



Policy and Regulatory Framework to Foster NbS

URWAN Training Kit 2



● Training Kit N° 1: Raising awareness and building understanding about NBS

- **Target: Urban planning departments, decision-makers, policy bodies**
- **Topics: regulations, finance, governance, case studies**
 - Local / National / EU regulatory tools
 - Financial mechanisms
 - Internal governance & stakeholder coordination
 - Best Practices and Case studies from Mediterranean cities

● Training Kit N° 2: Policy & Regulatory Framework

- **Target: Urban planning departments, decision-makers, policy bodies**
- **Topics: regulations, finance, governance, case studies**
 - Local / National / EU regulatory tools
 - Financial mechanisms
 - Internal governance & stakeholder coordination
 - Best Practices and Case studies from Mediterranean cities

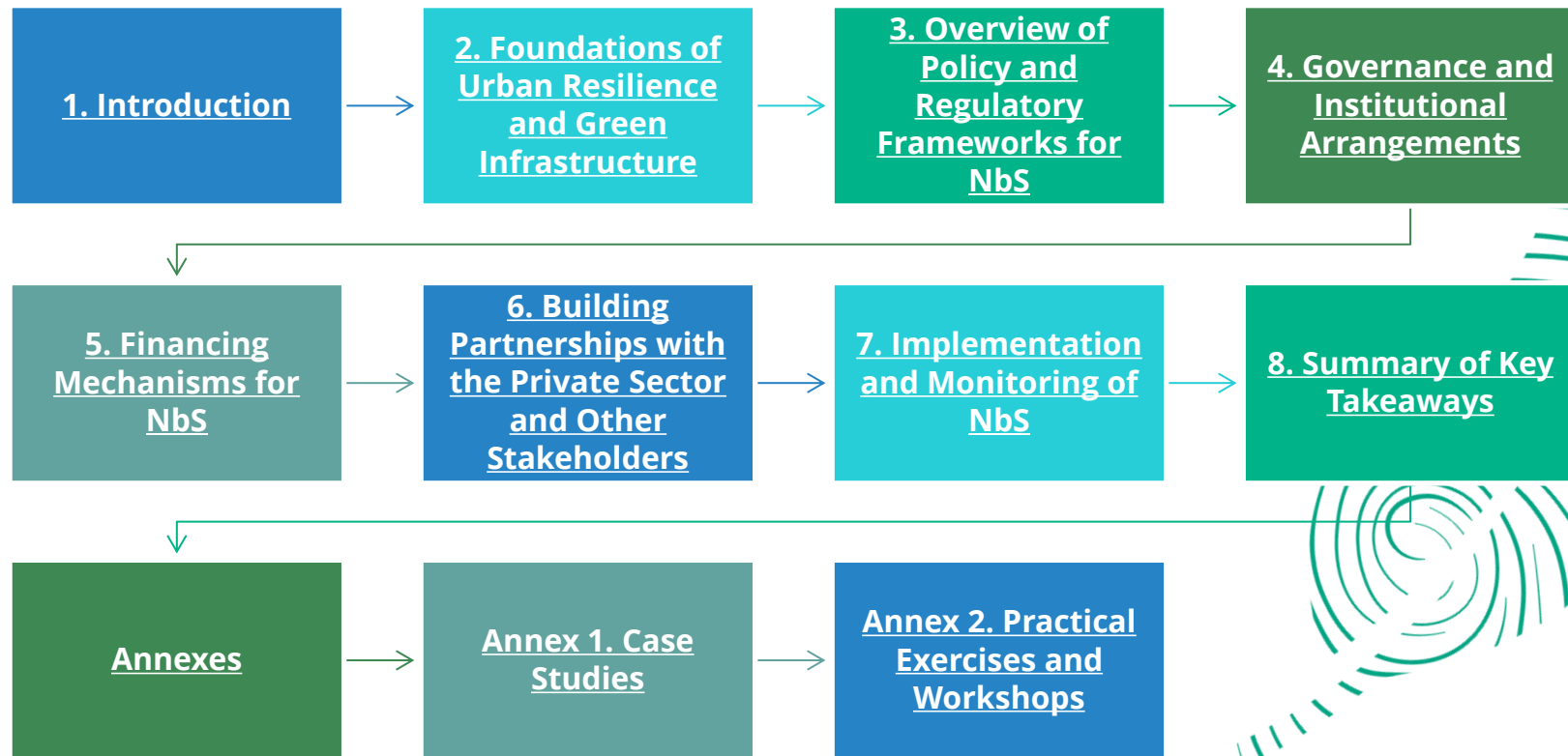
TK2

● Training Kit N° 3: Communicating to Foster Social Acceptance

- **Target: Municipal communication teams, educators, community actors**
- **Topics: public awareness, co-creation, engagement, data**
 - Public engagement and awareness
 - Communicating benefits and impacts of NbS
 - Co-creation methods and participatory tools
 - Data-based storytelling



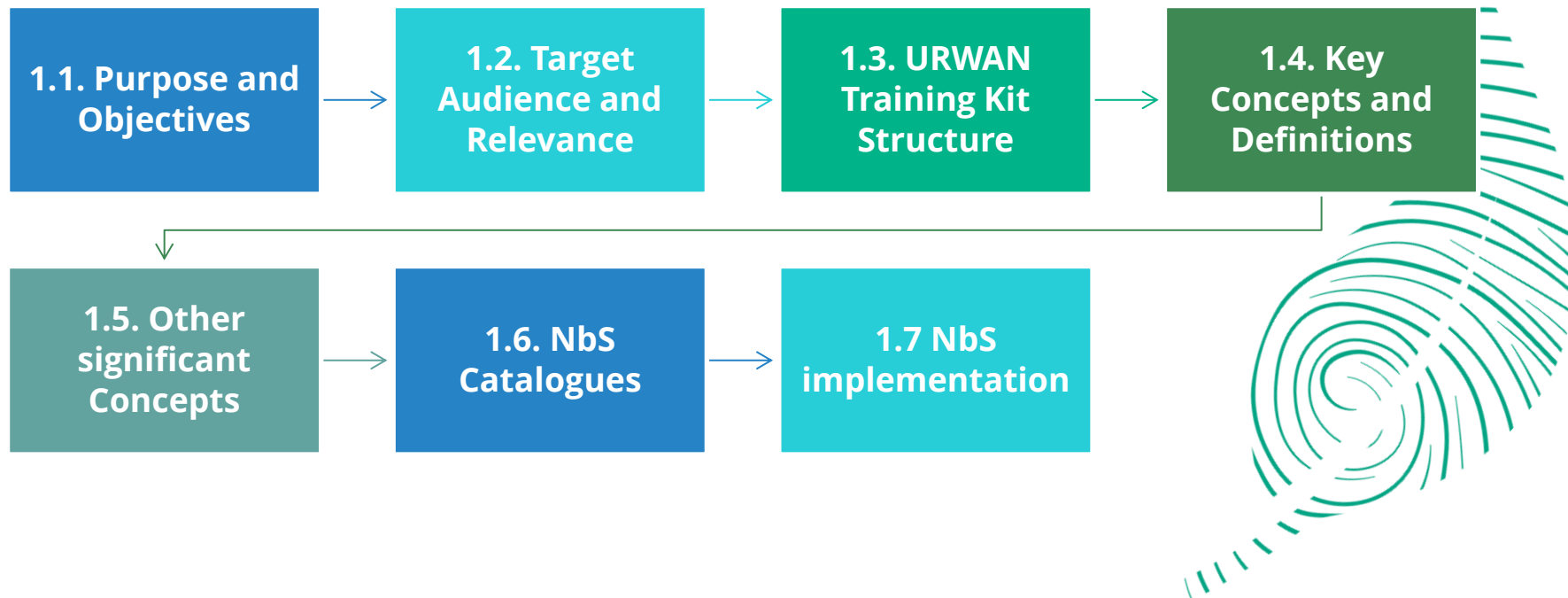
Table of Contents - URWAN Training Kit 2



1. Introduction



1. Introduction



1.1. Purpose and Objectives



The purpose of this Training Kit is to **strengthen knowledge and build practical skills** that support the integration of Nature-Based Solutions (NbS) into local urban governance and regulatory frameworks.



The main objective is to ensure that Local Governments have the **knowledge and skills to mainstream NbS**, crossing social, cultural and economic barriers to implementation.



The aim of the training kits is to **facilitate the projection, design, installation, and maintenance** of NbS by local authorities and professionals across departments.



The main objective is to ensure that Local Governments have the knowledge and skills to **integrate NbS in their core activities**, overcoming professional, social, cultural and economic barriers to implementation.

1.1.1 URWAN Specific Aims

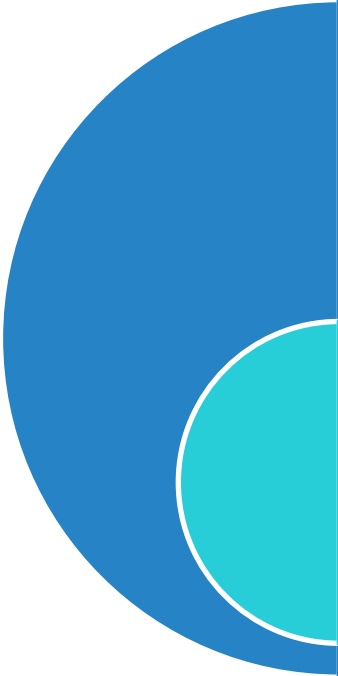


Increase knowledge between local administration, urban planners and spatial design professionals related to NbS **for water reuse** in urban areas to minimize resource use and maximize benefits to better respond to climate change.



Transform buildings and public facilities into water sources merging urban challenges and water management, in a climate-change adaptation perspective while promoting the **greening of urban surfaces** as place-based transformative potential.

1.1.2 URWAN Specific Objectives



Improve the capacity of the target cities' decision makers to **engage stakeholders on co-design** multifunctional NbS and tailor investments for more inclusive, beautiful, sustainable, and resilient living areas.

Multiply and amplify the effects of project results, integrating an economic, social, and cultural analysis of barriers for facilitating decision-makers to mainstream NbS **at a governance level**.



1.1.3 URWAN Specific Objectives

1.2. Target Audience and Relevance



Local Government Departments: urban planning and land use, mobility and transport, public works and infrastructures, water cycle management, environmental and green infrastructure management.



Relevant to all professionals working in Local Government, particularly those concerned with green space, urban resilience and water use and management.



Of significant interest to policy makers, CEO's and decision-makers, regional governments, regulatory bodies, sustainability and biodiversity teams.

URBAN PLANNING
AND LAND USE

MOBILITY
AND
TRANSPORT

PUBLIC
WORKS
AND
INFRASTRUCTURES

WATER
MANAGEMENT

NO NbS APPLICATION

NO Co-Benefits + NO Resilience

Parks + Gardens and other Green Infrastructure
Static conventional management!

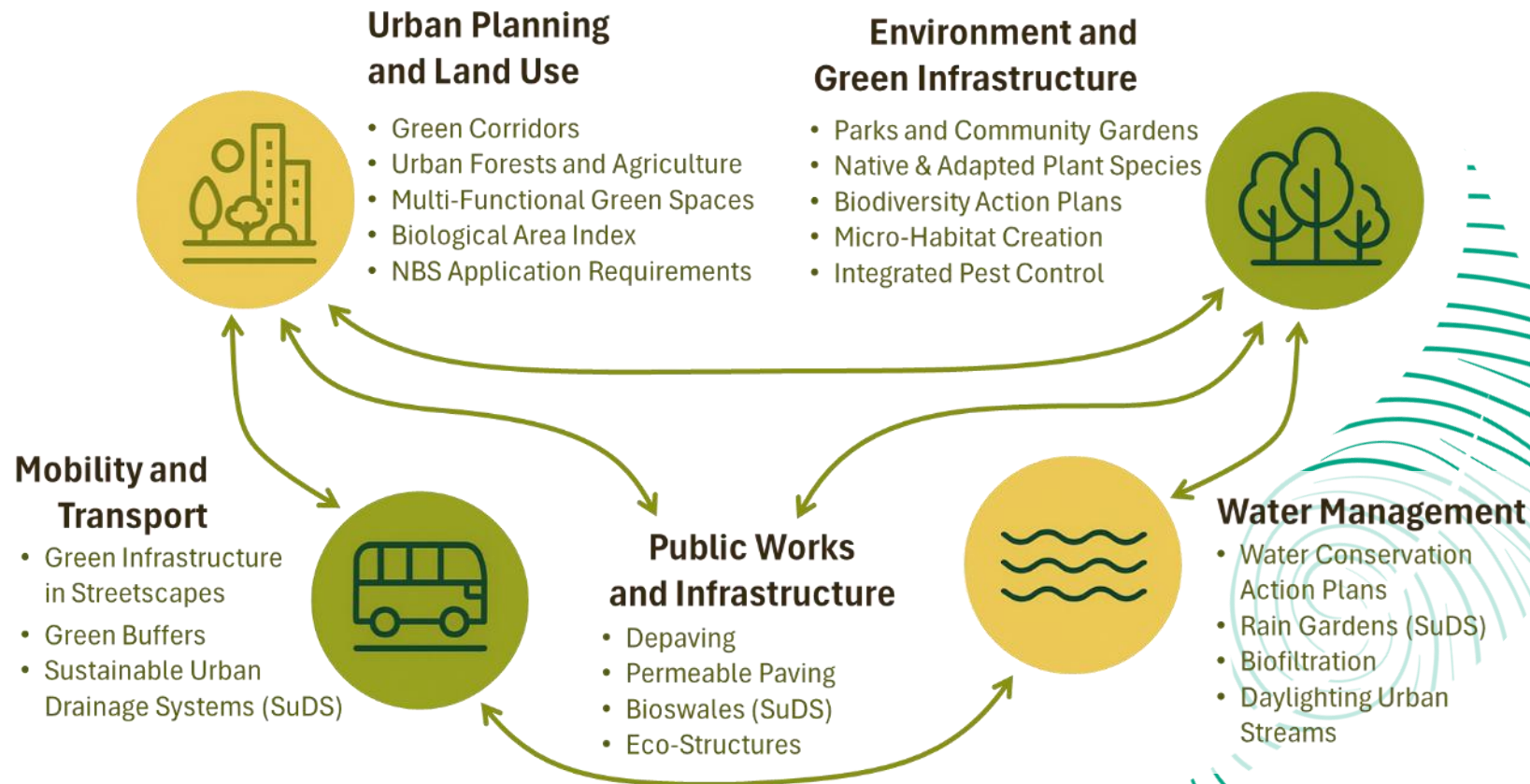
1.2.2. Harnessing NbS in Urban Departments

NbS APPLICATION

URBAN PLANNING
AND LAND USEMOBILITY
AND
TRANSPORTPUBLIC WORKS
AND
INFRASTRUCTURESWATER
MANAGEMENTENHANCED
RESILIENCE!*+ Green Infrastructure + Biodiversity + Adaptive Management*

Co-Benefits!

1.2.3. Harnessing Nbs in Urban Departments



1.3. URWAN Training Kit Structure

TRAINING KIT 02: POLICY & REGULATORY FRAMEWORK

- **Target: Urban planning departments, decision-makers, policy bodies**
- **Topics: regulations, finance, governance, case studies**
 - Local / National / EU regulatory tools
 - Financial mechanisms
 - Internal governance & stakeholder coordination
 - Best Practices and Case studies from Mediterranean cities

TK2

1.4. Key Concepts and Definitions



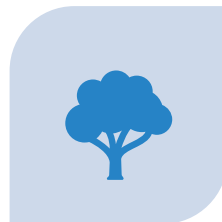
**NATURE-BASED
SOLUTIONS**



**ECOSYSTEM-
BASED
APPROACH**



**URBAN
RESILIENCE**



**GREEN
INFRASTRUCTURE**



**ECOLOGICAL
MANAGEMENT**



**EFFECTIVE
COMMUNICATION**



NbS: Nature-Based Solutions are actions that use natural processes and ecosystems to address societal challenges, i.e., climate change, water security, and biodiversity loss, while providing multiple environmental, social, and economic co-benefits. NBS enhance resilience by working *with* nature rather than against it, promoting sustainable and regenerative approaches to urban and territorial development.

Green Infrastructure: Green Infrastructure refers to a strategically planned network of natural and semi-natural areas — such as parks, green roofs, wetlands, and urban forests — designed to deliver ecosystem services like water purification, flood regulation, cooling, and recreation. Unlike isolated green elements, GI functions as an interconnected system that complements or replaces grey infrastructure to enhance environmental quality and urban liveability.

1.4.1. Basic Key Definitions



Ecological Management: A set of practices aimed at maintaining and enhancing the ecological functions of green spaces, including soil health, water retention, biodiversity, and natural regeneration. In the context of NbS, it ensures long-term performance and minimal external inputs.



Effective Communication: The ability to clearly and convincingly convey the value, function, and benefits of NbS to diverse audiences—citizens, policymakers, private sector—using accessible language, data storytelling, and culturally resonant narratives to foster social acceptance and engagement.



Urban Resilience (UR): The capacity of urban systems, including people, infrastructure, economy, and ecosystems, to survive, adapt, and thrive despite chronic stresses (e.g., water scarcity) and acute shocks (e.g., floods). NbS enhance resilience by using ecological functions to mitigate risks and increase adaptive capacity.



Ecological Approach: Emphasizes that human and ecosystem health are interconnected and dependent on functioning ecosystems, promoting integrated ecosystem management for biodiversity conservation and sustainable development.

1.4.1. Other Definitions

IUCN

(International Union for Conservation of Nature)

“Actions to protect, sustainably manage,
and restore natural or modified
ecosystems that address societal
challenges effectively and adaptively”
(2016)

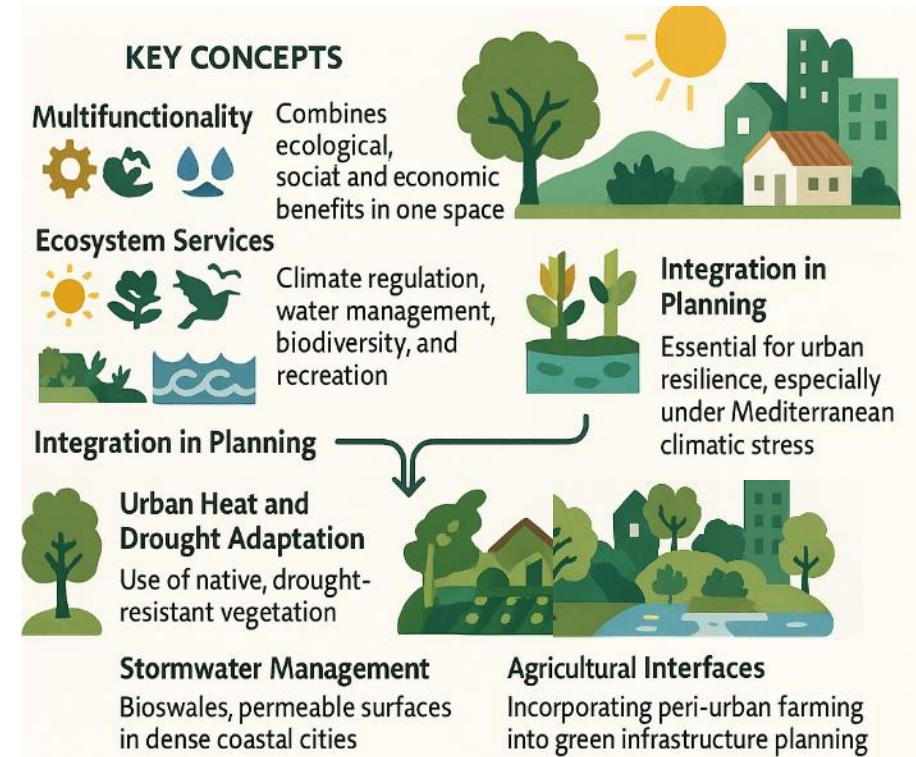
1.4.3. IUCN NbS definition



European Commission

“Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience.

Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions”



1.4.4. NbS definitions: EU Commission

UNEP - DHI Centre

Centre on Water and Environment

“ NbS for water resources management involve the planned and deliberate use of ecosystem services to improve water quantity and quality and to increase resilience to climate change.

They are typically adopted in conjunction with conventional water infrastructure to bring about more sustainable outcomes.”



Using and protecting natural ecosystems.

Existing ecosystem services moderating water in a catchment are identified, quantified, utilized and protected to the extent possible



Restoring ecosystems.

Degraded ecosystems are rehabilitated to restore or enhance ecosystem services.



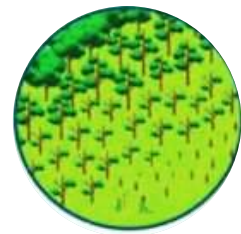
Creating new ecosystems.

Nature-based solutions are used to reproduce ecosystem services where there are cost-effective benefits for sustainable water resources management.

1.4.5. NbS definitions: UNEP-DHI

Riparian vegetation
strips

Aquifer recharge



Reforestation

Natural and
artificial wetlandsUrban buildings
and green spaces**Sustainable Development Goals
(SDG)**

1.4.6. NbS Application and Sustainable Development Goals

Constructed Wetlands for Wastewater Treatment

Engineered systems that mimic natural wetlands, using plants, soils, and microbial activity to treat any kind of polluted waters. They remove contaminants like nitrogen, phosphorus, and heavy metals while enhancing biodiversity.

Sustainable Urban Drainage Systems (SUDS)

A range of water management practices, including green roofs, rain gardens, and permeable pavements, designed to slow, store, and filter stormwater runoff. These systems reduce urban flooding and improve water quality by filtering pollutants.

Green Infrastructure for Cooling Management

Urban green spaces, such as bioswales and rain gardens, that capture, slow down, and filter stormwater. These systems prevent contaminants from entering waterways while providing ecosystem services like habitat creation.

1.4.7. A working example of NbS: Constructed Wetlands, SUDS and Cooling GI

European Commission

“Green Infrastructure (GI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services.”

US Environmental Protection Agency (EPA)

“Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. It complements grey infrastructure and provides environmental, economic, and social benefits.”

Benefits



Environmental



Social



Economic

1.4.8. Green Infrastructure definitions: EU Commission & US EPA

Definition:

A strategically planned network of natural and semi-natural areas, designed and managed to deliver a wide range of ecosystem services”

(European Commission, 2013)

**Multifunctionality**

Combines ecological, social, and economic benefits in one space

**Stormwater Management**

Bioswales, permeable surfaces in dense coastal cities

Key Concepts**Urban Heat and Drought Adaptation**

Use of native, drought-resistant

**Network-Based Approach**

Links urban parks, green roofs, wetlands, coastal habitats, and peri-urban agriculture

**Integration in Planning**

Essential for urban resilience, especially under Mediterranean climatic stress

Mediterranea Context**Agricultural Interfaces**

Incorporating peri-urban farming into green infrastructure planning



1.5. Other significant Concepts



**BIODIVERSITY
(BIO)**



**ECOSYSTEMIC
SERVICES (ES)**



**LOW IMPACT
DEVELOPMENT
(LID)**



**ADAPTIVE
MANAGEMENT
(AM)**



**PARTICIPATIVE
DESIGN (PD)**



**CO-CREATION
(CCR)**



● Ecosystemic Services (ES)

The benefits that humans obtain from ecosystems, including provisioning (e.g. clean water), regulating (e.g. flood control, air purification), supporting (e.g. soil formation, pollination), and cultural (e.g. recreation, aesthetic value) services. NbS are designed to enhance and harness these services within urban systems. (EUR-Lex)

● Biodiversity

The variety of life at genetic, species, and ecosystem levels. In the context of NbS, biodiversity underpins the resilience and functionality of green infrastructure, contributing to ecosystem services like pest control, water regulation, and climate adaptation.

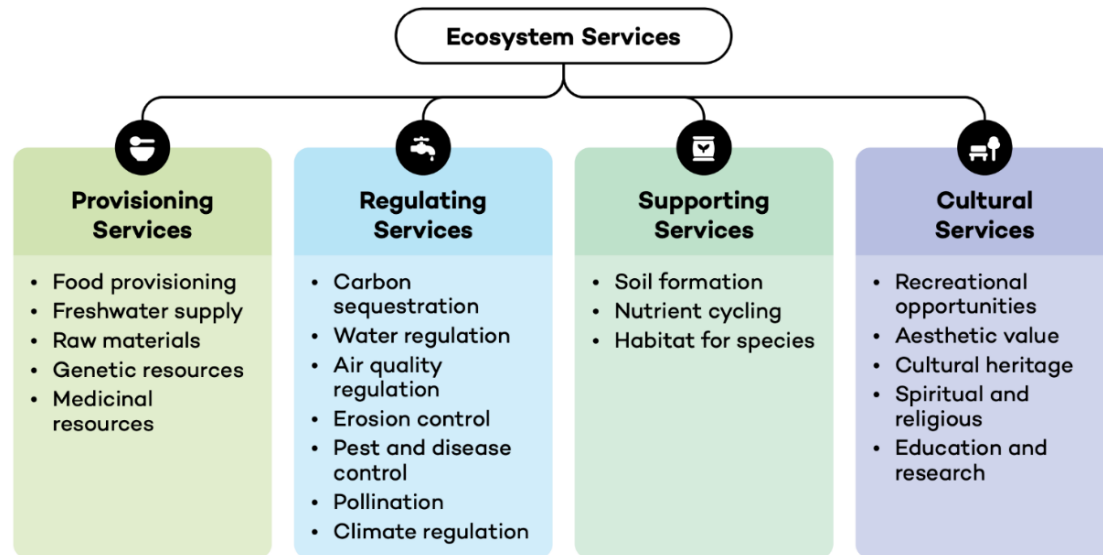
● Low Impact Development (LID) + Water-sensitive urban design (WSUD)

Planning and design approaches that manage stormwater and urban runoff through decentralized, small-scale, and nature-inspired practices (SbN) such as permeable pavements, rain gardens, and green roofs, to mimic natural hydrology and reduce environmental impact.

1.5.1. Other Definitions

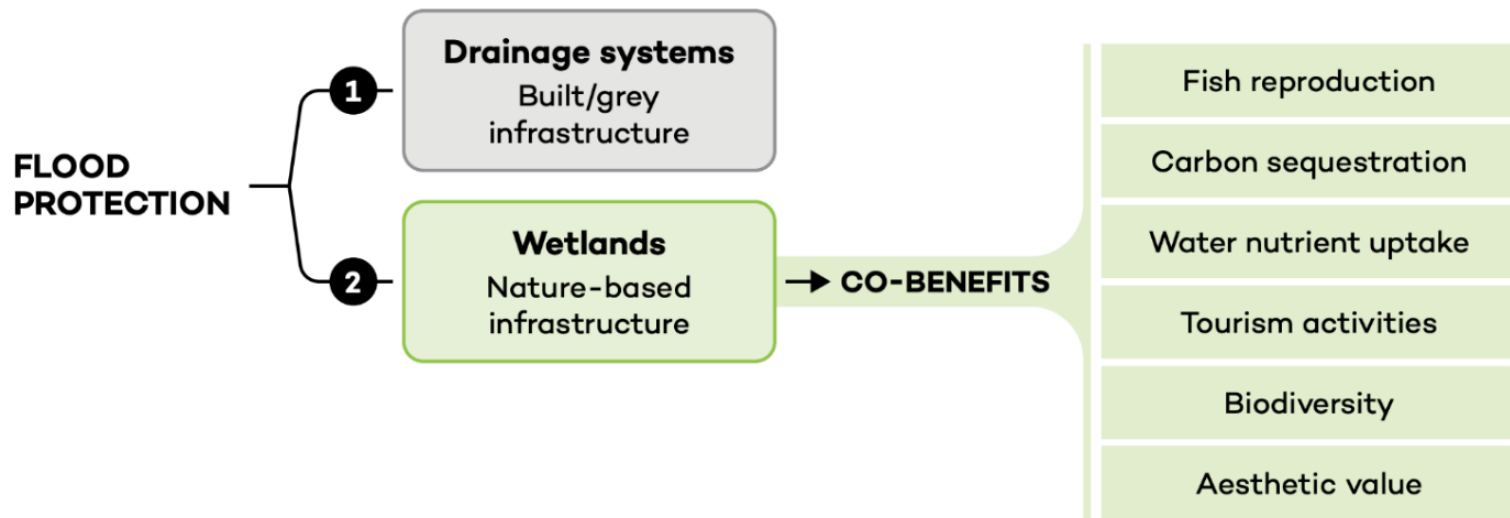
ES Provision

NbS can provide a number of Ecosystem (or Ecosystemic) Services that include Provisioning, Regulating, supporting and Cultural Services.



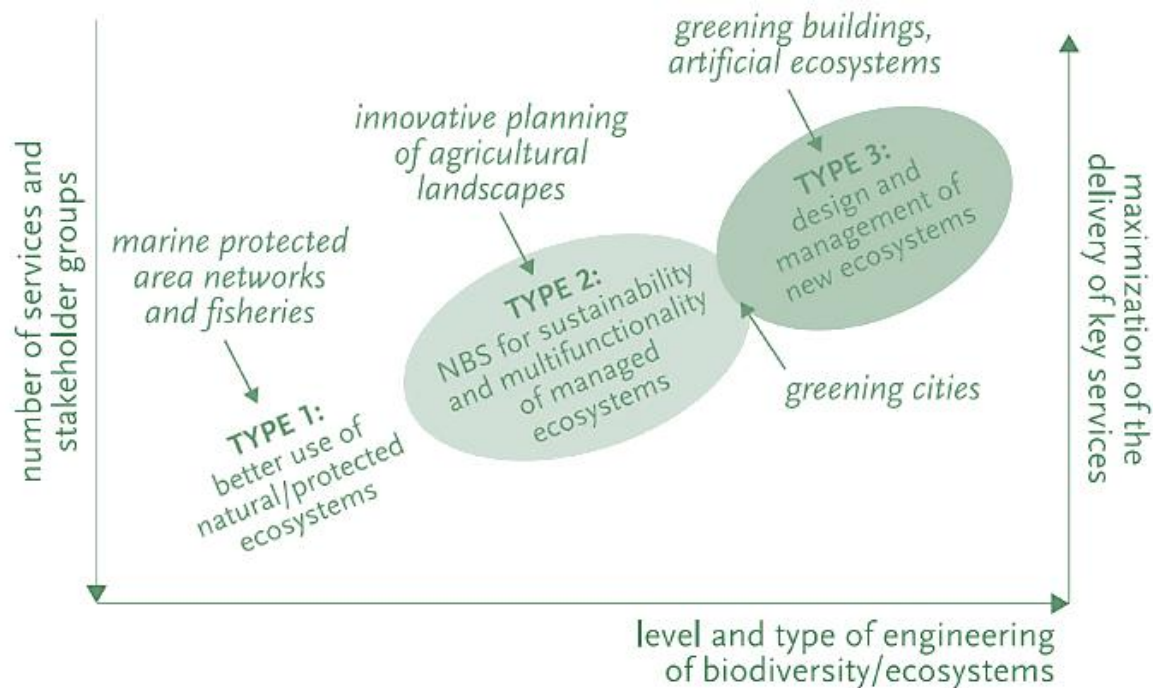
- Ecosystem Services identification is an essential part of NbS planning as they feed justify their implementation in certain areas.
- Identification of intended Services to be provided by NbS is key to creating Performance Indicators for monitoring.

1.5.2. Ecosystem Services

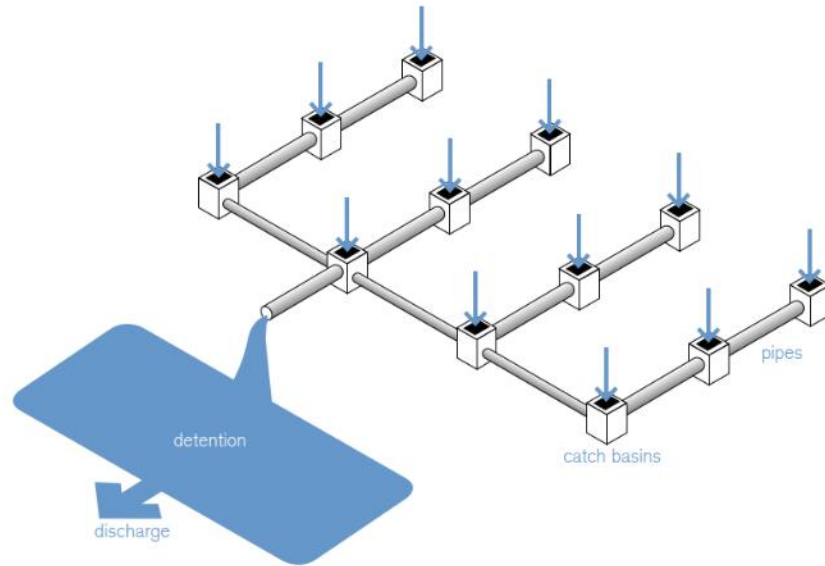


- Ecosystem Services generate intended Benefits that need to be monitored **but also generate Co-Benefits!**
- Co-benefits are an important part of NbS implementation as they feed into the **Cost Benefit Analysis.**
- Co-Benefits can be identified at an early stage and during the operational phase.

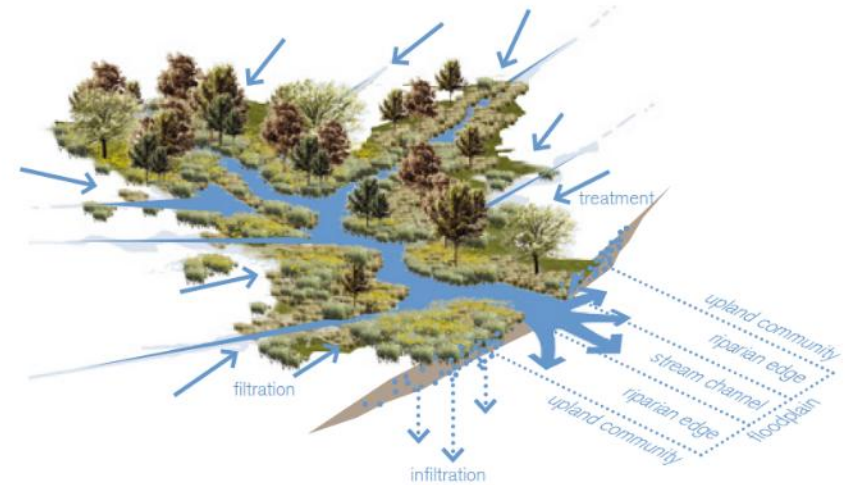
1.5.3. Ecosystem Services Co-Benefits



1.5.4. Ecosystem Services Co-Benefits



conventional management: "pipe-and-pond" infrastructure
drain, direct, dispatch



low impact management: watershed approach
slow, spread, soak

1.5.5. Low Impact Development (LID)

Source – Natural Base Solutions SL adapted from LID Manual.

1.6. NbS Catalogues



An **NbS Catalogue** is a resource that provides information and guidance on various nature-based solutions (NbS) that can be implemented in urban environments.



These catalogues help users **identify, understand, and implement NbS** to address urban challenges like climate change impacts, water management issues, and social well-being. An NbS catalogue is essentially a guide or reference document that:

Defines NbS

Provides Examples

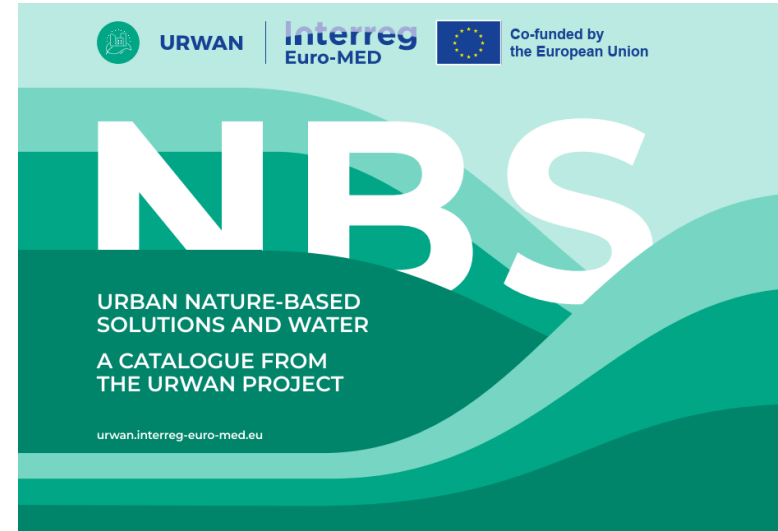
Offers Technical Assistance

Supports Decision-Making

Categorisation

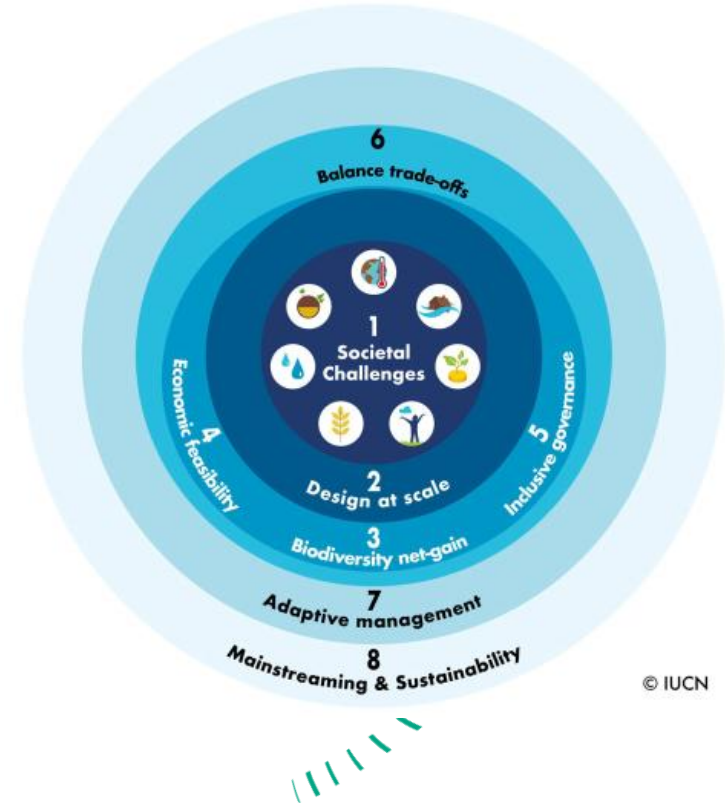
Technical Details

- This Catalogue is designed to emphasize how NbS contribute to multiple ecosystem services
- The catalogue classifies NbS into two main categories:
 - **Water “Snob”** NbS, which do not account for their water requirements and depend on conventional potable water sources from public distribution networks.
 - **Water “Smart”** NbS, which are designed to utilize alternative water sources beyond potable supplies.



1.7. NbS Implementation

- NbS Implementation needs to be supported by standards and procedures.
- The IUCN Global Standard - SAT (Self-Assessment Tool) is an online platform that helps users evaluate Nature-based Solutions (NbS) projects against the IUCN Global Standard for NbS's eight criteria.
- The tool guides users through questions and documentation to perform a self-assessment, identify gaps, design new interventions, and track progress towards aligning their projects with the global standard for effective, sustainable NbS.
- If you are planning to use the IUCN Global Standard for Nature-based Solutions and/or require the self-assessment tool, you will need to register.



- These 9 tips offer a simple structured path from planning to long-term maintenance:



**Assess Assets
and Obstacles**



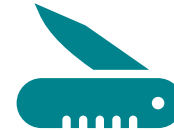
**Identify Urban
Needs**



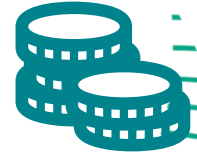
**Envision
Nature's Role**



**Prioritise NbS
Options**



**Design
Multifunctional
Solutions**



**Establish
Funding
Strategies**



**Communicate
and Engage**



**Implement
Effectively**



**Monitor and
Evaluate**



1.7.1. Simple steps to NbS implementation (9 Tips)

● Adopting NbS can be challenging for **Small Towns!**

● Follow a few simple steps:

- Adopt a **2-page** “NbS Note” or a “Green-Blue Infrastructure Charter”
- Use the **IUCN Global Standard** (8 criteria, 28 indicators) as the quality benchmark.
- Align with **national strategy** for municipal adaptation plans of for **Green Infrastructure**.
- Constitute a “**NbS Board**” with 3 to 5 people and meet at set intervals.
- Involve local **NGOs and other non-profits** in project development.
- **Find a regional partner** for support and guidance.
- Nominate a **NbS Coordinator** and a rotating **Inter-municipal coordinator**



1.7.2. NbS Governance for a Small Town

Adopting NbS in Small Towns: A Practical Path

Adopting NbS can be challenging for small towns and cities, but some towns have succeeded by following a few steps.



Adopt a 2-page "NbS Note"
or a GGreen-Blue
Infrastructure Charter



Use the IUCN Global Standard
(8 criteria, 28 indicators)
as the quality benchmark



Align with national strategy
for municipal adaptation plans
or for Green Infrastructure



Constitute a "NbS Board" with
3 to 5 people and meet
at set intervals



**Involve local NGOs and other
non-profits in project
development**



Find a regional partner
for support and guidance



Nominate a NbS Coordinator
and a rotating inter-municipal
coordinator



**Nominate rotating
Intermunicipal Coordinator**

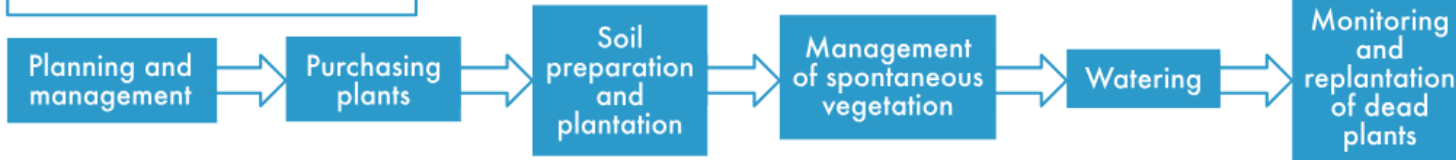
- NbS can be applied in **rural contexts** to fit local needs.
- Cities can implement **Agricultural NbS** to enhance their ES provision.
- Example: BONEX project, Alentejo region, Portugal.



Cover crops



Water line restoration



1.7.4. NbS implementation in rural contexts



Start where you control land and timing to create a pilot project.

Pick one visible, multi-benefit site with low-cost works and schedule during school holidays; replicate once it works.



Pool capacity through supramunicipal partners.

Sign service agreements with provincial/inter-municipal consortia to access engineers, standard specs and shared procurement,



Adopt a lightweight quality guiding standard with a 2-page checklist.

Use the free IUCN Global Standard for NbS (8 criteria, 28 indicators) as a 2-page checklist at concept/design to avoid missteps and to convince partners/volunteers.



Avoid complex projects and redesign.

Apply small initiatives like planting trees, rain gardens, depaving or changing the maintenance regime.



Shift maintenance methods to avoid costly budgets.

Include as many actions as possible in existing maintenance procedures and resources.

1.7.5. NbS implementation with minimal staff

- **Measure KPIs simply via citizen science or NGOs participation.**
 - Deploy inexpensive temperature and precipitation loggers; train a teacher/volunteer to run monthly protocols.
- **Shift maintenance methods to avoid costly budgets.**
 - Include as many actions as possible in existing maintenance procedures and resources.
- **Standardise, share and reuse documents and templates/details.**
 - If neighbouring towns have applied some solutions request to consult their documentation.



1.7.6. NbS implementation with minimal staff

Small-Town NbS: Quick-Start Actions

Practical steps for municipalities ≈5.000 residents



Start where you control land and timing to create pilot project



Adopt a lightweight quality guiding standard with a 2-page checklist



Pick one visible, multi-benefit site with low-cost works and schedule during school holidays; replicate once it works



Use the free IUCN Global Standard for NbS (8 criteria, 28 indicators) as a 2-page checklist at concept/design to avoid missteps and to convince partners/volunteers



Pool capacity through supramunicipal partners



Avoid complex projects and redesign

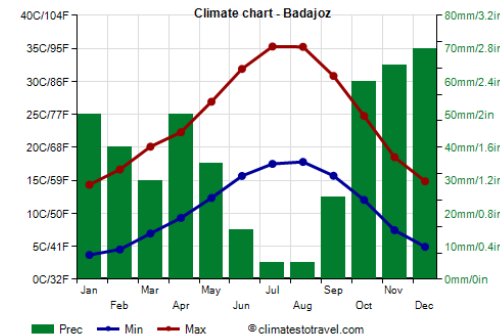


Sign service agreements with provincial/inter-municipal consrtia to access engineers, standard shared procuremt procuremnett



Apply small initiatives like planting trees, rain gardens, depaving or changing the maintenance regime

- Objective: To increase the resilience of educational buildings as they face intense heat periods and water scarcity.
 - This project aims to enhance the comfort of the students and faculty that occupy the space.
 - This project was co-funded by the LIFE programme by the European Union.
- **Population: 2,645**
 - Size: 65 km²
 - Climate: Mediterranean Sub-humid
 - Risks: Heat Waves, drought and water scarcity

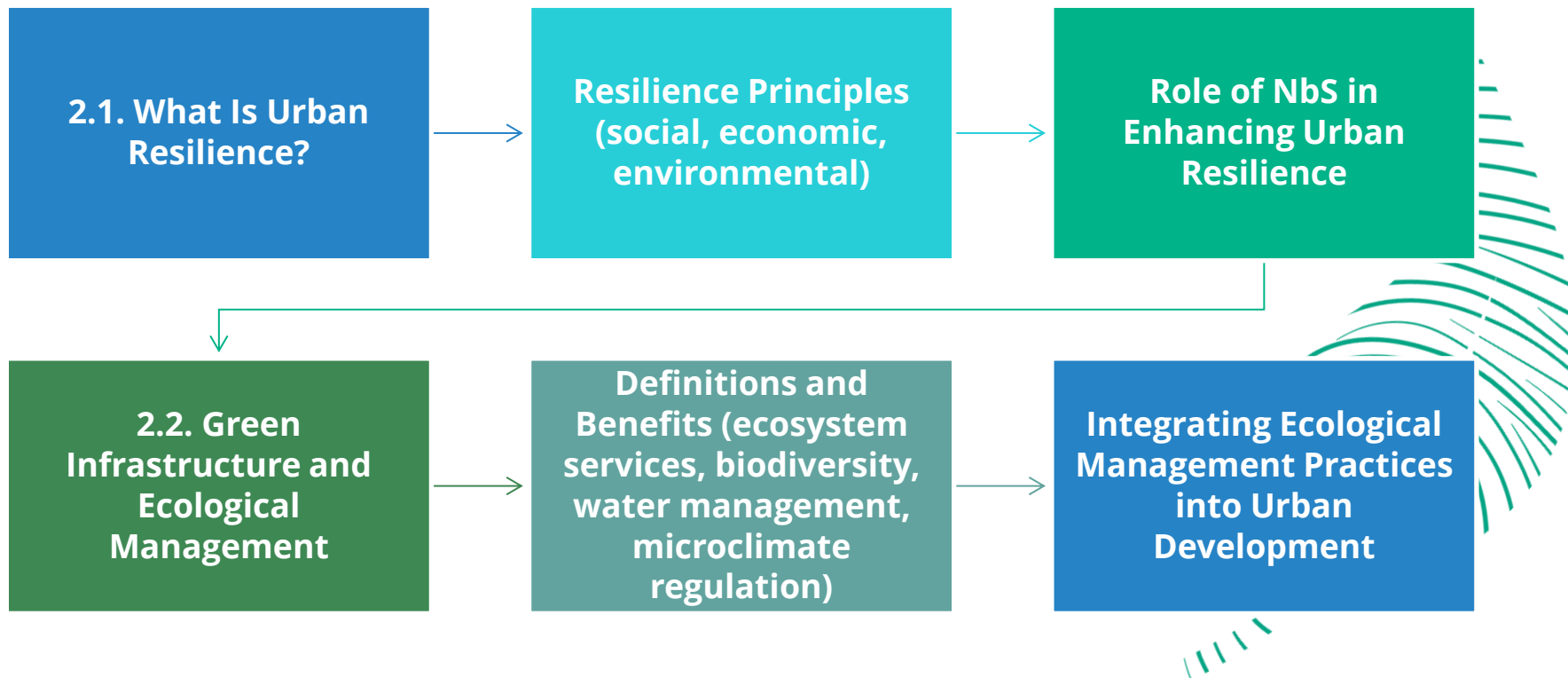


1.7.8. my BUILDINGisGREEN LIFE, Solana de los Barros, Badajoz, Spain, 2024

2. Foundations of Urban Resilience and Green Infrastructure



2. Foundations of Urban Resilience and Green Infrastructure



2.1. What Is Urban Resilience?

- **Urban resilience** is the ability of a city to anticipate, absorb, recover from, and adapt to a wide range of shocks and stresses, such as extreme weather, droughts, or social inequity.
- It is built upon **three interdependent** pillars:
 - **Social resilience:** fostering inclusive communities with strong social networks.
 - **Economic resilience:** diversifying local economies and ensuring access to essential services.
 - **Environmental resilience:** protecting ecosystems and regulating natural cycles.



KEY SHOCKS AND STRESSES



Heatwaves



Floods



Drought

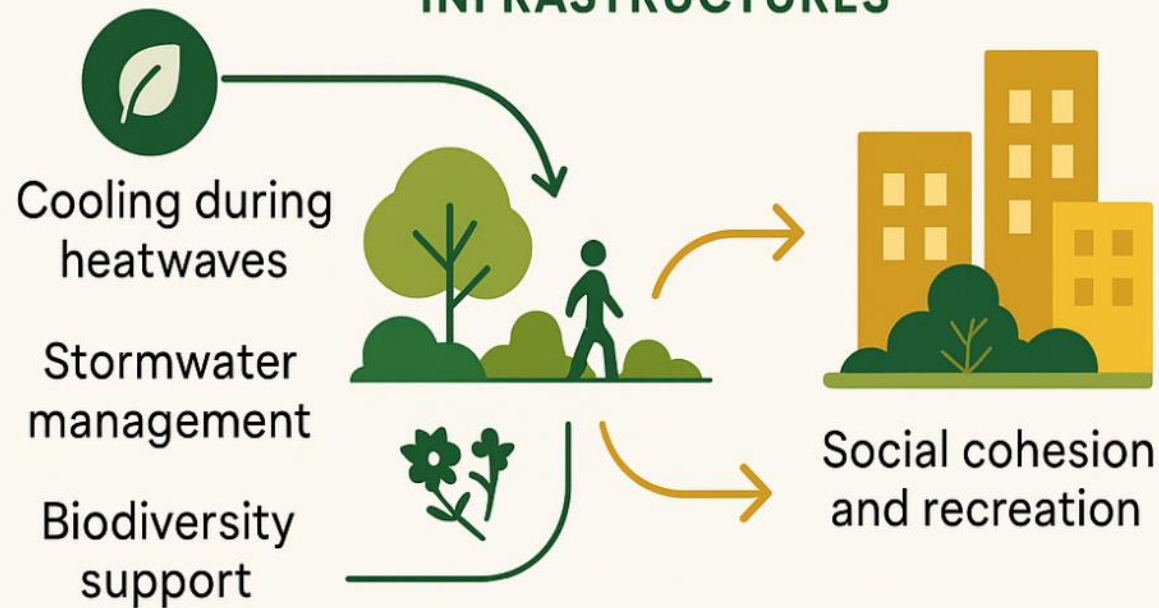


Social unrest

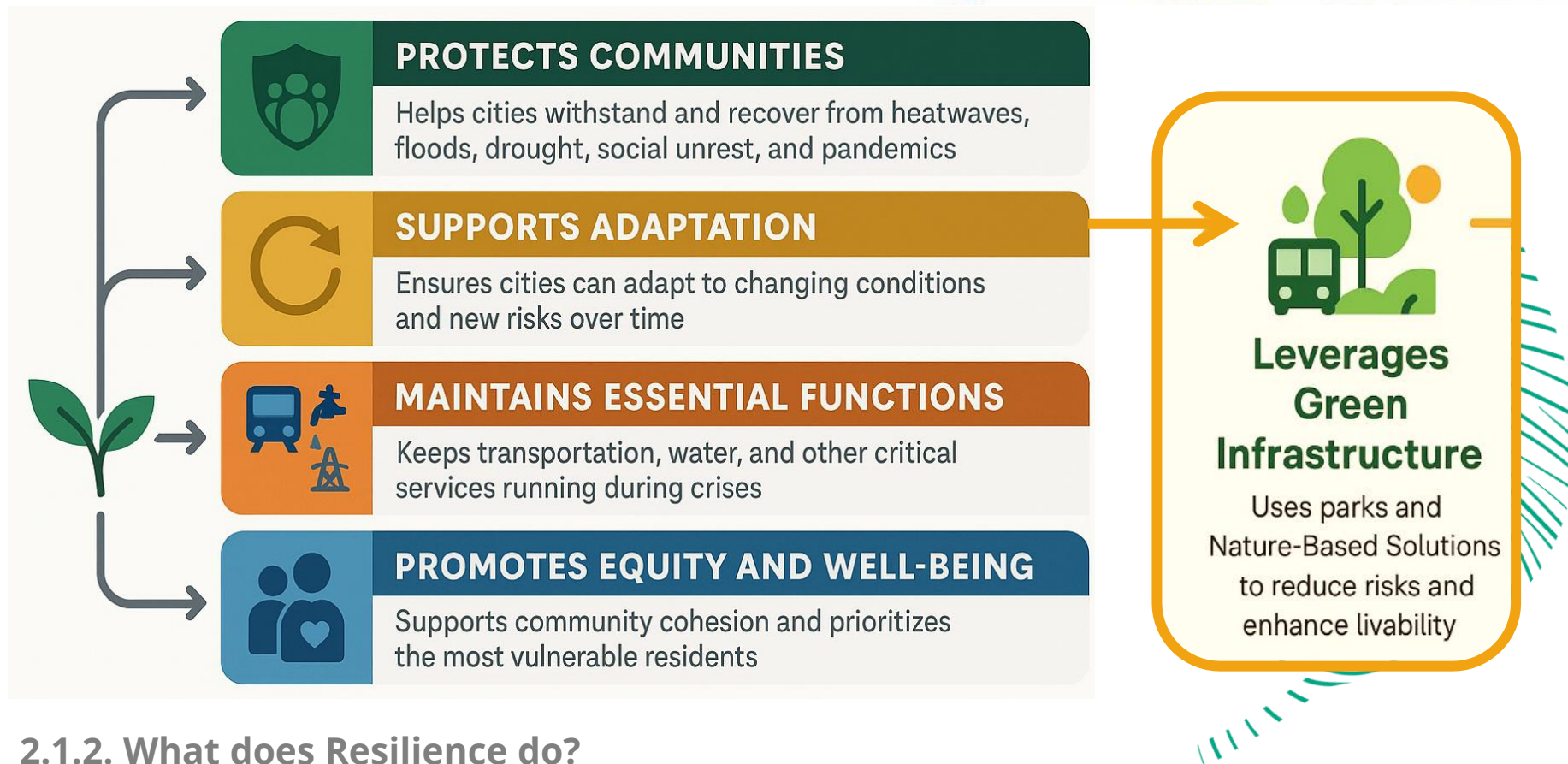


Pandemics

PARKS AS SOCIAL-ECOLOGICAL INFRASTRUCTURES



2.1.1. Why Urban Resilience Matters



2.1.2. What does Resilience do?

- NbS provide potential to shift towards transformative climate change action and **build resilience** in social, ecological and urban systems.
- NbS bring more, and more diverse, natural features and processes into cities, through **locally adapted**, resource-efficient and systemic interventions.
- NbS are **cost-effective**, provide environmental, social and economic benefits and help build resilience.
- City resilience is **underpinned by several qualities** that apply both at city and at individual system scales.



Robustness (ability to withstand a shock), for example, housing and bridges built to withstand a flood.



Redundancy (functional diversity), for example having many evacuation routes.



Resourcefulness (ability to mobilize when threatened), for example a group within a community that can quickly mobilize to convert a community center into a flood shelter.



Rapidity (ability to contain losses and recover in a timely manner), for example quick access to sources of financing to support recovery.

Properties of a resilient system

2.1.2. The Role of NbS in enhancing Urban Resilience

2.2. Green Infrastructure and Ecological Management



Green Infrastructure (GI) refers to a **network of natural and semi-natural systems**, such as parks, green roofs, rain gardens, and urban forests.

GI provides important **ecosystem services**:

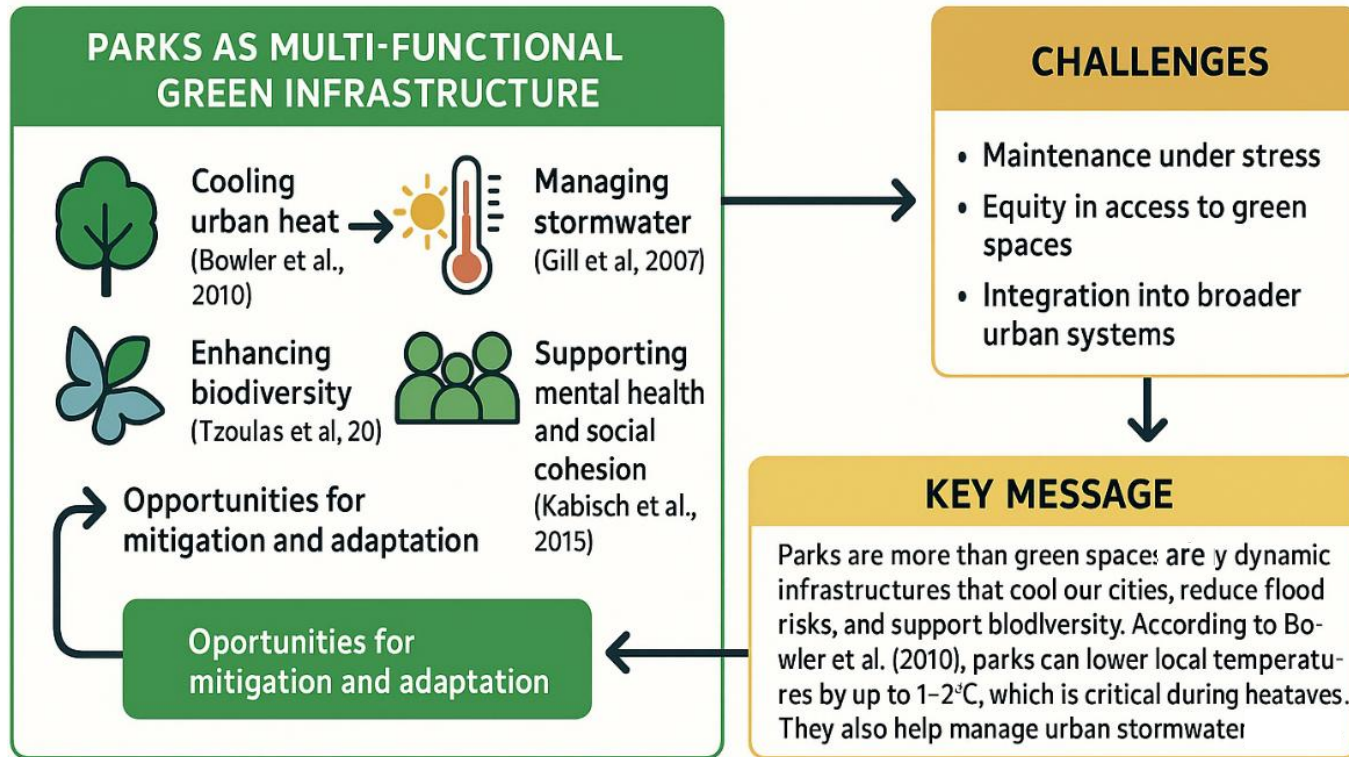
- **Water management:** flood mitigation, groundwater recharge.
- **Biodiversity enhancement:** habitat creation, ecological connectivity.
- **Microclimate regulation:** shade, cooling, air quality improvement.
- **Cultural and recreational value.**



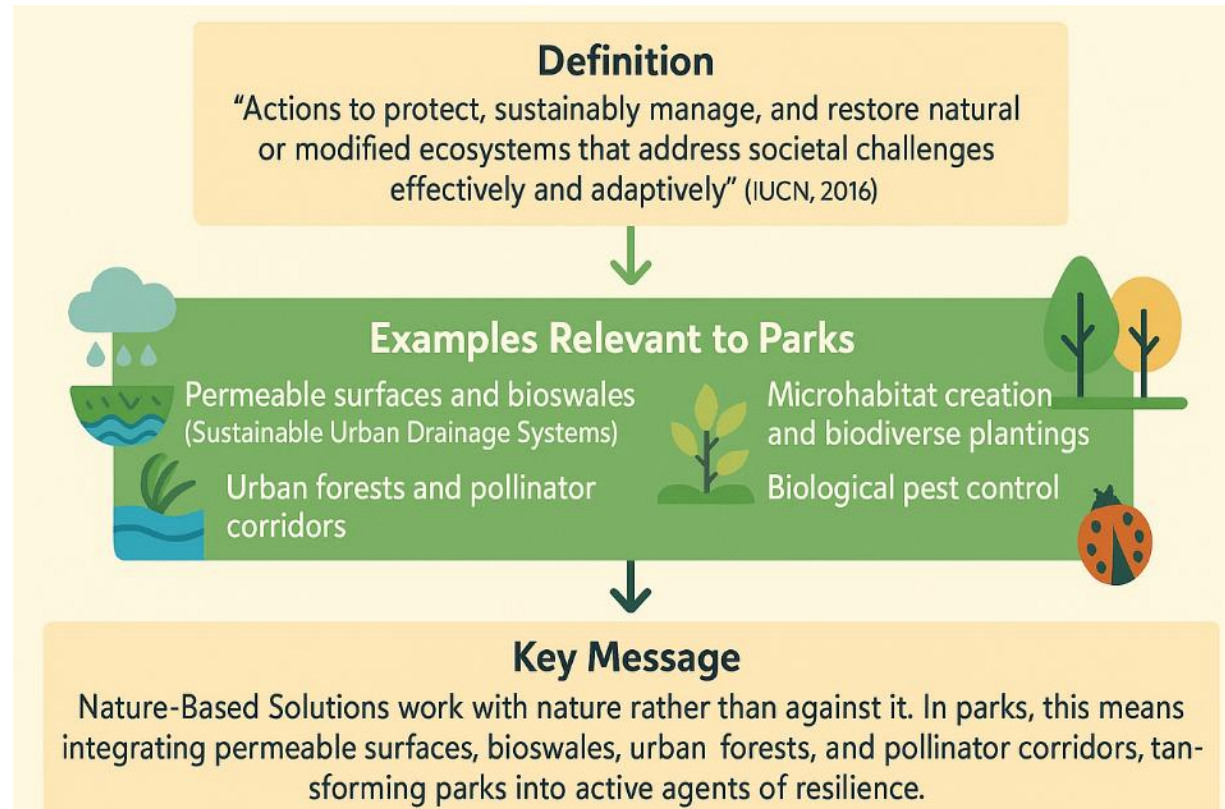
Ecological Management ensures that these systems **remain functional and resilient** over time by applying maintenance strategies that respect ecological processes.



GI and EM form the **operational backbone of NbS** in sustainable, resilient cities.



2.2.1. Parks as Multifunctional Green Infrastructure



2.2.2. NbS and Ecological Management: A path Forward

3. Overview of Policy and Regulatory Frameworks

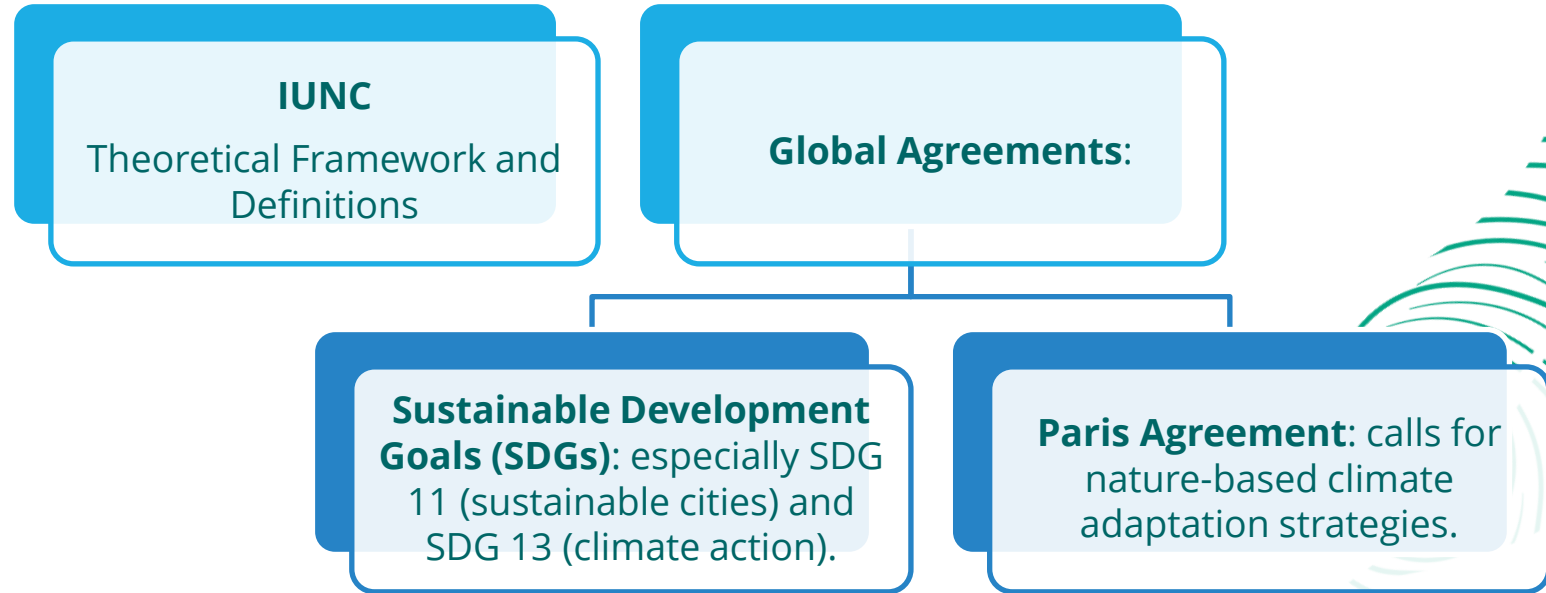


3. Overview of Policy and Regulatory Frameworks for NbS



3.1. Global International Policy Landscape

- **NbS are increasingly embedded** in global agendas and key frameworks include:



3.2. EU Policy Landscape

- **NbS are increasingly embedded** in global and European agendas and Key frameworks include:

**Global Agreements
and Policies**

**EU Biodiversity
Strategy 2030:**
promotes urban
greening and ecosystem
restoration.

**Water Framework
Directive:** encourages
integrated water
management, where
NbS can play a major
role.

 Biodiversity	 Forests	 Land use and forestry	 Water	 Agriculture	 Climate change adaptation	 Disaster risk reduction
· Biodiversity Strategy for 2030 · Strategy on Green Infrastructure	Forest Strategy	LULUCF Regulation	· Water Directive · Floods directive	Common Agricultural Policy	Strategy on adaptation to climate change	Action Plan on the SFDRR 2015-2030
EA/EbAp Ecosystem Approach/ Ecosystem-based Approaches	SFM Sustainable Forest Management	SFM Sustainable Forest Management	NWRM Natural Water Retention Measure	NWRM Natural Water Retention Measure	GI/BGI Green Infrastructure and Blue-Green Infrastructure	Eco-DRR Ecosystem-based Disaster Risk Reduction
GI/BGI Green Infrastructure and Blue-Green Infrastructure	SM/EbM Sustainable Management and Ecosystem-based Management	SM Sustainable Management			SM/EbM Sustainable Management and Ecosystem-based Management	
SM/EbM Sustainable Management and Ecosystem-based Management						

3.2.1. Policy sectors for NbS (EU)

3.3. National and Local Regulatory Instruments

Planning regulations, zoning laws, and building codes: To ensure automatic NbS integration into urban development.

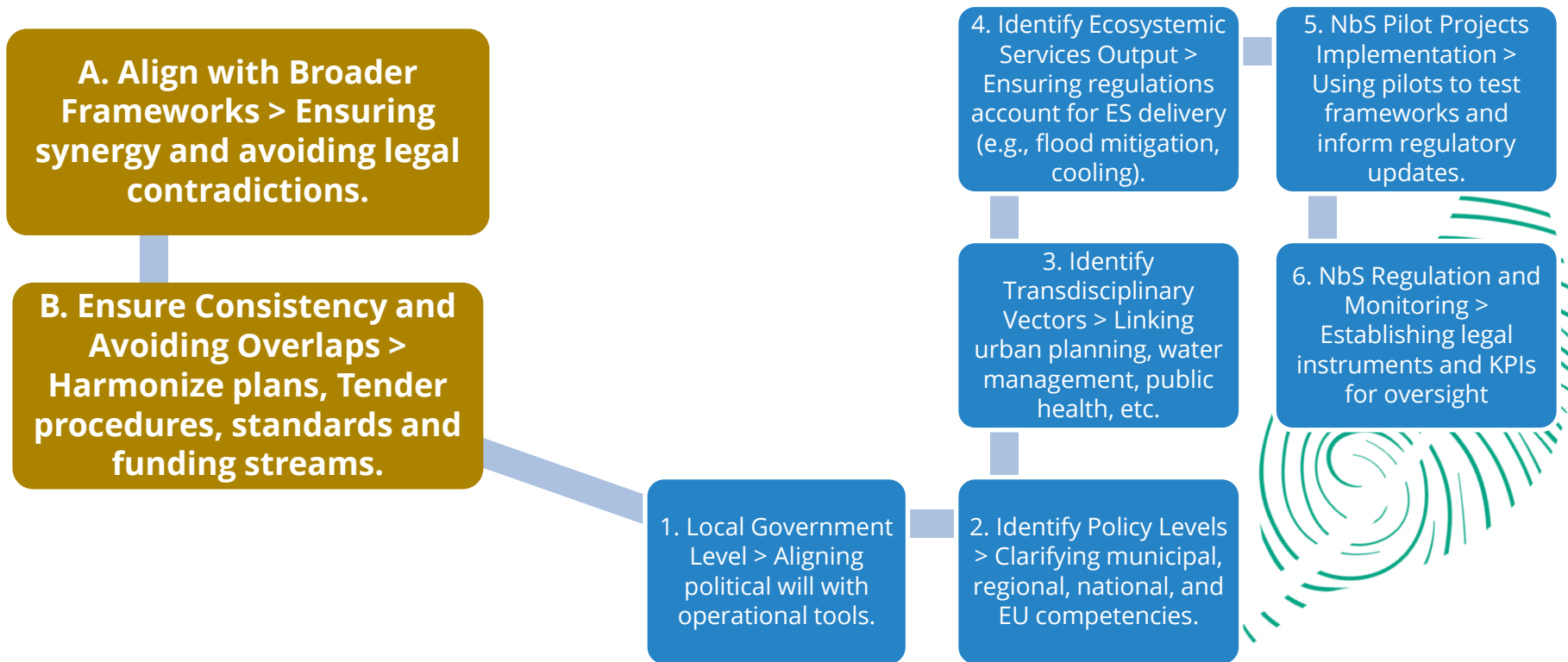
Strategic Masterplans: To ensure early adoption when regulations have not been updated.

Technical Standards and Best Practice requirements: To ensure that implementation projects consider NbS adequately.

Environmental permits and standards: To ensure that NbS presence in developments become key for approval and regulate ecological performance and risk.

Public procurement procedures: allow for NbS-friendly design and maintenance contracts.

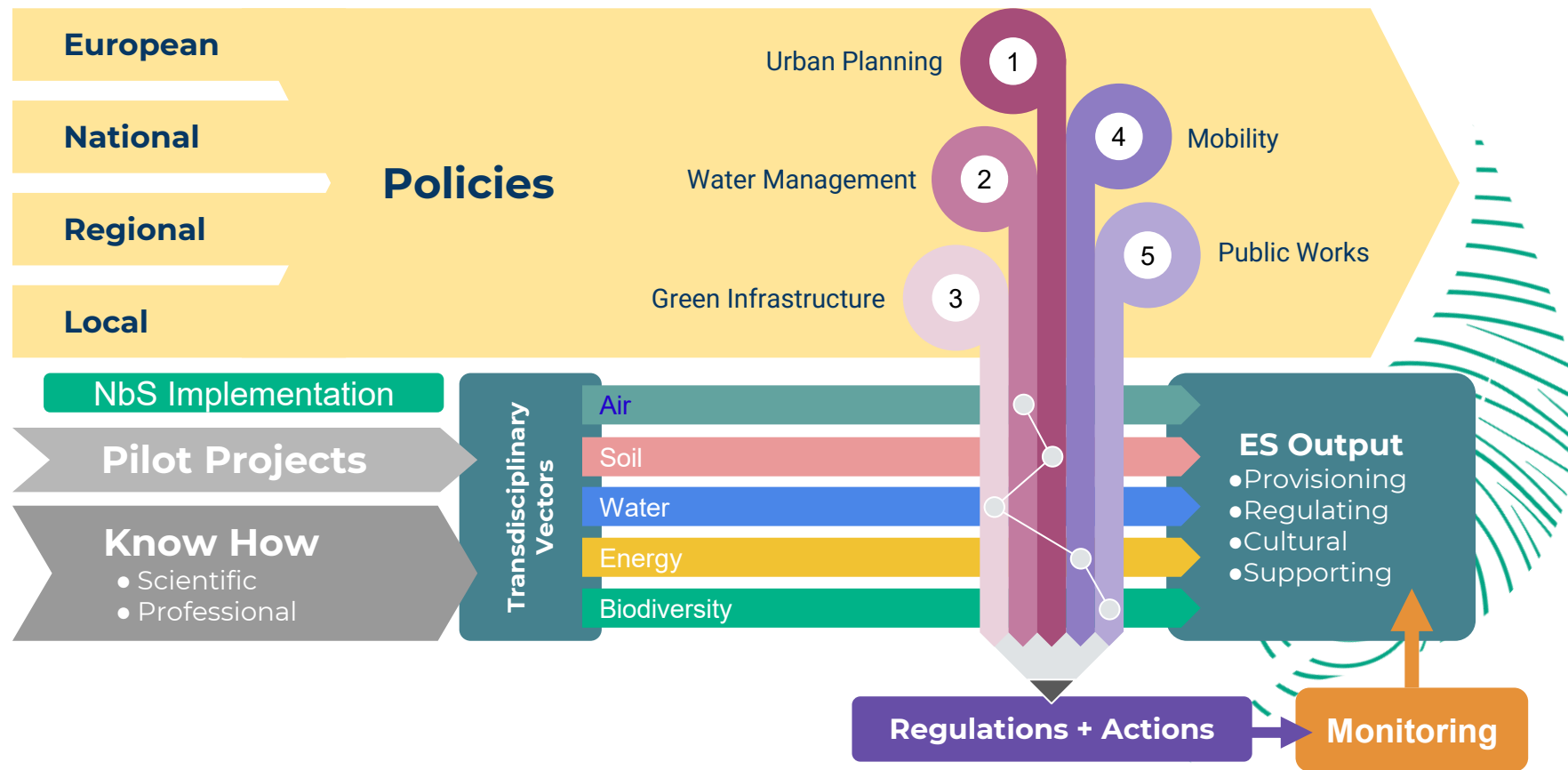
3.4. Harmonizing Policy Levels



- **Effective implementation requires coordination across scales and sectors**
 - **Local Government Level** > Aligning political will with operational tools.
 - **Identify Policy Levels** > Clarifying municipal, regional, national, and EU competencies.
 - **Identify Transdisciplinary Vectors** > Linking urban planning, water management, public health, etc.
 - **Identify Ecosystemic Services Output** > Ensuring regulations account for ES delivery (e.g., flood mitigation, cooling).
 - **NbS Pilot Projects Implementation** > Using pilots to test frameworks and inform regulatory updates.
 - **NbS Regulation and Monitoring** > Establishing legal instruments and KPIs for oversight.



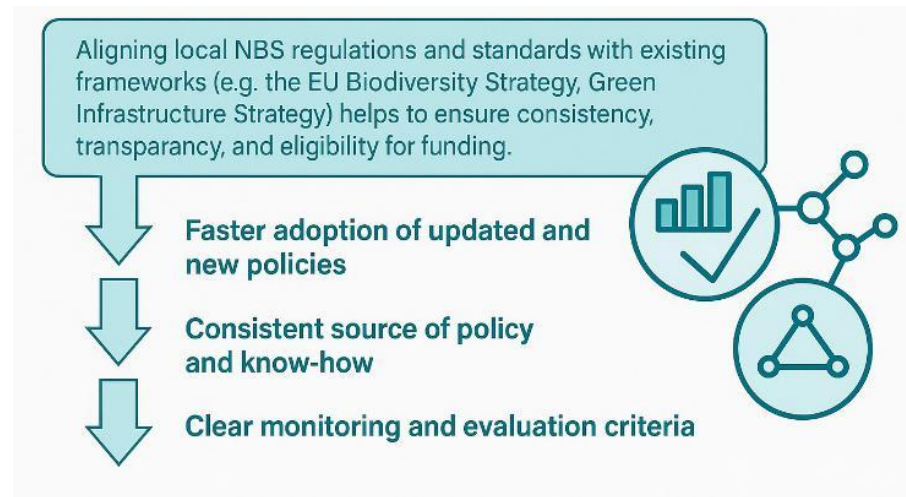
3.4.1. Coordination across Legal Frameworks and Standards



3.5. Aligning Local Regulations with Frameworks

Remember:

- Aligning local regulations for NbS with existing frameworks, **ensures consistency & transparency.**
- Facilitating information exchange between different governance levels **improves performance.**
- Regulatory alignment **enhances the eligibility of local projects** for funding opportunities and favours compliance.



Practical Exercises and Workshops (See Annex 2)



11.1. Step-by-Step NbS
Implementation Sprint



11.2. Detecting Policy
Gaps



11.3. Harmonization
Ladder (Local ↔
Regional ↔ EU)



11.4. PPP Canvas for an
NbS (Finance workshop)

3.6. Barcelona Implementation Strategy



Barcelona embraced a progressive approach to integrating NbS and Biodiversity enhancement into its urban landscape several years ago.



This process has been guided by municipal plans and policies that align with broader European and global sustainability goals.



The gradual adoption of NbS application policies started with the adoption and development of ecological urban planning strategies.

- **Barcelona City Context**
- **Barcelona's Local Government Structure**
- **Urban Ecology Agency creation and mandate**
- **Green Infrastructure and Biodiversity Strategy**



3.6.1. Case Study - Barcelona Implementation Strategy

Territorial Structure



Each district has autonomy to manage local services and community engagement

Technical Vectors

-  Urban planning and housing
-  Water supply and wastewater treatment
-  Parks, gardens, and green infrastructure
-  Waste collection
-  Mobility and transport
-  Infrastructures and public space

Complex Governance and Delivery Model

- Municipal agencies
 - Public and semi-public entities
- Decentralized system with overlapping mandates

Challenge: Coordination and Updating

- Resource-intensive
- Organisationally complex
- Essential for NBS and sustainability mainstreaming

3.8. Urban Ecology Agency

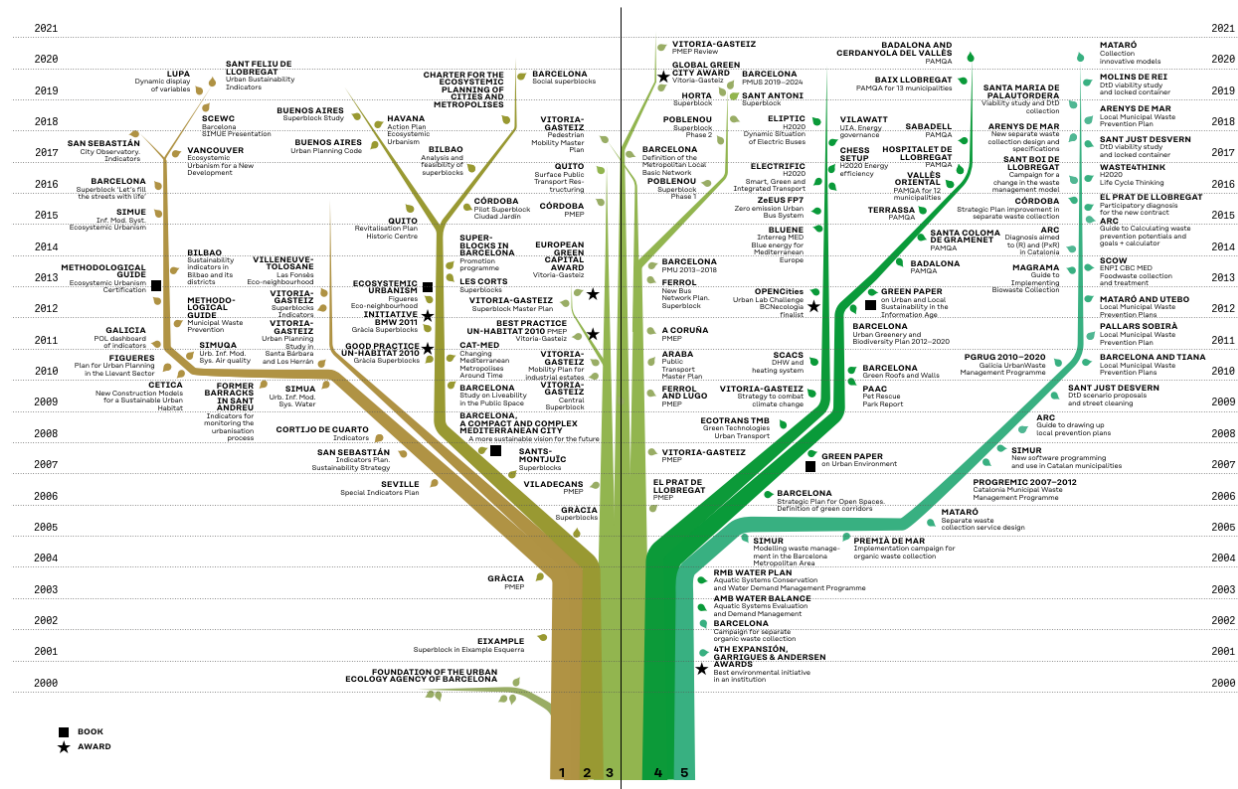
- Barcelona's gradual adoption of NbS starts in 2000 with the creation of the **Urban Ecology Agency of Barcelona**, a public consortium created to develop ecological urban planning strategies at regional level.
- Its main purpose was to **formulate instruments** that allowed the rethinking of cities in relation to sustainability (economic, social, ecological, and territorial), developing tools, models and indicators.
- Through **information and data modelling systems**, the agency developed strategic planning projects for different vectors: urban planning, mobility, environmental, green infrastructure, etc.



Case Study: Barcelona Implementation



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

THE FIVE BRANCHES

1 URBAN SUSTAINABILITY INDICATORS

The first branch includes the Agency's compilation of concepts and instruments and their application to the design, transformation and ecosystemic planning of cities and metropolises.

2 URBAN REGENERATION STRATEGIES

BCNecologia has participated in multiple urban transformation projects where superblocks have acted as a conduit for functional and urbanistic proposals based on ecosystemic urbanism principles.

3 MOBILITY AND PUBLIC SPACE

The Agency has been catapulted around the world by its vision of a more sustainable mobility and public space model, in which the city is reorganised to give the pedestrian priority, followed by the cyclist and public transport.

4 ENVIRONMENT

The fourth branch brings together projects that directly deal with the analysis of energy flows, the water cycle, noise and air pollution, and biodiversity.

5 CIRCULAR ECONOMY

The Waste and Material Cycle Area makes up a fifth branch, which carries a host of important projects, plans and awareness-raising campaigns revolving around innovative waste management and prevention models and tools to manage this waste.

3.8.1. Urban Ecology Agency: The 5 Branches

3.9. Hierarchy of Municipal Norms and Technical Documents





The approval of the Greenery and Biodiversity Plan 2013-2020 in 2012 generated the conditions for the **development of an NbS** based regulatory framework in urban design.



This allowed for the **gradual implementation of pilot projects** and innovative designs in several areas and locations and sparked the creation of several departmental plans and strategies.



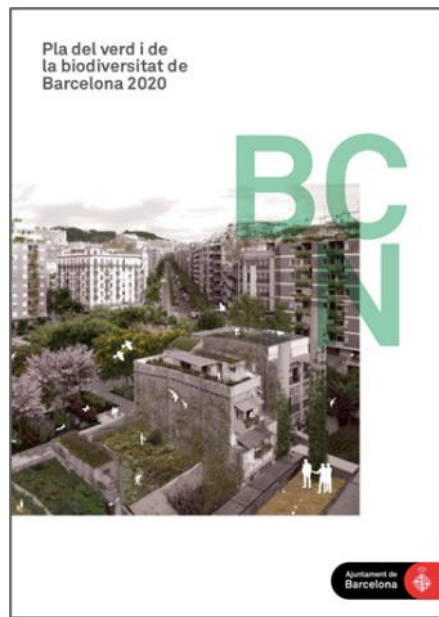
The plan opened the doors to trying **specific solutions** in rewilding, biological pest control, water management, etc.

3.9.1. Policy and Regulatory Framework for NbS

3.10. Green Infrastructure and Biodiversity Strategy

- The Agency's work resulted in the publication of **several studies and strategic documents** concerning green infrastructure.
- The most relevant document produced was **Barcelona Green Infrastructure and Biodiversity Plan (2013-2020)**, which outlined ambitious goals for enhancing urban biodiversity and increasing the quantity and quality of green infrastructure.
- It describes **urban metabolism functions** most closely related to green infrastructure and biodiversity.
- It also defines **clear goals, strategic lines and actions** that could be integrated in any urban project.





2013-2020 Deployment of the Greenery and Biodiversity Plan, through 10 strategic lines and 68 actions.

Global Environmental Status 2020:

Health plays a larger role!

“Healthy biodiversity is the essential infrastructure that sustains all life on Earth, including human life.”

CBD Executive Secretary



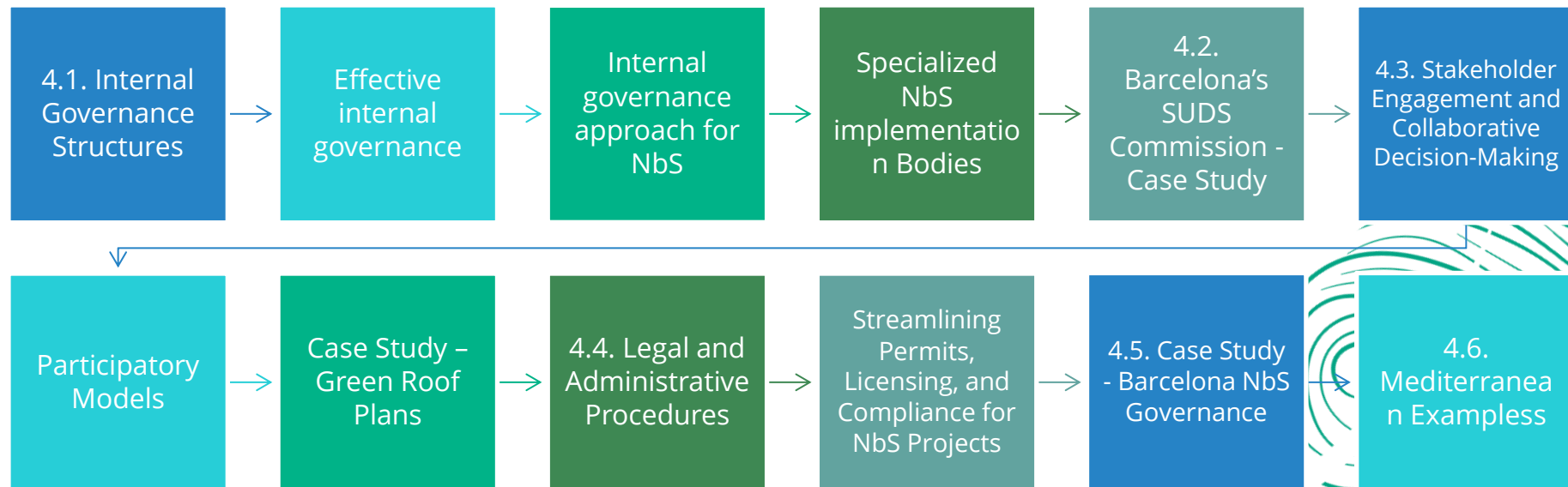
2020-2030 Deployment of new Greenery and Biodiversity Plan, with a larger role for NbS in human health

3.10.1. A New Phase: The Nature Plan 2030

4. Governance and Institutional Arrangements



4.1. Governance and Institutional Arrangements



4.1. Internal Governance Structures



Structure at a glance!



Political Champion (Deputy Mayor/Committee Chair): sets vision, unblocks cross-department issues.



NbS Technical Office: pipeline, standards, funding, risk assesment



Asset Owners: Parks/Green, Water–Drainage, Roads/Public Works, City Cleaning (O&M budgets; deliver).



Support: Procurement & Legal, Finance, Data/IT–GIS, Communications.



Community/NGO Liaison: co-maintenance agreements and volunteer protocols.





Overlapping Responsibilities

Implementing NbS often involves overlapping operational responsibilities across urban planning, environmental services, infrastructure, and finance. Effective internal governance and awareness is essential for integrating NbS across all policy areas.



Cross-Departmental Coordination

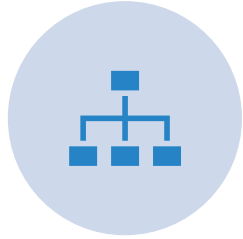
Overlapping operational responsibilities can lead to conflict or to oversight deficiencies. Top-down approaches do not always work best. Coordination mechanisms such as interdepartmental committees are needed to ensure coherence, avoid duplication, and leverage synergies.



Specialised NbS Working Groups

Dedicated bodies can help guide strategy, prioritise investments, and troubleshoot implementation challenges across departments. They act as innovation hubs and accountability mechanisms within municipal governance.

4.1.1. Effective internal governance



**Cross-Departmental
Coordination (urban
planning, environment,
finance)**



**Avoid Planning in a Silo:
Fragmentation and
negative impact**



**Integrative cross
departmental approach -
Map potential actors
involved**



**Commissions - Working
Groups – Task Forces**

4.1.2. Internal Governance Approach for NbS

● NbS Commissions - Working Groups – Task Forces

- **Commission** – Requires political clout. Role in policy implementation guidance for integration of NbS into operational standards, oversight and regulation. Brings together people across departments to bring changes and transfer of knowledge to create alignment across policies.
- **Working Group** – Similar to a Commission but without political clout. Brings together people across departments to develop projects and create voluntary alignment across policies. Sets best practices and recommendations.
- **Task Force** - Requires political clout. Brings together a number of selected individuals. Useful where there is resistance to change but it can generate resentment. Output focused on specific projects or issues, with roles such as coordination, addressing barriers to implementation, pilot projects, monitoring and reporting/tracking outcomes.



4.1.3. Specialized NbS implementation Bodies

4.2. Sustainable Urban Drainage Systems Commission

Barcelona had been **implementing SUDS on a project-by-project basis** since around 2005.

However:

- SUDS **were being built** by Parks and Gardens and the Housing and Urban Design Department
- The gradual implementation of pilot projects and innovative designs generated **interest, dissemination and precedents**.
- **This was not enough** to expand the application of NbS across departments.
- Water Cycle Department felt it **needed to be involved** in SUDS design and maintenance.
- There were doubts about **what department was responsible for what** (supervision, maintenance, health).



SUDS COMMISSION OF BARCELONA CITY COUNCIL

Barcelona begins to implement SUDS in 2005. The SUDS Commission was established in 2016.

Entities initiating the commission:

Barcelona Water Cycle

Parks and Gardens Institute

Municipal Urbanism Institute

Urban Projects

Sustainability Office

Mobility and Infrastructure

Health Public Agency

The functions of the commission are:

- Promote studies on the implementation, management and follow-up of SUDS.
- Systematize data management and projects related to SUDS techniques.
- Promote training in municipal technical services.
- To promote information to the citizenry, through signage, holding of conferences, on-line information.
- Sharing in the municipal organization about the SUDS benefits.
- SUDS Master Plan Coordination.

4.2.1. Specialised NbS implementation Bodies: Barcelona's SUDS Commission

ESPAI: AMPLIACIÓ DEL PARC DEL PUTGET

Ajuntament de Barcelona **Green Blue Management**



Tipus de SUDS emprats:

D-DIP R-ALU F-RAS F-FRA F-COB I-PAV I-DIP I-ESC I-PAR T-CUN T-EST T-

Descripció:
L'espai annex al Parc del Putget era un terreny amb una forta pendent i escassa accessibilitat, que abocava l'aigua cap al carrer. La solució d'urbanització d'aquest espai va integrar els processos de drenatge en tots els seus aspectes: des de la creació de paviments drenants, la utilització de murs de gabions, la construcció de nombroses rases de graves i la construcció d'una xarxa de drenatge per infiltració que té la funció de limitar la velocitat de l'escorrentia a les pendents i la seva circulació incontrolada per les pendents de les àrees de plantació. El sistema està connectat per un sobreexidor al clavegueram de la ciutat.
L'actuació de projecte es completà uns mesos després de l'inauguració del parc amb una rasa aigües a munt del cap del talús per evitar que les aigües plujanes provinents de la part alta del bosc arribin a la zona del talús. Aquesta rasa drenant està connectada a un pou de graves.

Referència addicional a l'informe:

Nom Projecte: Ampliació del Parc del Putget
Districte: Sarrià - Sant Gervasi
Promotor: Ajuntament de Barcelona
Parcs i Jardins de Barcelona. Institut Municipal.
Any aprovació projecte: 2009
Any finalització construcció: 2011
Superfície d'actuació: 12.000 m²

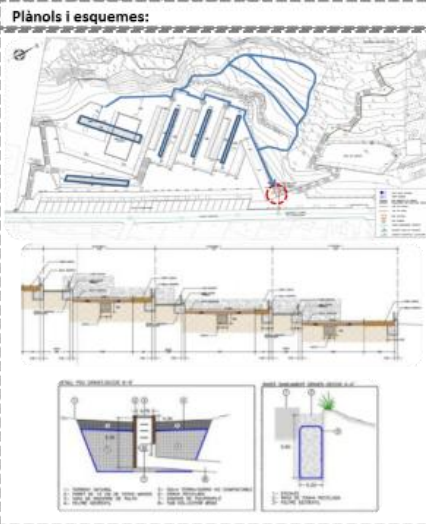
Es disposa de projecte d'execució amb càlcul de drenatge?
SI

Es disposa de projecte As-Built amb càlcul de drenatge?

Estat Previ:



Plànols i esquemes:



Construcció i estat actual:



4.3. Stakeholder Engagement and Collaborative Decision-Making

- NbS projects require **awareness, input and ownership** from a spectrum of actors.

- **Key Stakeholders:**

- Public Authorities (local, regional, national)
- Professionals (Architects, Engineers, Landscape Designers)
- Private Sector (developers, utilities, service providers)
- Civil Society (NGOs, neighbourhood associations, residents)
- Academia and Research Institutions

- **Multidisciplinary Approach**

Effective NbS governance depends on **collaboration between diverse disciplines**.
Engaging a broad knowledge base helps ensure **technical soundness and legitimacy**.



● Participatory Models

- Participation
- Co-creation,
- Citizen science,
- Participatory budgeting

● Can enhance trust and long-term success by **involving communities** in planning, design, and maintenance decisions.

● It is necessary to understand the **drivers of public awareness** and understand correctly the needs of stakeholders.



4.3.1. Participatory Models

4.3.2. Co Governance Case Studies for Green Roof Plans

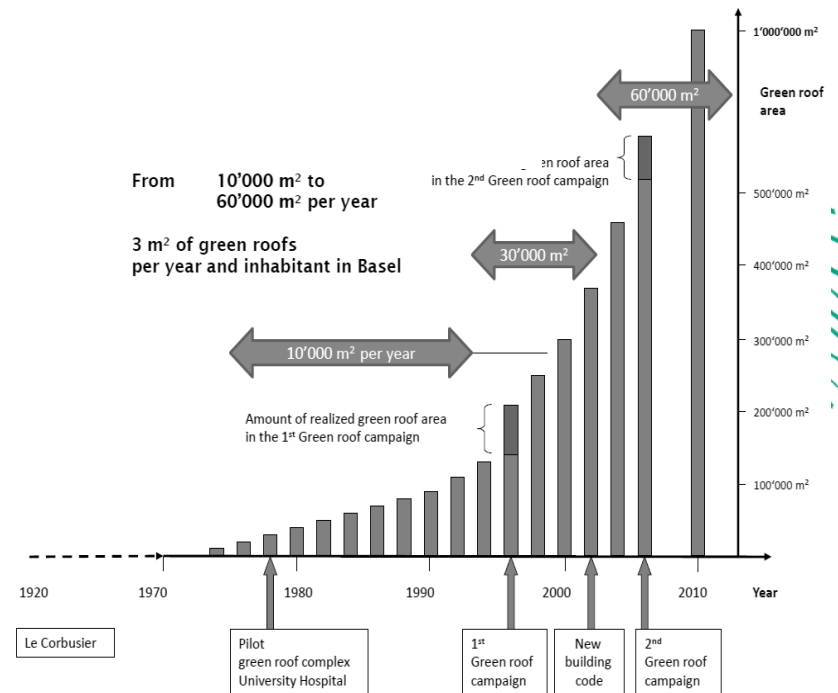
● Green Deal Green Roofs, The Netherlands

- A government-funded partnership between public and private actors.
- Aimed to develop innovative business models for green roofs is the Green Deal Green Roofs
- Now called the National Roof Plan in the Netherlands.

● Rewilding and Green Roofs Programme. Barcelona, Spain

- A Local Authority Funding programme to help private owners implement green roofs in their buildings.

● Green Roofs Plan, Basel, Switzerland



4.4. Legal and Administrative Procedures

Administrative clarity and regulatory support are necessary for facilitating NbS uptake.

Streamlining Permits and Licensing

Traditional procedures are often tailored for grey infrastructure.

NbS require updated permitting pathways that recognise their multifunctionality and long-term benefits.

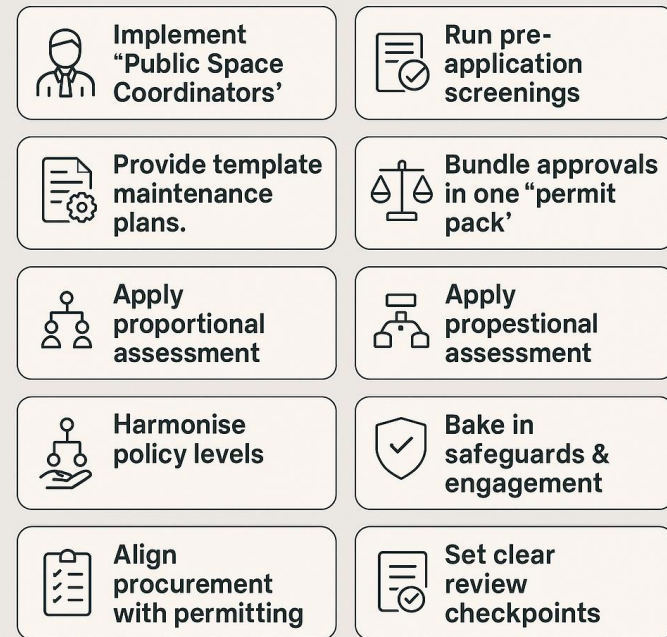
Overcoming Bureaucratic Barriers

Institutional inertia, fragmented responsibilities, and outdated norms can slow progress.

Cities must develop guidelines, update procurement templates, and integrate NbS criteria into urban planning.

● Implement “Public Space Coordinators”

- Run pre-application screenings!
- Use standard templates and models
- Provide template maintenance plans.
- Bundle approvals in one “permit pack”
- Apply proportional assessment
- Harmonise policy levels
- Align procurement with permitting
- Bake in safeguards & engagement
- Set clear review checkpoints



4.4.1. Streamlining Permits, Licensing & Compliance for NbS

4.5. Barcelona NbS Governance

- Barcelona's NbS implementation and Development strategy can be seen as a transferable Mediterranean example
- NbS strategy for development and Implementation in Barcelona has resulted in the acceptance of several multi-scale NbS design Tools



4.6. Mediterranean Examples

Alicante

Benicassim

Cannes

Heraklion

Lisbon

Montpellier

Seville

Solana de los Barros

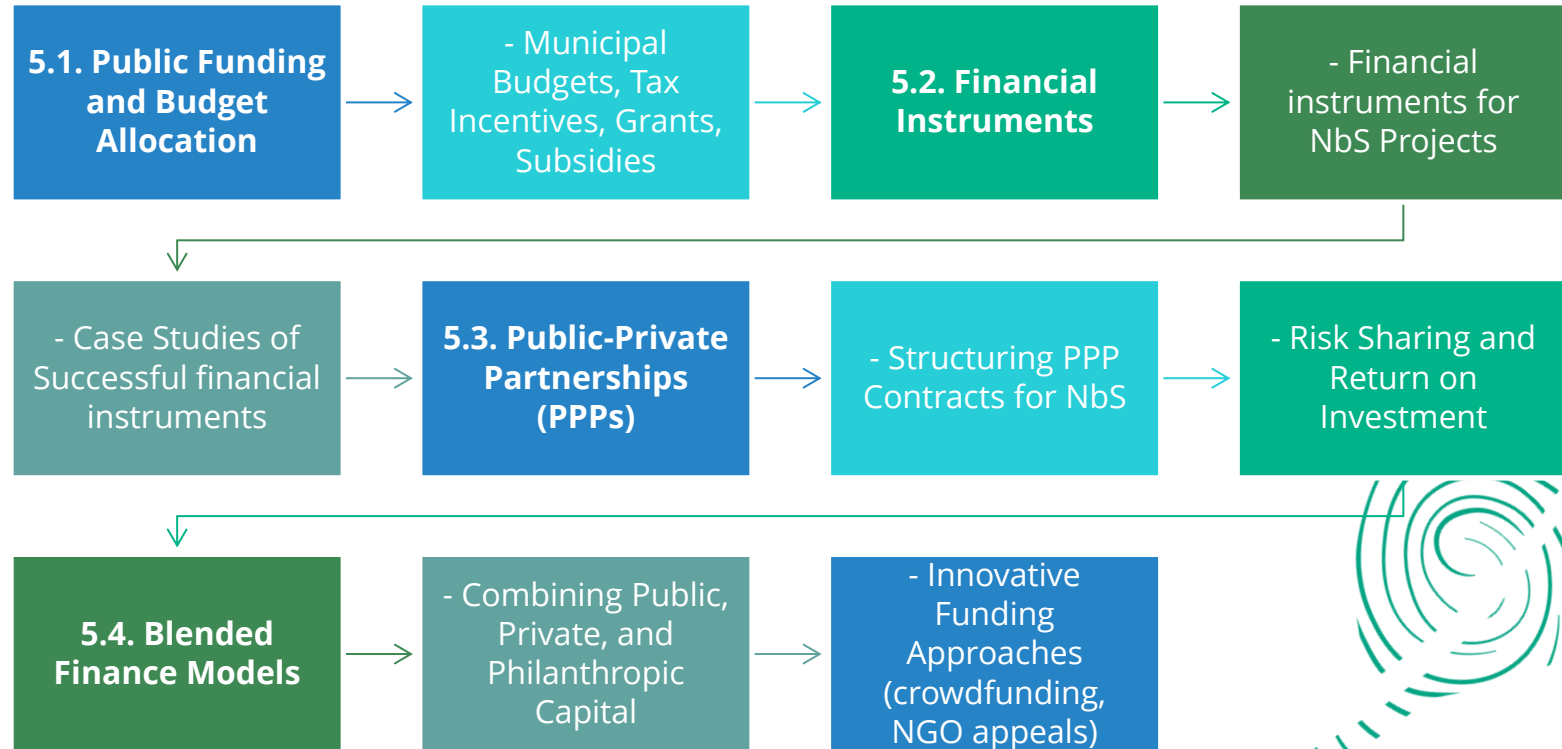
Thessaloniki



5. Financing Instruments for NbS

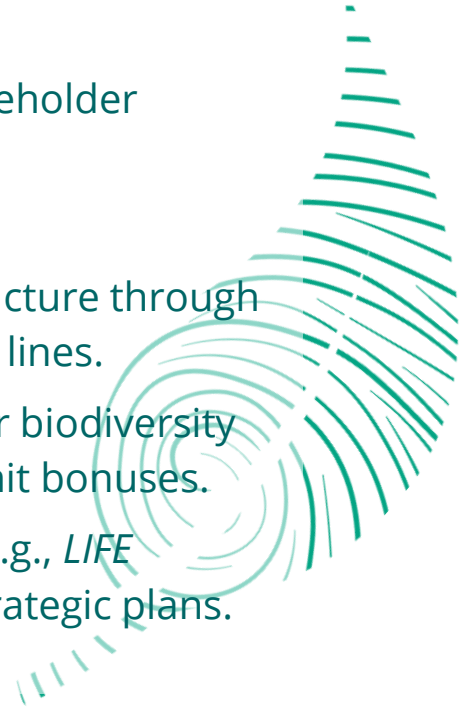


5. Financing Instruments for NbS



5.1. Public Funding and Budget Allocation

- NbS provide long-term economic, environmental, and social returns, but they require **initial investments** and **financial planning**.
- A diversified funding strategy **enhances resilience**, encourages stakeholder involvement, and ensures project sustainability.
- **Public resources** remain a primary driver for NbS implementation:
 - **Municipal Budgets:** Cities can earmark funds for green infrastructure through urban planning, environmental protection, or climate adaptation lines.
 - **Tax Incentives:** Incentivising green roofs, permeable surfaces, or biodiversity enhancements through property tax reductions or building permit bonuses.
 - **Grants and Subsidies:** Accessing national and EU-level funds—e.g., *LIFE Programme, Horizon Europe, Green Deal*—for pilot projects and strategic plans.



Building a nature-positive economy:
The role of policy and business



Cities at a crossroads: Challenges
and opportunities in the nature-positive economy



EU policy: Enabling or hindering
the nature-positive transition?



Private sector leadership in the
built environment's nature-positive transition



Scaling change: Nature-positive
urban policy in practice



Final reflections



5.1.1. Building a Nature Positive Economy

5.2. Financial Instruments for NbS

01	Municipal Budgets	• Building stormwater management infrastructure • Rain gardens
02	Tax Incentives	• Tax reduction for stormwater mitigation measures
03	Grants	• Fund for citizens and/or organisations to plant permeable surfaces and/or rain gardens.
04	Development Fees for Green	• Requiring developers to convey parkland or pay into a fund for parkland • Payments for tree canopy loss during property development (Compensation)

Municipal Budgets

- The City of Barcelona started the “Superilles” (Superblocks) programme in 2020 to convert road space for pedestrians, public space and nature-based solutions.
- Its goals were to create 21 green centres, providing 6.6 hectares (16.3 acres) of urban green space.
- Trees and vegetation were planted in areas that previously had hard surfaces, providing stormwater mitigation and reducing the urban heat island effect.
- The City will be making improvements to the Sant Antoni Superblock in 2026, adding green space.



5.2.1 Financing Instruments for NbS - Municipal Budgets

- The budget between 2020-2024 was 32,800,000 EUR.
- The City has budgeted 11,500,000 EUR for improvements to the Sant Antoni Superblock.
- The funds were mobilized using the conventional budgeting measures used in Barcelona for capital investments.
- This relies on its ability to levy taxes from various local activities.



5.2.2. Financing Instruments for NbS - Municipal Budgets

Urban Stormwater Management Tax, France

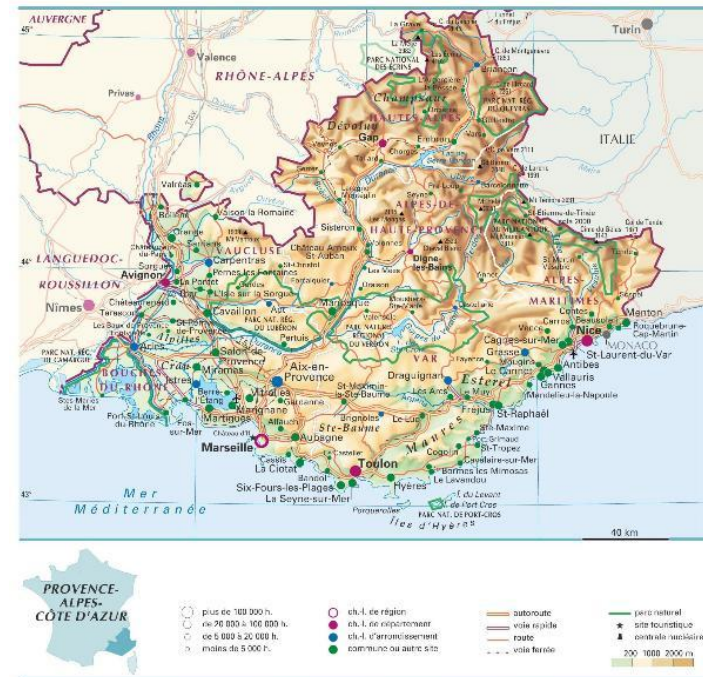
- Local governments can implement and set this tax, which has been allowed since France passed its “Grenelle 2” Law in 2010.
- By law, the maximum rate that can be charged is €1 per square metre. Property owners must declare to the local government the percentage of the property that is permeable.
- The tax can be reduced by 20% to 100% if property owners take measures that reduce or avoid water run-off.
- The proceeds of the tax must be used for urban stormwater management.



5.2.3. Financing Instruments for NbS – Tax Incentives

Sud Provence-Alpes Côte-d'Azur region, France

- The regional government of Sud Provence-Alpes Côte-d'Azur offers grants to property owners for installing rain barrels.
- The grants range between €1,000 to €6,000 of installation costs. This grant exists as of 2024.
- France's Mediterranean coast has seen greater periods of water scarcity relative to the rest of the country.



5.2.4. Financing Instruments for NbS – Grants

“Grey into Green” Programme Wrocław, Poland

- The Municipality of Wrocław funds schools to convert schoolyards to nature-based solutions, e.g. vegetable or rain gardens, green walls, and pollinator meadows.
- The municipality funds 85% while the remaining 15% is covered by the schools.
- The 2017-2020 budget for this programme was 640,000 EUR (3,000,000 PLN).



5.2.5. Financing Instruments for NbS – Grants

The “Granada Standard”

- A technical reference document in Spain for ornamental trees’ economic valuation of in public and private spaces.
- Its main objectives are:
 - To estimate the economic value of trees.
 - To unify technical and economic valuation criteria.
 - To assist in compensation processes, responsibilities or calculation of damage to vegetation.
 - To serve as a guide for urban green heritage management.



5.2.6. Financing Instruments for NbS – Norma Granada

PURPOSE

Evaluate the economic value of ornamental trees and plants in urban landscaping

KEY VALUATION CRITERIA



- species
- size
- age
- health
- location
- landscape integration
- rarity
- environmental function

MAIN VALUATION FORMULA

Replacement value
× Correction factors



COMMON APPLICATIONS

- urban planning
- transplant assessment
- compensation for damage
- legal expert reports



GEOGRAPHICAL FOCUS

Mediterranean context (Spain, Catalonia, Balearic Islands, southern Fr.,



Last revised in 2006, calls for integration of ecological and climate adaptation values

5.3. Financial Instruments for NbS Projects

01	Green Bonds	• Parkland development
02	Pay-For-Performance Bonds	• Targeted for specific NbS outcomes
03	Voluntary Measures	• Tree planting
04	Community Asset Transfer	• Partnering with community to have NbS



Bonds are **a form of debt**, where the money raised is used (use of proceeds) to fund predetermined activities. A green bond is a fixed income product (debt) that is issued to finance environmental projects. High investor demand can allow for green bonds to be sold at a premium, reducing the cost of servicing debt.



It is necessary to develop **a green bond framework** when issuing a green bond for the first time. To be credible and avoid greenwashing, green bonds' intended proceeds must be reviewed by a second- or third-party opinion provider. The bonds are assessed against voluntary frameworks like the Green Bond Principles and the Climate Bond Standard.

5.3.1 Financial Instruments for NbS Projects – Green Bonds

Cities and regions are increasingly adopting dedicated financial tools to support NbS.

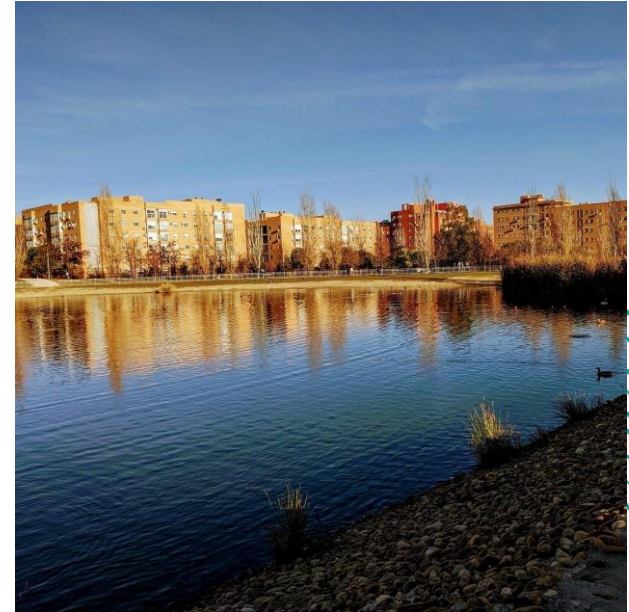
- **Green Bonds:** Issued by municipalities or development banks to finance environmental projects, including NbS for flood control or urban greening.
- **Environmental Impact Bonds (EIBs):** Outcome-based financing where returns are tied to environmental performance (e.g., stormwater retention or air quality improvements).



5.3.2. Financial Instruments for NbS Projects – Green Bonds

Green Bonds Example: Community of Madrid, Spain

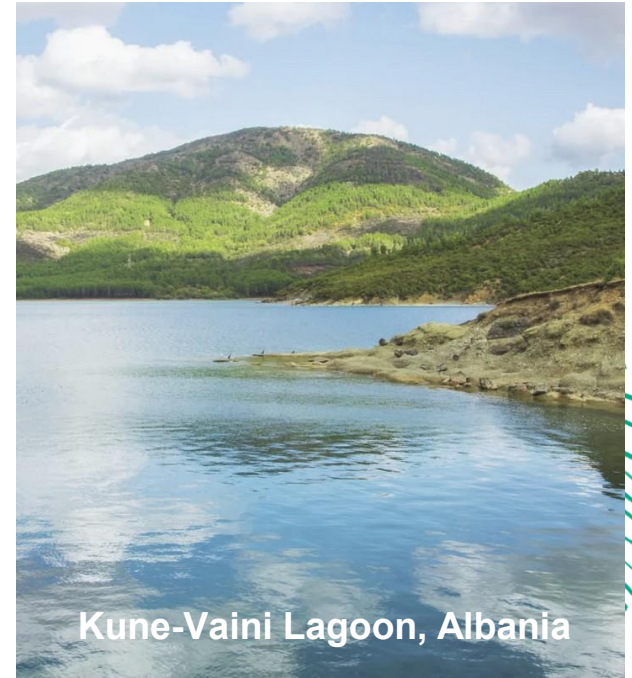
- The Community of Madrid issued its first green bond in April 2020. It was worth 700,000,000 EUR with a coupon rate of 0.827%.
- The use of proceeds were partly for green bond conservation.
- It funded the maintenance of public parks in the region, e.g. Parque Valdebernardo in the east of Madrid.
- Proceeds were also used to fund non-profit organizations focused on natural heritage and reducing biodiversity loss in the region.



Parque Forestal de Valdebernardo

5.3.3. Financial Instruments for NbS Projects – Green Bonds

- Pay-For-Performance Bonds (AKA Environmental Impact Bonds)
- The key difference from green bonds is the focus on outcomes.
- This framework brings in multiple partners to compensate for the financing gap that exists between government and philanthropy.
- Best practice is to have an external company verify the outcomes.
- Having a multipartite model allows for risk-sharing regarding environmental performance and takes time to organise.



5.3.4. Financial Instruments for NbS Projects - Pay-For-Performance Bonds

Voluntary Schemes

- GAIA - Green Area Inner-city Agreement (Bologna, Italy; Pop. 387,000)
- Bologna produced its own scheme to fund tree planting to help alleviate drought and extreme temperatures.
- Businesses would voluntarily participate by getting a free audit of their carbon dioxide offset potential.
- Companies would then enter into an agreement with the Municipality of Bologna to purchase trees.



5.3.5. Financial Instruments for NbS Projects - Voluntary Measures GAIA

- Bologna identified a potential 3,000 trees could be planted on 23 public sites.
- GAIA contributes to climate adaptation under the Bologna Adaptation Plan.
- The initial phase of GAIA cost 1,202,000 EUR.
- Eighteen companies participated and 1,405 trees were planted.



5.3.6. Financial Instruments for NbS Projects - Voluntary Measures



Local governments can transfer management or ownership of public land or buildings to a community organisation. These arrangements should be structured for a long-term lease period.



The community organisation may not have the expertise or staff necessary to deliver the service. Therefore, the local governments should have mechanisms in place to monitor and anticipate issues.

5.3.7. Financial Instruments for NbS Projects - Community Asset Transfer



Example “Beyond a Construction Site” (Ljubljana, Slovenia): A long-abandoned property that was slated for real estate development was turned over to Obrat, **a community organisation**. They ran a community garden and educational activities.



Obrat was originally given a one-month lease then, they had recurring one-year leases between 2011 to 2022. **This was done free of cost.** The City informed the group to leave the space since there were plans to build apartment units.



5.3.8. Financial Instruments for NbS Projects - Community Asset Transfer

5.4. Public-Private Partnerships (PPPs) - Relevant PPP Models

01	Operations & Maintenance	• An organisation manages an existing asset and delivers service. It receives fee and incentive payments. It is responsible for operations and maintenance expenses.
02	Lease	• A contractor takes over the asset and provides service at a specified quality. It is responsible for operations and maintenance expenses.
03	Build, Transfer, Operate	• Receives payment from user, which may be government. The asset is financed by government. Ownership is transferred after construction.



Private sector involvement brings innovation, investment capacity, and long-term management potential.



PPP Contracts for NbS: Structured agreements where private actors co-finance, design, build, and maintain NbS interventions (e.g., green corridors, bioswales, urban forests).



Risk Sharing: Risk and return are distributed between city governments and partners based on performance targets and investment scale.



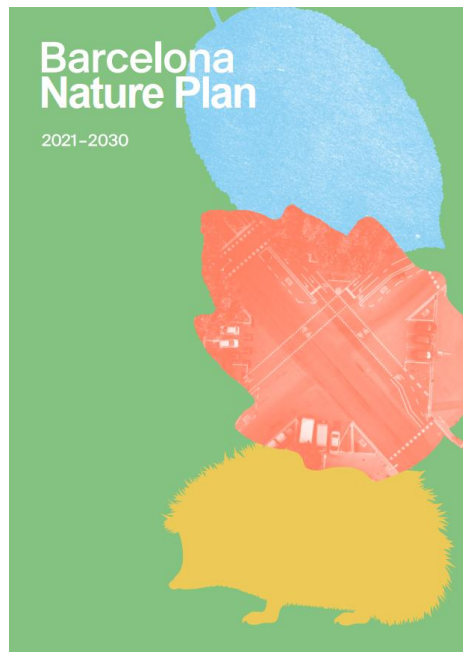
Return on Investment (ROI): Demonstrating co-benefits—reduced flood damage, increased property values, or health improvements—strengthens the business case.

5.4.1. Public-Private Partnerships (PPPs) - Structuring PPP Contracts for NbS

- PPPs are defined by UN-Habitat as long-term contracts between a private entity and a government for providing a public asset or service.
- This model tends to apply to grey infrastructure projects (e.g. transit, tolled highways).
- PPPs can be tailored to a public entity's needs.
- PPPs have a mixed history from going over budget, exceeding deadlines and not delivering the intended savings to the public.
- PPPs can be used for NbS, but private firms need an attractive return.



5.4.2. Public-Private Partnerships (PPPs) - Structuring PPP Contracts for NbS



Action 17. To take a deep look at complementary funding systems such as green taxation and sponsorship and to apply them



Mercat de Sant Antoni Superblock.

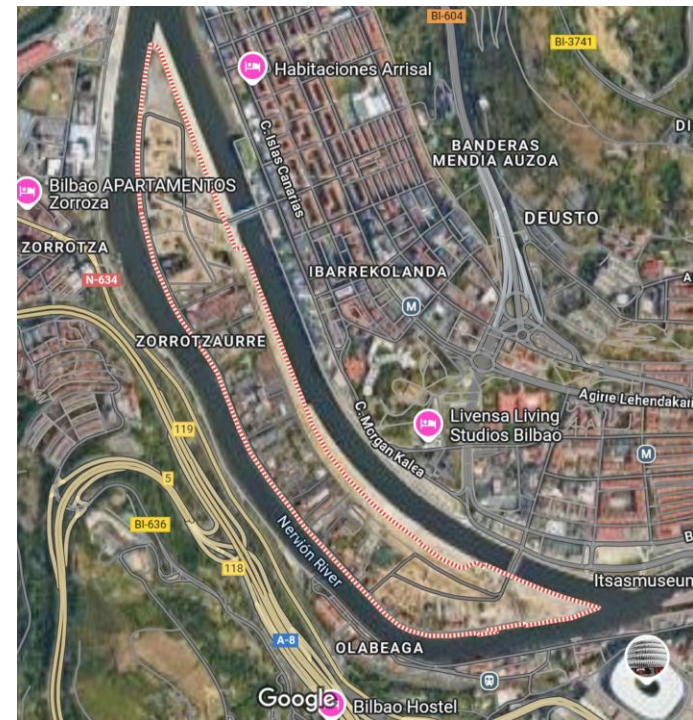
92. To analyse the cost of maintaining existing and planned greenery and biodiversity, with regard to human, financial and material resources. To include the new associated infrastructures such as SUDS, structural soils, green roofs.

93. To study the possibilities of green taxation and alternative management and funding channels for creating and maintaining green spaces, such as private sponsorship, stewardship actions, temporary assignments of use, permits, discounts etc.

5.4.3 Public-Private Partnerships (PPPs) - Structuring PPP Contracts for NbS

Example: Flood proofing in Zorrotzaure (Bilbao, Spain)

- Property owners and the City Council of Bilbao have worked together to redevelop the Zorrotzaure district to make it flood resilient.
- It was previously a peninsula; however, it has been turned into an island to ensure it does not flood.
- The conversion to an island was in accordance with a master plan from 2004.



5.4.4 Public-Private Partnerships (PPPs) - Structuring PPP Contracts for NbS

- The Zorrotzaure Management Commission was formed with ownership split 51% and 49% between the municipality and private landowners.
- The public and private partners share responsibility for the redevelopment and its costs in accordance with their percentage of ownership.
- Zorrotzaure has a mix of residential, commercial and cultural uses.
- Over 500 people live there. Construction is ongoing.



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

5.4.5 Public-Private Partnerships (PPPs) - Structuring PPP Contracts for NbS

5.5. Blended Finance Models



Blended finance is defined as involving the use of public and philanthropic funds to change the risk/return profile of investment projects in order to attract the private sector.



The public or philanthropic sectors are typically the first investors in a conservation finance project that serves as a proof of concept. The public or philanthropic sectors can be the subordinate partners in an investment.



This approach de-risks the project for the private sector. Blended finance requires multiple stakeholders, and its structuring is sophisticated to meet the return needs of different actors.



Blended finance is a keyway to help bring in private capital for large-scale NbS projects.

Types of Blended Finance models

- Government can provide technical assistance funds
- Guarantees and risk insurance encourage private sector involvement
- Concessional finance can help to bring in private capital.

Blended Finance Types and Likely Providers

	Philanthropic Foundations	Donors and Multi-donor Funds	Development Finance Institutions
Type 1 Design and Preparation Funds			
Type 2 Technical Assistance Funds			
Type 3 Guarantees and Risk Insurance			
Type 4 Concessional Finance			

Source: Earth Security

5.5.1. Blended Finance Models - Types

Innovative Funding Approaches

- Radici asked citizens to donate funds to plant 10 trees in 10 parks in Bologna.
- A goal was set of raising 3,000 EUR.
- Rewards were provided to donors in accordance with the donation amount.
- Radici ran between 2016-2019.



5.5.2. Blended Finance Models - Crowdfunding Radici (Bologna, Italy)

Practical Exercises and Workshops (See Annex 2)



11.1. Step-by-Step NbS Implementation Sprint



11.2. Detecting Policy Gaps



11.3. Harmonization Ladder (Local ↔ Regional ↔ EU)

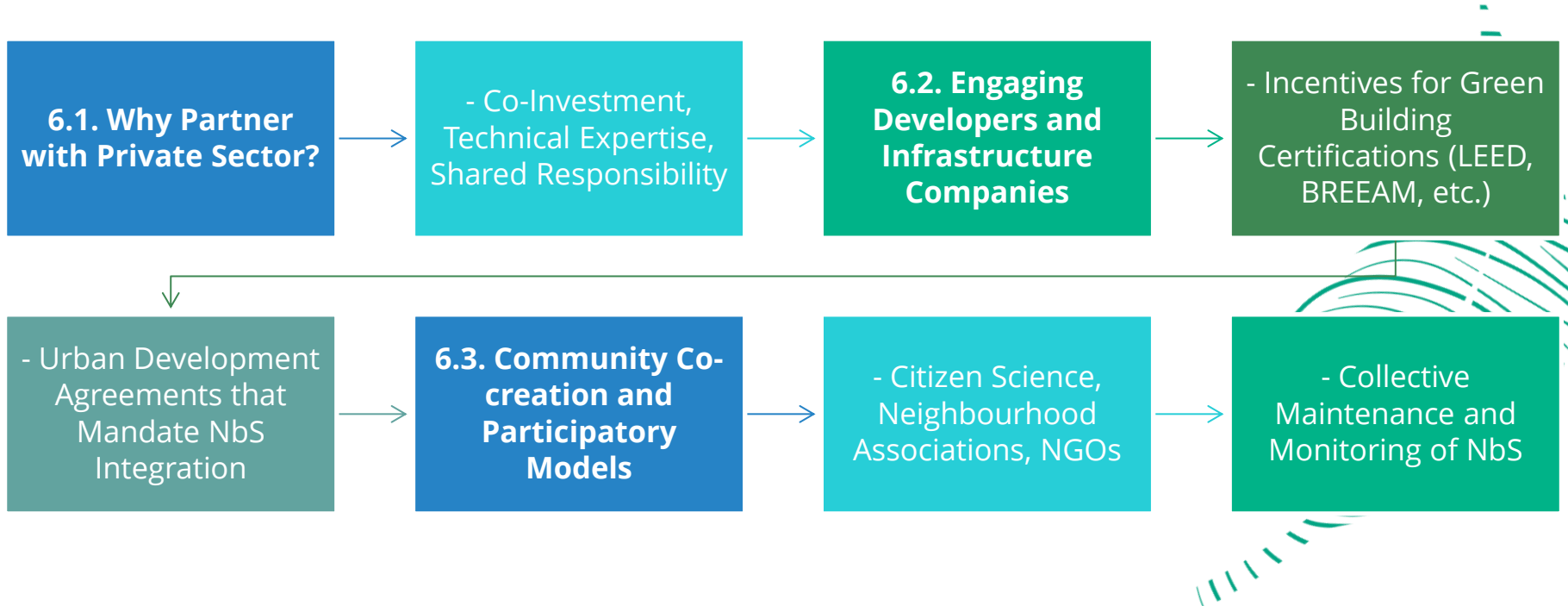


11.4. PPP Canvas for an NbS (Finance workshop)

6. Building Partnerships with the Private Sector and Other Stakeholders



6. Building Partnerships with Stakeholders

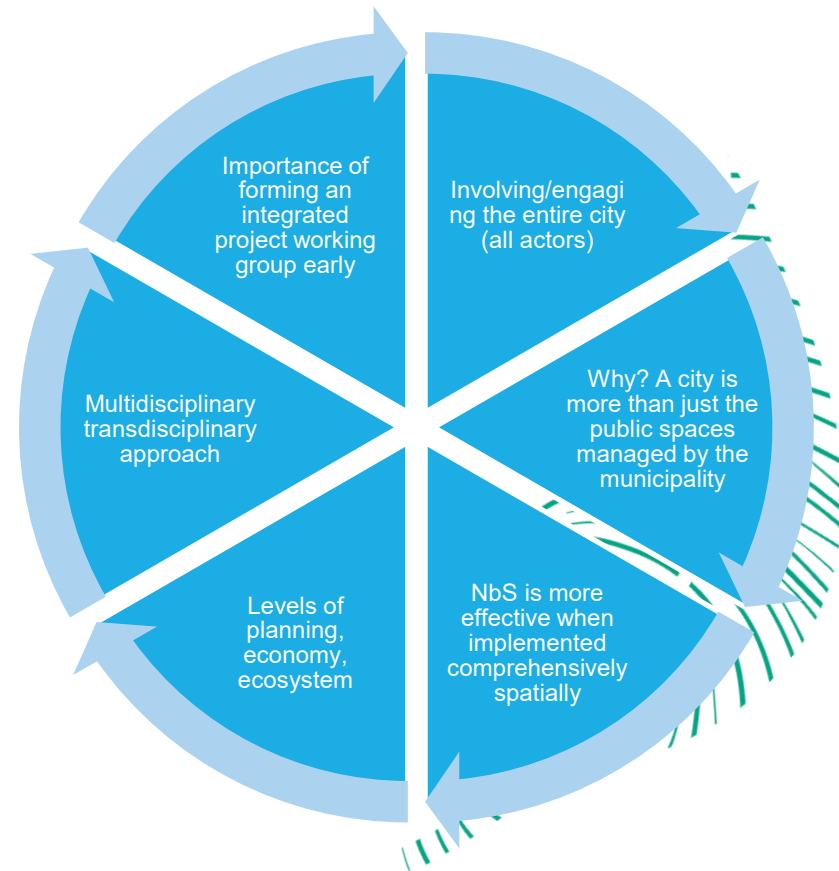


6.1. Why Partner with the Private Sector?

- Implementing and maintaining Nature-Based Solutions (NbS) at scale requires collaborative governance.
- Partnerships with private actors, civil society, and local communities enable co-investment, broaden expertise, and ensure long-term viability.
- Engaging private actors creates mutual benefits and shared ownership.
 - **Co-Investment:** Reduces public financial burden and unlocks capital for larger-scale interventions.
 - **Technical Expertise:** Private companies bring specialised knowledge in engineering, landscaping, materials, and digital innovation.
 - **Shared Responsibility:** Joint planning and implementation foster accountability, improve outcomes, and enable integrated maintenance strategies.



- Involving/engaging the entire city (all actors).
- Why? A city is more than just the public spaces managed by the municipality.
- NbS is more effective when implemented comprehensively spatially.
- Levels of planning, economy, ecosystem.
- Multidisciplinary transdisciplinary approach.
- Importance of forming an integrated project working group early.



6.1.1. Why Partner with the Private Sector?

- Private sector participation not only brings additional financial resources but also introduces innovative business models, operational efficiencies, and a focus on measurable outcomes that can enhance the effectiveness and impact of NbS projects.
- Scaling up pilot projects:
 - Co-Investment
 - Technical Expertise
 - Shared Responsibility and de-risk investment
- Building the NbS ecosystem requires multiple stakeholders to work together across different interconnected layers of the economy. These can be divided into four groups:
 - i) government and public policy decision-makers;
 - ii) capital holders and allocators;
 - iii) investment pipeline (including projects, corporates, and cooperatives); iv) people and communities.



6.1.2. Why Partner with the Private Sector?

6.2. Engaging Developers and Infrastructure Companies

- Urban development is a critical opportunity for embedding NbS.
 - **Incentives for Green Certification:**
 - Municipalities can offer tax breaks, density bonuses, or fast-track permits to developments certified under systems like **LEED**, **BREEAM**, or **DGNB**, which include NbS components such as green roofs or vegetated façades.
 - **Urban Development Agreements:**
 - Public-private agreements can **mandate NbS integration** into new developments, e.g., bioswales in parking lots, tree-lined streets, or green buffers, linking environmental performance to planning approvals.



Incentives for Green Certification



Municipalities offer tax breaks, density bonuses, or fast-track permits

Applies to LEED, BREEAM, BGNB
NBS elements include green roof, vegetated façades, sustainable landscaping

Urban Development Agreements



Public-private planning agreements mandate NBS inclusion

- Examples: bioswales in parking lots
- Tree-lined streets, green buffers

Environmental performance linked to planning approvals



Incentives for Green Building Certifications (LEED, BREEAM, etc.)

- Used to specify and measure the sustainability performance of buildings, ensuring that projects meet sustainability goals and continue to perform optimally over time.



Urban Development Agreements that Mandate NbS Integration

- Can mandate (stick) and incentivise (carrot) NbS
- Inclusion of NbS in project requirements
- Design competitions
- Policy incentives: permit/plan approval expediting
- Market appeal of certified projects

6.2.2. Engaging Developers and Infrastructure Companies

6.3. Community Co-creation and Participatory Models

Engaging citizens and civil society builds social acceptance and ensures relevance.

Citizen Science:

Involving residents in monitoring biodiversity (Bioblitz), water quality, or heat island effects strengthens awareness and data collection.

Neighbourhood Associations & NGOs:

These groups can co-design and co-manage NbS projects, such as community gardens or pollinator pathways, increasing visibility and local pride.

Collective Maintenance and Stewardship:

Models like “*adopt-a-tree*”, *neighbourhood green committees*, or *school-based greening projects* reinforce long-term care through civic engagement.

Purpose: keep NbS working, safe, and welcoming through shared care

- Why collective? It lowers costs, improves reliability, and creates better data for decisions.
- Municipality/utility: sets service levels and safety rules; keeps the asset register and work orders.
- Contractor/SME: specialist tasks (pruning, sediment removal, repairs) + monthly inspection.
- Community group/school/NGO: light routine care following citizen-science good practice (training, feedback, recognition).
- University/technical partner (optional): seasonal surveys and method support.
- Safety & access: provide a simple Do/Don't list, basic PPE, and a clear escalation channel for hazards.
- Base checklists on established SuDS/NbS maintenance guidance.
- Tools we already have: paper forms + QR codes/WhatsApp or a free form app (e.g., tools from WeObserve/Citizen Observatories).



6.3.1. Collective Maintenance and Monitoring of NbS

● Citizen Science (residents, schools) — “light & frequent”

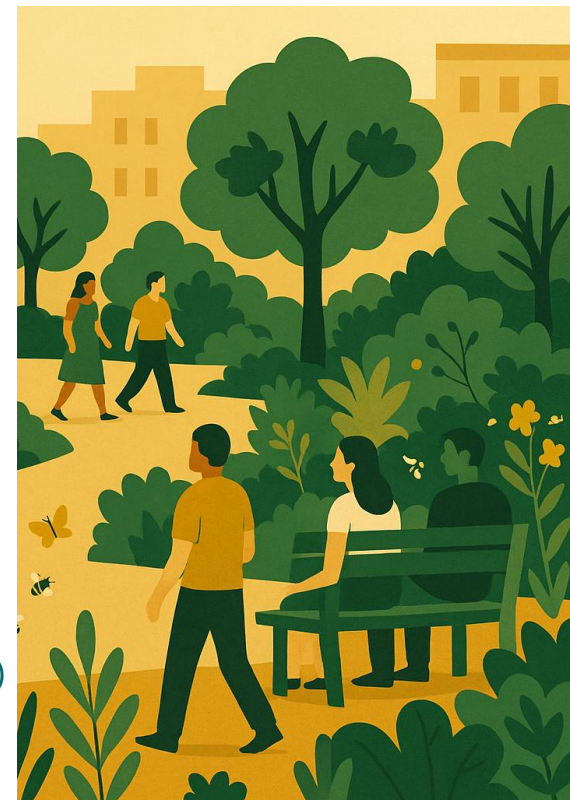
- Spot checks after rain (blocked inlets, litter, standing water)
- 10-minute biodiversity counts + fixed photo-points
- Report issues via QR/WhatsApp form; add one photo
- Help water young trees in heatwaves (May–Sept)

● Neighborhood Associations — “local coordinators”

- Recruit and rota volunteers; host 60–90 min training
- Keep a simple logbook per site (who did what, when)
- Organize monthly clean-ups; relay priority issues to city/contractor
- Co-design small improvements (benches, shade plants, signage)

● NGOs/Universities — “methods & quality”

- Provide checklists and mini-protocols; train trainers
- Do seasonal surveys (vegetation cover, pollinators, shade/temperature)
- Validate a sample of community data; publish a 1-page dashboard
- Advise on safety, inclusion, and nature-positive gardening

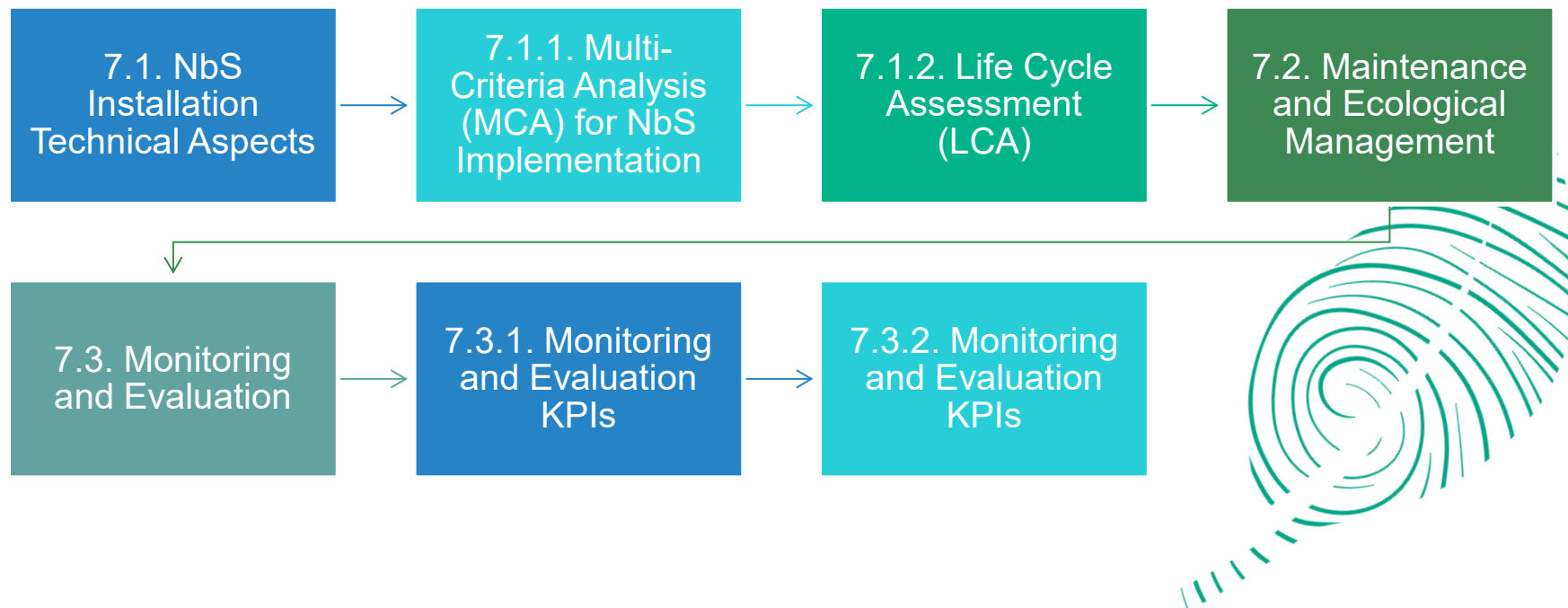


6.3.2. Role of Citizen Science, Neighborhood Associations & NGOs in NbS

7. Implementation and Monitoring



7. Implementation and Monitoring of NbS



7.1. NbS Installation Technical Aspects

To ensure performance, NbS must be embedded within broader urban strategies:

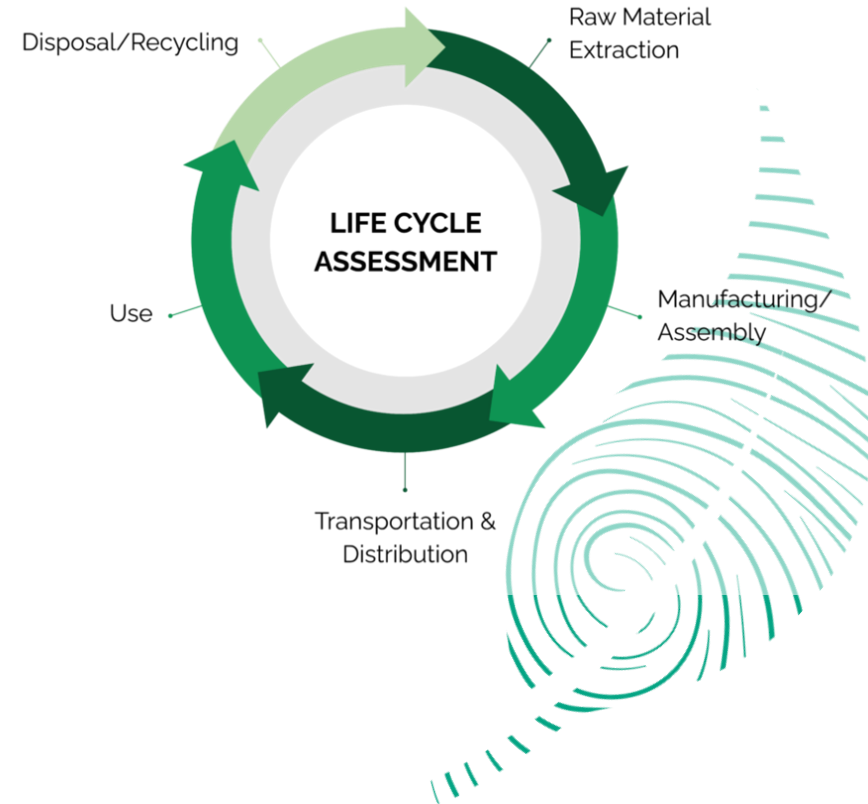
- **Alignment with Urban Plans and Policies:** NbS should be integrated with city master plans, sustainable mobility strategies, water management policies, and climate adaptation frameworks.
- **Ecological Integrity and Biodiversity Gains:** Design must respect site-specific ecological dynamics. This includes using native or beneficial species, enhancing ecological connectivity, and avoiding invasive plants or habitat degradation.
- *Example:* In Barcelona, SUDS projects are coordinated with **water management, parks and gardens and mobility departments** to maximize multifunctionality (e.g., rain gardens that also enhance cycle ways).



- [illegible]

Sour ce – Ajuntament de Barcelona

- **Life Cycle Assessment (LCA)** allows work to go beyond the traditional scope of NbS.
- Ecosystem Services are foreseen **including environmental impacts** generated over the entire life cycle of the NbS.
- This spans: raw material extraction, through materials processing, production, distribution, and use stages, to end-of-life management.
- **Connects NbS with Circular Economy!**



7.1.2. Life Cycle Assessment (LCA)

7.2. Maintenance and Ecological Management

Proper care ensures that NbS continue delivering ecosystem services over time.

- **Long-Term Upkeep and Budgeting:**

Maintenance plans should be embedded in procurement and funding agreements, with clear timelines, responsible entities, and adaptive measures for extreme events.

- **Ecological Management Indicators:** Key indicators may include:

- Pollinator presence
- Bird presence
- Microfauna presence
- Plant health and survival rates
- Pests and Biological Control Allies Presence

- ***Example:* Paris monitors green roofs annually for vegetation cover, stormwater retention, and biodiversity presence.**



7.3. Monitoring and Evaluation

Key Performance Indicators (KPIs):

Should cover a range of outcomes:

- **Environmental:** temperature reduction, runoff volume, biodiversity counts
- **Social:** user satisfaction, health improvements, accessibility
- **Economic:** cost savings, job creation, increased property values

Data Collection and Reporting Tools:

- GIS mapping and remote sensing
- Community-based monitoring (citizen science)
- Environmental sensors (e.g., water quality probes, temperature loggers)
- Before/after comparisons and visual storytelling

● Define KPIs for Environmental, Social, and Economic Performance

- Environmental mm of runoff avoided / % inlets functional after storms; $\Delta^{\circ}\text{C}$ surface/air in shade; vegetation cover (%); pollinators per 10-min count.
- Social user satisfaction (1–5), visits/hour, number of community participants per site, response time to reported issues (days).
- Economic O&M cost €/site/season, avoided damage proxies (flood clean-up hours), asset lifespan (years), co-funding leveraged (€).

● Tools & methods for data & reporting

- Collection QR/mobile forms, photo-points, simple transects, rain/temp loggers, level sensors in inlets, maintenance & City Cleaning logs.
- Quality short protocols, sample checks by staff/NGO, auto time-stamp & geo-tag.
- Reporting one-page quarterly dashboard + map; traffic-light status vs targets; “what changed & why.”

● Co-develop KPIs with stakeholders (incl. City Cleaning)

- 60–90 min workshop: agree goals → shortlist 5–8 KPIs → assign owner, method, frequency, threshold → validate feasibility with City Cleaning, Parks, Water, Mobility, NGOs, neighborhood reps.

7.3.1. Monitoring and Evaluation KPIs

- **Keep indicators flexible & local**

- Set baselines by district, use seasonal bands (summer heat / autumn storms).
- Allow trigger updates after pilots (e.g., inlet-clear threshold from 80%→90%)
- Add context-specific metrics (e.g., litter accumulation rate, drought-stress flags).

- **Mini KPI template (use per site)**

- Outcome→ Indicator→ Unit/Method→ Freq→ Owner→ Target/Trigger

Example:

“Flooding ↓” → “% inlets functional” → “Visual check after ≥ 10 mm rain” → “Monthly + post-storm” → “City Cleaning” → “ $\geq 90\%$; if $< 80\%$ → priority crew in 48 h.”

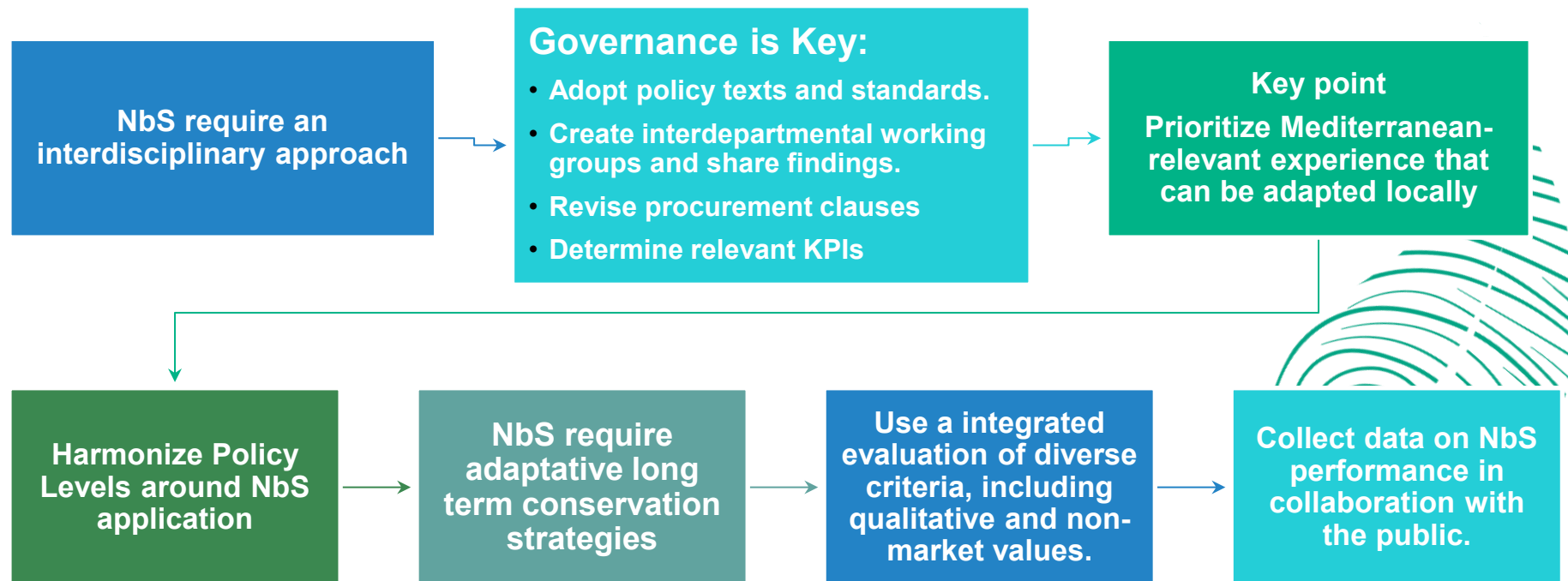
7.3.2. Monitoring and Evaluation KPIs



8. Summary of Key Takeaways



8. Summary of Key Takeaways



Practical Exercises and Workshops (See Annex 2)



11.1. Step-by-Step NbS Implementation Sprint



11.2. Detecting Policy Gaps



11.3. Harmonization Ladder (Local ↔ Regional ↔ EU)



11.4. PPP Canvas for an NbS (Finance workshop)



Annex to Policy and Regulatory Framework to Foster NbS

URWAN Training Kit 2 Annexes

Release: Version 10
Date: 10/11/2025



Annexes



Annex 1. Case Studies



1.6. Annex Case Study - NbS Catalogues



Case Study: URWAN NbS Catalogue



URWAN

Co-funded by
the European Union

URWAN

Co-funded by
the European Union

NBS

URBAN NATURE-BASED
SOLUTIONS AND WATER

A CATALOGUE FROM
THE URWAN PROJECT

urwan.interreg-euro-med.eu

9 water snob NbS

11 water smart Nbs

TABLE OF CONTENTS

Interreg
Euro-MEDCo-funded by
the European Union

WATER SNOB NBS		
Green roof	7	
Living wall vertical garden	9	
Green façade vertical garden	11	
Green Balcony	13	
Urban trees	15	
Green pergola	17	
Urban vegetable garden	19	
Urban park/green area	21	
Artificial pond/wetland	23	
WATER SMART NBS		
Bioretention area	26	
Rain garden	28	
Infiltration trench	30	
Vegetated swale	32	
Tree boxes	34	
Detention basin	36	
Storage pond	38	
Treatment wetlands	40	
Water recycling living wall	42	
Water recycling green facade	44	
Rooftop treatment wetland	46	

1.6.1. URWAN NBS Catalogue for final users

- **URWAN NbS Catalogue** is designed to emphasize how NbS contribute to multiple ecosystem services
- Underlines the importance of understanding specific water requirements and maintenance needs.
- The catalogue allows users to easily explore and compare different NbS options in relation to local contexts.
- The catalogue classifies NbS into two main categories:
 - **Water “Snob”** NbS, which do not account for their water requirements and depend on conventional potable water sources from public distribution networks.
 - **Water “Smart”** NbS, which are designed to utilize alternative water sources beyond potable supplies.

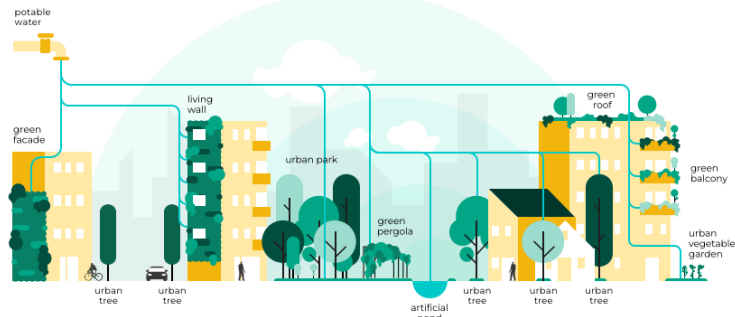


The greening of urban areas needs water!

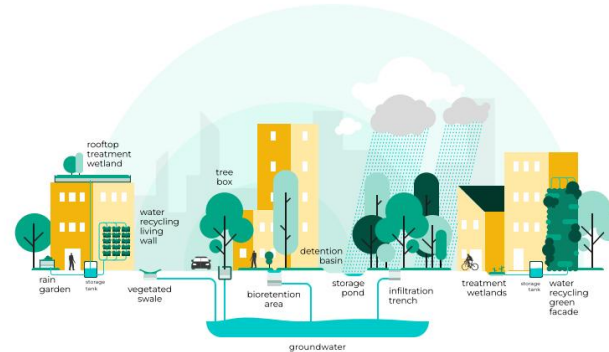
WATER SNOB NBS



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

WATER SMART NBS



[Link to Catalogue Online](#)

1.6.3. URWAN Water Smart and Water Snob NbS interventions

BENEFITS

URWAN Interreg Euro-MED Co-funded by the European Union

WATER QUANTITY When the solution helps reduce the adverse effects of stormwater.	WATER QUALITY When the solution contributes to the purification of polluted water.	WATER PROVISION When the solution provides excess for other uses.	URBAN BIODIVERSITY When the solution provides a habitat for species than Homo Sapiens.
AESTHETIC When the solution transforms the urban space, making it more beautiful.	COOLING When the solution creates an area large enough to be directly used by people.	RECREATION When the solution creates an area large enough to be directly used by people.	

5

DRAWBACKS

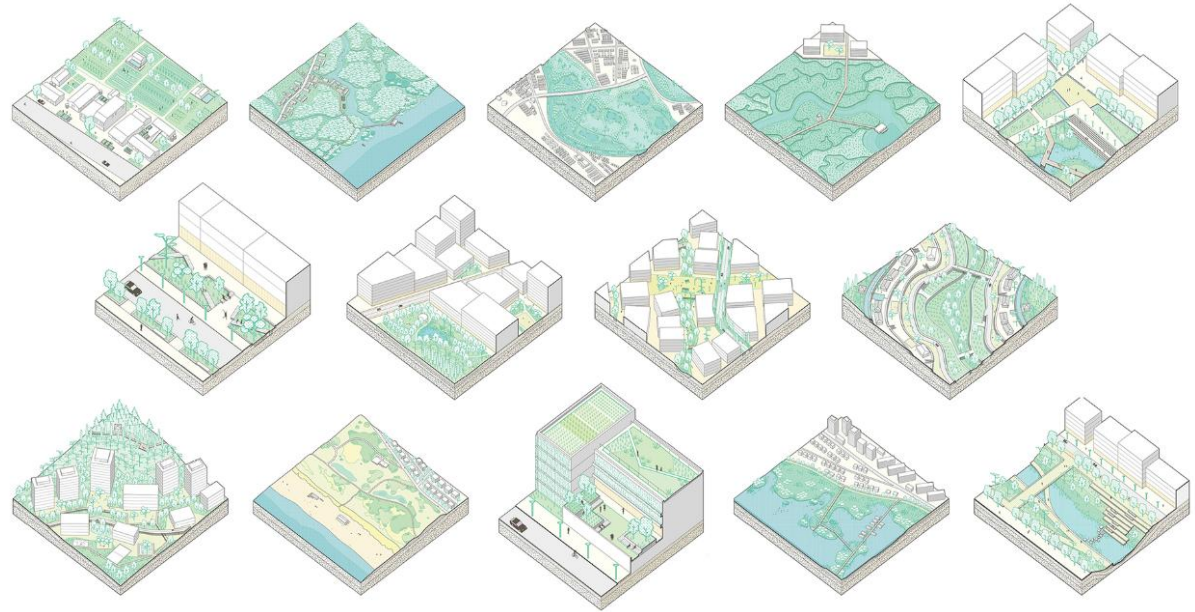
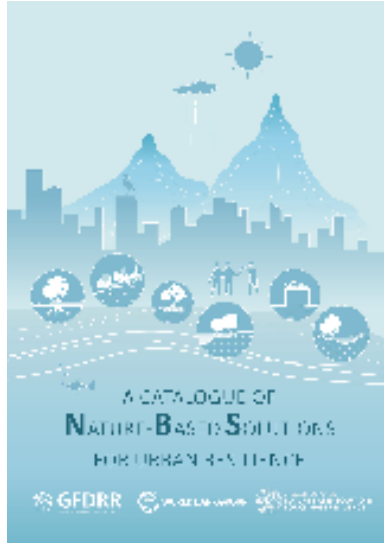
URWAN Interreg Euro-MED Co-funded by the European Union

SOCIAL ACCEPTABILITY	 high	 medium	 low
INVESTMENT COSTS Estimated for the construction of 1 square metre of NBS	 < 100€	 ranging from 100€ to 300€	 > 300€
O&M COSTS Estimated for the maintenance of 1 square metre of NBS	 < 1 m ² /year	 ranging from 1€ and 5€ m ² /year	 > 5€ m ² /year

6

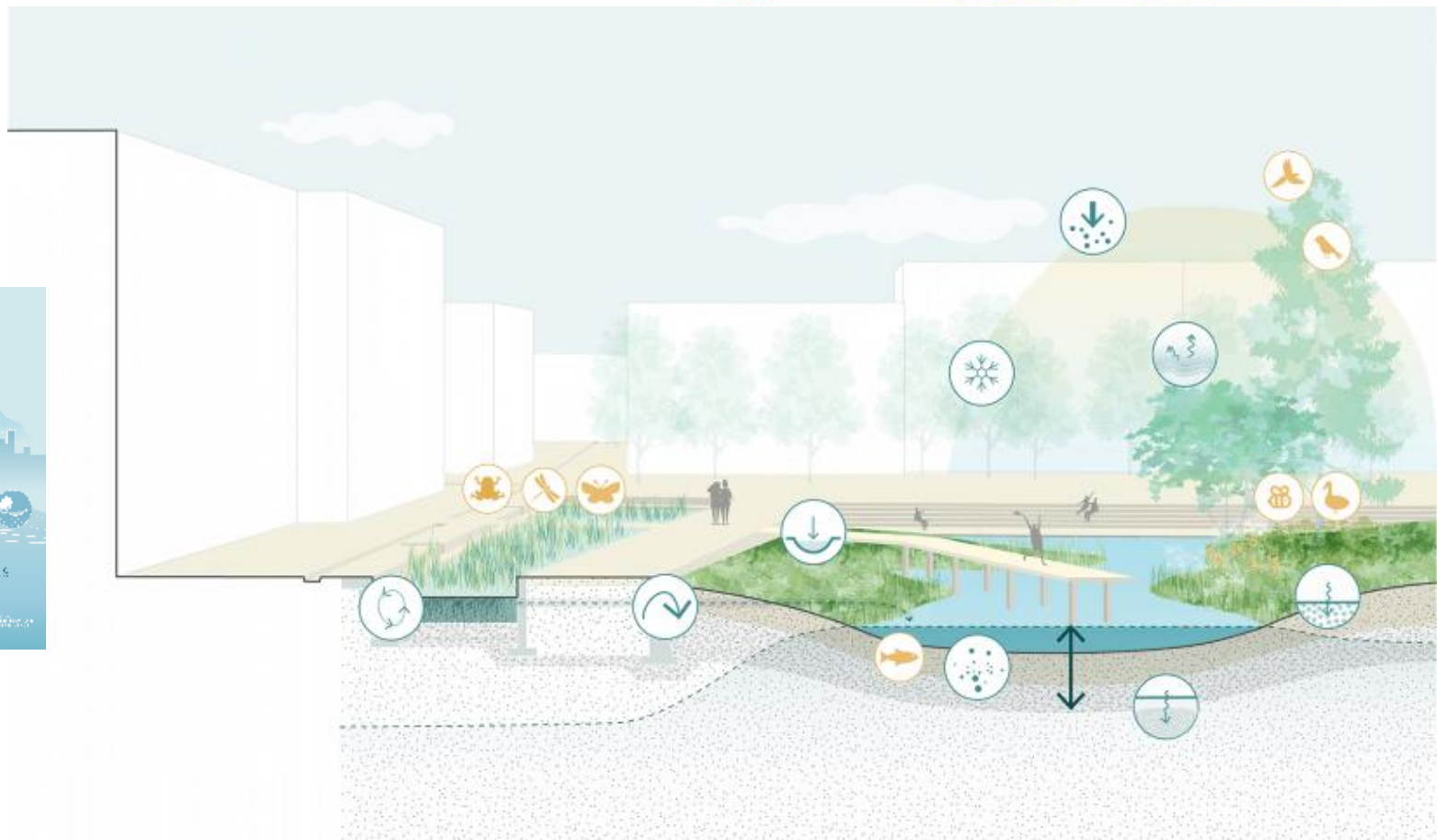
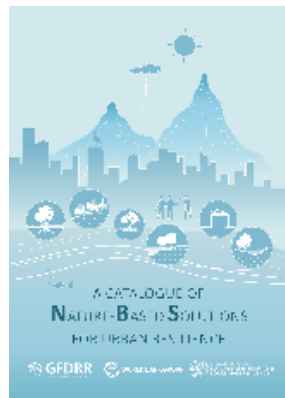
1.6.4. URWAN NBS Catalogue benefits and drawbacks

1.6.5. Other NbS Catalogues: World Urban Bank



- World Urban Bank NbS Catalogue: A Catalogue of Nature-based Solutions for Urban Resilience
- NbS are organized in Families

1.6.6. NbS Catalogue: World Urban Bank



3.4. Annex Case Study - Harmonizing Policy Levels

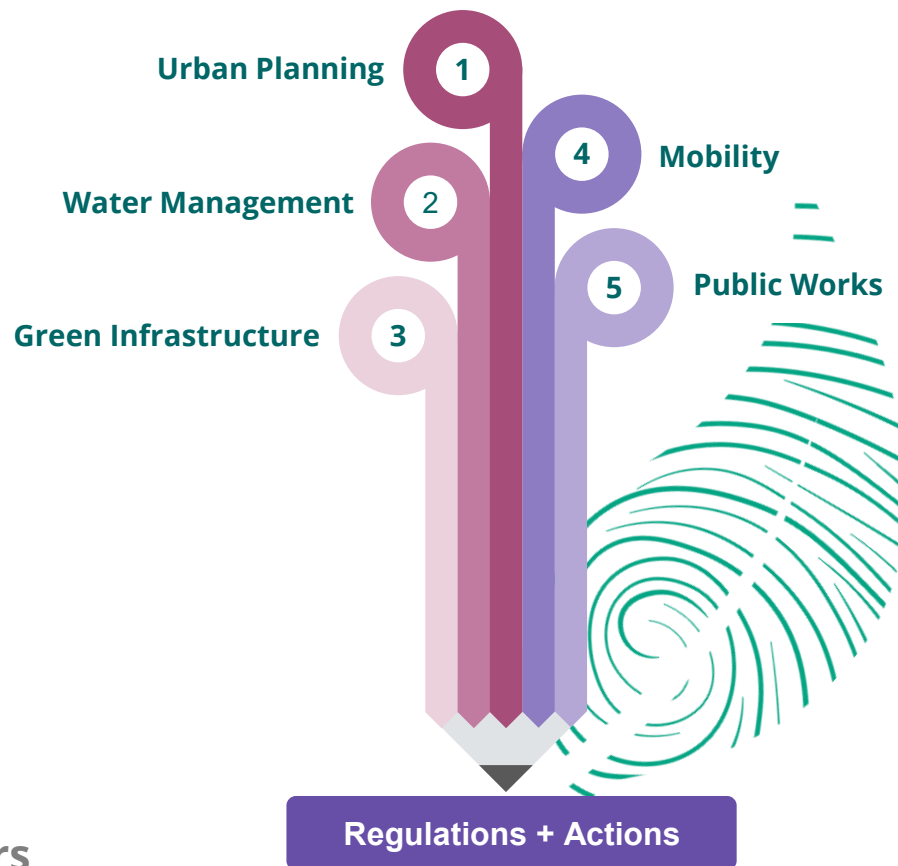


3.4. Harmonizing Policy Levels Step-by-Step

- **Effective implementation requires coordination across scales and sectors:**
 - **Local Government Level** > Aligning political will with operational tools.
 - **Identify Policy Levels** > Clarifying municipal, regional, national, and EU competencies.
 - **Identify Transdisciplinary Vectors** > Linking urban planning, water management, public health, etc.
 - **Identify Ecosystemic Services Output** > Ensuring regulations account for ES delivery (e.g., flood mitigation, cooling).
 - **NbS Pilot Projects Implementation** > Using pilots to test frameworks and inform regulatory updates.
 - **NbS Regulation and Monitoring** > Establishing legal instruments and KPIs for oversight.

Step-by-step Approach 1

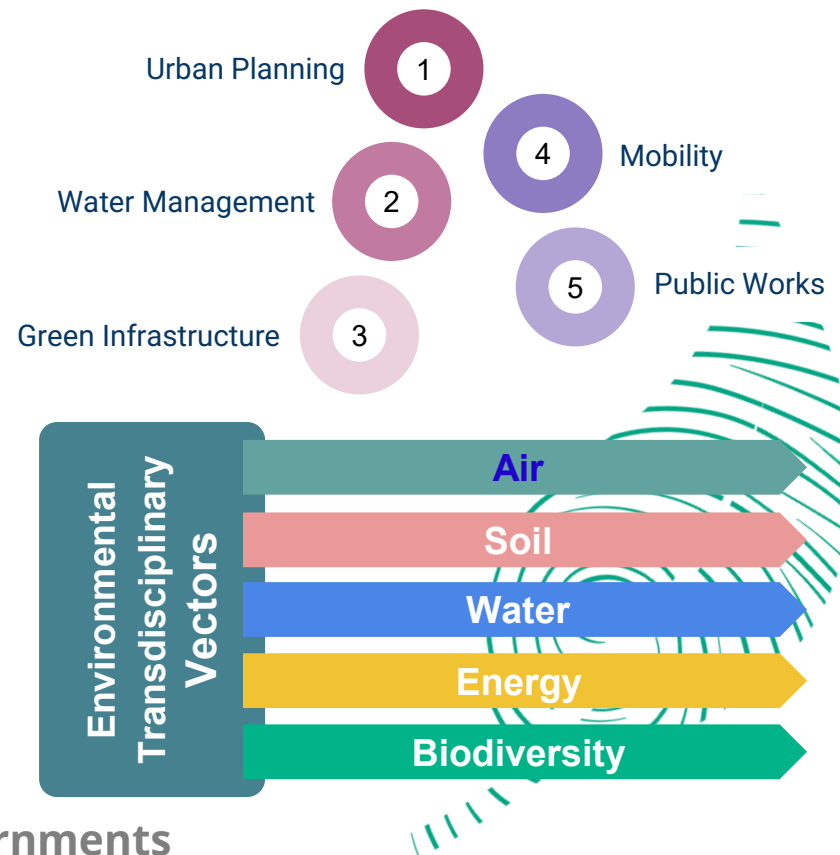
- **Aligning political will with operational tools.**
- Implementing NbS within urban contexts requires a **policy framework** that bridges strategic objectives at the city-wide level with operational actions at the departmental level.
- NbS implementation is an approach that requires **changes to operational procedures.**
- This implies changes in **regulations, internal procedures and culture and actions.**



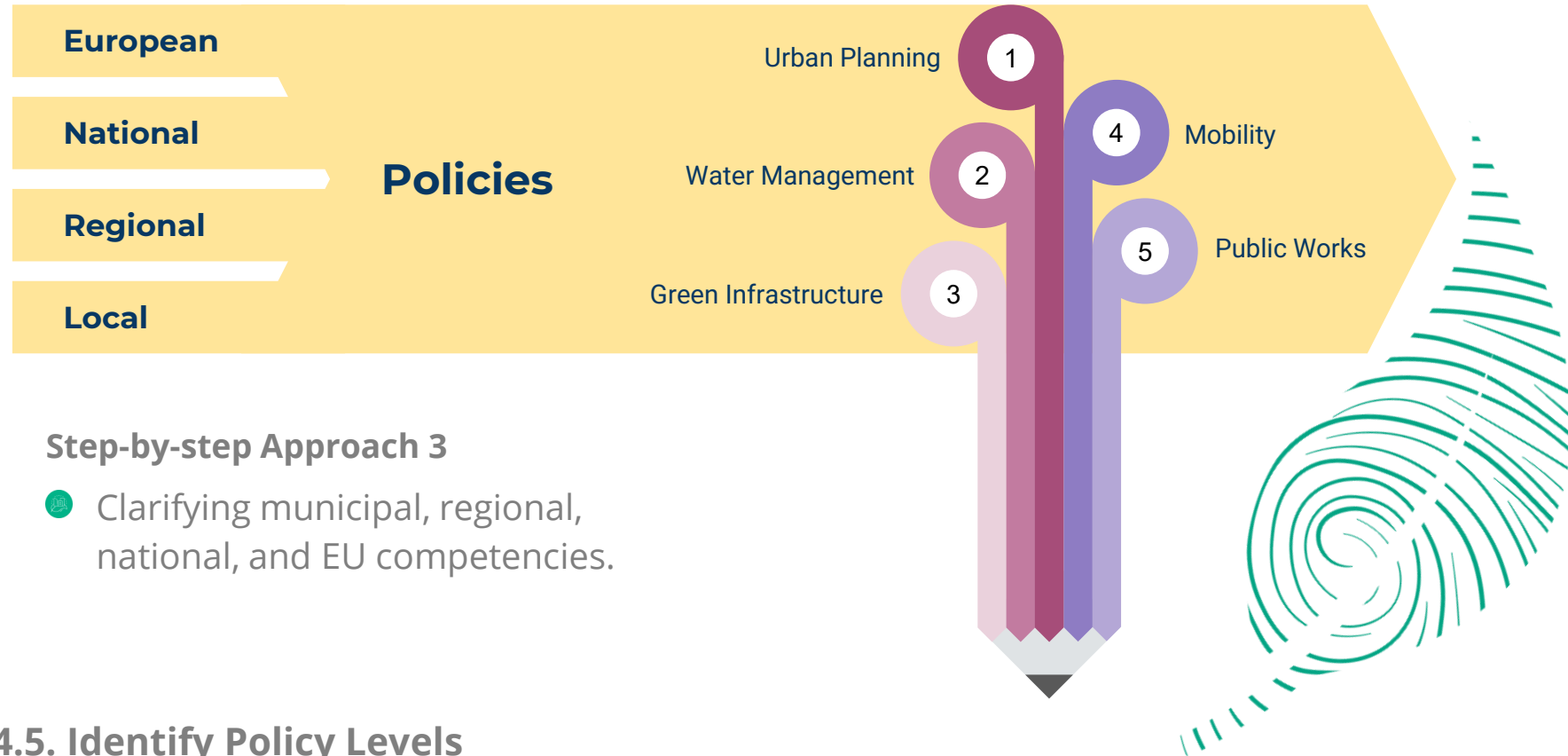
3.4.2. Coordination across scales and sectors

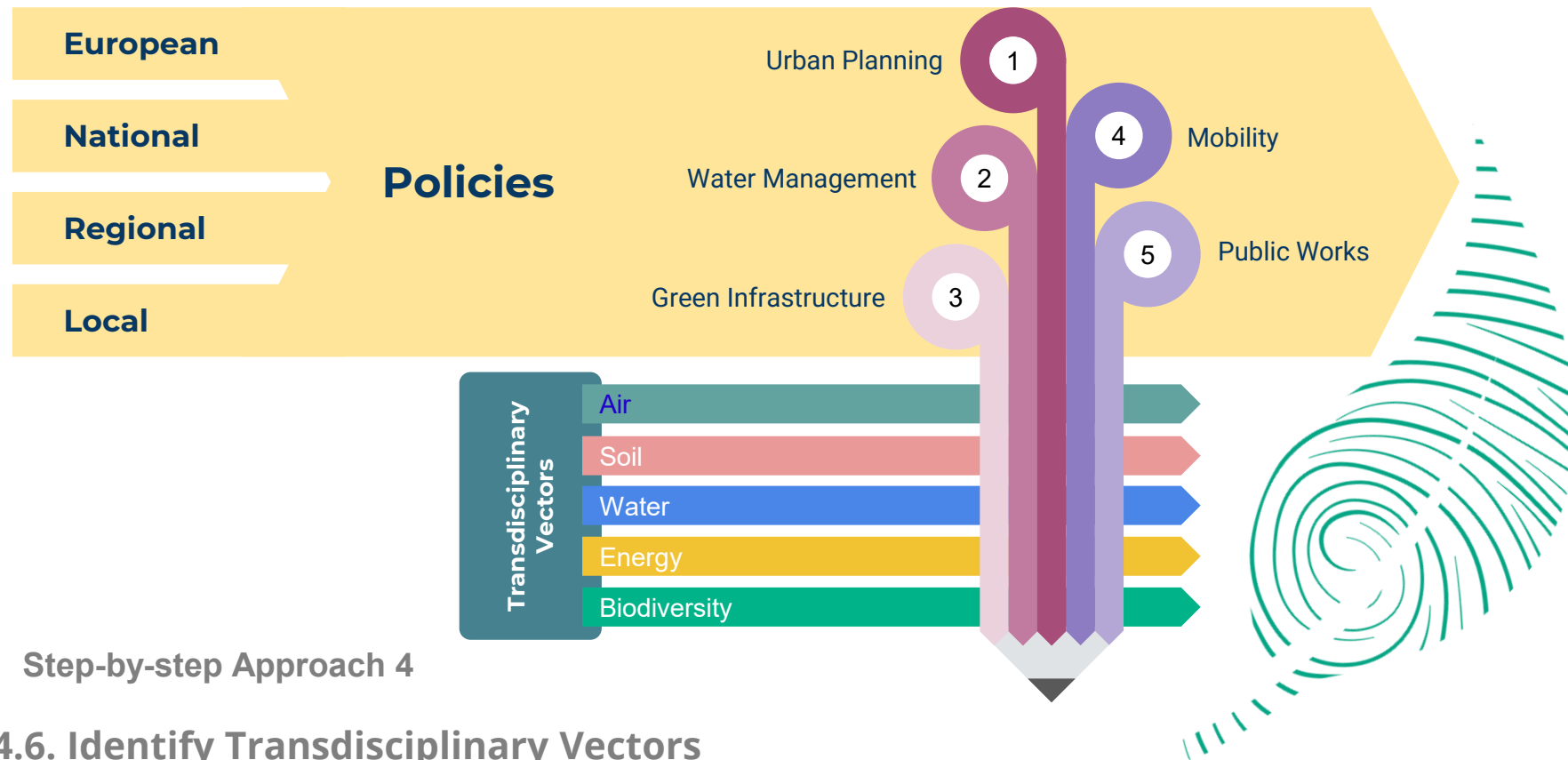
Step-by-step Approach 2

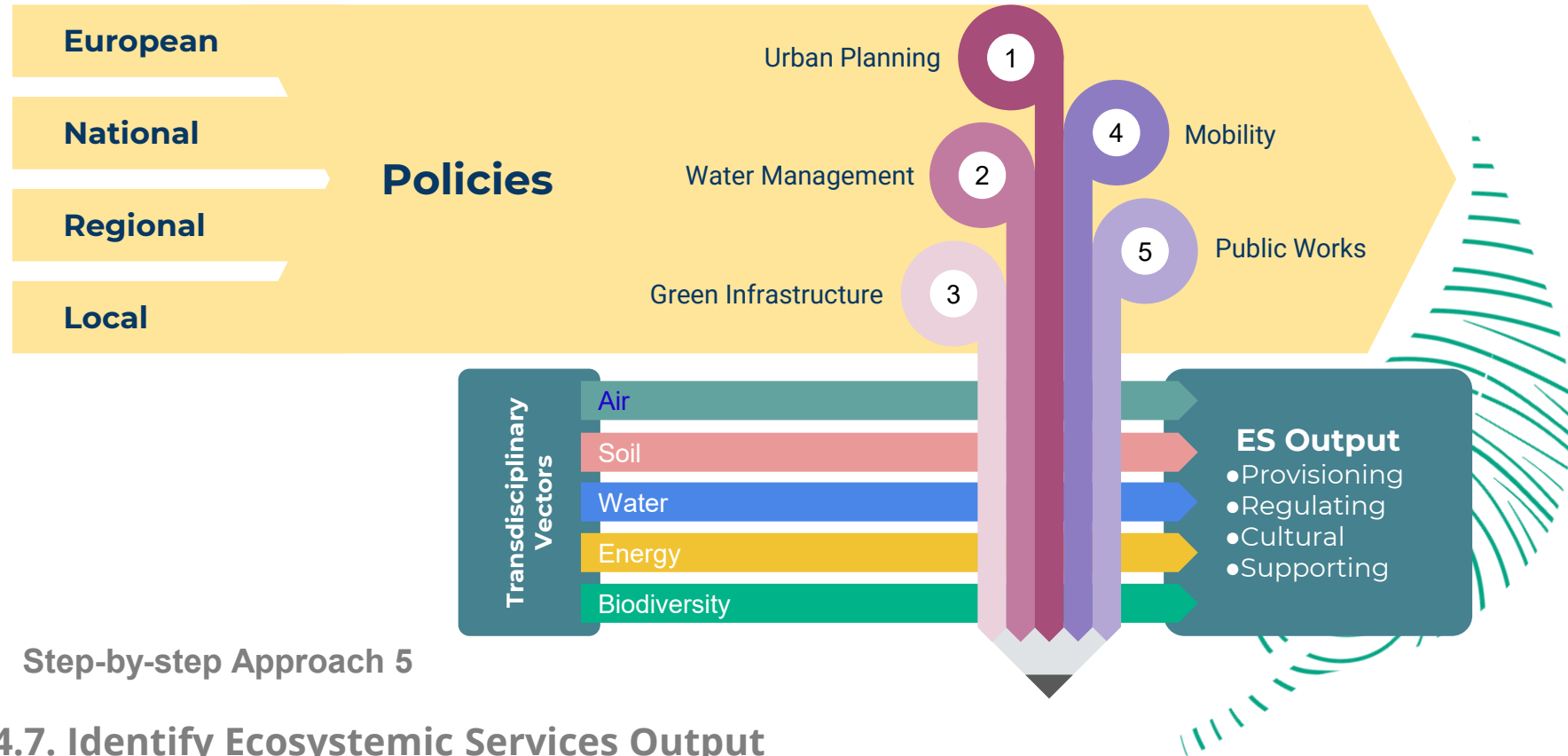
- Implementing NbS in Local Governments requires the participation of **various departments**.
- Departments must successfully identify when and where **their activities intersect** with the relevant Environmental Transdisciplinary Vectors.

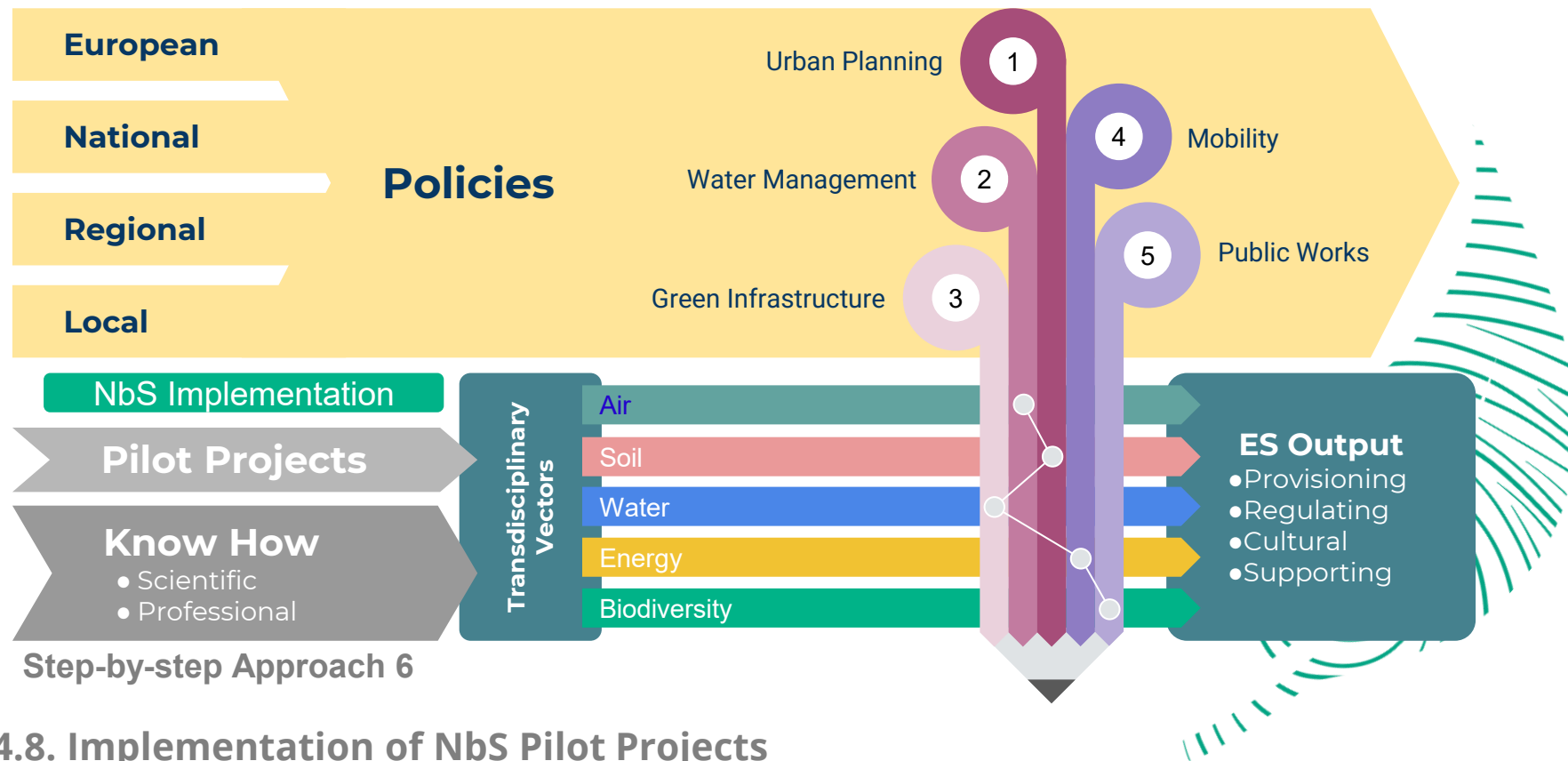


3.4.3. Effective Implementation in Local Governments

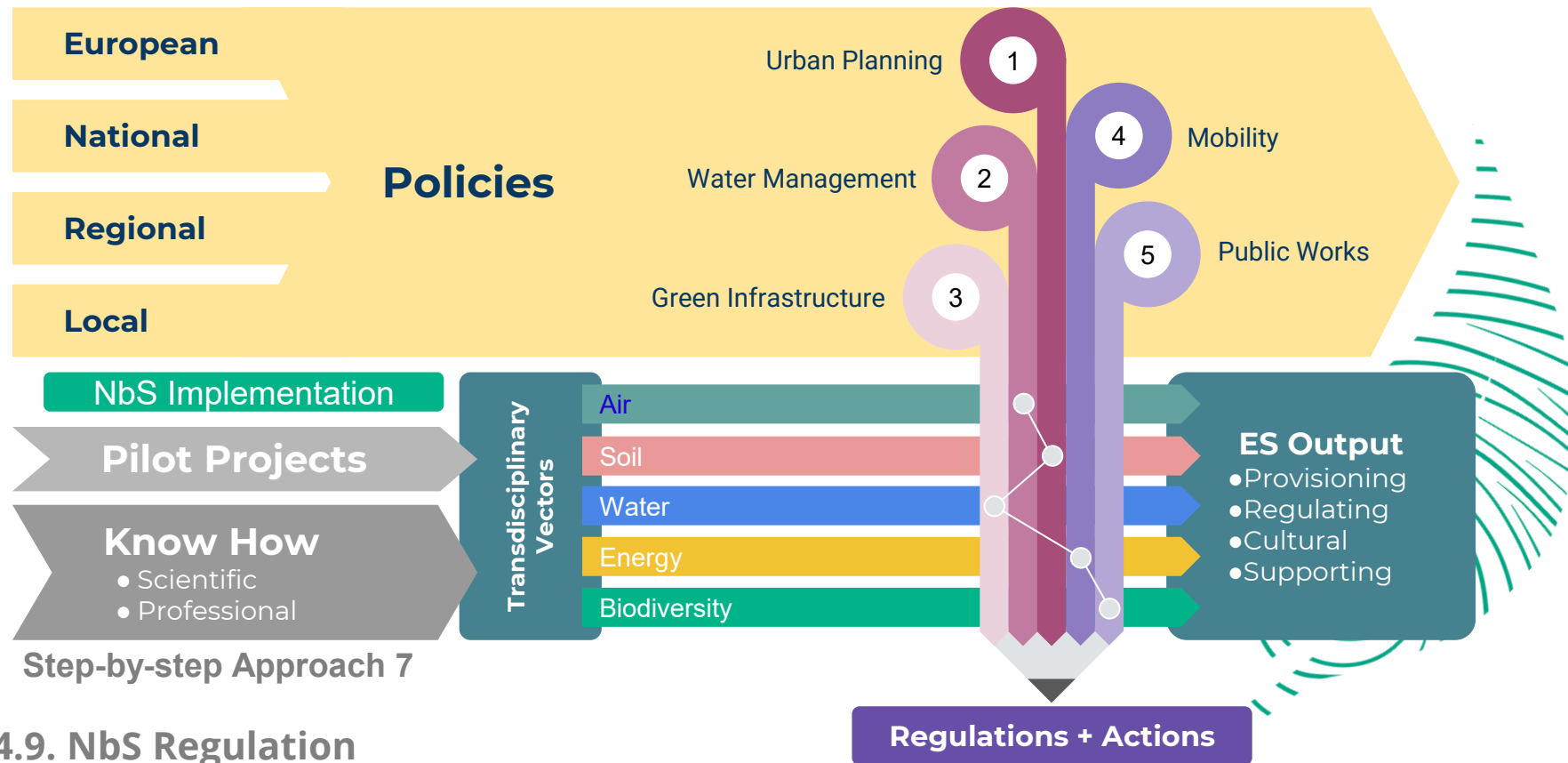




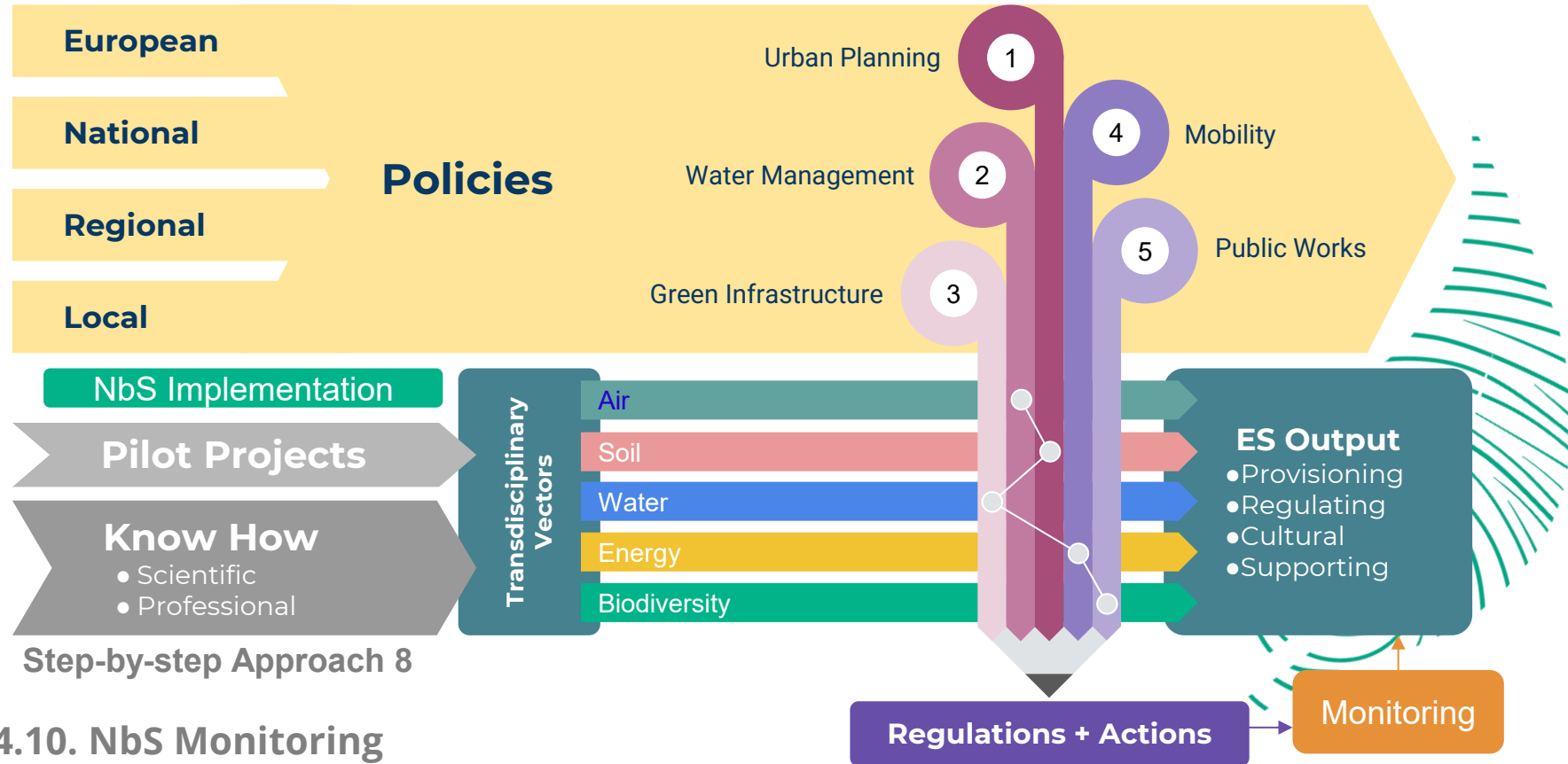




3.4.8. Implementation of NbS Pilot Projects



3.4.9. NbS Regulation



3.4.10. NbS Monitoring

3.7. Annex Case Study - Barcelona Implementation Strategy



3.7. Barcelona City Context

1. Barcelona City Context
2. Urban Ecology Agency creation and mandate
3. Green Infrastructure and Biodiversity Strategy
4. Barcelona's Local Government Structure



Case Study: Barcelona Implementation



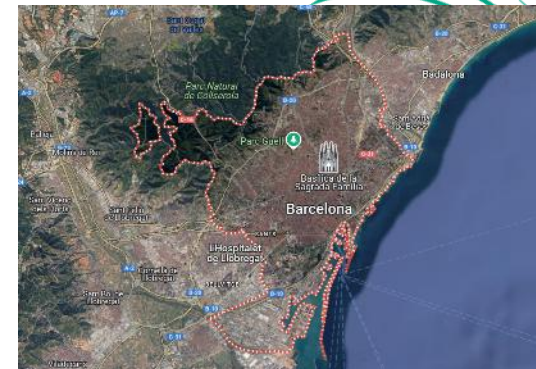
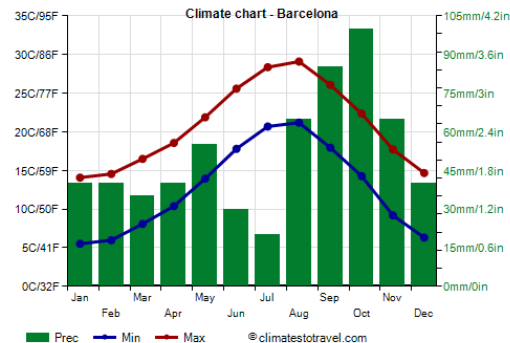
URWAN

Interreg
Euro-MEDCo-funded by
the European Union

- Population: 1,732,066
- Size: 101.4 km²
- Climate: Mediterranean Sub-humid
- Average Yearly Precipitation: 640 mm
- Risks: Flash floods, combined sewer overflows, drought, and heat waves



3.7.1. Barcelona City Context





3.7.2. Barcelona City Context



3.7.3. Barcelona City Context



3.7.4. Barcelona City Context

- Barcelona Local Government Structure has two main branches: Territory (10 Districts) and Technical Vectors.
- The latter are responsible for delivering various services, including housing, urban development, water supply and treatment, refuse collection, parks and gardens management, mobility and transport and Infrastructures.

Territorial Structure



Each district has autonomy to manage local services and community engagement

Technical Vectors

- Urban planning and housing
- Water supply and wastewater treatment
- Parks, gardens, and green infrastructure
- Waste collection
- Mobility and transport
- Infrastructures and public space

Complex Governance and Delivery Model

- Municipal agencies
 - Public and semi-public entities
- Decentralized system with overlapping mandates

Challenge: Coordination and Updating

- Resource-intensive
- Organisationally complex
- Essential for NBS and sustainability mainstreaming

3.7.5. Barcelona City Context



Barcelona embraced a progressive approach to integrating NbS and Biodiversity enhancement into its urban landscape several years ago.



This process has been guided by municipal plans and policies that align with broader European and global sustainability goals.



The gradual adoption of NbS application policies started with the adoption and development of ecological urban planning strategies.

3.7.6. Barcelona City Context

3.8. Urban Ecology Agency

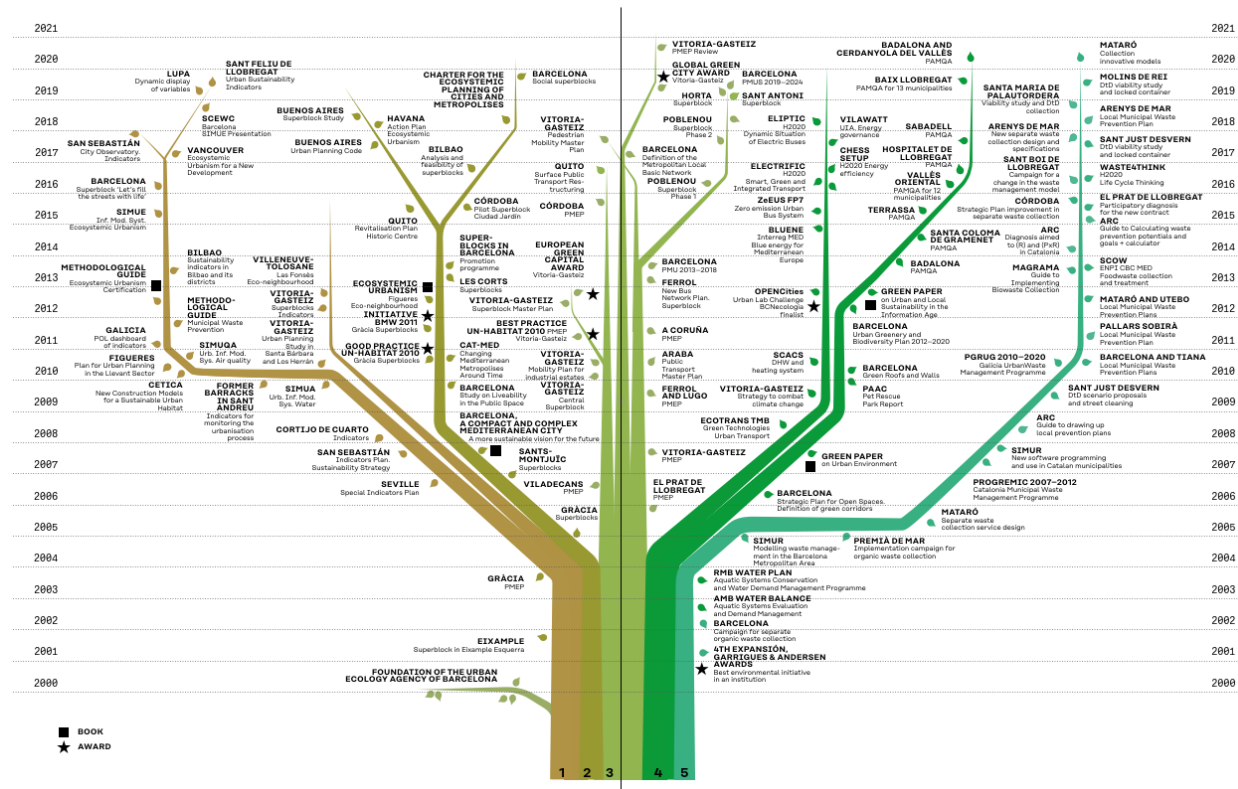
- Barcelona's gradual adoption of NbS starts in 2000 with the creation of the **Urban Ecology Agency of Barcelona**, a public consortium created to develop ecological urban planning strategies at regional level.
- Its main purpose was to **formulate instruments** that allowed the rethinking of cities in relation to sustainability (economic, social, ecological, and territorial), developing tools, models and indicators.
- Through **information and data modelling systems**, the agency developed strategic planning projects for different vectors: urban planning, mobility, environmental, green infrastructure, etc.



Case Study: Barcelona Implementation



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

THE FIVE BRANCHES

1 URBAN SUSTAINABILITY INDICATORS

The first branch includes the Agency's compilation of concepts and instruments and their application to the design, transformation and ecosystemic planning of cities and metropolises.

2 URBAN REGENERATION STRATEGIES

BCNecologia has participated in multiple urban transformation projects where superblocks have acted as a conduit for functional and urbanistic proposals based on ecosystemic urbanism principles.

3 MOBILITY AND PUBLIC SPACE

The Agency has been catapulted around the world by its vision of a more sustainable mobility and public space model, in which the city is reorganised to give the pedestrian priority, followed by the cyclist and public transport.

4 ENVIRONMENT

The fourth branch brings together projects that directly deal with the analysis of energy flows, the water cycle, noise and air pollution, and biodiversity.

5 CIRCULAR ECONOMY

The Waste and Material Cycle Area makes up a fifth branch, which carries a host of important projects, plans and awareness-raising campaigns revolving around innovative waste management and prevention models and tools to manage this waste.

3.8.1. Urban Ecology Agency: The 5 Branches

Case Study: Barcelona Implementation



URWAN

Interreg
Euro-MED
Co-funded by
the European Union

Founding and Institutional Origins

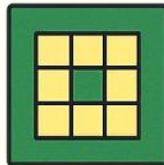
2000

- Ajuntament de Barcelona
- Area Metropolitana de Barcelona (AMB)
- Diputacio de Barcelona



Public consortium created to integrate ecology into urban planning

Key Contributions and Tools



Superblocks

Urban
MetabolismSustainability
IndicatorsNeighborhood
Plans

Continuation of tools and team members,
ongoing work under the new structure

Vision and Mission

- Promote ecological urbanism
- Support sustainable mobility, green infrastructure, energy efficiency, and biodiversity
- Develop participatory urban strategies and urban metabolism models



Salvador Rueda
Founding director

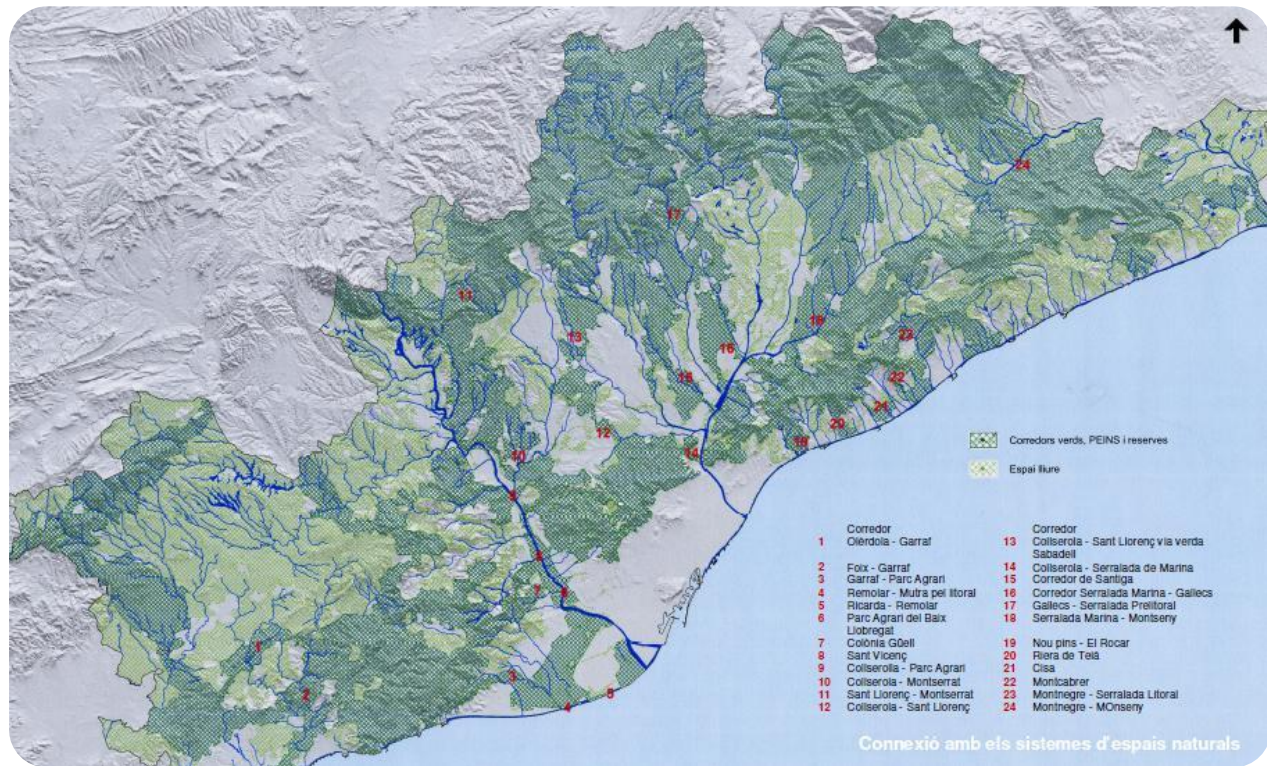
Institutional Evolution (2021–Present)

**Direccio d'Ecologia Urbana
– Barcelona Regional**



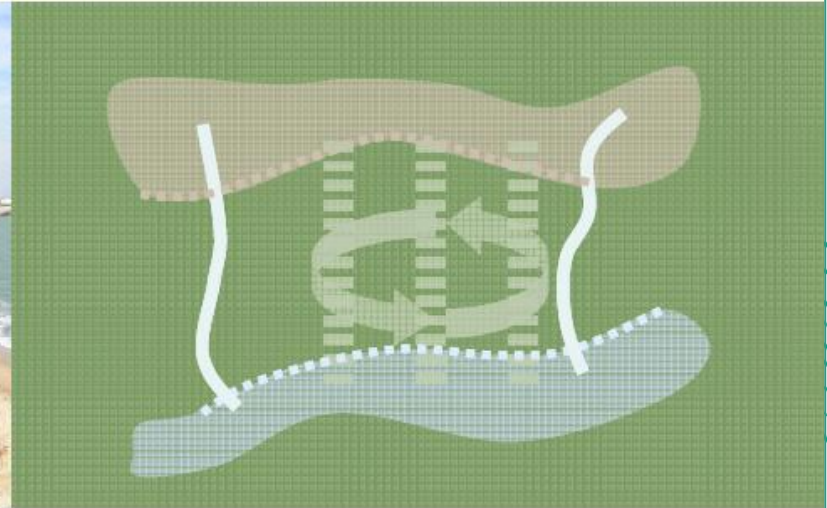
Ongoing work under the new structure

3.8.2. Urban Ecology Agency: Origins, Vision and Legacy



3.8.3. Urban Ecology Agency: Strategic Plans

Pla Estratègic d'Espais Lliures a Barcelona Definició dels Corredors Verds Urbans



3.8.4. Urban Ecology Agency: Green Corridors

Case Study: Barcelona Implementation

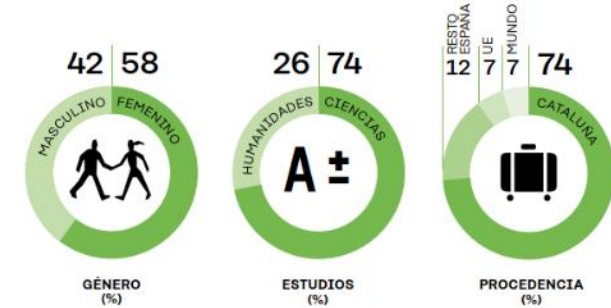


URWAN

Interreg
Euro-MED

 Co-funded by
the European Union

- The Agency was **transdisciplinary**, with a great variety of professional profiles that exemplified a new way of understanding and designing the city.
- Almost 25% of professional profiles were trained in **Environmental Sciences**.
- 20% of professional profiles were specialized in **different forms of Engineering**.
- 17% of professional profiles were specialized in **Architecture and Urban Design**.
- Other profiles included **specialisations** in Geography, Economy, Journalism, Biology, Physics, Computing, Sociology, and others.



3.8.5. Urban Ecology Agency: Professional Profiles

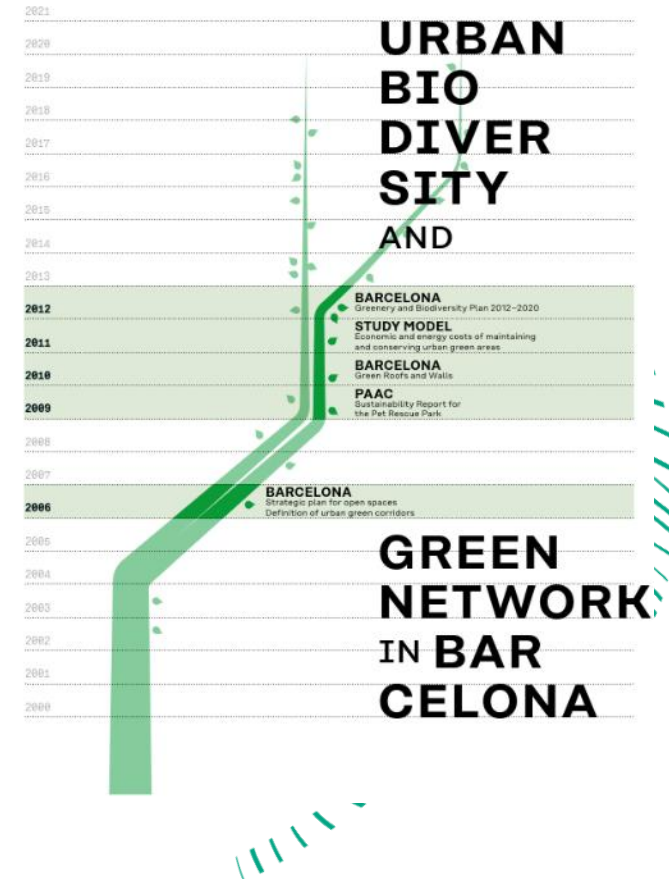
Case Study: Barcelona Implementation



URWAN

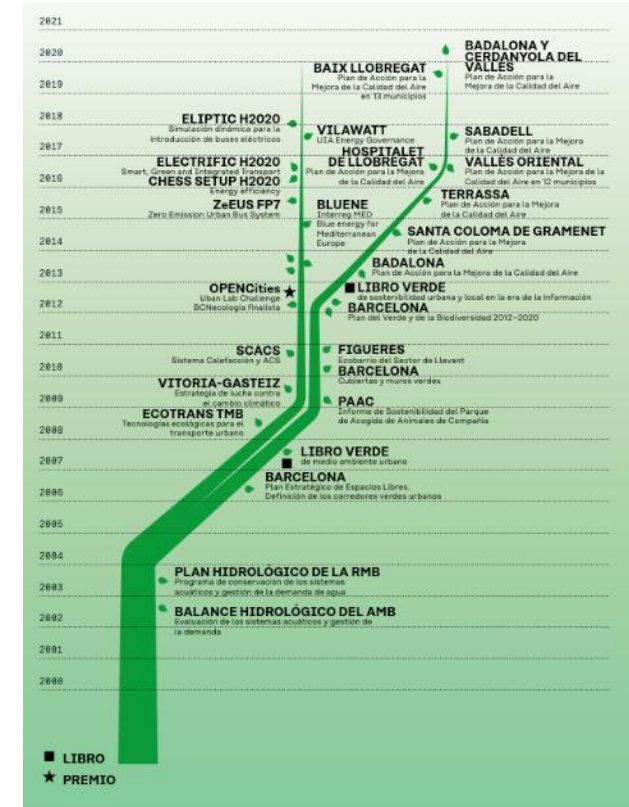
Interreg
Euro-MEDCo-funded by
the European Union

- The Agency's mission was to **apply ecological thinking** to the design and management of cities, promoting integrated strategies for:
 - Sustainable mobility
 - Energy efficiency
 - Green infrastructure
 - Circular resource management
 - Participatory governance
- The agency worked locally, regionally and internationally, **developing models and tools** that were adopted by cities across Europe, Latin America, and beyond.



3.8.6. Urban Ecology Agency: Ecological Thinking

- **Integrated Urban Models:** Simulating and comparing planning scenarios from a resource and habitability perspective.
- **Superblocks:** Urban cells that reclaim public space for pedestrians, greenery, and social uses and reduce through traffic.
- **Urban Metabolism:** Measuring consumption of energy, water, materials, and waste to guide sustainable planning.
- **Sustainability Indicators and Plans:** Applied at both city and neighbourhood scales, with participatory components.
- These key concepts were **published and disseminated** systematically.



3.8.7. Urban Ecology Agency: Key Concepts and Tools

3.9. Barcelona's Local Government Structure

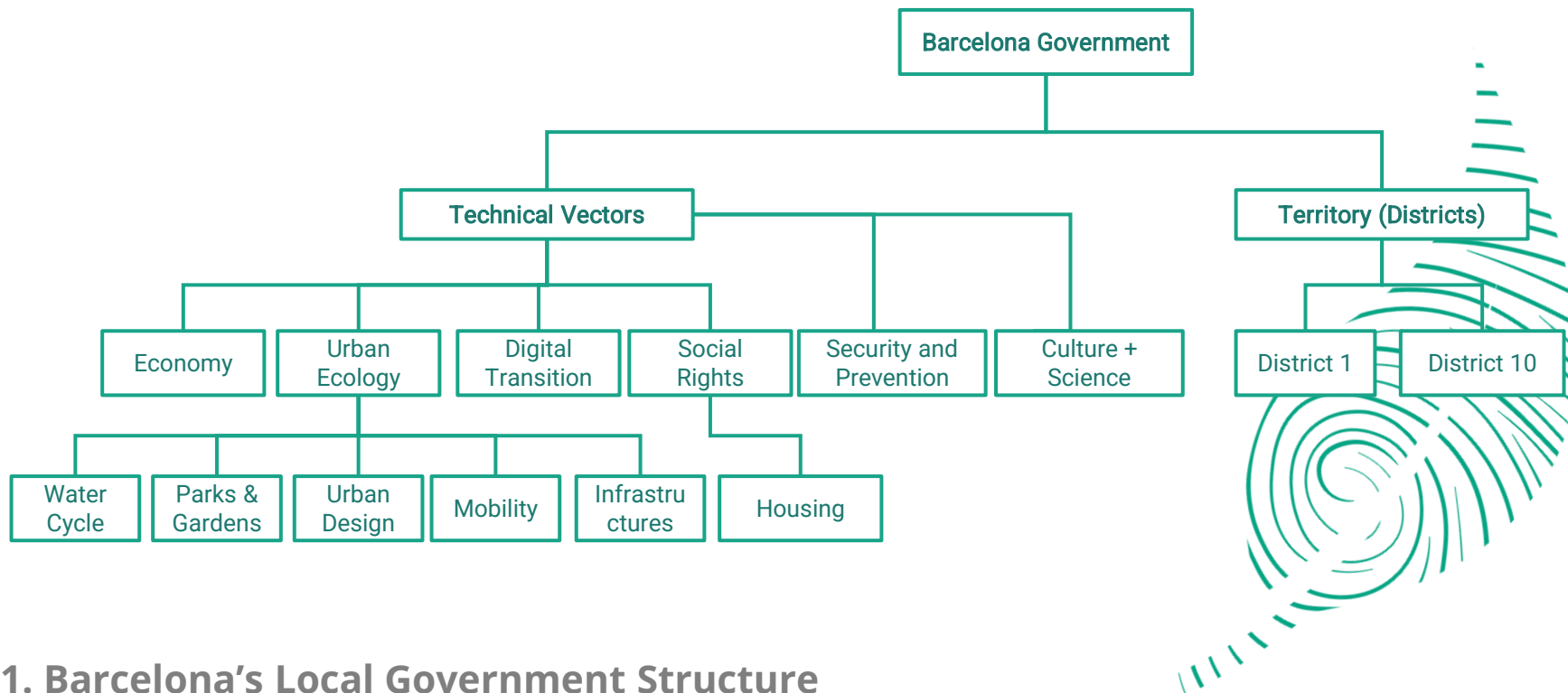
Territorial Structure



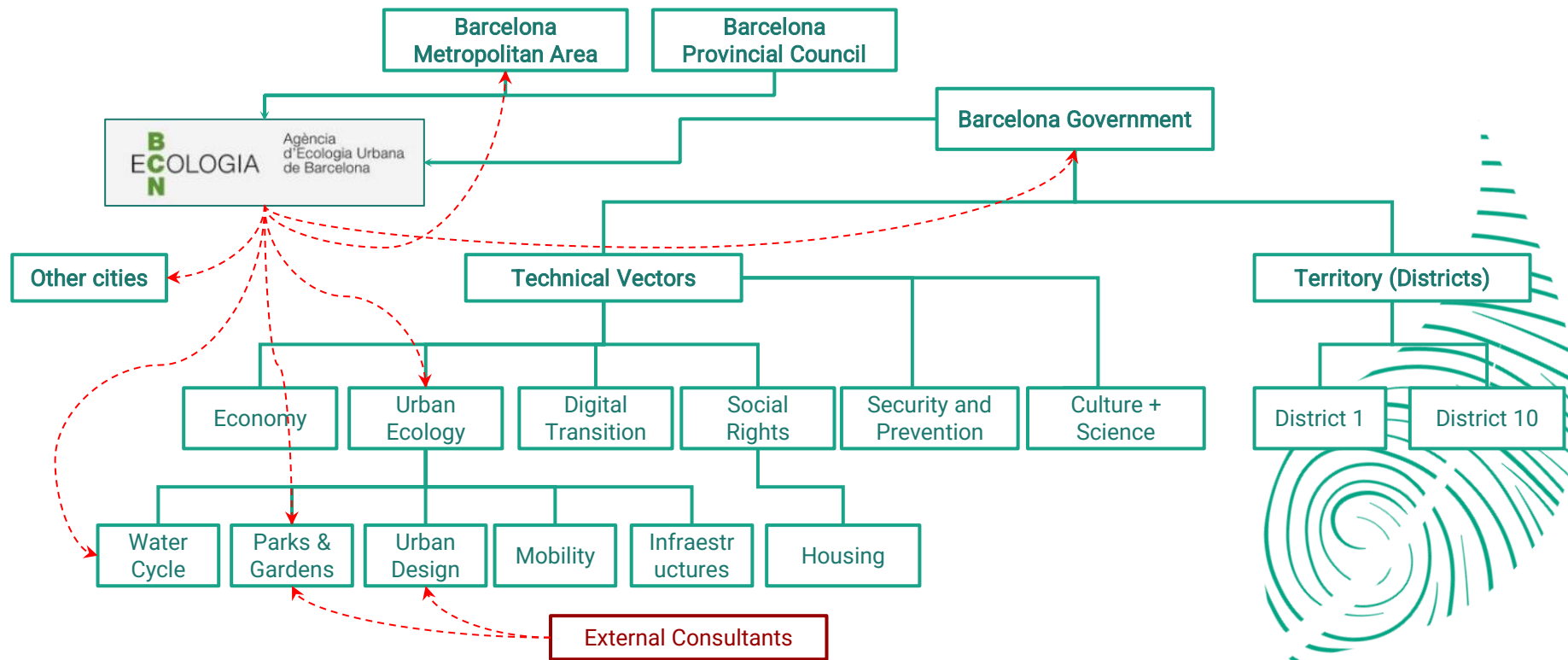
Each district has autonomy to manage local services and community engagement

Technical Vectors

-  Urban planning and housing
-  Water supply and wastewater treatment
-  Parks, gardens, and green infrastructure
-  Waste collection
-  Mobility and transport
-  Infrastructures and public space



3.9.1. Barcelona's Local Government Structure



3.9.2. Barcelona's Local Government Structure & Agency

- The Agency developed in a **participatory manner** with strategic projects in 5 different Branches or Vectors to support Local Government Departments efforts:
- URBAN SUSTAINABILITY INDICATORS
- URBAN REGENERATION STRATEGIES
- MOBILITY AND PUBLIC SPACE
- ENVIRONMENT
- CIRCULAR ECONOMY
- This approach resulted in a significant level of knowledge generation, **decentralised decision making** and synergic overlap between departments.



3.9.3. Barcelona's Transdisciplinary Vectors

- The Agency also developed **sustainability criteria** for urban green spaces according to environmental vectors.
- This allowed for the creation of strategies and projects with **measurable impacts**:

- Biodiversity**
- Water**
- Residues and Materials**
- Energy**
- Stakeholders**

	BIODIVERSIDAD 1 Preservar y fomentar la diversidad vegetal 2 Preservar y fomentar la biodiversidad faunística 3 Conectar las zonas verdes
	AGUA 1 Adaptar la gestión y la selección de especies a criterios de xerojardinería 2 Minimizar las pérdidas de agua en las zonas regadas y mejorar el sistema de drenaje 3 Usar eficientemente el riego 4 Utilizar fuentes alternativas de agua 5 Utilizarla de modo eficiente y ambiental en usos ornamentales
	RESIDUOS Y MATERIALES 1 Minimizar la producción de residuos 2 Evitar la producción de residuos tóxicos y peligrosos 3 Separar en origen y gestionar correctamente los residuos generados 4 Optimizar el consumo de materiales y recursos 5 Utilizar técnicas, materiales y producción de bajo impacto ambiental
	ENERGÍA 1 Utilizar iluminación más eficiente que produzca menos contaminación lumínica 2 Utilizar energías renovables 3 Reducir el consumo energético de la maquinaria
	VISITANTES 1 Potenciar la participación ciudadana en el mantenimiento y la gestión de las zonas verdes 2 Desarrollar actividades educativas e informativas en las zonas verdes 3 Garantizar y facilitar el uso público de las zonas verdes

2011. Criterios de sostenibilidad del verde urbano según vectores ambientales.

Fuente: BCNecología

3.9.3. Sustainability Criteria and Indicators

3.10. Green Infrastructure and Biodiversity Strategy

- The Agency's work resulted in the publication of **several studies and strategic documents** concerning green infrastructure.
- The most relevant document produced was Barcelona **Green Infrastructure and Biodiversity Plan (2013-2020)**, which outlined ambitious goals for enhancing urban biodiversity and increasing the quantity and quality of green infrastructure.
- It describes **urban metabolism functions** most closely related to green infrastructure and biodiversity.
- It also defines **clear goals, strategic lines and actions** that could be integrated in any urban project.



The Agency understood Urban Ecology as a Cross-Cutting Framework

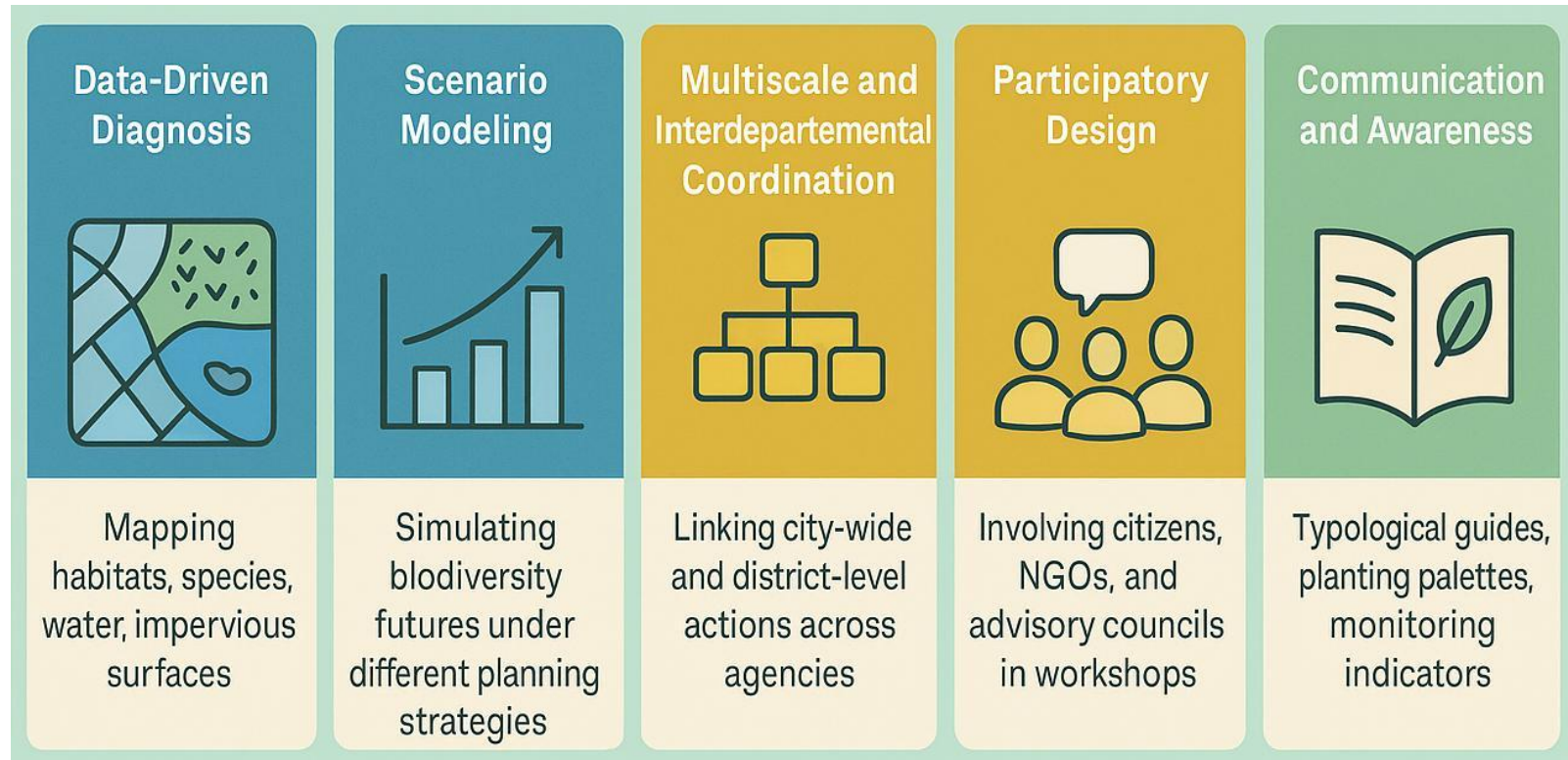
The agency approached Biodiversity not as a separate theme, but as **a structural layer in urban systems** — closely linked with Water, Energy, Public Space, and Mobility.

In the Biodiversity Plan, this meant:

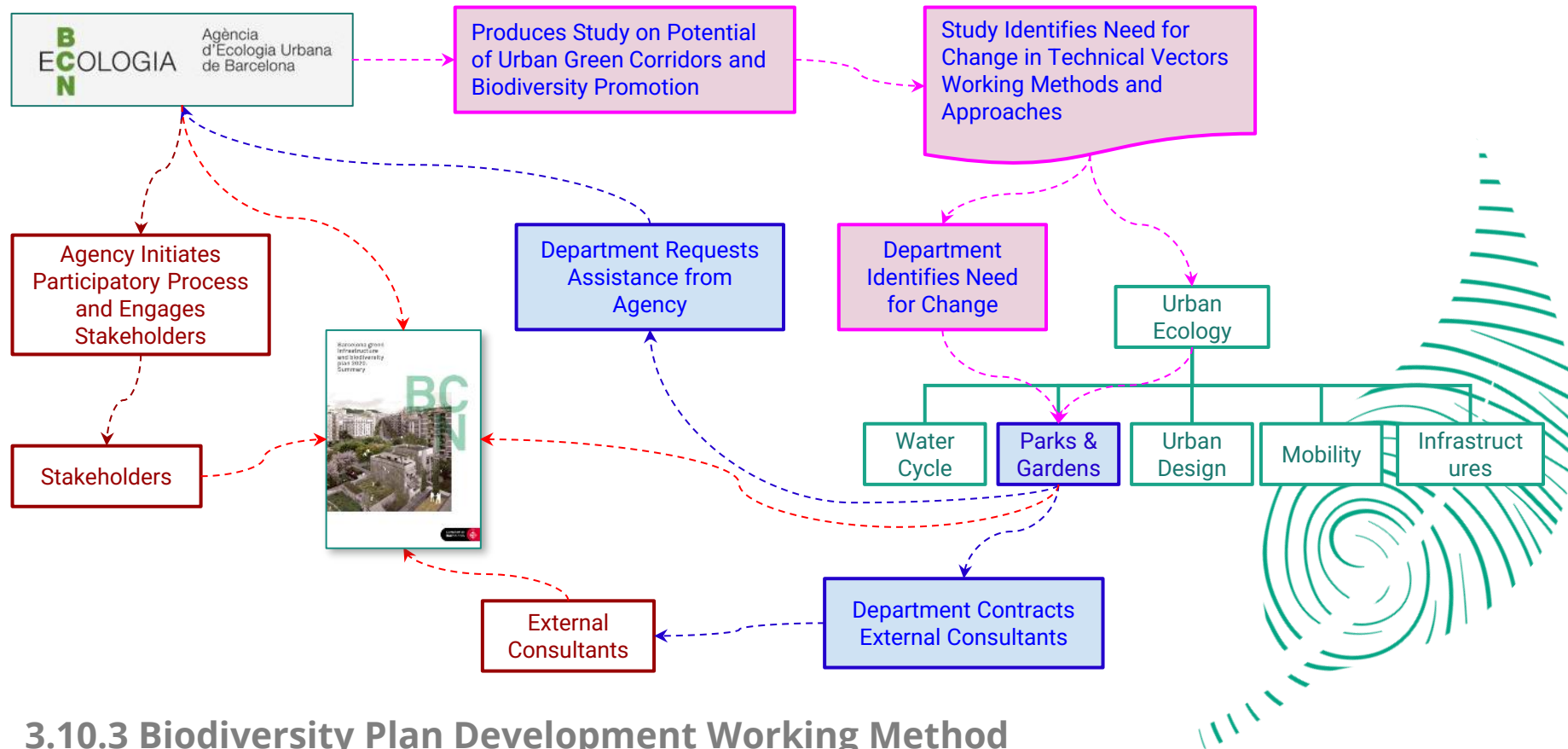
- Framing biodiversity as an **urban infrastructure**.
- **Linking biodiversity** to citizen well-being, climate adaptation, and ecosystem services (ES).

3.10.1. Green Infrastructure and Biodiversity Strategy Approach





3.10.2. Biodiversity Plan Development Working Method



3.10.3 Biodiversity Plan Development Working Method

Stage	Method or Tool Used	Biodiversity Plan Example
1. Cross-cutting Framework	Ecological Urbanism	Biodiversity as infrastructure, not add-on
2. Data Driven Diagnosis	Urban metabolism, ecological indicators, inventories, GIS	Mapping habitats, permeability, fragmentation
3. Scenario Modelling	Integrated urban models and future simulations	Compare biodiversity futures based on policy intensity
4. Multiscale & Multidepartment	Institutional coordination, district-city integration	Typologies adapted to each urban context
5. Participation	Public workshops, expert panels, collaborative tools	Feedback via steering groups, expert advice, schools, NGOs
6. Operational Tools	Manuals, monitoring, budgeting	Plant lists, habitat typologies, performance indicators
7. Communication	Visual storytelling and public - professional education	Corridor maps, campaign materials, visuals, simplified metrics

3.10.4 Biodiversity Plan Working Method Summary Table



3.10.5. Hierarchy of Municipal Norms and Technical Documents



The approval of the Greenery and Biodiversity Plan 2013-2020 in 2012 generated the conditions for the **development of an NbS** based regulatory framework in urban design.



This allowed for the **gradual implementation of pilot projects** and innovative designs in several areas and locations and sparked the creation of several departmental plans and strategies.



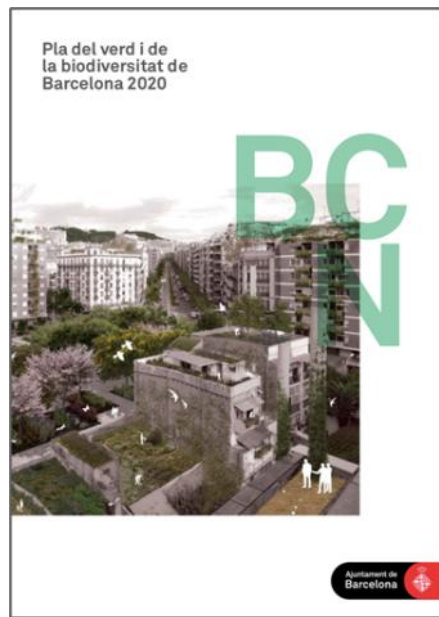
The plan opened the doors to trying **specific solutions** in rewilding, biological pest control, water management, etc.

3.10.6. Policy and Regulatory Framework for NbS

- Over the years, Barcelona Local Government Departments have developed a considerable number of **NbS adapted to Mediterranean urban conditions**.
- These have been developed in **both a planned and ad-hoc fashion**, with some developments arising independently of centrally planned strategies.

- These NbS include:
 - Green Roofs**
 - Green Walls**
 - SUDS**
 - Structural Soils**
 - Depaving**
 - Micro-habitat creation**
 - Selective Mowing**

3.10.7. NbS Developed in Barcelona



2013-2020 Deployment of the Greenery and Biodiversity Plan, through 10 strategic lines and 68 actions.

Global Environmental Status 2020:

Health plays a larger role!

“Healthy biodiversity is the essential infrastructure that sustains all life on Earth, including human life.”

CBD Executive Secretary



2020-2030 Deployment of new Greenery and Biodiversity Plan, with a larger role for NbS in human health

3.10.8. A New Phase: The Nature Plan 2030

4. Annex Case Study - Internal Governance: Barcelona's Example



8.4. Barcelona as a Mediterranean Benchmark

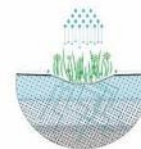
- Barcelona's NbS implementation and Development strategy can be seen as a transferable Mediterranean example
- NbS strategy for development and Implementation in Barcelona has resulted in the acceptance of several multi-scale NbS design Tools

Multi-Scale NbS Design Tools

NbS Developed and Implemented in Barcelona



Barcelona Biological
Area Factor (BBAF PDU)



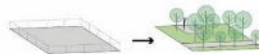
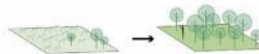
SUDs



Complexitat verd carrers



Verd privat



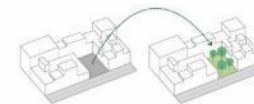
Naturalitzar àmbits de
qualificació 6



Pocket gardens



Naturalitzar espais
propers a verd de
dimensió



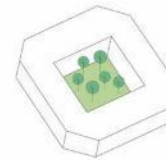
Parcel·les verdes



Murs verds



Superilles - Eixos verds



Adquisició de sòl



Jardins efímers



Cobertes verdes

Barcelona has developed an extensive **Green Corridor** creation programme supported by Nature-Based Solutions.

Green Corridors connect outlying natural areas with the urban fabric and provide a **backbone for the city's ecological infrastructure** to thrive by incorporating green spaces and fostering biodiversity.

- Enhance **mobility and cycling**, improving city attractiveness and well-being
- **Restore ecosystems** through providing space for ecological connection
- Adaptation to climate change, **improving resilience** through stormwater retention and infiltration, reducing the chance of combined sewer overflows
- **Mitigating climate change** through CO₂ sequestration.

Barcelona green
infrastructure
and biodiversity
plan 2020

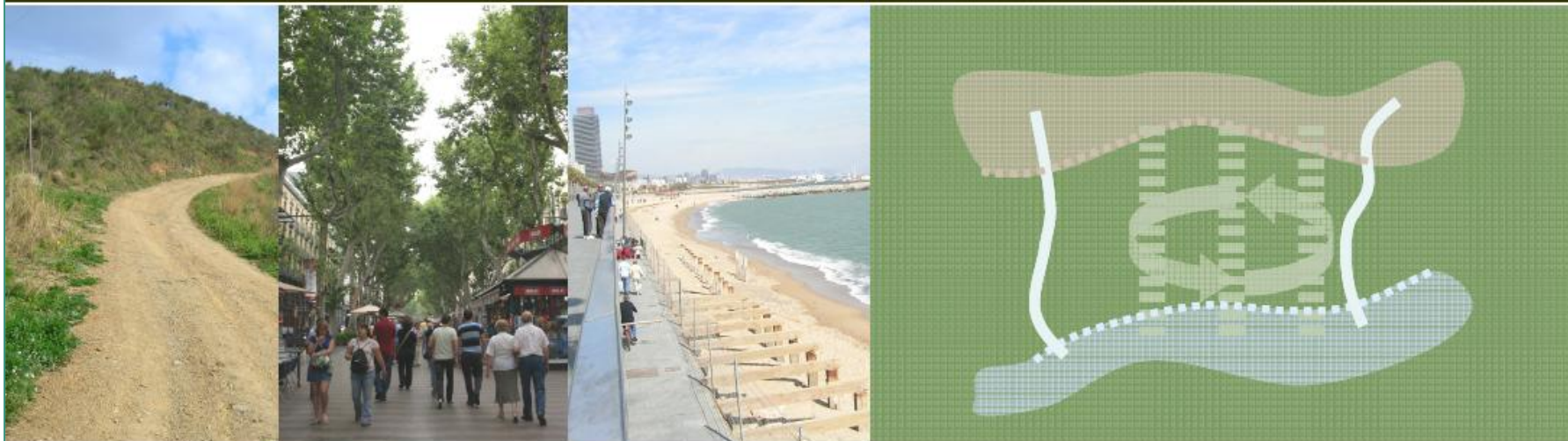


Ajuntament de Barcelona

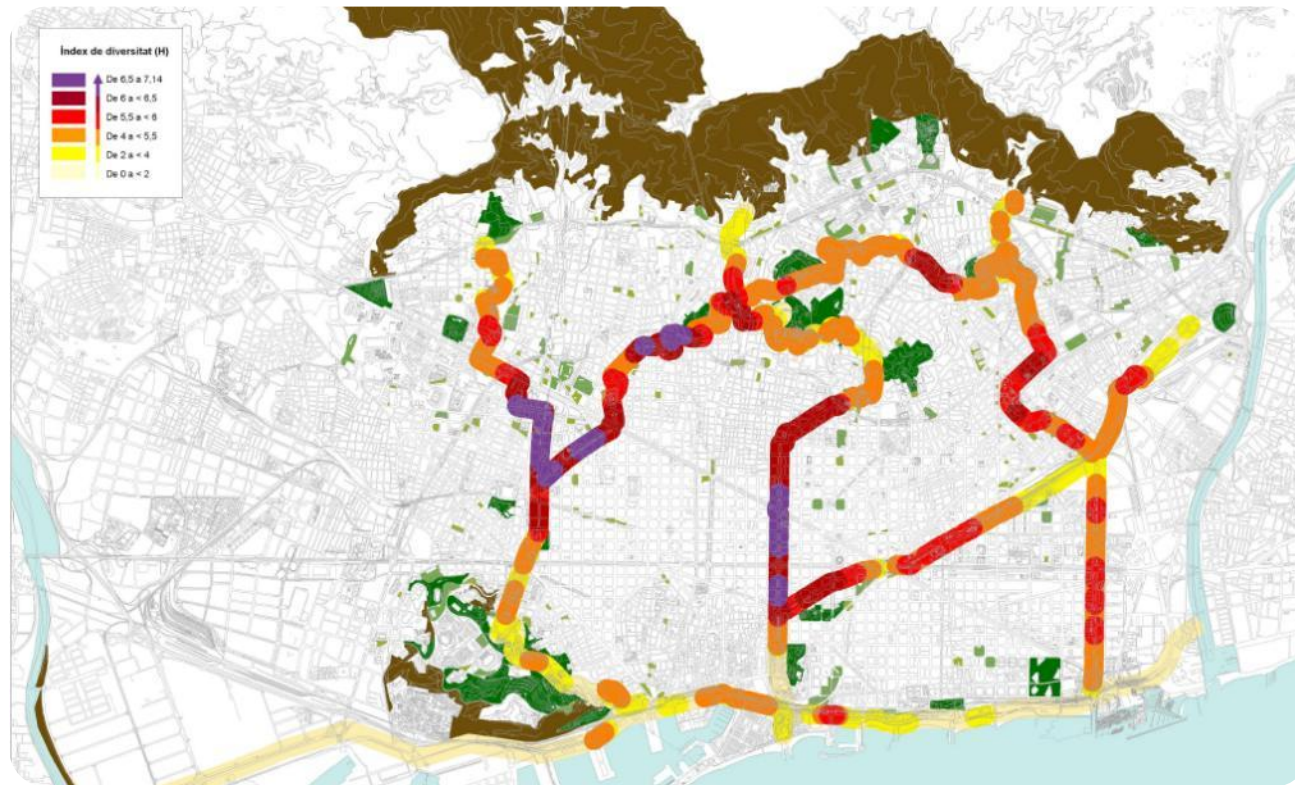


8.4.1. Green Corridors: Incorporating nature into the city.

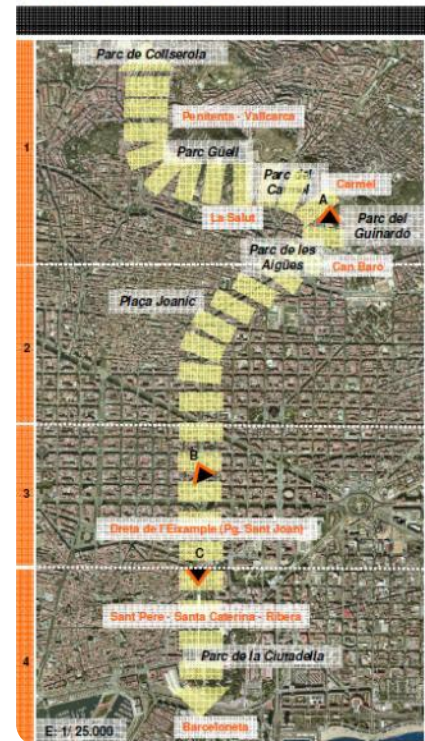
Pla Estratègic d'Espais Lliures a Barcelona Definició dels Corredors Verds Urbans



8.4.1. Green Corridors: Incorporating nature into the city.



Collserola - Ciutadella



8.4.2. Green Corridors: Incorporating nature into the city.



Imatge 37. Carril bici d'un sentit (1,5m) en calçada. Font: Elaboració pròpia.



Imatge 38. Carril bici bidireccional (3,00m) segregat en calçada. Font: Elaboració pròpia.



Imatge 39. Carril bici bidireccional segregat (3,00m) en passeig central. Font: Elaboració pròpia.

Als espais compartits entre bicicletes i vianants, diferents elements de mobiliari urbà com



Imatge 40. Carril bici bidireccional (2,50m) segregat a un carrer interior de superilla.

Font: Elaboració pròpia

Però que fa al traçat de la xarxa, els corredors urbans són eixos que per les seves característiques -continuitat, enllaç amb punts d'interès- són molt adequats per a la circulació de bicicletes. Cal garantir que els corredors urbans tinguin una accessibilitat adequada per a les bicicletes, amb espais reservats a la circulació d'aquestes ben definits i senyalitzats que evitin els conflictes amb els vianants.

Els corredors definits cobreixen part de la xarxa per a bicicletes existent actualment a la ciutat i de la futura xarxa proposada per BCNeologia. Queden sense cobrir les zones situades a la part alta de la ciutat, on els pendents no permeten l'accés en bicicleta.

XARXA ACTUAL	TOTAL
Xarxa Bicienda actual dins dels corredors (km)	40,13
% respecte carril bici Barcelona	63,10%

XARXA PROPOSADA	TOTAL
Xarxa Bicienda proposada dins dels corredors (km)	133,68
% respecte Xarxa Bici Barcelona	63,22%

8.4.3. Green Corridors: Incorporating nature into the city.

- As can be seen in the matrix, each route in the corridor network presents a different situation.
- The set of indicators appearing in the left column allows us to assess the strengths and weaknesses of each axis.
- These include the intensity of the required intervention and the type of specific action: planting new large trees, freeing up public space, making the city more permeable, improving accessibility by public transport, etc.

	Anella Interior			Corredors Verds Urbans			Corredors Externs	
	Nou Barris – Turó del Putget	Turó del Putget – Parc Joan Miró	Ciutadella - Besòs	Collserola Ciutadella 9.8km	Collserola Montjuïc 6.7km	Collserola Fórum 7.5km	Corredor Litoral 14.2km	Corredor Collserola 53.5km
Espais d'estada per corredor								1
Potencial de transformació futura 2								
Permeabilitat del sòl								
Possibilitat d'albergar Arbrat de gran port								
Verd privat								
Verd públic								
Carril bici xarxa actual								
Accessibilitat amb transport públic								

1) Es considera només la zona urbana del corredor.

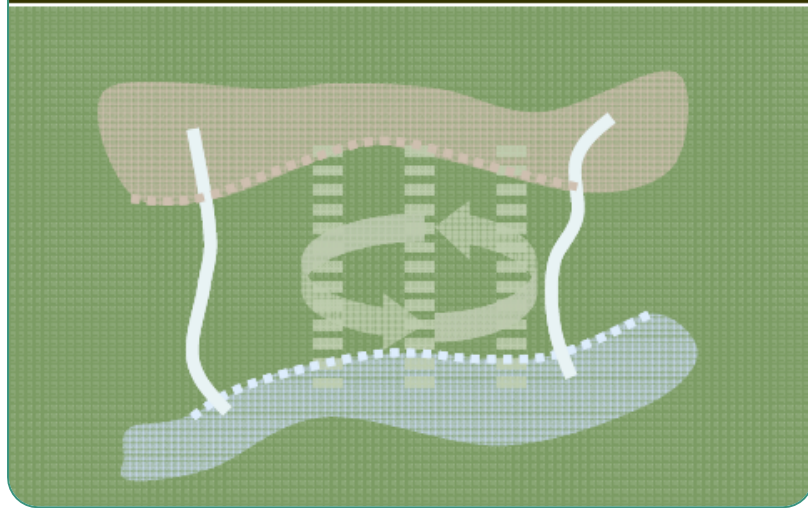
2) En relació als projectes urbanístics aprovats.

Segons el resultat de l'indicador: major menor

8.4.4 Green Corridors: Incorporating nature into the city.

Strategic Plan 2006

Pla Estratègic d'Espais Lliures a Barcelona Definició dels Corredors Verds Urbans



Design Guide 2010

Communication



8.4.5. Green Corridors: Incorporating nature into the city



8.4.6. Green Corridors: Incorporating nature into the city

- The paradigmatic Green Corridor in Barcelona, aiming at increasing ecological and social connectivity within the city.
- The total length of the renovated part is 1.2 km and it was completed in 2015.
- Utilised participatory approaches with the dissemination of information and education and citizen oversight.
- Co-governance management with government and non-government actors.



Environmental impacts	Economic impacts	Sociocultural impacts
- Climate change - Reduced emissions - Strengthened capacity to address climate hazards/natural disasters - Environmental quality - Improved soil quality - Water management and blue areas - Improved water quality - Increased protection against flooding - Improved stormwater management - Green space and habitat - Increased green space area - Increased conversion of degraded land or soil - Reduced biodiversity loss - Increase number of species at risk - Increase ecological connectivity across regeneration sites and scales - Other	- More sustainable tourism - Stimulate development in deprived areas - Attraction of business and investment	- Social justice and cohesion - Fair distribution of social, environmental and economic benefits of the NBS project - Improved livability - Improved access to urban green space - Increased opportunities for social interaction - Health and wellbeing - Improved physical health - Improved mental health - Gain in activities for recreation and exercise - Cultural heritage and sense of place - Improvement in people's connection to nature - Protection of natural heritage - Protection of historic and cultural landscape / infrastructure - Increased appreciation for natural spaces - Other

8.4.7. Green Corridors: Incorporating nature into the city

- The approval of the **Greenery and Biodiversity Plan 2013-2020** generated the conditions for the development of an NbS based regulatory framework in urban design.
- This allowed for the **gradual implementation of pilot projects** and innovative designs in several areas and locations and sparked the creation of several departmental plans and strategies,
- Several departments started trying various approaches to the application of NbS across projects, and once there was enough critical mass a request for a specific technical norm and specific governance was issued.
- In 2020, the Mayoress issued a “Technical instruction for the application of environmental criteria in construction projects” which **made application of NbS, including SUDS, mandatory** for all projects

8.4.8. Policy and Regulatory Framework for NbS

Greenery and Biodiversity Plan 2013-2020.

The Greenery and Biodiversity Charter is a reference guide, which covers how to design the city and its green spaces while taking into account the environmental services and adopting pro-biodiversity and sustainability criteria.

Barcelona Nature Plan for 2030.

Plan for the Improvement of Biodiversity in the Barcelona Metropolitan Area Network of Parks and Beaches (2018). Declaration from the Network of Cities and Towns towards Sustainability for a green and socially fair recovery (September 2020).



8.

Implementa-
tion: 20 actions
and 100 projects

8.4.9. Policy and Regulatory Framework for NbS

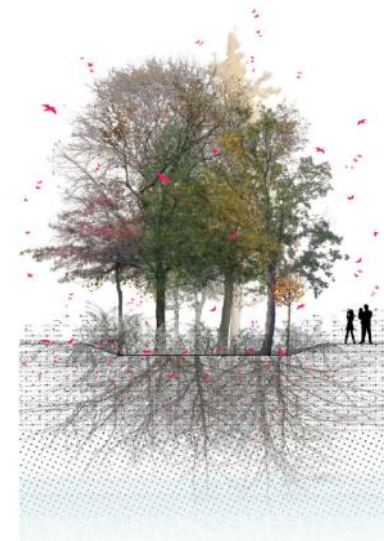
Ajuntament
de Barcelona

Parcs i Jardins

BARCELONA
REGIONAL

The Greenery and Biodiversity Charter is a reference guide which covers how to design the city and its green spaces while considering the environmental services and adopting pro-biodiversity and sustainability criteria.

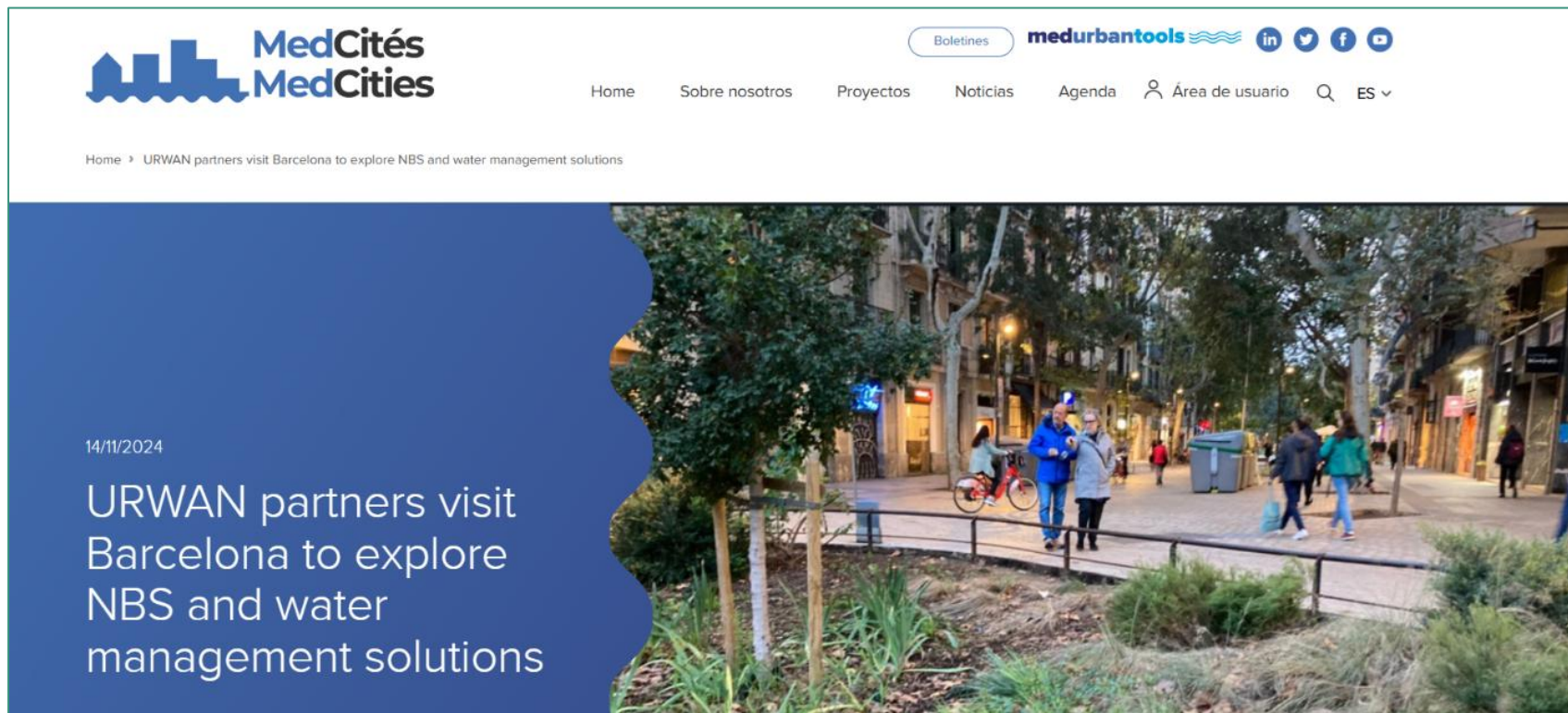
- Multifunctional: It has the capacity to offer a lot of provisioning regulating cultural and supporting services.
- Dynamic: It is based on living matter and as such, evolves over time and space. The organisation of this living matter has the capacity to constitute habitat and, therefore, to promote the presence of fauna and flora through attractive relationships with other nearby green systems.
- Interactive: The components of green spaces (soil, water, vegetation) form a set of systems with complex interrelationships that are also related to the built environment and to the urban structure itself.
- Sustained: Like any infrastructure, it needs constant maintenance. Managing and monitoring it over time is just as important as its design.



**Greenery and
Biodiversity Charter**

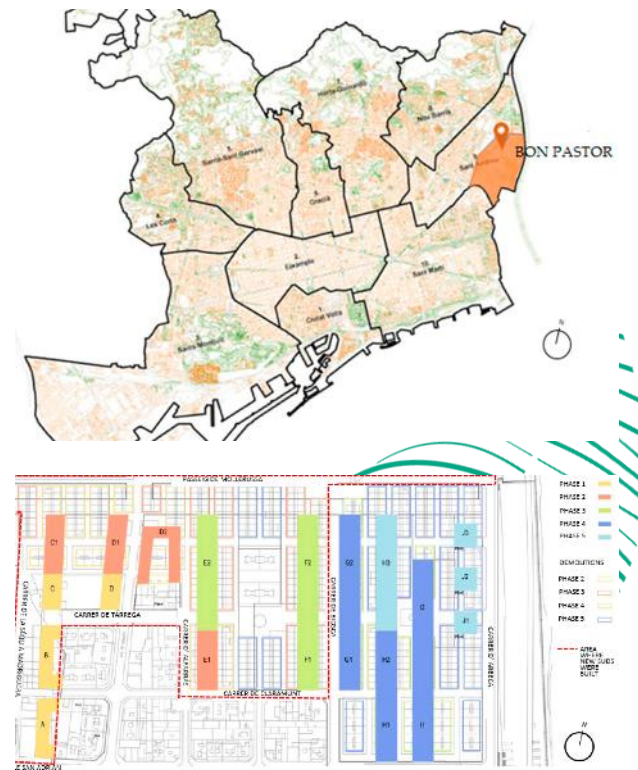
8.4.10. Ensure an Integrative Approach

8.5. Urban Drainage Systems 2005-2025, Barcelona



The screenshot shows the MedCités website interface. At the top, there is a navigation bar with the MedCités logo on the left and a menu on the right including 'Boletines', 'medurbantools', and social media icons. Below the navigation bar, a breadcrumb trail reads 'Home > URWAN partners visit Barcelona to explore NBS and water management solutions'. The main content area features a large blue wave-shaped graphic on the left containing the date '14/11/2024' and the title 'URWAN partners visit Barcelona to explore NBS and water management solutions'. To the right of the text is a photograph of a modern urban street in Barcelona, showing a paved walkway, trees, and people walking.

- Bon Pastor neighbourhood in the Sant Andreu district of Barcelona was a disadvantaged area had out-of-date housing and **a flood prone street design.**
- The urban renewal process focused on **managing runoff at source** by de-paving and rewilding the urban landscape.
- Phases E, F, and G integrated Sustainable Urban Drainage Systems (SUDS) for **climate change adaptation.**



8.5.1. Bon Pastor Streets, 2011-2016, Barcelona

- Several conventional streets were replaced by **linear gardens** and pedestrian areas.
- Others had parking spaces replaced with bioswales and rain gardens.
- Key design attributes include:
 - Diversity of SUDS with permeable paving
 - Areas dedicated to bioretention: rain gardens, bioswales
 - Structural Soil strips between street trees.



8.5.2. Bon Pastor Streets, 2011-2016, Barcelona

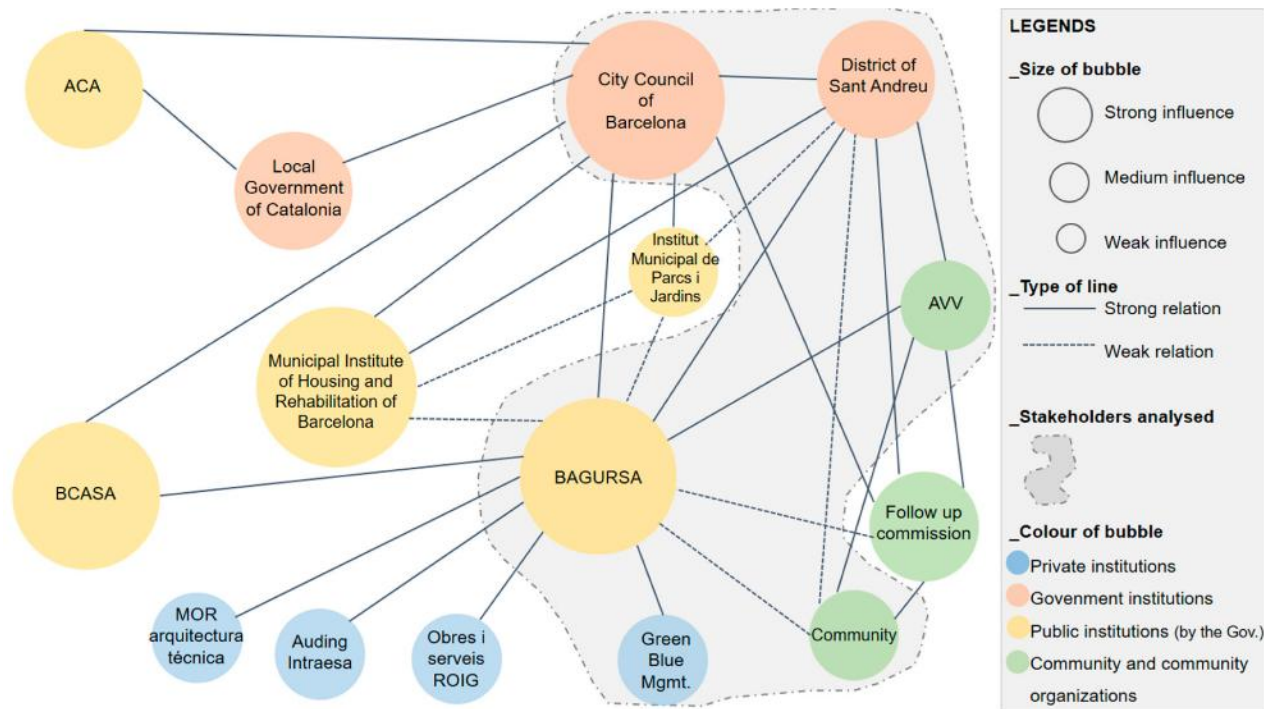
Identified Benefits Include:

- **Improved microclimate** and mitigated urban heat island effect.
- No street flooding and a significant **contribution to recharging** the underlying aquifer.
- Community involvement and **participatory decision making** helped stimulate commitment towards sustainable issues within the community groups (AVV).
- Exemplified how Low Impact Design can be instrumental in **community benefits and water run-off management and conservation**.



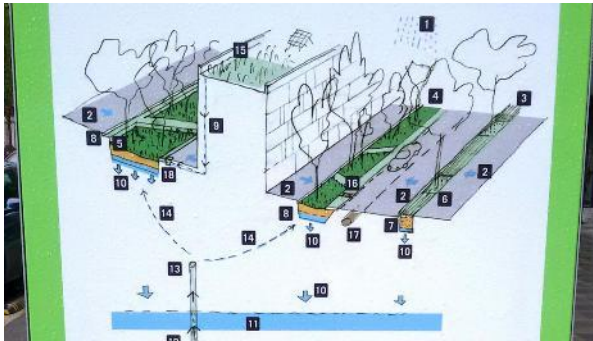
8.5.3. Bon Pastor Streets, 2011-2016, Barcelona

Stakeholders map of Bon Pastor SUDS.



8.5.4. Bon Pastor Streets, 2011-2016, Barcelona

Non-Structural Measures



8.5.5. Bon Pastor Streets, 2011-2016, Barcelona

Municipal Urban Planning Institute, Barcelona
City Council

Green street Strategy for biodiversity and
sustainable and passive stormwater
management

Featuring: Bioretention areas, permeable
pavements, floodable flowerbeds and buried
retention-infiltration tanks.



8.5.6. Cristobal de Moura Green Axis, 2018-2019, Barcelona

- These SUDS are capable of capturing, treating, retaining, and returning to the ground through infiltration the runoff generated **for the 10-year return period** for design rainfall.
- This includes the 17,900 m² of urbanised area (of which 3,500 m² are green spaces) and also **the roofs of adjacent buildings**.
- The rainfall over an area of 32,000 m² is **managed in this Green Axis**, which has more than 2,200 m³ of rainwater storage volume.



8.5.7. Cristobal de Moura Green Axis, 2018-2019, Barcelona

Local Government Departments have progressively developed a diverse array of Nature-Based Solutions (NbS), both through strategic planning and ad-hoc implementation, adapted to the Mediterranean urban context.



Green Roofs



Green Walls

(SUDS: Sustainable Urban Drainage Systems)



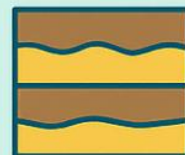
Depaving and Permeabilization



Selective Mowing Regimes



SUDS



Structural Soils



Micro-habitat Creation



Some of these interventions arose independently of centrally planned strategies, driven by specific project needs or grassroots innovation

5. Annex Case Study - Barcelona SUDS Commission



8.6. Sustainable Urban Drainage Systems Commission

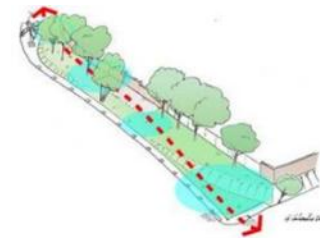
Barcelona had been **implementing SUDS on a project-by-project basis** since around 2005.

However:

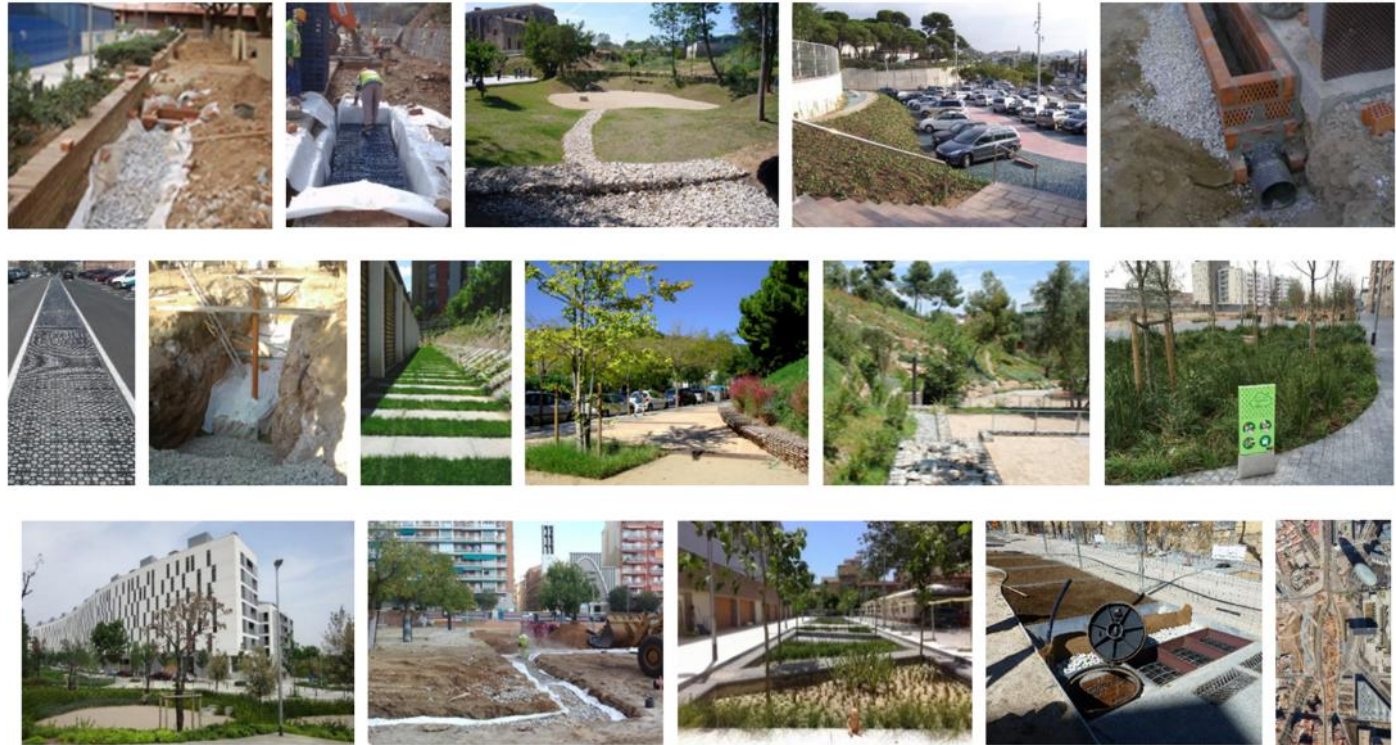
- The gradual implementation of pilot projects and innovative designs generated **interest, dissemination and precedents**.
- **This was not enough** to expand the application of NbS across departments.
- There were doubts about **what department was responsible for what** (supervision, maintenance, health).
- SUDS were being built by Parks and Gardens and the Housing and Urban Design Department, but Water Cycle Department felt it **needed to be involved** in SUDS design and maintenance.

In parallel with the emergence of policy frameworks and strategic documents, **experimental examples of NbS** were implemented in BCN:

- They were designed and executed by different departments as **Pilot Projects**.
- Projects were implemented in a **decentralised manner**.
- They were mainly concerned with the provision of **green infrastructure** (green roofs and green walls) and with **stormwater management** (SUDS)



8.6.1. Experimental NbS Application Phase



8.6.2. Experimental NbS Application Phase



8.6.3. Experimental NbS Application Phase



8.6.4. Experimental NbS Application Phase



SUDS COMMISSION OF BARCELONA CITY COUNCIL

Barcelona begins to implement SUDS in 2005. The SUDS Commission was established in 2016.

Entities initiating the commission:

Barcelona Water Cycle
Parks and Gardens Institute
Municipal Urbanism Institute

Urban Projects
Sustainability Office
Mobility and Infrastructure
Health Public Agency

The functions of the commission are:

- Promote studies on the implementation, management and follow-up of SUDS.
- Systematize data management and projects related to SUDS techniques.
- Promote training in municipal technical services.
- To promote information to the citizenry, through signage, holding of conferences, on-line information.
- Sharing in the municipal organization about the SUDS benefits.
- SUDS Master Plan Coordination.

Barcelona's SUDS Commission (Sustainable Urban Drainage Systems)

- A practical example: this interdepartmental group **aligned** storm-water management with urban design.
- The SUDS Commission **integrated technical expertise and policy coordination** to advance nature-based drainage strategies.
- It facilitated the delivery of Barcelona's broader ecological transition plans at **operational level**.

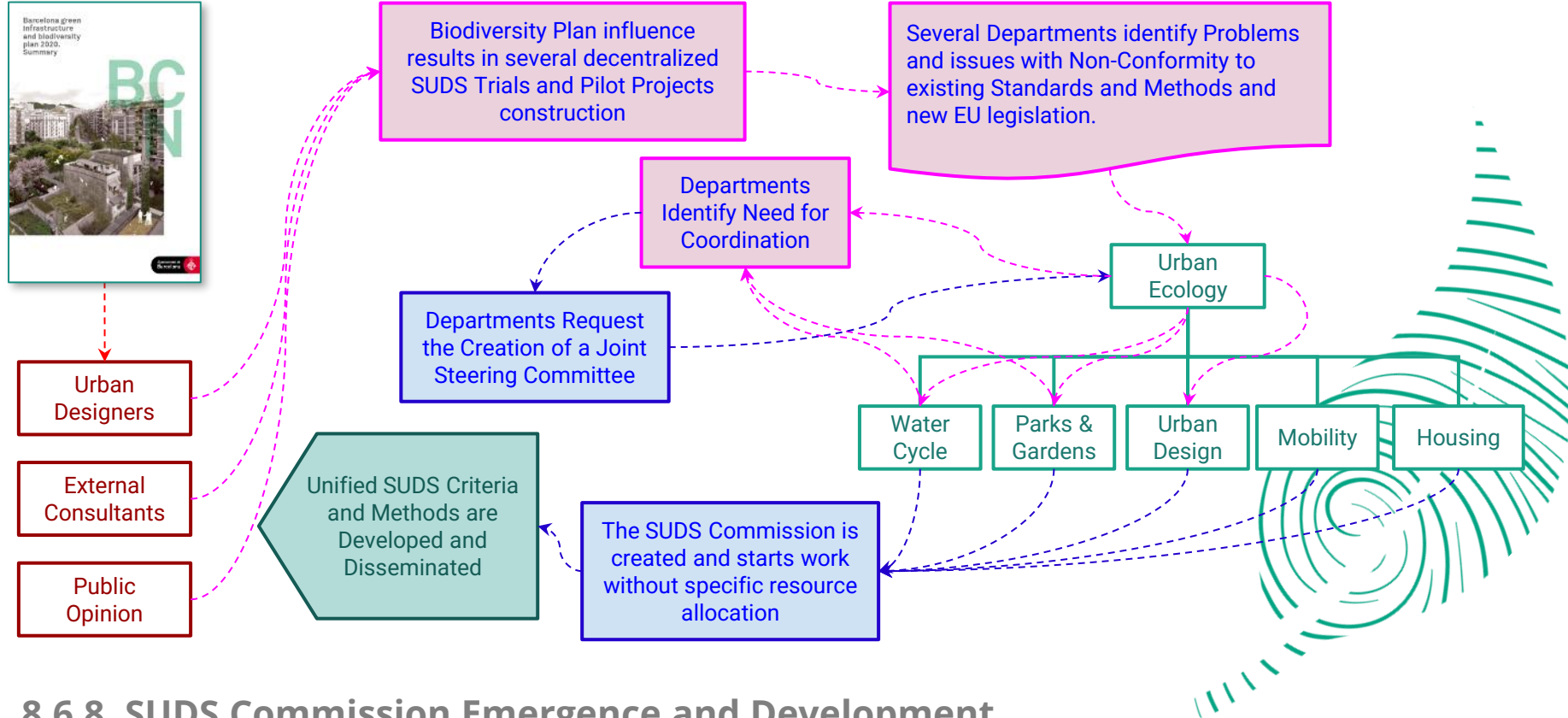


8.6.6. Specialised NbS implementation Bodies: Barcelona's SUDS Commission

- In 2015, changes in EU policy regarding urban stormwater management made apparent that a change in governance and operational methods was needed urgently.
- However, the nature of this change and the best way to implement it remained elusive and unclear, with several departments claiming ownership of the issue.

To overcome these obstacles, a **Sustainable Urban Drainage Systems Commission** was formally established in January 2016 within the City's Urban Ecology Department.

8.6.7. Sustainable Urban Drainage Systems Commission



8.6.8. SUDS Commission Emergence and Development

Case Study: Barcelona SUDS Commission



URWAN

 Interreg
Euro-MED

 Co-funded by
the European Union

ORIGINS AND FOUNDATION

Created in 2016 by the Urban Ecology Department



Ajuntament
de Barcelona



AMB



Diputació
de Barcelona



Parcs i
Jardins



Barceló
Cicle Aigua



Institut Municipal
d'Urbanisme

STRATEGIC PHASES OF IMPLEMENTATION

EXPERIMENTAL

Pilot projects

ACCEPTANCE

Validation
and support

INTEGRATION

Citywide roll-out

CHANGE

Broad transforma-
tion

NORMALIZATION

CORE FUNCTIONS OF THE COMMISSION



Promote SUDS studies and data



Provide internal training



Coordinate strategy



Disseminate to the public



Develop technical standards



Integrate with citywide planning

BROADER INTEGRATION WITH MUNICIPAL PLANS



Climate Plan
(Pla Clima)



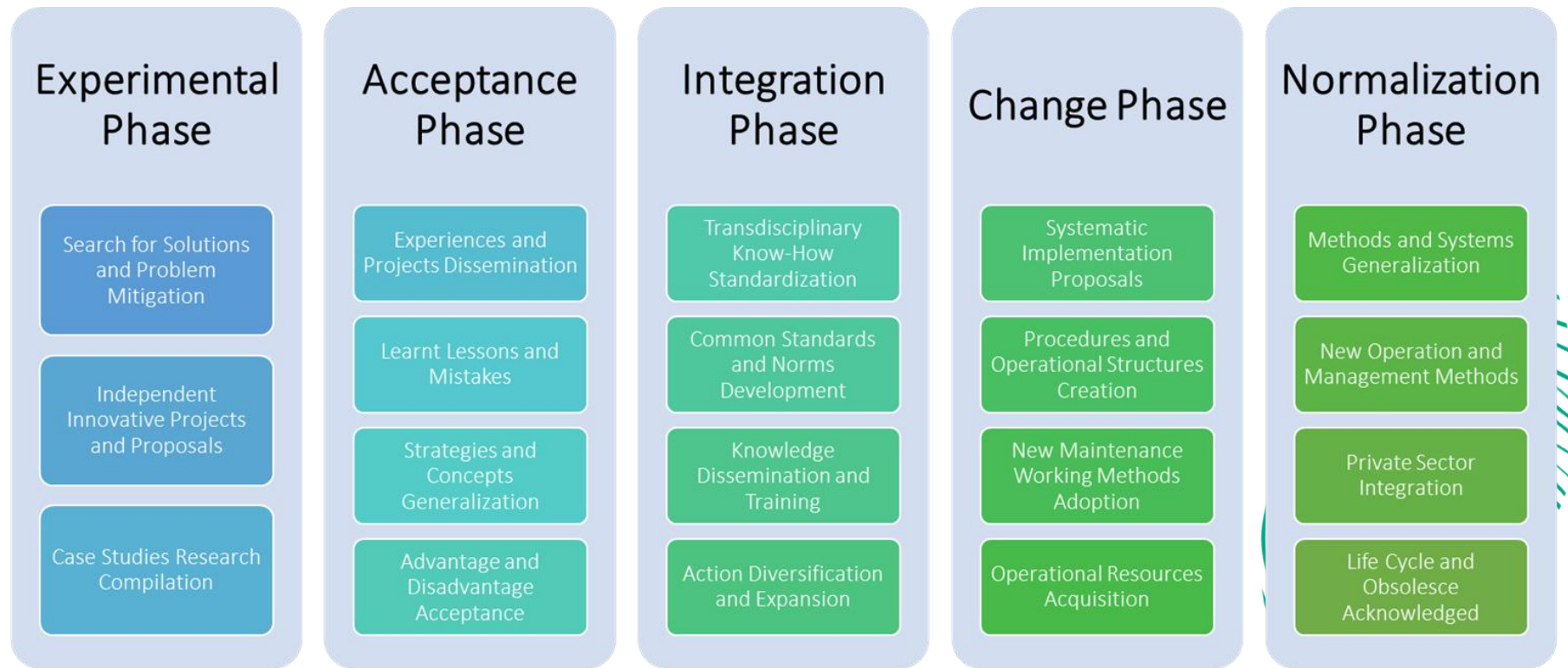
Green
Infrastructure
Plan



Sanitation
Master Plan
(PDISBA)



Alternative
Water Resources
Plan



8.6.8. Phased Strategy to Mainstream SUDS Adoption

The Commission **coordinated SUDS integration** across major municipal frameworks, including:

- Barcelona Climate Plan
 - New Greenery and Biodiversity Plan 2030
 - Alternative Hydric Resources Plan
-
- It also contributed to Barcelona's renewed **Integrated Wastewater Management Plan (PDISBA 2020)**, which coordinated both large-scale underground stormwater storage and decentralized SUDS measures, thus **bringing together NbS and conventional infrastructure**.

8.6.9. Role of SUDS Commission within broader Urban Strategy

ESPAI: AMPLIACIÓ DEL PARC DEL PUTGET

Ajuntament
de Barcelona

Green Blue Management



Tipus de SUDS emprats:



D-DIP R-ALU F-RAS F-FRA F-COB I-PAV I-DIP I-ESC I-PAR T-CUN T-EST T-RIO

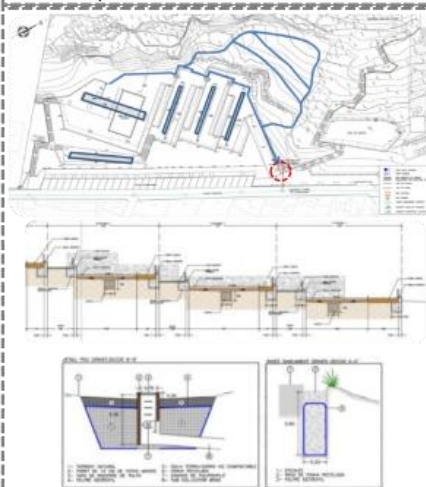
Descripció:

L'espai annex al Parc del Putget era un terreny amb una forta pendent i escassa accessibilitat, que abocava l'aigua cap al carrer. La solució d'urbanització d'aquest espai va integrar els processos de drenatge en tots els seus aspectes: des de la creació de paviments drenants, la utilització de murs de gabions, la construcció de nombroses rases de graves i la construcció d'una xarxa de drenatge per infiltració que té la funció de limitar la velocitat de l'escorrentia a les pendents i la seva circulació incontrolada per les pendents de les àrees de plantació. El sistema està connectat per un sobreexidor al clavegueram de la ciutat.

L'actuació de projecte es completà uns mesos després de l'inauguració del parc amb una rasa aigües a munt del cap del talús per evitar que les aigües plujanes provinents de la part alta del bosc arribin a la zona del talús. Aquesta rasa drenant està connectada a un pou de graves.

Referència addicional a l'informe:

Plànols i esquemes:



Construcció i estat actual:



Nom Projecte: Ampliació del Parc del Putget

Districte: Sarrià - Sant Gervasi

Promotor: Ajuntament de Barcelona

Parcs i Jardins de Barcelona. Institut Municipal.

Any aprovació projecte: 2009

Any finalització construcció: 2011

Superfície d'actuació: 12.000 m²

Es disposa de projecte d'execució amb càlcul de drenatge?

SI

Es disposa de projecte As Buit amb càlcul de drenatge?

Estat Previ:



ESPAI: CAN CORTADA



Tipus de SUDS emprats:



Descripció:

S'ha dissenyat la xarxa de drenatges per tal de minimitzar l'aportació d'aigua plujana a la xarxa de clavegueram i contribuir a evitar la seva sobresaturació en episodis de fortes pluges, afavorint la infiltració d'aigua al terreny amb tots els avantatges que això comporta. L'escorrentia generada a les cobertes i a la urbanització es dirigeix cap a les zones de parterres inundables, que compten amb pous d'infiltració i sobreelsidors que connecten els diferents parterres entre si per regular els caudals abans de que es produeixi la infiltració al freàtic, i franges amb paviment permeable i sol estructural que uneix l'arbrat; de tal manera que només davant d'episodis de pluges de magnitud significativa es produeixi un desbordament cap a la xarxa de col·lectors unitària.

Referències addicionals als projectes:

Nom Projecte: Projecte d'urbanització del P.M.U. per a l'ajust dels habitatges de l'avinguda de l'Estatut

Districte: Horta-Guinardó

Promotor: Ajuntament de Barcelona
Barcelona Gestió Urbanística, S.A.

Any aprovació projecte: 2012

Any finalització construcció: 2014

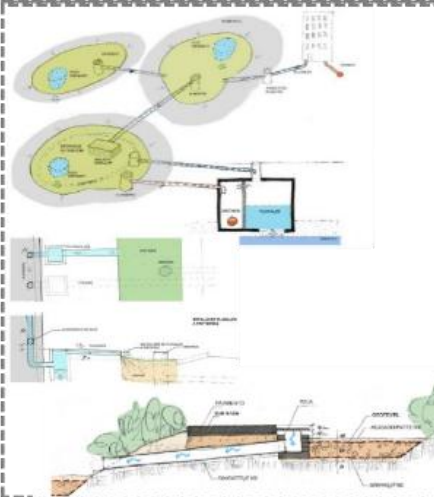
Superfície d'actuació: 26.400 m²

Es disposa de projecte d'execució amb càlcul de drenatge?
Sí

Estat Previ:



Plànols i esquemes:



Construcció i estat actual:



ESPAI: BON PASTOR



Tipus de SUDS emprats:



Descripció:

Les aigües pluvials provinents de la xarxa separativa dels edificis de nova construcció i de la major part de la superfície de voreres, espais de vianants i vials, es dirigeixen cap a parterres inundables on l'aigua s'evacuarà per processos d'infiltració al terreny, evaporació i evapotranspiració. Sols en casos de pluges significatives es produirà un sobreiximent cap a la xarxa de clavegueram. A més a més s'han utilitzat altres tipus de SUDS, com franges de biorretencció i escocells d'infiltració al carrer de Biosca. S'aprofita la permeabilitat del terreny del barri de Bon Pastor per donar continuïtat a la xarxa separativa d'evacuació d'aigües residuals i pluvials imposada pel Codi Tècnic de l'Edificació i a l'hora contribuir al bon funcionament del sistema de sanejament i drenatge de la ciutat.

Referències addicionals als projectes:

Stratègia de gestió de l'aigua a Barcelona

Nom Projecte: Projecte d'urbanització del barri de Bon Pastor. Fase E.

Districte: Sant Andreu

Promotor: Ajuntament de Barcelona
Barcelona Gestió Urbanística, S.A.

Any aprovació projecte: 2015

Any finalització construcció: 2016

Superfície d'actuació: 12.325 m²

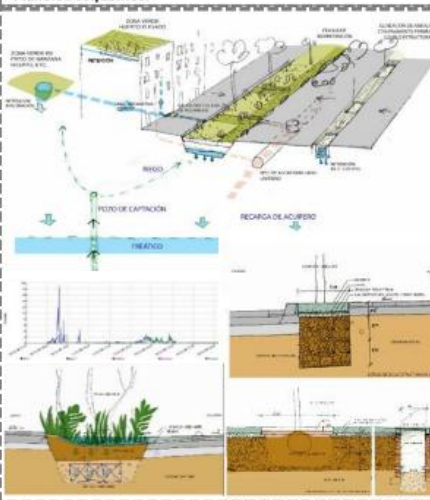
Es disposa de projecte d'execució amb càlcul de drenatge?
Sí

Es disposa de projecte de Bull. amb càlcul de drenatge?

Estat Previ:



Plànols i esquemes:

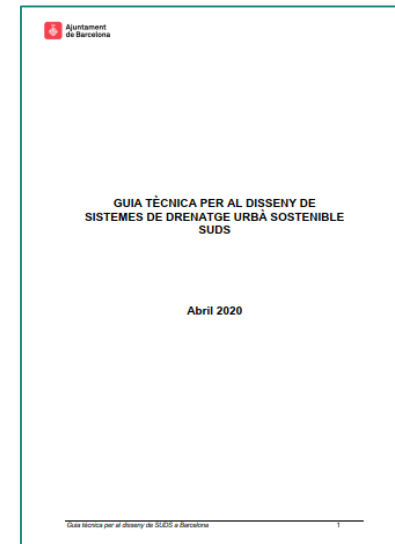


Construcció i estat actual:



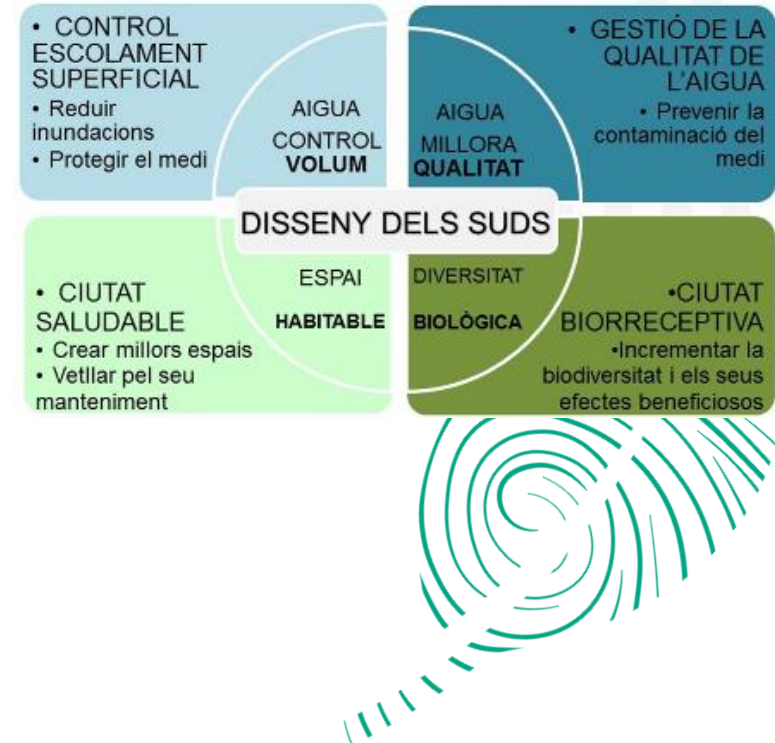
The Commission coordination resulted in direct the creation of:

- An internal knowledge hub
- A SUDS Design Technical Guide
- A SUDS Maintenance Contract
- Articles, conferences and training packages



8.6.13. SUDS Commission Impact and Legacy

- **The SUDS Commission functioned as:**
 - a Cross-departmental Steering Group, overseeing and mainstreaming Sustainable Urban Drainage Systems in Barcelona's urban agenda.
 - Its mission was to break departmental barriers and share knowledge and operational needs.
 - It fostered practical innovation, standardized processes, built capacities, strengthened governance, and ensured that SUDS are now integral to both municipal infrastructure and citizen experience.



8.6.14. SUDS Commission Summary

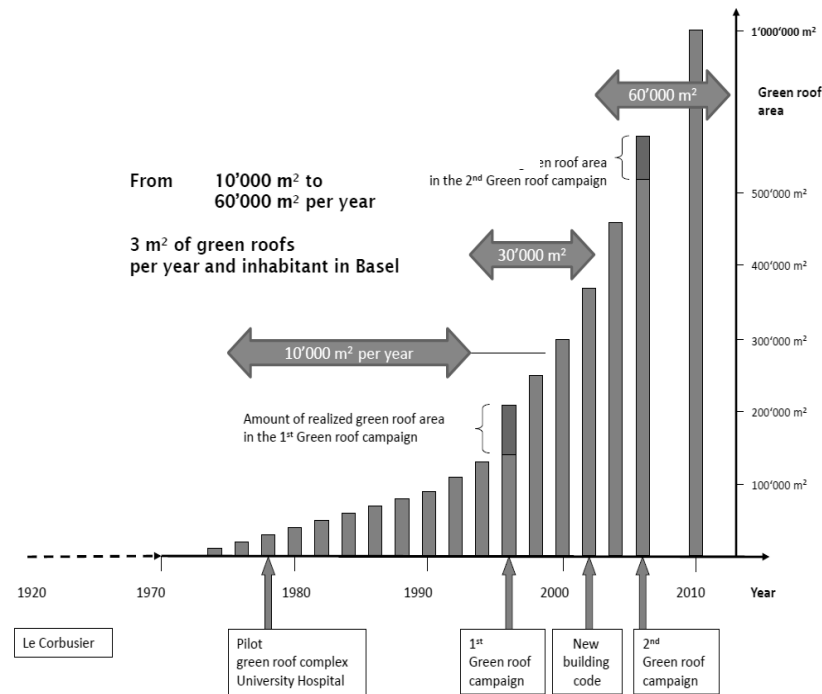
8.3. Co Governance Example: National Roof Plan

- **Green Deal Green Roofs:** A government-funded partnership between public and private actors aimed to develop innovative business models for green roofs is the Green Deal Green Roofs (now called the National Roof Plan) in the Netherlands.
- This network connects all relevant stakeholders in the green roof sector, including municipalities, water utilities, roofing firms and homeowners.
- It specifically aims to improve structural conditions for mainstreaming green roofs across the country, for example, by lobbying for sewage tax breaks for green roof homeowners.
- Besides financially supporting the mainstreaming of green roofs, it also promotes the development of multifunctional green roofs by bringing all stakeholders together to share visions and expertise.
- As a result, green roofs that are developed under the scheme can deliver multiple benefits, including biodiversity, aesthetics, cooling, and water retention.



- **Combining mitigation and adaptation measures**
- The City of Basel has promoted green roofs via investment in incentive programmes, which provided subsidies for green roof installation (1996-1997 up to 20 CHF per m², then 2005-2007 up to 30-40 CHF per m², in the latter case only for retrofitting existing buildings).
- The programmes were funded from the Energy Saving Fund made up of 5% of all customers' energy bills in the Basel canton. In 2002, an amendment to the City of Basel's Building and Construction Law was passed.

Green Roofs Plan, Basel, Switzerland



4.3.2. Green Roofs Plan, Basel

8. Annex Case Studies of Mediterranean Examples



8.1. Annex Case Studies of Mediterranean Examples

Alicante

Benicassim

Cannes

Heraklion

Lisbon

Montpellier

Seville

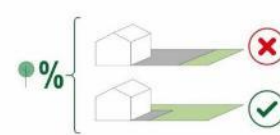
Solana de los Barros

Thessaloniki

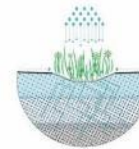


8.2. Mediterranean Case Studies

- Examples from Mediterranean Cities with Advanced NbS Policies and Developments related to water management.



Barcelona Biological
Area Factor (BBAF PDU)



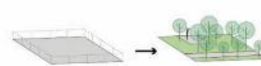
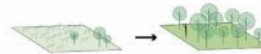
SUDS



Complexitat verd carrers



Verd privat



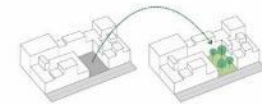
Naturalitzar àmbits de
qualificació 6



Pocket gardens



Naturalitzar espais
propers a verd de
dimensió



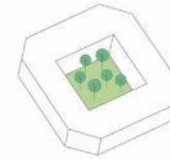
Parcel·les verdes



Murs verds



Superilles - Eixos verds



Adquisició de sòl



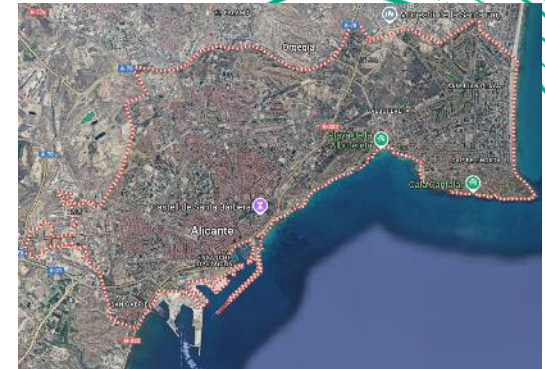
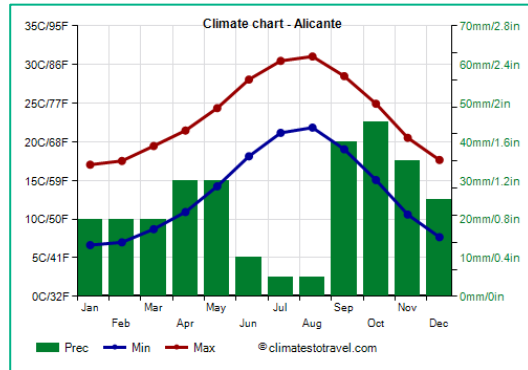
Jardins efímers



Cobertes verdes

8.3. City of Alicante, Spain

- Population: 358,608
- Size: 201.3 km²
- Climate: Mediterranean Sub-humid
- Average Yearly Precipitation: 284.5 mm
- Risks: Drought, Flooding, Heat Waves, Desertification



[The programme](#)[Look for funding](#)[Approved projects](#)[Policy solutions](#)[Get expert support](#)[Meet our community](#)[Home](#) / [Find policy solutions](#) / [Good practices](#) / 'La Marjal' floodable park

'La Marjal' floodable park



GREEN

Climate change



8.3.1. La Marjal Floodable Park, 2015, Alicante

Source - <https://www.interregurope.eu/good-practices/la-marjal-floodable-park>

- Project focus: Sustainable Drainage System, Green Infrastructure, Water Recycling



8.3.2. La Marjal Floodable Park, 2015, Alicante

- Project focus: Sustainable Drainage System, Green Infrastructure, Water Recycling



8.3.3. La Marjal Floodable Park, 2015, Alicante

- **Project focus: Biodiversity Promotion and Conservation**



8.3.4. La Marjal Floodable Park, 2015, Alicante

- **Project focus: Resources Needed, Governance and Benefits**
 - The park required the investment of €3.6M, provided by the **municipal water operator**.
 - The park is half-owned by Alicante City Council, the service provider, and half-owned by Hidraqua, a Public-Private Enterprise that **operates regionally** in all areas of the water distribution and treatment cycle.
 - The water stored after intense rainfall is pumped by the pumping station in the park to a water treatment plant for reuse.
 - This water resource has increased the supply of reclaimed water in Alicante.



8.3.5. La Marjal Floodable Park, 2015, Alicante

- **Project focus: Lessons Learned and Influence**
 - A major success story led by the **city technical staff**, with nearly 60,000 cubic metres of water retained to date.
 - Alicante now aspires to **recycle 90-100%** of all stored water from current 30-40% with a specific plan for water recycling.
 - Alicante is planning the construction of **3 new floodable parks** that mimic “La Marjal” concept alongside 12 new conventional anti-pollution storage units.
 - Alicante City Council and Alicante Water Company intend to strengthen the **public-private partnership** formula.



8.3.6. La Marjal Floodable Park, 2015, Alicante

- **Project focus: Lessons Learned and Influence**
 - “La Marjal” has **inspired** the creation of similar parks regionally and across Spain.
 - The City of Torrevieja has developed **3 floodable parks** (2024) following Alicante’s example.
 - These parks **have modest capacities** between 9,000 and 1,000 cubic metres but they can still play a significant role.
 - The **finance model has been public-private** like Alicante.



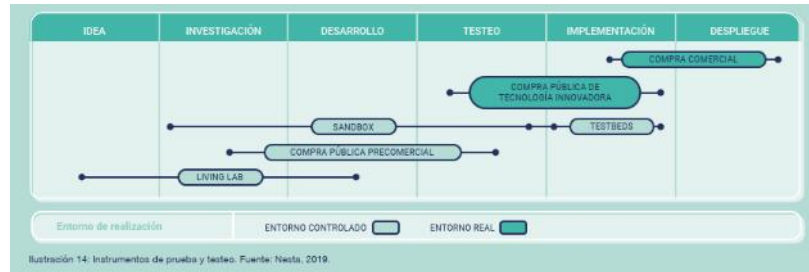
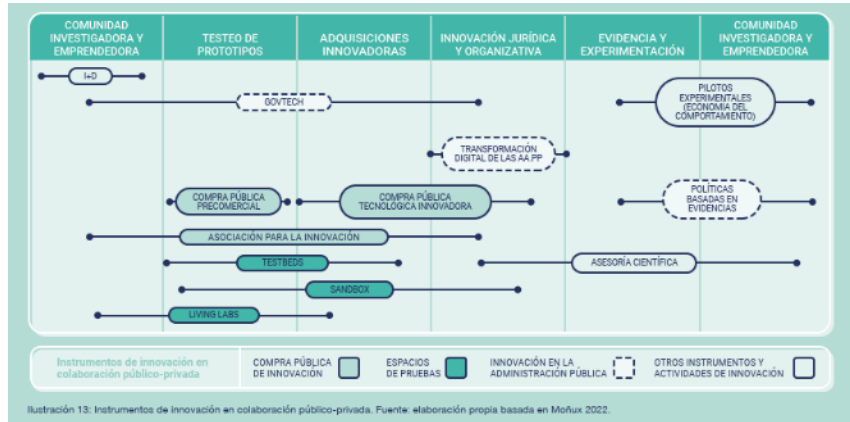
8.3.7. La Marjal Floodable Park, 2015, Alicante

- **Project focus: Effect on Innovation “Regulatory Sandbox” for Water Cycle**
- Alicante Water Company has produced a **“Sandbox guide for Integrated Water Cycle Management”**
- A Regulatory Sandbox in Europe is a **Controlled Environment** where companies can test innovative products, services, or business models under the supervision of regulators.
- This allows for **experimentation with new technologies**, while mitigating potential risks and gaining valuable insights into their real-world implications.
- **The first of its kind**, this sandbox approach aims to foster innovation, reduce legal uncertainties, and promote a better understanding of emerging technologies in water management.



8.3.8. La Marjal Floodable Park, 2015, Alicante

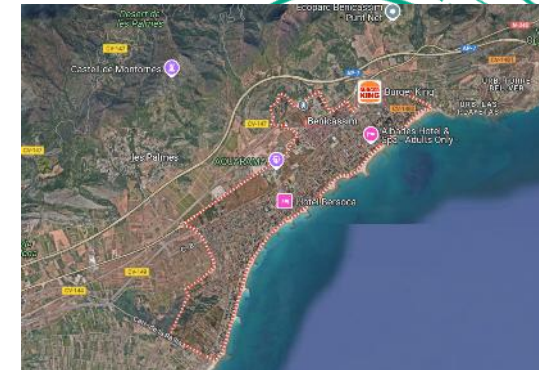
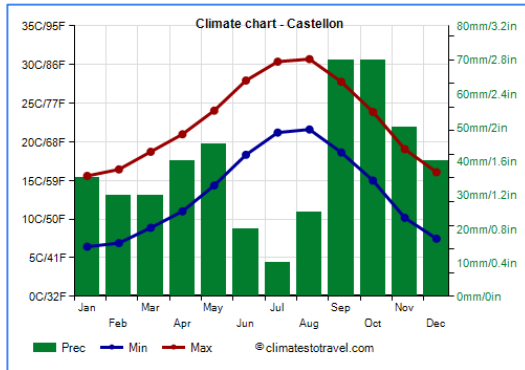
- Project focus: Effect on Innovation “Regulatory Sandbox” for Water Cycle



8.3.9. La Marjal Floodable Park, 2015, Alicante

8.5. City of Benicassim, Spain

- Population: 18,991 (60,000 in summer)
- Size: 36.1 km²
- Climate: Mediterranean Sub-humid
- Average Yearly Precipitation: 411 mm
- Risks: Flash flooding, drought and heat waves.



[The programme](#)[Look for funding](#)[Approved projects](#)[Policy solutions](#)[Get expert support](#)[Meet our community](#)[Home](#) / [Find policy solutions](#) / [Good practices](#) / [Ceramic Sustainable Urban Drainage System \(CERSUDS\)](#)

Ceramic Sustainable Urban Drainage System (CERSUDS)



GREEN

Circular economy



8.5.1. CerSUDS, 2014-2020, Benicassim

- LIFE CERSUDS is a project focused on sustainable water management in urban environments.
- The project seeks to develop and implement innovative solutions for rainwater management, with the goal of reducing flood risk and improving water quality in cities.
- This is a European Project funded by the European Commission through the LIFE programme.

**PERMEABLE CERAMIC SYSTEM AS A
SUSTAINABLE URBAN DRAINAGE SOLUTION:
PRINCIPLES, DESIGN AND EXECUTION**

Demonstrator Project in Benicàssim
(Castelló)



8.5.1. CerSUDS, 2014-2020, Benicassim

- The permeable paving is based on the **use of ceramic tiles of low commercial value**.
- The system envisages cutting the ceramic tiles into **strips of specific width**, which will then be **bundled into permeable ceramic units**.
- Each module consists of seven strips obtained by cutting ceramic tiles.
- The development of these units **provides speed and simplicity in paving construction**.



8.5.1. CerSUDS, 2014-2020, Benicassim

- **Project focus: Resources Needed, Governance and Benefits**
- The cost of this **experimental demonstrator** amounted to €757,105 for 3,000 m²
 - The cost includes the manufacture of the ceramic pavement, the project and the construction management, the costs of personnel dedicated to the management and the urbanisation works.
 - Several locations are interested in **replicating this project**.
 - The project has a **complex governance structure** with several partners in the construction and technology sectors, other European cities and local entities.



8.5.1. CerSUDS, 2014-2020, Benicassim

Project focus: Governance and Benefits

- Furthermore, a Monitoring Committee was formed by several entities from a Regional Working Group created in the E2STORMED project.
- This allowed incorporating CerSUDS experience, needs and concerns in the definition and monitoring of the project.

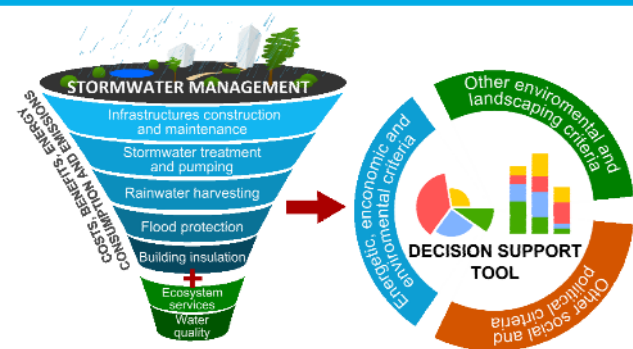


8.5.1. CerSUDS, 2014-2020, Benicassim

Project focus: Governance and Benefits

- The E²STORMED contributed to **improving energy efficiency in the urban water cycle** by promoting the use of innovative stormwater solutions in mediterranean cities.
- Existing management tools were tested by the cities, allowing an **incorporation of energy reduction** in planning and decision-making processes.
- The main output of the project was the **E²STORMED Decision Support Tool (DST)**

E²STORMED DECISION SUPPORT TOOL



E²STORMED PILOT STUDIES



8.5.1. CerSUDS, 2014-2020, Benicassim

Project Actions Structure Diagram

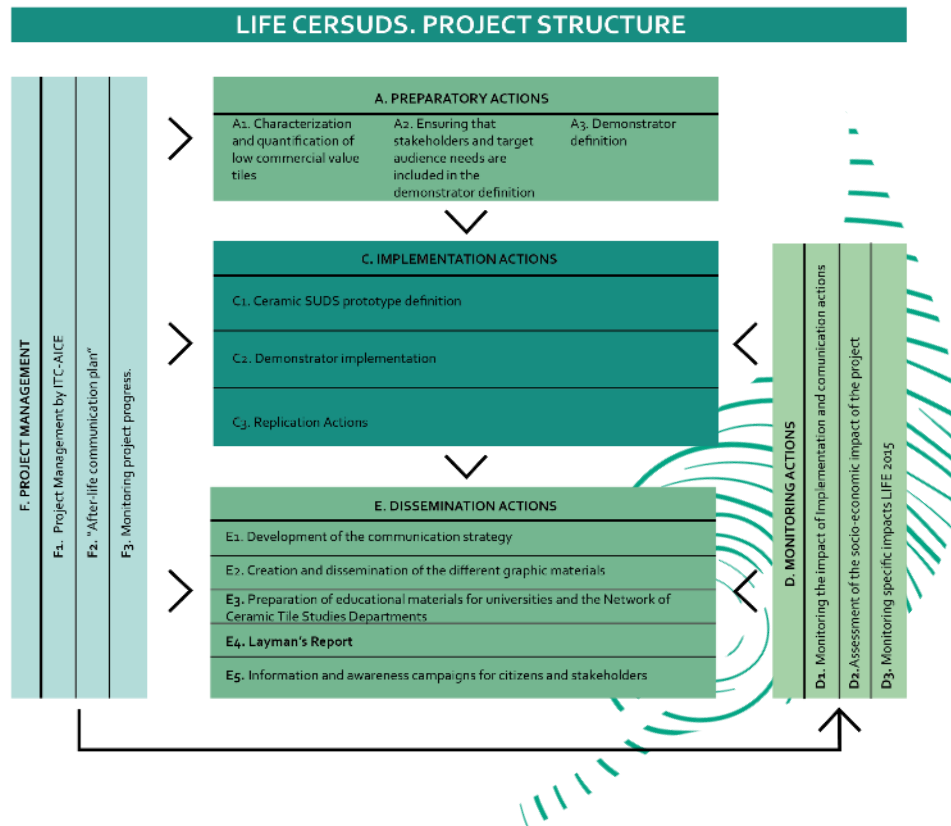
A. PREPARATORY ACTIONS

C. IMPLEMENTATION ACTIONS

D. MONITORING ACTIONS

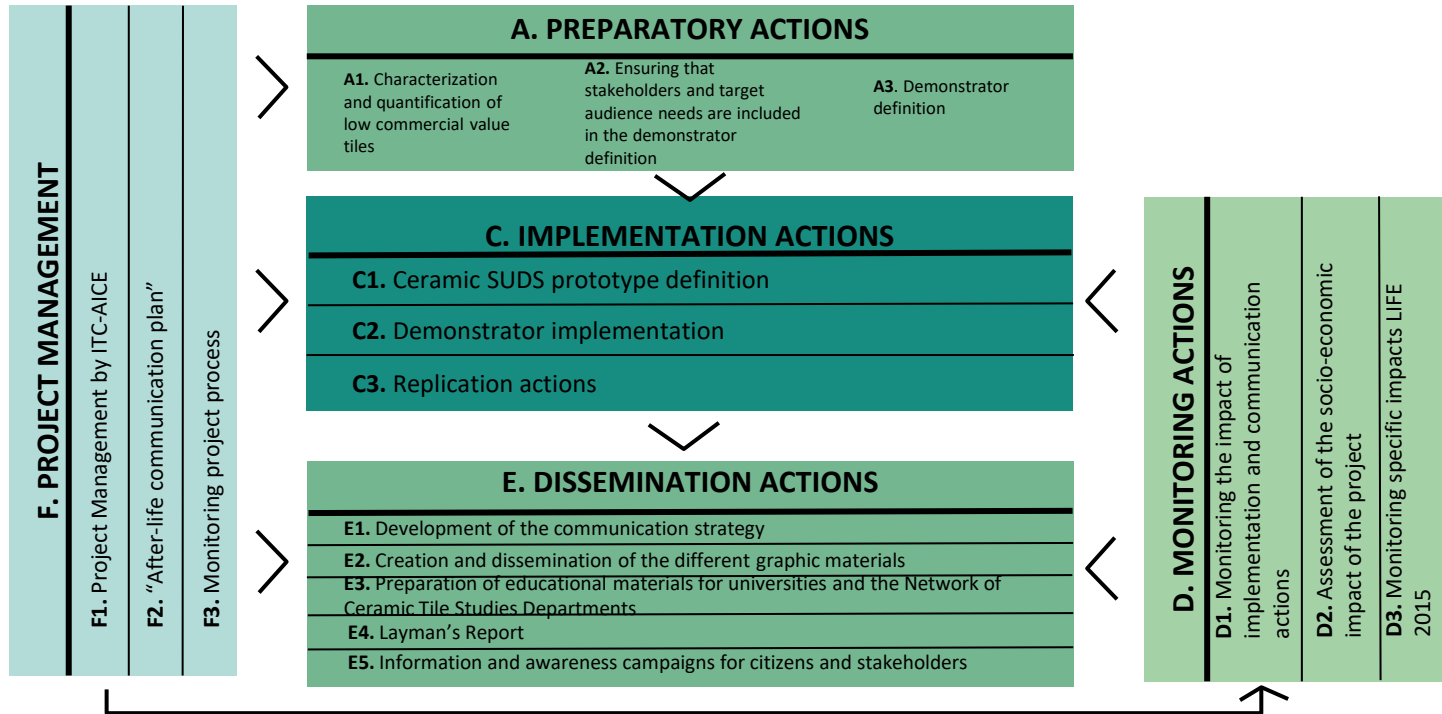
E. DISSEMINATION ACTIONS

F. PROJECT MANAGEMENT



8.5.1. CerSUDS, 2014-2020, Benicassim

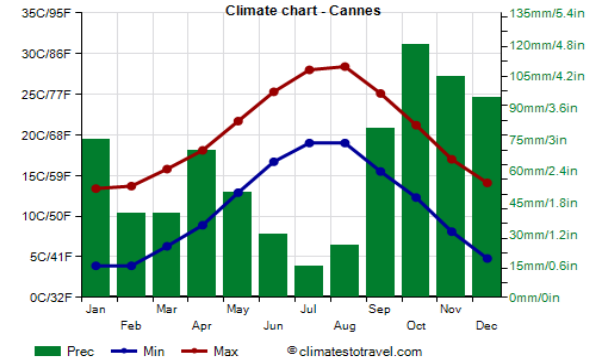
LIFE CERSUDS. PROJECT STRUCTURE



8.5.1. CerSUDS, 2014-2020, Benicassim

8.6. City of Cannes, France

- Metropolitan Population: 74,040 [2022]
- Metropolitan Area: 19.6 km²
- Climate: Mediterranean Temperate
- Average Yearly Precipitation: 829 mm
- Risks: Flash flooding, drought and sea level rise



- The PRIME project raises public awareness of the risks to the Mediterranean coastline and Cannes' surrounding countryside while protecting and restoring the Mediterranean's *Posidonia oceanica* meadows.
- Restoring seagrass meadows in specific areas goes some way to mitigating their decline and is an effective solution that could lead to reviving lost carbon stores and sinks and re-establishing other vital benefits that these seagrasses bring to the ecosystem.
- Each *Posidonia oceanica* restoration campaign requires a site-specific experimental study. As well as returning the ecosystem to its original state, restoration also strengthens the seagrasses and slows down their erosion.



<https://www.amisdufestival.com/en/post/project-7-naturdive-taking-action-to-save-posidonia-the-lungs-of-the-mediterranean>

8.6.1. PRIME: Restoring the Mediterranean Coastline, Cannes, FR

The restoration of such plant life, in appropriate areas, is an effective option that has the potential to re-establish reserves and lost carbon sinks, as well as other important ecosystem services provided by underwater plant habitats.

Actions:

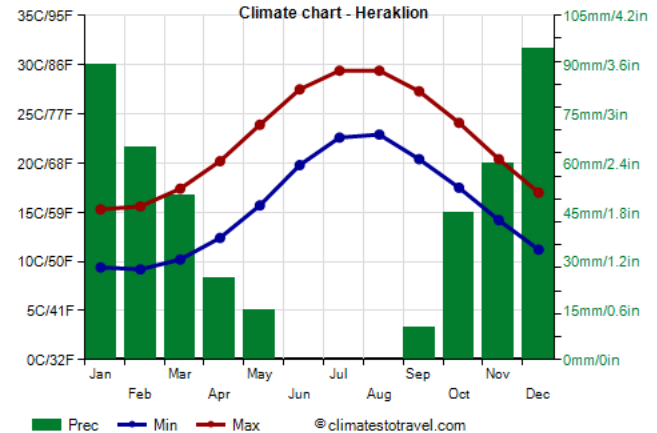
- Observing - to assess the ecological condition of the environment
- Understanding - contributing to scientific knowledge, educating citizens and future generations on the preservation of the environment
- Protecting and Restoring coastal marine ecosystems.



8.6.2. PRIME: Restoring the Mediterranean Coastline, Cannes, FR

8.7. City of Heraklion, Greece

- Metropolitan Area: 243.4 km²
- Metropolitan Population: 211,370 [2021]
- Metropolitan Area: 243.4 km²
- Climate: Mediterranean (hot-summer)
- Average Yearly Precipitation: 500.6 mm
- Risks: Diminishing rainfall, drought and flash flooding



2018 – 2024,

- Objective: To integrate climate governance into the management of green infrastructure at the local level, enhancing urban resilience to climate change.



<https://climate-adapt.eea.europa.eu/en/mission/solutions/mission-stories/urban-green-infrastructure-story-18>

Project LIFE GrIn, Heraklion, Greece

A 10-year management plan for Urban Green Areas was developed for the Municipalities of Marousi and Heraklion. According to this plan, the following actions were implemented:

- Creation of a new UGA (Urban Green Area)
- Upgrading of existing UGA (Urban Green Areas) in selected areas of the city
- Promotion and communication with city institutions and citizens.

Πριν / Before



6 μήνες μετά / 6 months later



https://lifegrin.gr/wp-content/uploads/2025/04/Laymans_Report.pdf

Project LIFE GrIn, Heraklion, Greece

Key Actions:

- Establishment of a national registry of urban green areas to systematically collect and organize information on green spaces.
- Development of strategic management plans for urban green areas, resulting in new model green spaces within Heraklion.
- Integration of green infrastructure into local climate adaptation strategies to mitigate urban heat island effects and improve biodiversity.



Project LIFE GrIn, Heraklion, Greece



Outcomes:

- The project led to improved ecological quality of urban green areas, reduced greenhouse gas emissions, and enhanced public awareness and participation in climate adaptation efforts
- The project's key achievement is the upcoming enactment of the policy as state law by the Ministry of Environment and Energy.

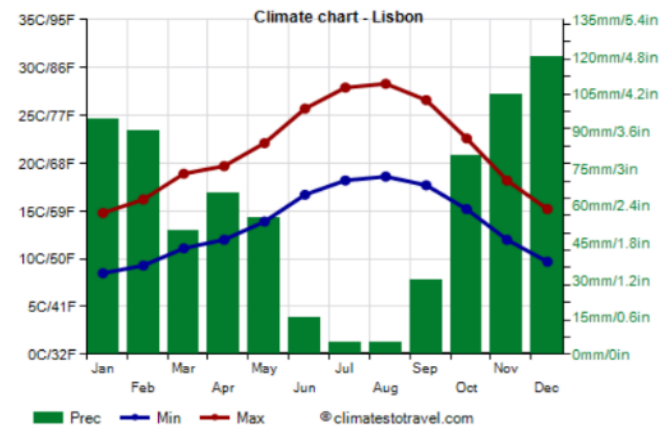


https://lifegrin.gr/wp-content/uploads/2025/04/Laymans_Report.pdf

Project LIFE GrIn, Heraklion, Greece

8.8. City of Lisbon, Portugal

- Metropolitan Population: 2,972,000 [2021]
- Size: 3,015 km²
- Climate: Temperate Mediterranean (subtropical)
- Average Yearly Precipitation: 774 mm
- Risks: Extreme heat, seasonal flooding, and droughts



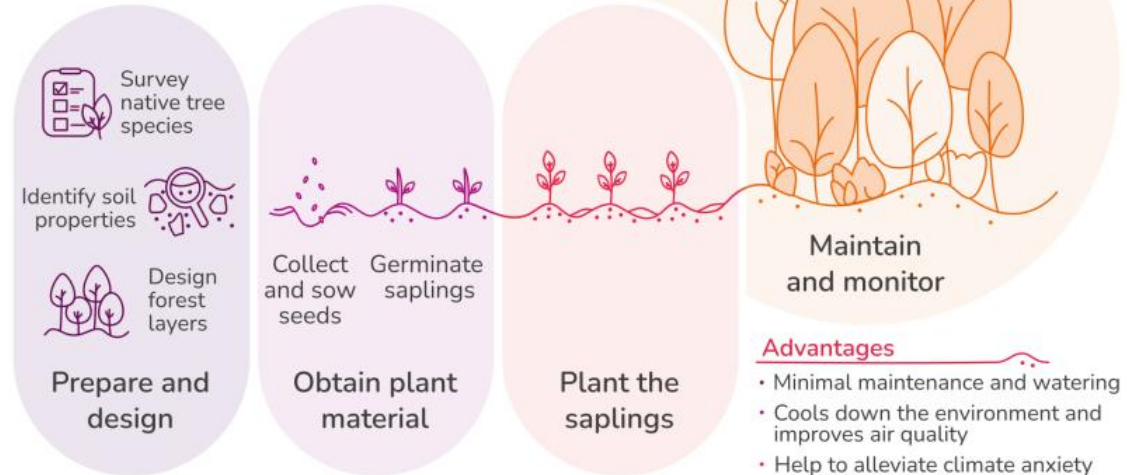
- **Re-natura Lisbon 2021-2022**
- Project area: 300 m² (then later expanded to a new development of 1500m²)
- Funded by corporate investments, Horizon 2020 programme, and EU funding



Miyawaki Method:

- Started at 300 m² pilot plot, then expanded to 1500 m²
- Biodiversity density: 3 species per m²

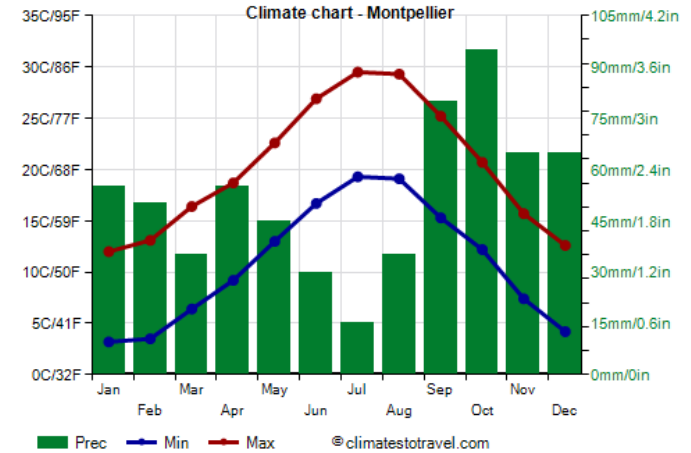
The Miyawaki Fast Forest



RENATURA, Lisbon, Portugal

8.9. City of Montpellier, France

- Population: : 307,101 [2022]
- Size: 56.88 km²
- Climate: Mediterranean (hot-summer)
- Average Yearly Precipitation: 739 mm
- Risks: Flash flooding and drought



2010 - 2018

Objective: Create a new city district embracing concepts of sustainability and innovation to build with nature, rather than against it



Parc Marianne Ecodistrict, Montpellier, France

- Built on a former floodplain, the ecodistrict was designed so that the natural terrain could be used as a **retention basin**.
- The retention basin also serves as a park, providing **co-benefits** such as habitats for wildlife and recreational space for citizens.



Parc Marianne Ecodistrict, Montpellier, France

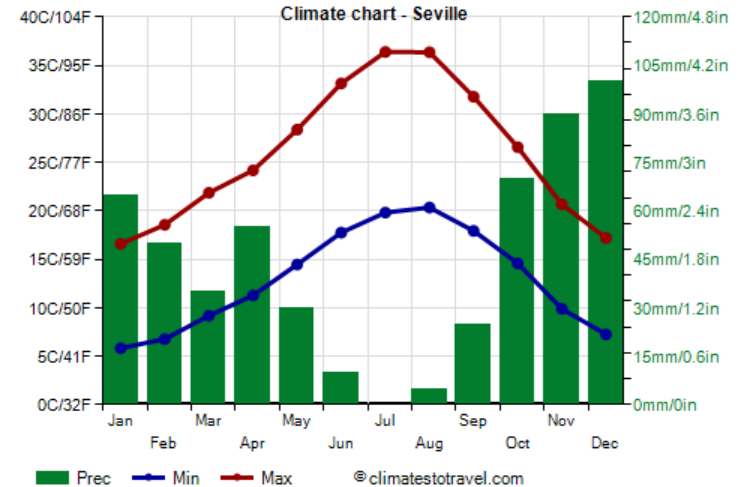
- The municipality, SERM and architects worked together to set design requirements
- The project was financed through developers buying parcels of the municipality-owned land through design competitions
- Due to parcels being priced uniformly, the value added was solely due to the investor's concept, allowing them to focus on sustainability concepts.



Parc Marianne Ecodistrict, Montpellier, France

City of Seville, Spain

- Metropolitan Population: 1,519,639 [2021]
- Size: 140 km² (municipality) / 4,962.06 km² metro
- Climate: Mediterranean (hot-summer)
- Average Yearly Precipitation: 550mm
- Risks: Extreme heat waves, heavy rainfall and floods



Case Study: Mediterranean Examples



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

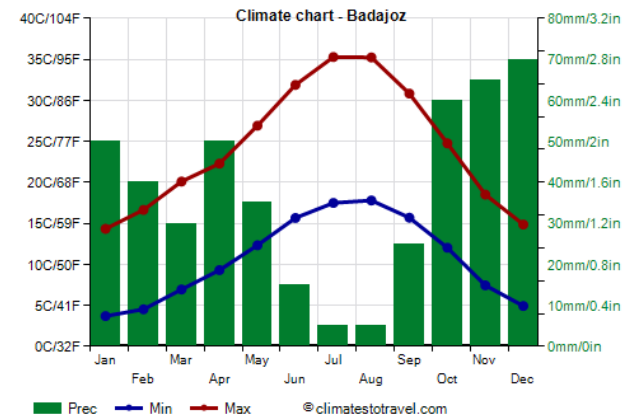
- 2018 - 2019
- Uses permeable pavements, rain gardens, and bioretention areas to filter and capture rainwater and/or runoff.
- The filtered water moves to storage cisterns and is then used for irrigation.



Greco Avenue, Seville, Spain

My building is green, Solana de los Barros, Badajoz, Spain, 2024

- **Population: 2,645**
- **Size: 65 km²**
- **Climate: Mediterranean Sub-humid**
- **Average Yearly Precipitation:**
- **Risks: Heat Waves, drought and water scarcity**
 - This project was developed in collaboration with various organizations, including CIMAC, Comunidade Intermunicipal do Alentejo Central
 - The Project was co-funded by the LIFE programme by the European Union.



Case Study: Mediterranean Examples



URWAN

Interreg
Euro-MEDCo-funded by
the European Union

- Objective: To increase the resilience of educational buildings as they face intense heat periods and water scarcity.
- This project aims to enhance the comfort of the students and faculty that occupy the space.
- Four types of Nature Based Solutions have been implemented for this project (in this order):
 - Green roofs
 - Green facades
 - Ventilation
 - The development of outdoor areas



My building is green, Solana de los Barros, Badajoz, Spain, 2024

- There are 3 green roofs containing a variety of at least 25 native plants, along with different types of green roof systems.
- 2 of the 3 roofs reuse excess water for irrigation.
- Extensive green roof:
 - Green roof with inner air chamber between the roof and vegetation substrate
 - Green roof with a more sustainable substrate allowing for better rainwater filtration



my BUILDINGisGREEN LIFE, Solana de los Barros

- Green Facades use metal structures that are perpendicular to the facade of the building to provide the building with shade.
- Climbing plants are used on these planters to aid in the protection from the sun.
- Ventilation was introduced to the school, opening during the night and morning hours and closing during the day.



my **BUILDINGisGREEN LIFE**, Solana de los Barros

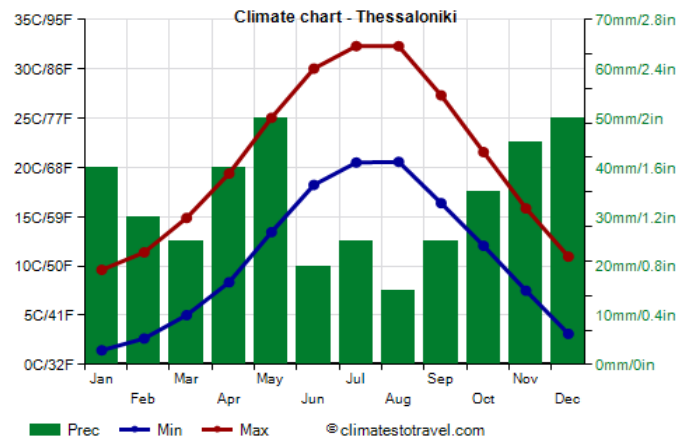
- Trees were planted around the playgrounds and outdoor areas of the school.
- Other measures were implemented:
 - porous pavements
 - shaded structures made from wood
 - metal planters with climbing vegetation



my BUILDINGisGREEN LIFE, Solana de los Barros

City of Thessaloniki, Greece

- Population: 1,006,112 [2021]
- Size: 1,285.61 km² (Metropolitan area)
- Climate: Mediterranean (Humid Subtropical)
- Average Yearly Precipitation: 687 mm
- Risks: Air pollution, drought, floods, heavy rainfalls, heatwaves and storms



2015

The October the 28th Street is a project striving to achieve sustainable rainwater management.

Bioretention systems were implemented with planted trees and plants in aims at reducing flooding meanwhile giving life back to a neglected street.

This project was funded by EU funds and public national budgeting.



October the 28th Street, Thessaloniki, Greece

Rain Water

Rainwater is collected from streets, roof gutters, and pavements.

Flower Beds

Functioning as rain gardens, containing a special soil mixture to purify the water.

Small Ditch

Sewer System

Clean, pollutant free water redirected to the city's central sewer system.



October the 28th Street, Thessaloniki, Greece

Annex 2. Practical Exercises and Workshops



Annex 2. Practical Exercises and Workshops



11.1. Step-by-Step NbS Implementation Sprint



11.2. Detecting Policy Gaps



11.3. Harmonization Ladder (Local ↔ Regional ↔ EU)



11.4. PPP Canvas for an NbS (Finance workshop)

Annex 2.1. 6-Step NbS Implementation Sprint (Group work)

- **Title: 6-Step NbS Implementation Sprint (20-25 min)**
- Objective: Turn the 6 clear steps into a practical mini-roadmap for one local NbS.
- Materials: Post-its, pens, A3 template (9 boxes) or shared board (Miro/Jamboard).
- Time: 25 minutes (15' work + 10' share-outs).
- Steps:
 - Pick a local NbS idea (e.g., rain garden at a school).
 - Map the 9 steps—one Post-it per step: key action, owner, risk.
 - Mark “week 1–4” actions with a ★.
 - Add 2 indicators you will monitor.
- Output: 1 photo/board with your 9-step mini-roadmap + 2 indicators.



Annex 2.2. Policy Gap Radar

- **Title: Policy Gap Radar (30 min)**
- On the slide (participant view)
- Objective: Spot the policy/regulatory gaps that block your NbS.
- Materials: A3 “radar” (or 2×2 matrix), stickers/markers, or online poll.
- Time: 30 minutes (20’ work + 10’ plenary).
- Steps:
 - Score your city (1–5) on: Planning/Zoning, Public Procurement, Permitting/Standards, Internal Governance, Financing, Monitoring.
 - Circle the two lowest.
 - For each: write one quick fix (<6 months) and one structural reform (≥1 year).
- Output: 1 radar or matrix + top-3 gaps with quick fix vs. structural reform.



Annex 2.3. Harmonization Ladder (Local↔Regional↔EU)

● **Title: Harmonization Ladder (Local↔Regional↔EU) (25–30 min)**

- Objective: Align a local NbS rule or plan with higher-level policies.
- Materials: A3 “ladder” (Local → Regional/National → EU), Post-its, pens.
- Time: 30 minutes (15’ work + 15’ report-out).
- Steps:
 - Choose one local lever (bylaw, design guide, maintenance SOP).
 - On each rung, note the relevant policy (e.g., river basin plan; EU Water/Green Deal links).
 - Add 1 alignment action per rung (who, what, when).
 - Add one conflict or overlap and how you’ll resolve it.
- Output: 1 Harmonization Ladder with 3 concrete alignment actions.



Annex 2.4. PPP Canvas for an NbS (Finance workshop)

- **Title: PPP Canvas for an NbS (Finance workshop) (20–25 min)**
- Objective: Sketch a Public-Private Partnership to design, implement & manage one NbS.
- Materials: A3 PPP Canvas (7 blocks), Post-its; or shared board.
- Time: 35 minutes (20' build + 15' pitches).
- Canvas blocks:
 1. Problem & NbS (what/where)
 2. Public value & KPIs (flood reduction, biodiversity, social use)
 3. Assets & Roles (city, utility, developer, NGO)
 4. CapEx / OpEx & Tenor (who pays what, when)
 5. Risk/Return & Guarantees (construction, performance, revenue)
 6. Procurement route (e.g., output/performance-based)
 7. Social contract (engagement, transparency, stewardship)
- Output: 1 PPP canvas + 90-second pitch.





TK2

Thank you for your attention

