and flooding; carbon sequestration; enhancement of biodiversity and fisheries production
		Restoration	
		Maintenance of slope vegetation	Reduced erosion and slope stabilization
		Maintenance of coastal, floodplain and riverine vegetation	Protecting lives and property from storms and flooding; carbon sequestration
Agriculture		Agroforestry	Carbon sequestration in soils and biomass; reduced erosion; maintenance of soil fertility; pollinator habitat; storm protection; shading
		Reduce tillage and carbon restoration practices	Carbon sequestration in soils; maintenance of soil fertility
		Agricultural intensification	Enhanced food security; reduced pressure for conversion of other areas.
Urban		Urban forests and green spaces	Carbon sequestration in biomass in vegetation; shading; stormwater disposal and flood protection; recreation
		Green roofs	Cooling; stormwater control; pollution reduction; carbon sequestration

# URBAN NATURE-BASED SOLUTIONS

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<sub>2</sub> emissions and 75% of natural resource consumption<sup>3</sup>. 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 largescale 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"<sup>4</sup>. 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.

## 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

## 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 m<sup>2</sup> 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

## 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 rehabilitation 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 km<sup>2</sup>
- 75,000 trees planted
- Around 30 m<sup>2</sup> of green space available per inhabitant

#### CO-BENEFITS ON THE ENVIRONMENT AND PEOPLE

- 200,000 tonnes of CO<sub>2</sub> 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

## 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<sub>2</sub>/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

### 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)

### 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
- Human health & air quality
- Water access
- 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

## 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

## 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 BIODIVERSITY, 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

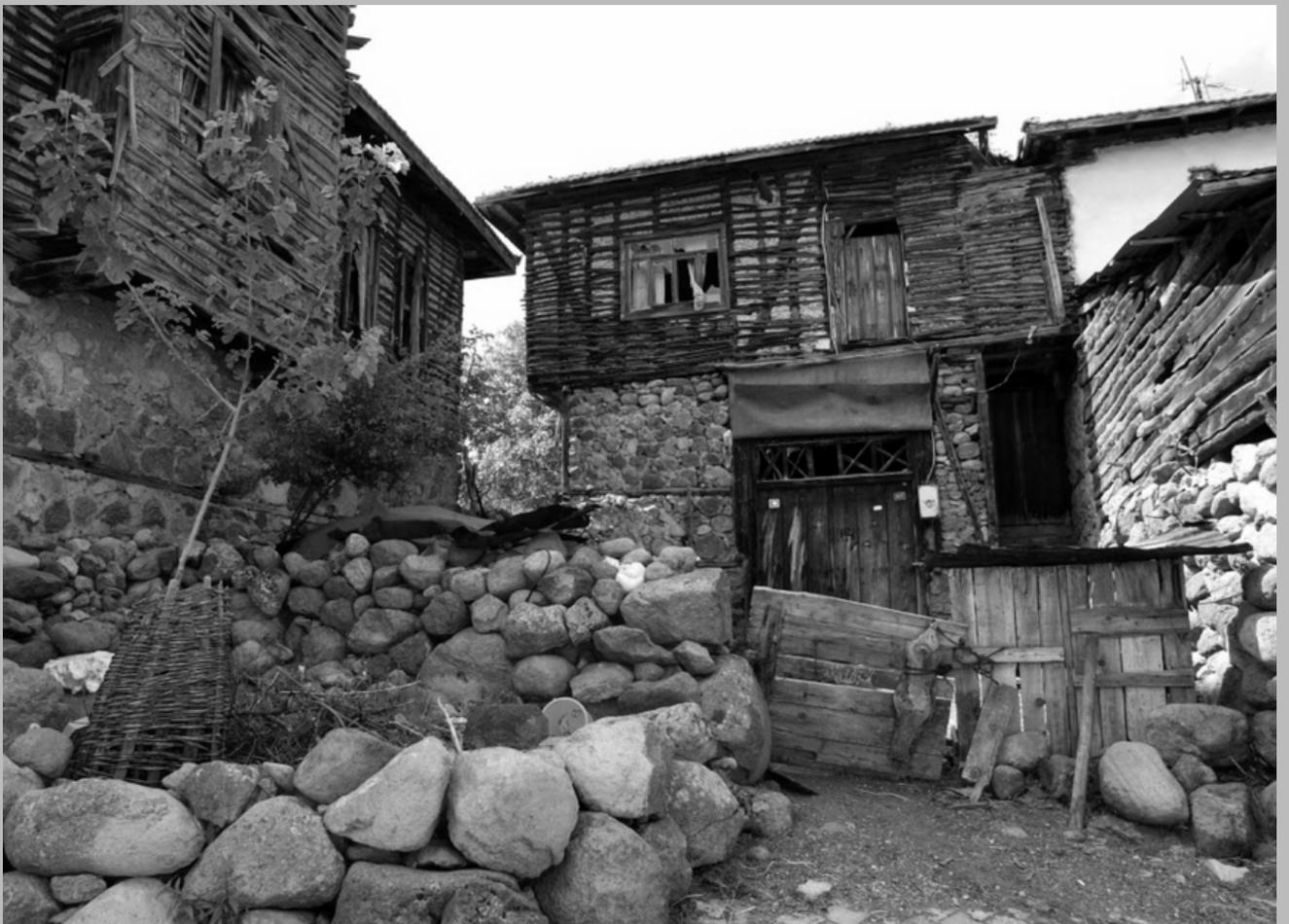
# TADYA

TADYA (Tahtacıörencik Village Ecological Living Collective) is to alternative food systems and communities that facilitate and promote sustainable food production, consumption, and distribution practices by:

- supporting small scale agriculture and local farmers,
- eliminating intermediaries, and creating direct food sale links between producers and consumers,
- involving and empowering different actors, and • encouraging a food system that is both economically and socially justice. They develop alternative solutions for food systems collectively, they can be examined from the perspectives of design for sustainability and social innovations, creative communities, community-centred design, and product-service-system design. They are also a good examples of regenerative living. Regenerative living is based on the concept of regeneration. Regeneration is when we adapt with nature, rejuvenating the health of Earth and us. Our actions leading up to regeneration, renews the health of the planet, and the health of human systems. T

he idea of adapting together with nature has been introduced previously. Indigenous peoples thrived in a variety of regenerative cultures for thousands of years prior to colonialization. In their local regions, indigenous peoples met their needs while working with and as a part of nature. Often, their actions benefited not only themselves but their local ecosystems. For instance, terra preta, is a kind of black soil that had been enriched by humans who added charred wood to the soil in places thousands of years ago.





"We do not need to invent sustainable human communities. We can learn from societies that have lived sustainably for centuries. We can also model communities after nature's ecosystems, which are sustainable communities of plants, animals, and microorganisms."

FRITJOF CAPRA