Designing nature-based solutions for multifunctionality

Stuart Connop

Image of Derbyshire St Pocket Park, UK © Stuart Connop

University of East London

Pioneering Futures Since 1898

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 730222

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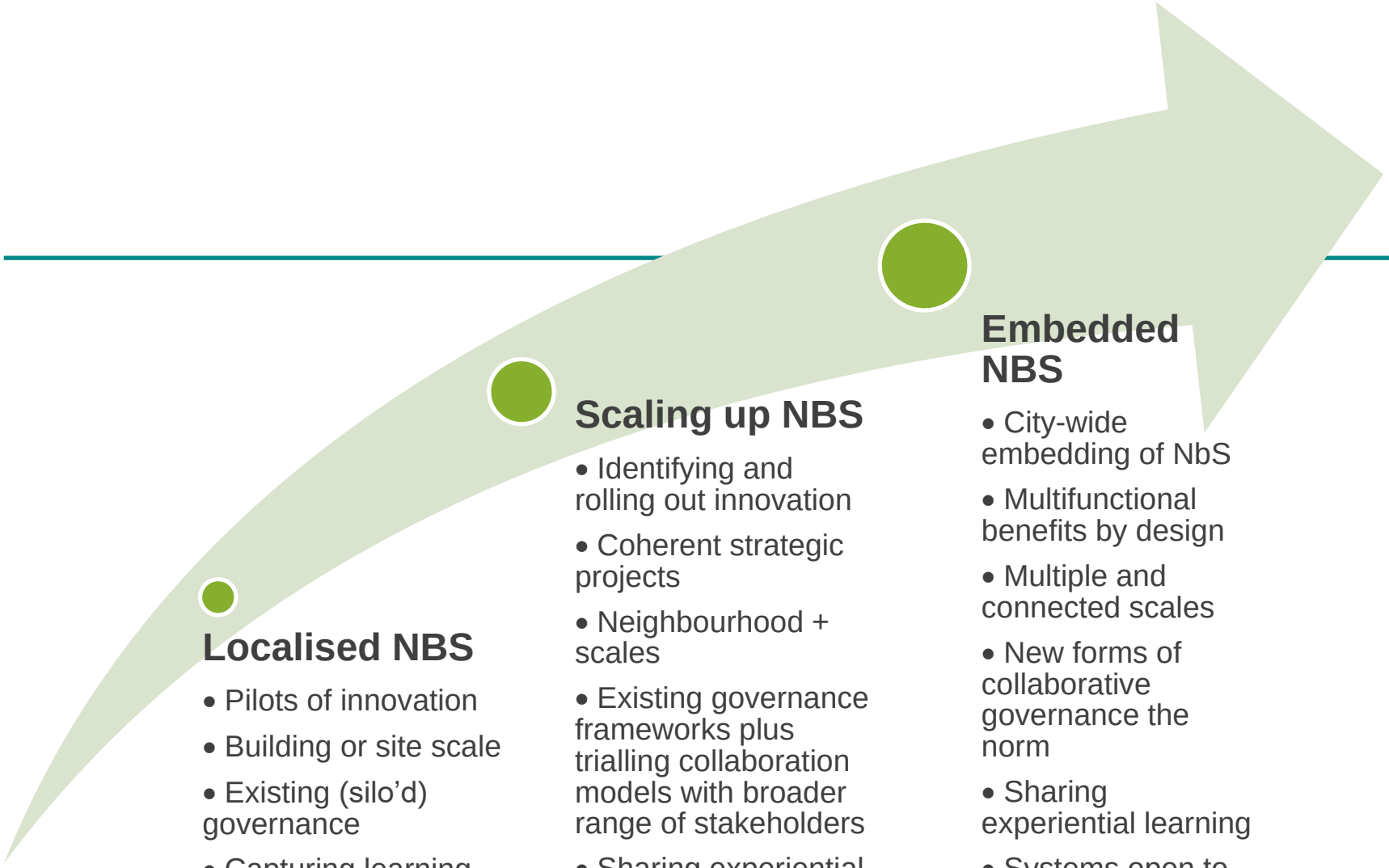
Scaling-up and financing within front-runner cities

Bringing cities to life, **Bringing life into cities.**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 730222



Localised NBS

- Pilots of innovation
- Building or site scale
- Existing (silo'd) governance
- Capturing learning

Scaling up NBS

- Identifying and rolling out innovation
- Coherent strategic projects
- Neighbourhood + scales
- Existing governance frameworks plus trialling collaboration models with broader range of stakeholders
- Sharing experiential learning

Embedded NBS

- City-wide embedding of NbS
- Multifunctional benefits by design
- Multiple and connected scales
- New forms of collaborative governance the norm
- Sharing experiential learning
- Systems open to innovation

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Figure of NBS scaling pathway developed in the EU H2020 project Connecting Nature

Connecting Nature Framework

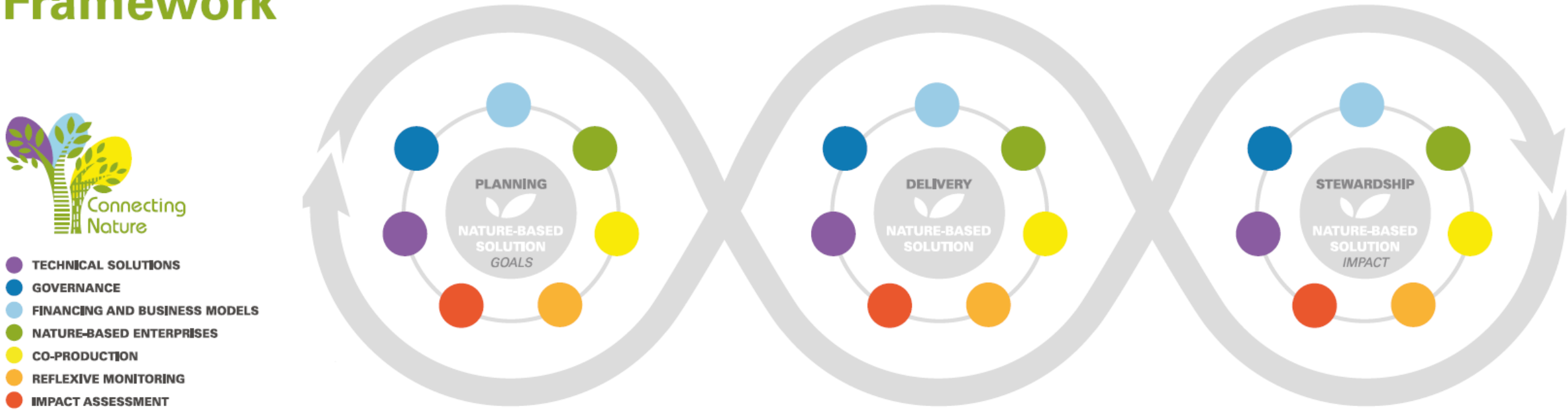

Figure of NBS Framework developed in the EU H2020 project Connecting Nature

What is a nature-based solution?

What can be achieved through a nature-based solutions approach?

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What are nature-based solutions?

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Nature-based solutions and multifunctionality

- **Inspired and supported by nature**
- Cost-effective
- **Ecological, social and economic benefits**
- Build resilience
- Bring more diverse, nature and natural features and processes into cities, landscapes and seascapes.

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Based on the European Commission nature-based solution definition

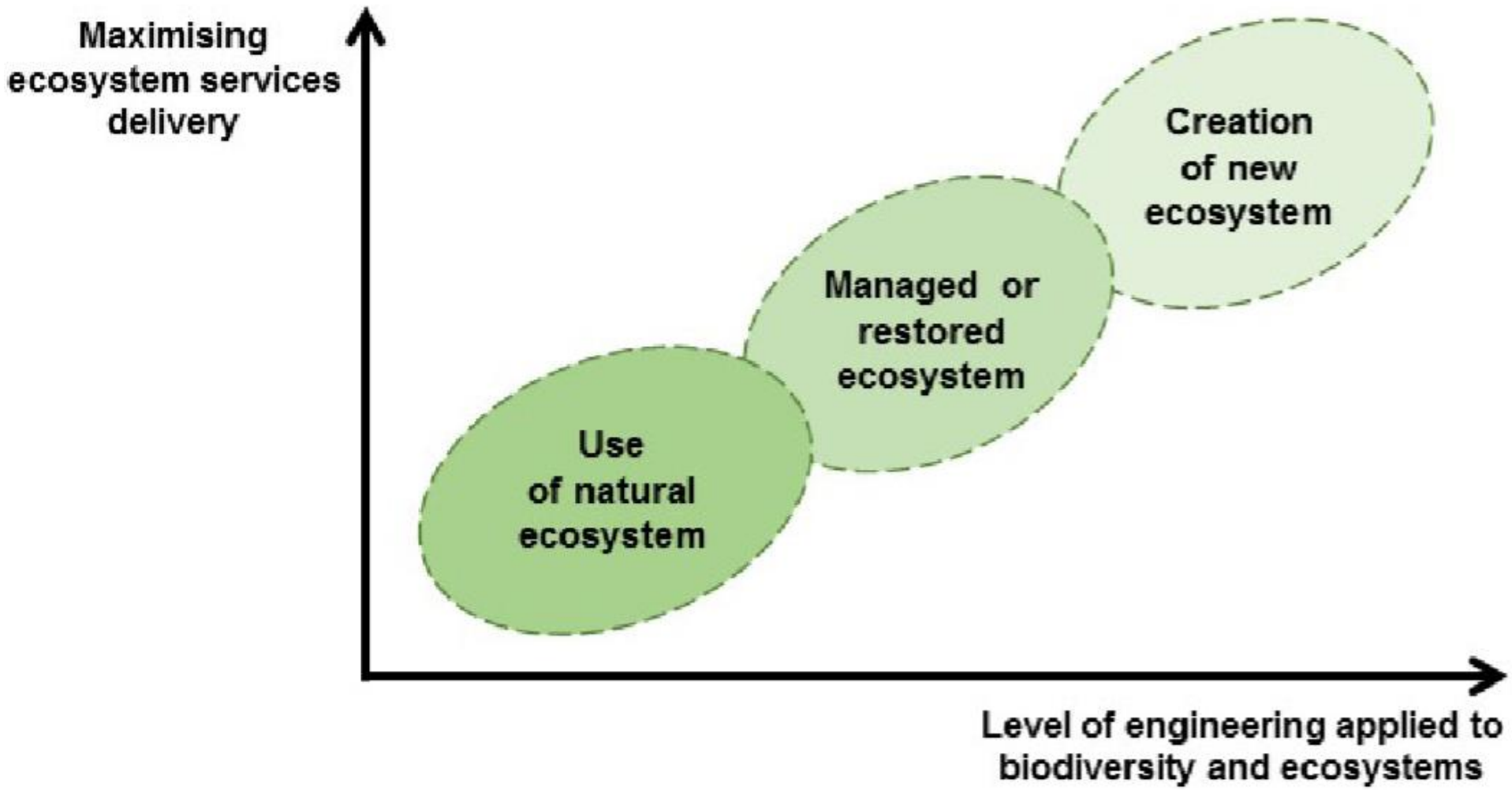

Figure ©IUCN: Adapted by IUCN from Eggemont et al. 2015

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Image of nature-based solutions in the UK and Belgium © Stuart Connop and the Connecting Nature project

Image of Buzzards Mouth Creek, UK © Stuart Connop

Environmental

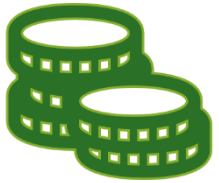
Some habitat value

Social

Amenity space

Economic

Reduced flood risk



Nature-based **Solution**…

"The answer to a problem"

Cambridge English Dictionary

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Nature-based **Solution**…

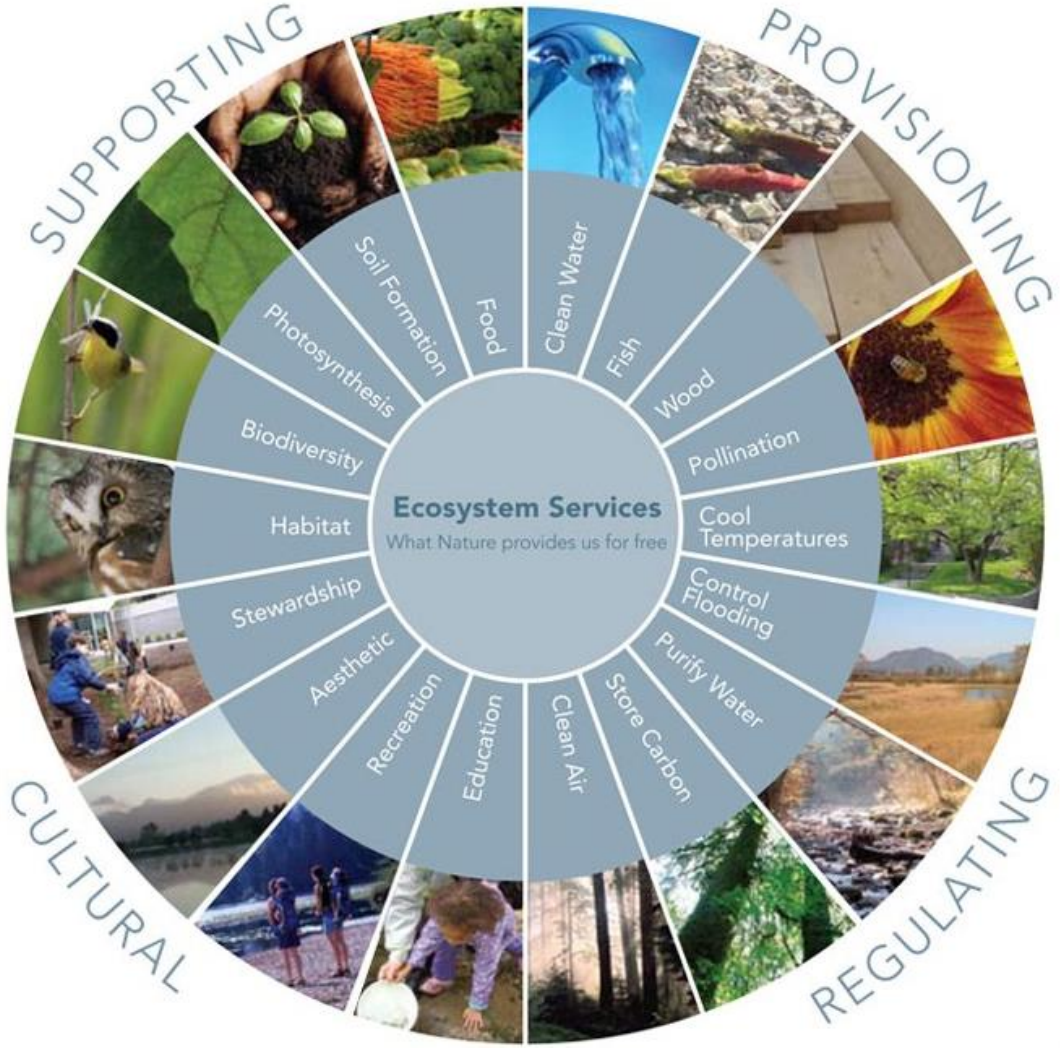

Figure ©IUCN

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Adaptive management

Figure of NBS adaptive management developed in the EU H2020 project Connecting Nature

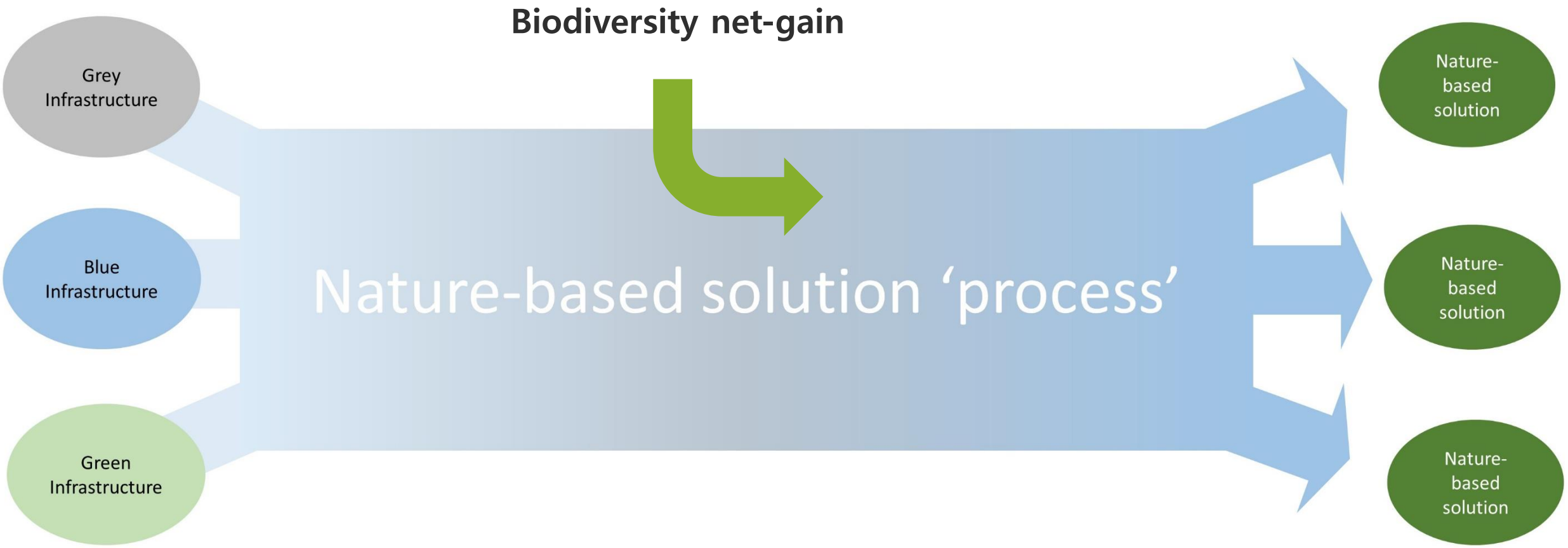

Figure of NBS adaptive management developed in the EU H2020 project Connecting Nature

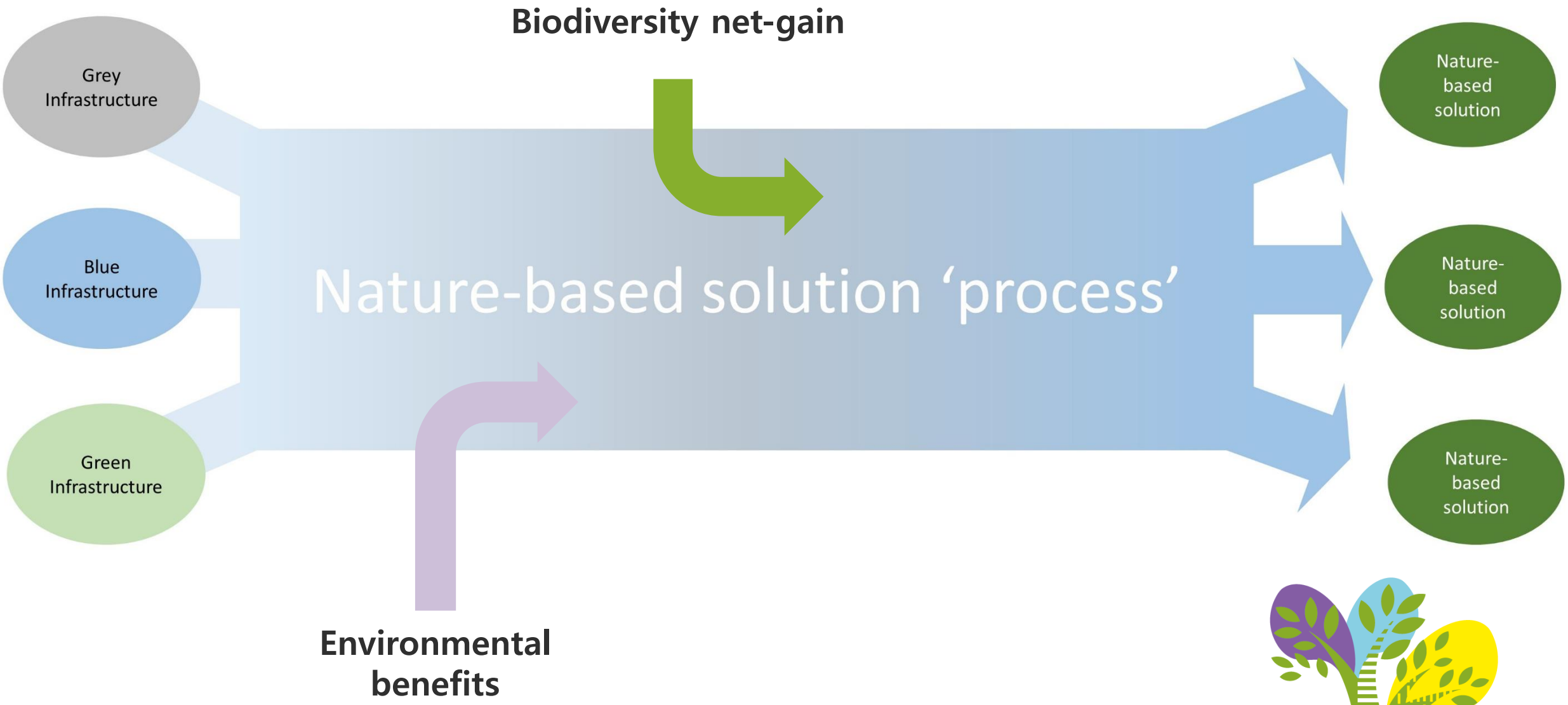

Figure of NBS adaptive management developed in the EU H2020 project Connecting Nature

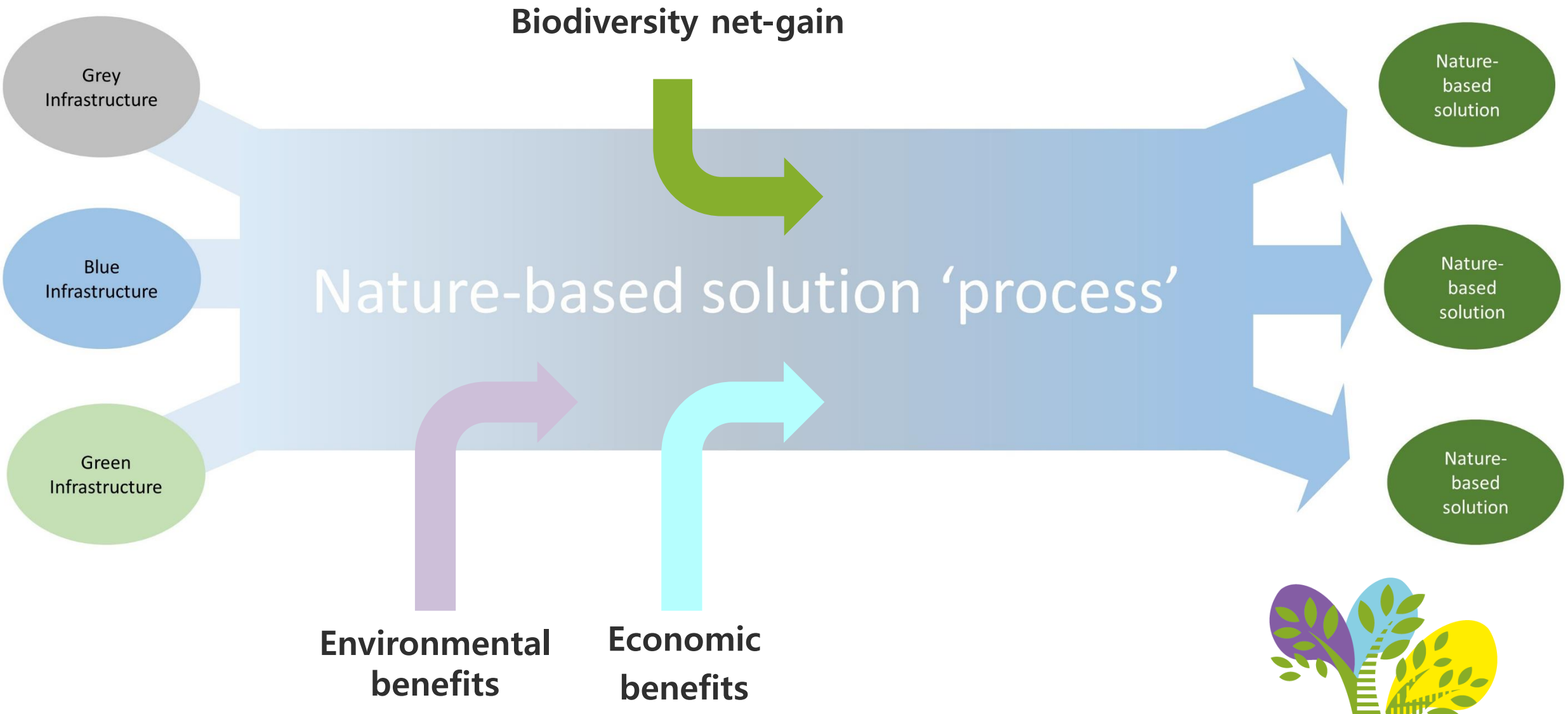

Figure of NBS adaptive management developed in the EU H2020 project Connecting Nature

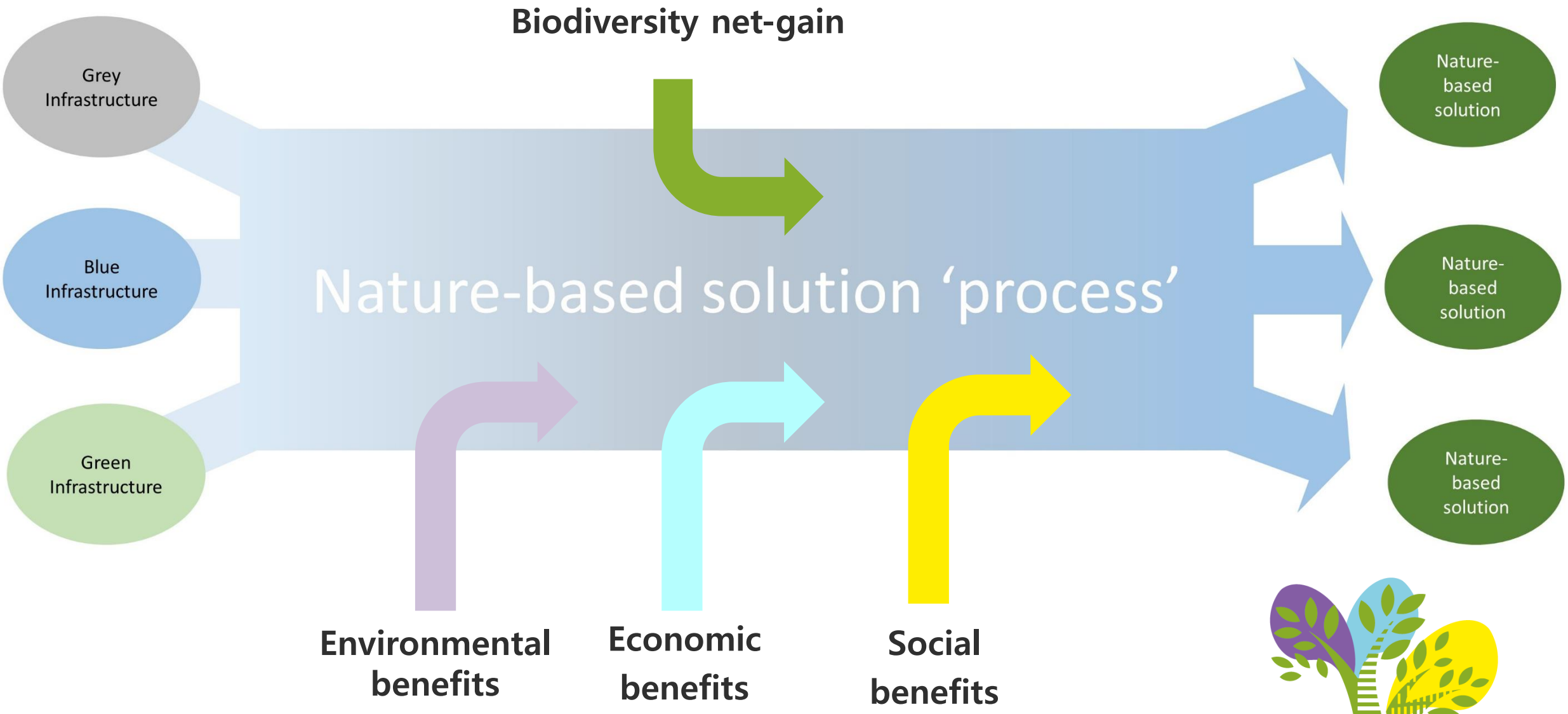

Figure of NBS adaptive management developed in the EU H2020 project Connecting Nature

NBS benefits

- Climate Resilience
- Water Management
- Natural & Climate Hazards
- Greenspace management
- Biodiversity enhancement
- Air Quality
- Knowledge and Social Capacity Building
- Place regeneration
- Participatory Planning and Governance
- Social Justice and Social Cohesion
- Health & Wellbeing
- New Economic Opportunities and Green Jobs

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Climate resilience

Climate Resilience
Total carbon removed or stored
Avoided greenhouse gas emissions from reduced building energy consumption
Estimated carbon emissions from reduced vehicle traffic
Changes in mean/max daily temperature
Air temperature reduction
Reduction of heatwave incidence
Urban Heat Island reduction
Increased evapotranspiration
Increased shading
Land surface temperature
Change in surface albedo
Soil temperature
Wetland restoration

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Water Management

Water Management
Surface water runoff reduction
Surface water availability
Groundwater depth & availability
Plant available water
Drinking water provision
Water quality improvement (N, P, Metal, Faecal colliform, etc)
Total Organic Carbon content of NBS effluents
Water infiltration
Delay and reduction in peak flow
Flood peak height
Volume of water removed/slowed from entering stormwater system
Morphological Quality Index
Ecological status of water

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

Connecting Nature

Natural & Climate Hazards

Natural & Climate Hazards
Disaster resilience
Annual direct and indirect losses (€)
Risk to critical urban infrastructure
Number of people adversely affected by natural disasters each year (number)
Natural areas and special protection areas exposed to risks
Insurance against catastrophic events
Flood vulnerability
Sea level including wave set-up
Coastal erosion (change in coastline expressed as m of retreat)
Landslide risk
Heatwave incidence
Effective drought index
Avalanche risk

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Greenspace management

Greenspace Management
Accessibility of green spaces for population
Total green, blue and green/blue space within a defined area
Ecosystem service provision
Land use change and green space configuration
Effective green infrastructure at the urban-rural interface
Total vegetation cover in area affected by NBS
Diversity of green space: Shannon Diversity Index of Habitats
Soil sealing
Soil carbon
Soil management and quality
Ambient pollen concentration
Urban food garden area per capita
New pedestrian, cycling and horse paths

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Biodiversity Enhancement

Biodiversity Enhancement
Area of habitats restored
Number of non-native species
Species diversity within defined area
Quantity of dead wood per unit area
Extent of habitat for native pollinator species
Proportion of natural areas within a defined urban zone
Number of conservation priority species
Number of native/local provenance species
Number of native bird species within a defined urban area
Habitat functional composition
Structural connectivity of blue/green infrastructure
Functional connectivity of blue-green infrastructure
Ecological integrity

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Air Quality

Air Quality
Number of days during which ambient air pollution concentrations exceeded threshold values during the preceding 12 months
Proportion of population exposed to ambient air pollution
European Air Quality Index exceedence
PM10 and PM2.5 removed by NBS vegetation
Total leaf area
Air pollution deposition
Air pollution absorption
Total O_3, SO_2, NO_2, CO removed by NBS vegetation
Ambient pollen concentration
Years of life lost (YLL), modelled impacts of poor air quality
Morbidity due to poor air quality
Air pollution emissions avoided

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Knowledge and Social Capacity Building

Knowledge and Social Capacity Building
Research and educational opportunities created
Number of people involved in environmental education activities
Pro-environmental identity
Environmental literacy
Pro-environmental behavior change

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Place Regeneration

Place regeneration
Derelict land reclaimed for NBS
Perceived safety
Reclamation of contaminated land
Area devoted to roads for vehicles
Preservation of cultural heritage during urban planning
Areal sprawl
Access to public amenities
Heritage accessibility
Incorporation of enviornmental design in buildings
Opportunities for tourism
Landscape perception: Viewshed
Socio-cultural inclusiveness
Population dynamics: population growth/proportion of elderly residents

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

Connecting Nature

Participatory Planning and Governance

Participatory Planning and Governance
Proportion of citizens involved in participatory processes per year
Empowerment: control and influence over decision-making
Adoption of new forms of participatory governance
Number of policies instituted to promote NBS
Trust in decision-making procedures and decision makers
Participation of vulnerable or traditionally under-represented groups
Consciousness of citizenship
Development of a climate resilience strategy
Adaptation of local plans and regulations to include NBS
Stakeholder involvement in co-creation/co-design of NBS
Citizen involvement in co-creation/co-design of NBS
Community involvement in implementation

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Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

Social Justice and Social Cohesion

Social Justice and Social Cohesion
Safety: Reduction in number of violent incidents, nuisances and crimes
Availability and equitable distribution of blue-green space
Area easily accessible to persons with physical disabilities
Rate of increase in property incomes
Proportion (%) of people who volunteer, either formally or informally
Change in skills/earnings potential for vulnerable groups
Social capital: quality of interactions within and between social groups
Different social group inclusion in co-creation/co-governance of NBS
Degree of trust, solidarity, tolerance and respect in a community
Participation of vulnerable or traditionally under-represented groups
Change in social interaction
Change in social support
Ownership of space and sense of belonging to the community

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Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

Health & Wellbeing

Health & Wellbeing
Increased outdoor physical activity
Change in level of chronic stress
General health
Mental health and wellbeing
Morbidity/mortality due to cardiovascular disease
Quality of Life (Index)
Incidence of obesity among adults/children
Heat related discomfort
Exposure to noise pollution
Visual access to greenspace
Morbidity/mortality related to respiratory diseases
Morbidity/mortality related to autoimmune diseases
Perceived chronic loneliness

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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New Economic Opportunities and Green Jobs

New Economic Opportunities and Green Jobs
Mean land and/or property price in proximity to greenspace
Number of jobs created
Retail activity in proximity to greenspace
New businesses created and gross value added (GVA) to local economy
Value of rates paid by businesses
New customers to existing and new businesses
Gross value added change in local economy
Social return on investment
Natural capital
Green procurement
Increase in tourism
Rural Productivity Index
Affordable and clean energy

Based on the work of the H2020 NBS project European Task Force: ***Draft version - under development at time of presentation***

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Image by Krisztina Papp from Pixabay

Benefits, co-benefits and trade-offs

- **Benefits** – intended biodiversity and ecosystem services designed into a nature-based solution (targeted benefits)
- **Co-benefits** - unintended/non-designed for benefits
- **Trade-offs** – the balance between ecosystem services

Definition developed through consensus in the EU H2020 project Connecting Nature

Benefits, co-benefits and trade-offs

- **Benefits** – intended biodiversity and ecosystem services designed into a nature-based solution (targeted benefits)
- **Co-benefits** - unintended/non-designed for benefits
- **Trade-offs** – the balance between ecosystem services
- **Disservices –** the negative impacts of implementing nature-based solutions

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Definition developed through consensus in the EU H2020 project Connecting Nature

NBS = global solutions

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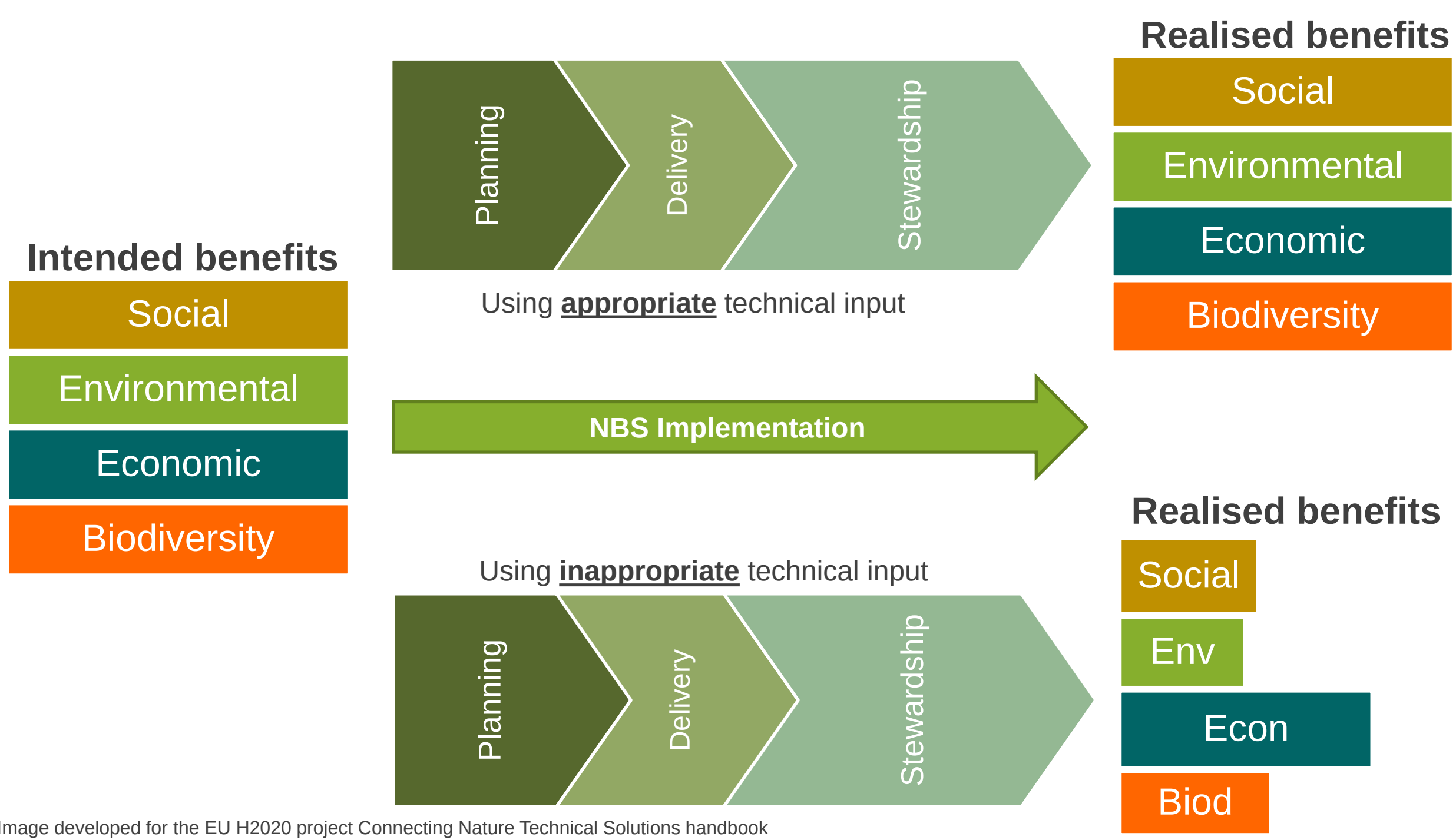
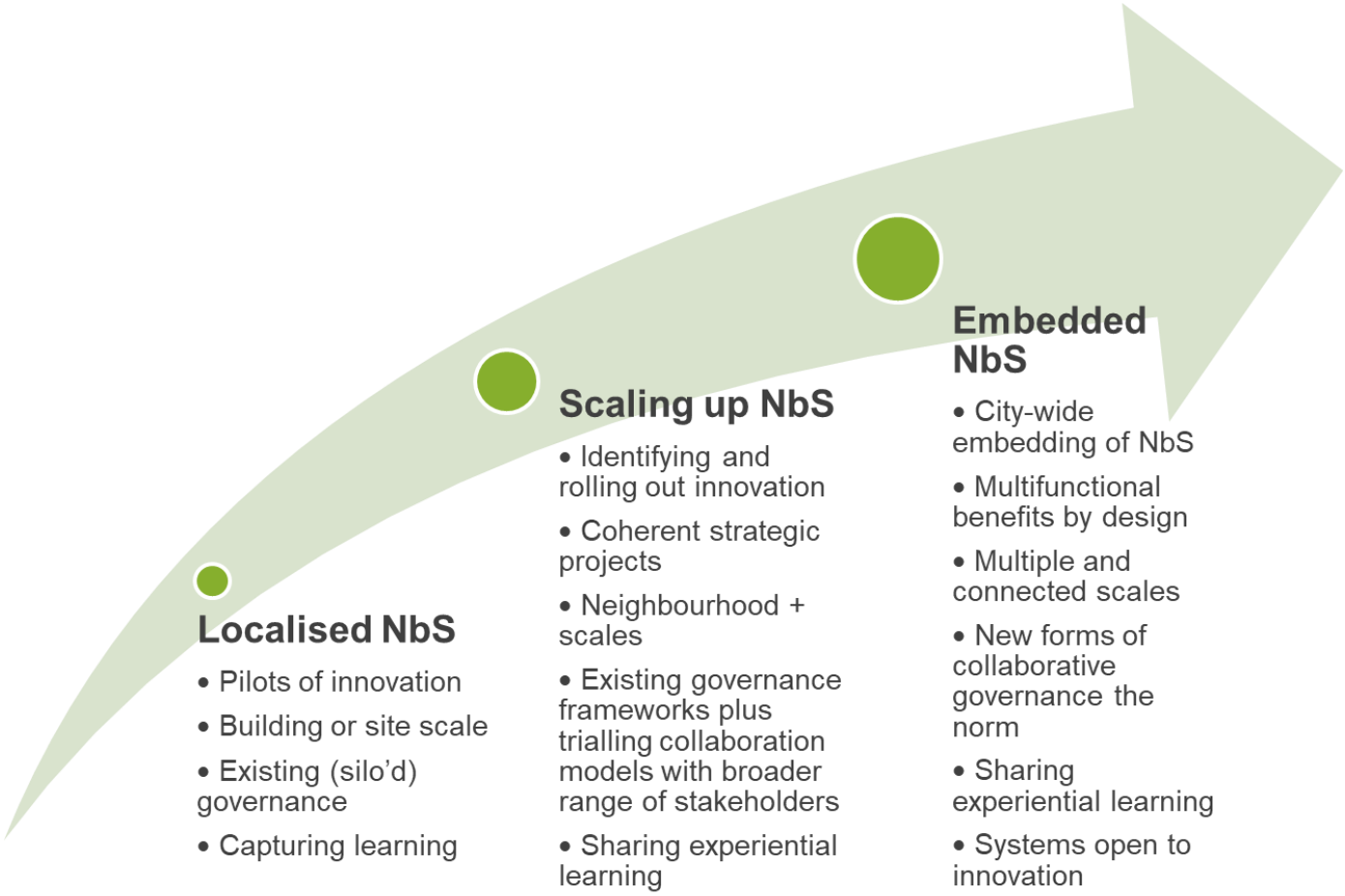


Image developed for the EU H2020 project Connecting Nature Technical Solutions handbook

Scaling nature-based solutions up & out



Upscaling – increasing the size or improving the quality of nature-based solutions

Outscaling – the widespread rollout of a nature-based solution pilot.

Figure of NBS scaling pathway developed in the EU H2020 project Connecting Nature

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NBS – Achieving multifunctionality

Three steps:

1. Define the landscape context
2. Define ‘needs of place’ context
3. Integration of ‘Landscape’ and ‘Place’

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1) Define the landscape context

- Reading the landscape
- What is the underlying landscape context?
- Focus on different scales: local, city, landscape
- What restrictions does this put on the design?
- How can the design link with this context?

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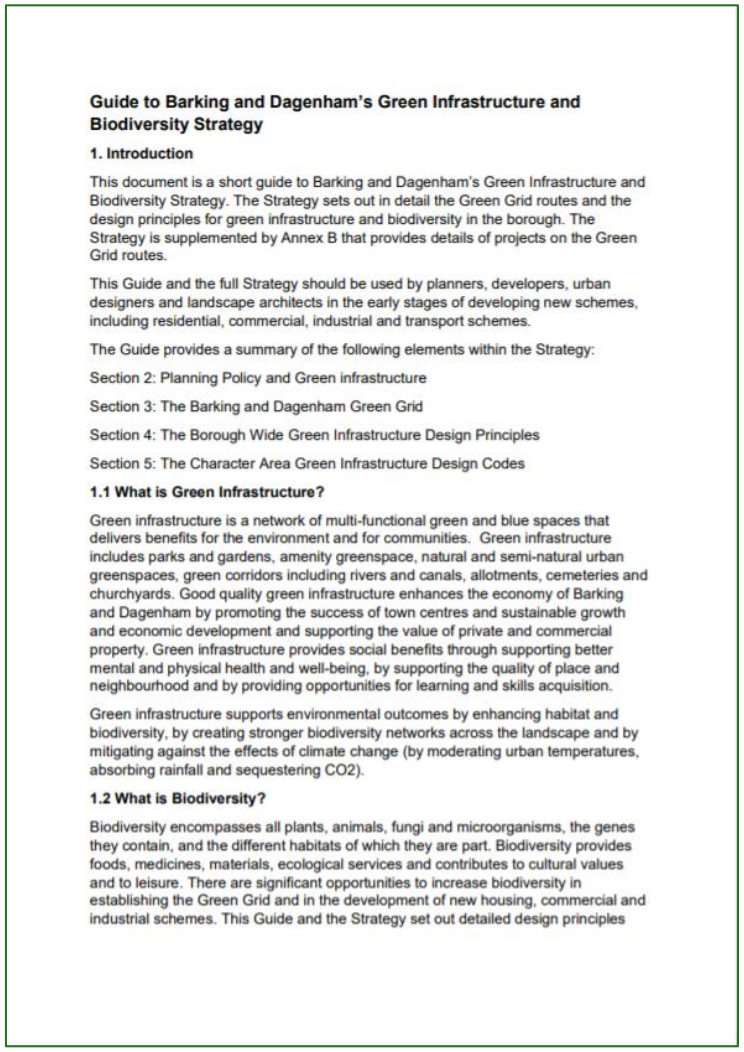
1) Define the landscape context

- Biodiversity Action Plans
- Green Infrastructure Strategies
- Planting recommendations



Guide to Barking and Dagenham's Green Infrastructure and Biodiversity Strategy

1. Introduction

This document is a short guide to Barking and Dagenham's Green Infrastructure and Biodiversity Strategy. The Strategy sets out in detail the Green Grid routes and the design principles for green infrastructure and biodiversity in the borough. The Strategy is supplemented by Annex B that provides details of projects on the Green Grid routes.

This Guide and the full Strategy should be used by planners, developers, urban designers and landscape architects in the early stages of developing new schemes, including residential, commercial, industrial and transport schemes.

The Guide provides a summary of the following elements within the Strategy:

Section 2: Planning Policy and Green infrastructure

Section 3: The Barking and Dagenham Green Grid

Section 4: The Borough Wide Green Infrastructure Design Principles

Section 5: The Character Area Green Infrastructure Design Codes

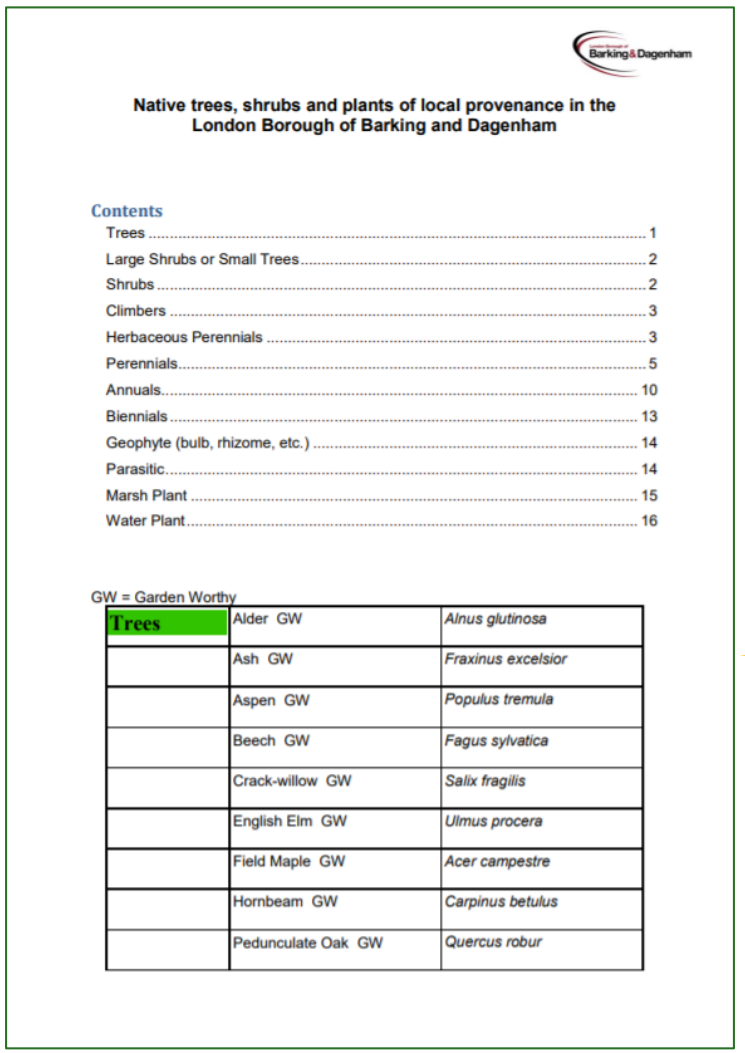
1.1 What is Green Infrastructure?

Green infrastructure is a network of multi-functional green and blue spaces that delivers benefits for the environment and for communities. Green infrastructure includes parks and gardens, amenity greenspace, natural and semi-natural urban greenspaces, green corridors including rivers and canals, allotments, cemeteries and churchyards. Good quality green infrastructure enhances the economy of Barking and Dagenham by promoting the success of town centres and sustainable growth and economic development and supporting the value of private and commercial property. Green infrastructure provides social benefits through supporting better mental and physical health and well-being, by supporting the quality of place and neighbourhood and by providing opportunities for learning and skills acquisition.

Green infrastructure supports environmental outcomes by enhancing habitat and biodiversity, by creating stronger biodiversity networks across the landscape and by mitigating against the effects of climate change (by moderating urban temperatures, absorbing rainfall and sequestering CO2).

1.2 What is Biodiversity?

Biodiversity encompasses all plants, animals, fungi and microorganisms, the genes they contain, and the different habitats of which they are part. Biodiversity provides foods, medicines, materials, ecological services and contributes to cultural values and to leisure. There are significant opportunities to increase biodiversity in establishing the Green Grid and in the development of new housing, commercial and industrial schemes. This Guide and the Strategy set out detailed design principles



Native trees, shrubs and plants of local provenance in the London Borough of Barking and Dagenham

Contents

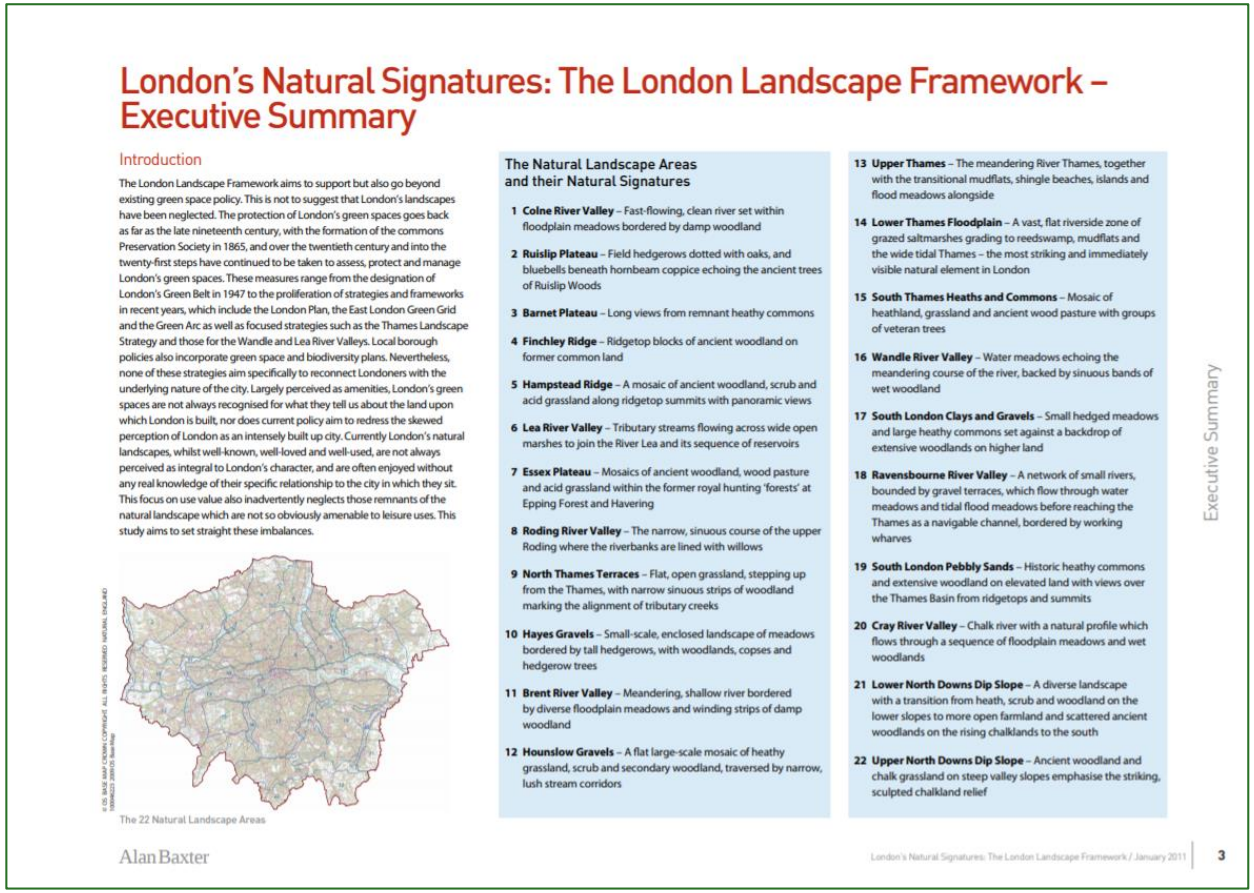
GW = Garden Worthy

Trees	Alder GW	*Alnus glutinosa*
	Ash GW	*Fraxinus excelsior*
	Aspen GW	*Populus tremula*
	Beech GW	*Fagus sylvatica*
	Crack-willow GW	*Salix fragilis*
	English Elm GW	*Ulmus procera*
	Field Maple GW	*Acer campestre*
	Hornbeam GW	*Carpinus betulus*
	Pedunculate Oak GW	*Quercus robur*

Figures: Barking and Dagenham Planning documents, UK

1) Define the landscape context

- Natural Signatures



London's Natural Signatures: The London Landscape Framework – Executive Summary

Introduction

The London Landscape Framework aims to support but also go beyond existing green space policy. This is not to suggest that London's landscapes have been neglected. The protection of London's green spaces goes back as far as the late nineteenth century, with the formation of the commons Preservation Society in 1865, and over the twentieth century and into the twenty-first steps have continued to be taken to assess, protect and manage London's green spaces. These measures range from the designation of London's Green Belt in 1947 to the proliferation of strategies and frameworks in recent years, which include the London Plan, the East London Green Grid and the Green Arc as well as focused strategies such as the Thames Landscape Strategy and those for the Wandle and Lea River Valleys. Local borough policies also incorporate green space and biodiversity plans. Nevertheless, none of these strategies aim specifically to reconnect Londoners with the underlying nature of the city. Largely perceived as amenities, London's green spaces are not always recognised for what they tell us about the land upon which London is built, nor does current policy aim to redress the skewed perception of London as an intensely built up city. Currently London's natural landscapes, whilst well-known, well-loved and well-used, are not always perceived as integral to London's character, and are often enjoyed without any real knowledge of their specific relationship to the city in which they sit. This focus on use value also inadvertently neglects those remnants of the natural landscape which are not so obviously amenable to leisure uses. This study aims to set straight these imbalances.

The 22 Natural Landscape Areas

The Natural Landscape Areas and their Natural Signatures

1 **Colne River Valley** – Fast-flowing, clean river set within floodplain meadows bordered by damp woodland

2 **Ruislip Plateau** – Field hedgerows dotted with oaks, and bluebells beneath hornbeam coppice echoing the ancient trees of Ruislip Woods

3 **Barnet Plateau** – Long views from remnant heathy commons

4 **Finchley Ridge** – Ridgetop blocks of ancient woodland on former common land

5 **Hampstead Ridge** – A mosaic of ancient woodland, scrub and acid grassland along ridgetop summits with panoramic views

6 **Lea River Valley** – Tributary streams flowing across wide open marshes to join the River Lea and its sequence of reservoirs

7 **Essex Plateau** – Mosaics of ancient woodland, wood pasture and acid grassland within the former royal hunting 'forests' at Epping Forest and Havering

8 **Roding River Valley** – The narrow, sinuous course of the upper Roding where the riverbanks are lined with willows

9 **North Thames Terraces** – Flat, open grassland, stepping up from the Thames, with narrow sinuous strips of woodland marking the alignment of tributary creeks

10 **Hayes Gravels** – Small-scale, enclosed landscape of meadows bordered by tall hedgerows, with woodlands, copses and hedgerow trees

11 **Brent River Valley** – Meandering, shallow river bordered by diverse floodplain meadows and winding strips of damp woodland

12 **Hounslow Gravels** – A flat large-scale mosaic of heathy grassland, scrub and secondary woodland, traversed by narrow, lush stream corridors

13 **Upper Thames** – The meandering River Thames, together with the transitional mudflats, shingle beaches, islands and flood meadows alongside

14 **Lower Thames Floodplain** – A vast, flat riverside zone of grazed saltmarshes grading to reedswamp, mudflats and the wide tidal Thames – the most striking and immediately visible natural element in London

15 **South Thames Heaths and Commons** – Mosaic of heathland, grassland and ancient wood pasture with groups of veteran trees

16 **Wandle River Valley** – Water meadows echoing the meandering course of the river, backed by sinuous bands of wet woodland

17 **South London Clays and Gravels** – Small hedged meadows and large heathy commons set against a backdrop of extensive woodlands on higher land

18 **Ravensbourne River Valley** – A network of small rivers, bounded by gravel terraces, which flow through water meadows and tidal flood meadows before reaching the Thames as a navigable channel, bordered by working wharves

19 **South London Pebbly Sands** – Historic heathy commons and extensive woodland on elevated land with views over the Thames Basin from ridgetops and summits

20 **Cray River Valley** – Chalk river with a natural profile which flows through a sequence of floodplain meadows and wet woodlands

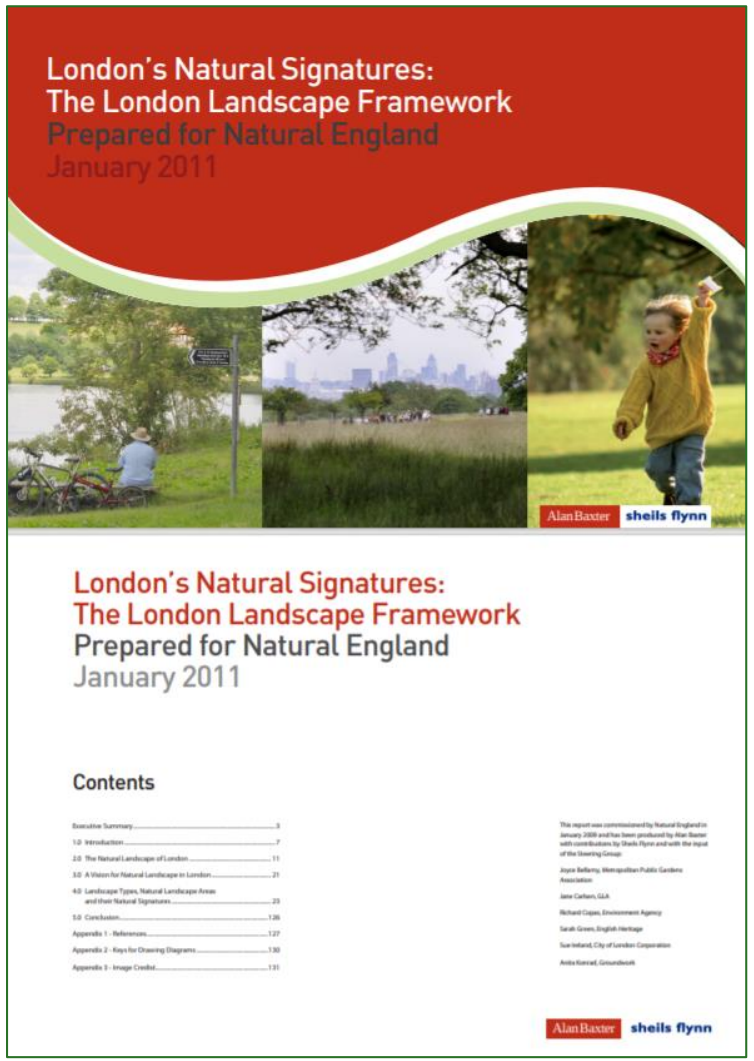
21 **Lower North Downs Dip Slope** – A diverse landscape with a transition from heath, scrub and woodland on the lower slopes to more open farmland and scattered ancient woodlands on the rising chalklands to the south

22 **Upper North Downs Dip Slope** – Ancient woodland and chalk grassland on steep valley slopes emphasise the striking, sculpted chalkland relief

Executive Summary

Alan Baxter

London's Natural Signatures: The London Landscape Framework / January 2011 | 3



London's Natural Signatures:
The London Landscape Framework
Prepared for Natural England
January 2011

Alan Baxter sheils flynn

London's Natural Signatures:
The London Landscape Framework
Prepared for Natural England
January 2011

Contents

Alan Baxter sheils flynn

Figures: London natural signatures report for Natural England:

1) Define the landscape context

- Use local knowledge (urban ecologists?)
- Local record centres
- Develop new knowledge
- Site visits

2) Define ‘needs of place’ context

- A clear understanding of place
- Needs of a place: social, economic, environmental
- Different scales: local, city, landscape
- Can these needs be prioritised?

Image © Paula Vandergert

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2) Define ‘needs of place’ context

- Strategic policy scans
- Co-creation workshops with local residents and stakeholders
- Data from local authority departments, regional governmental organisations, and non-governmental organisations

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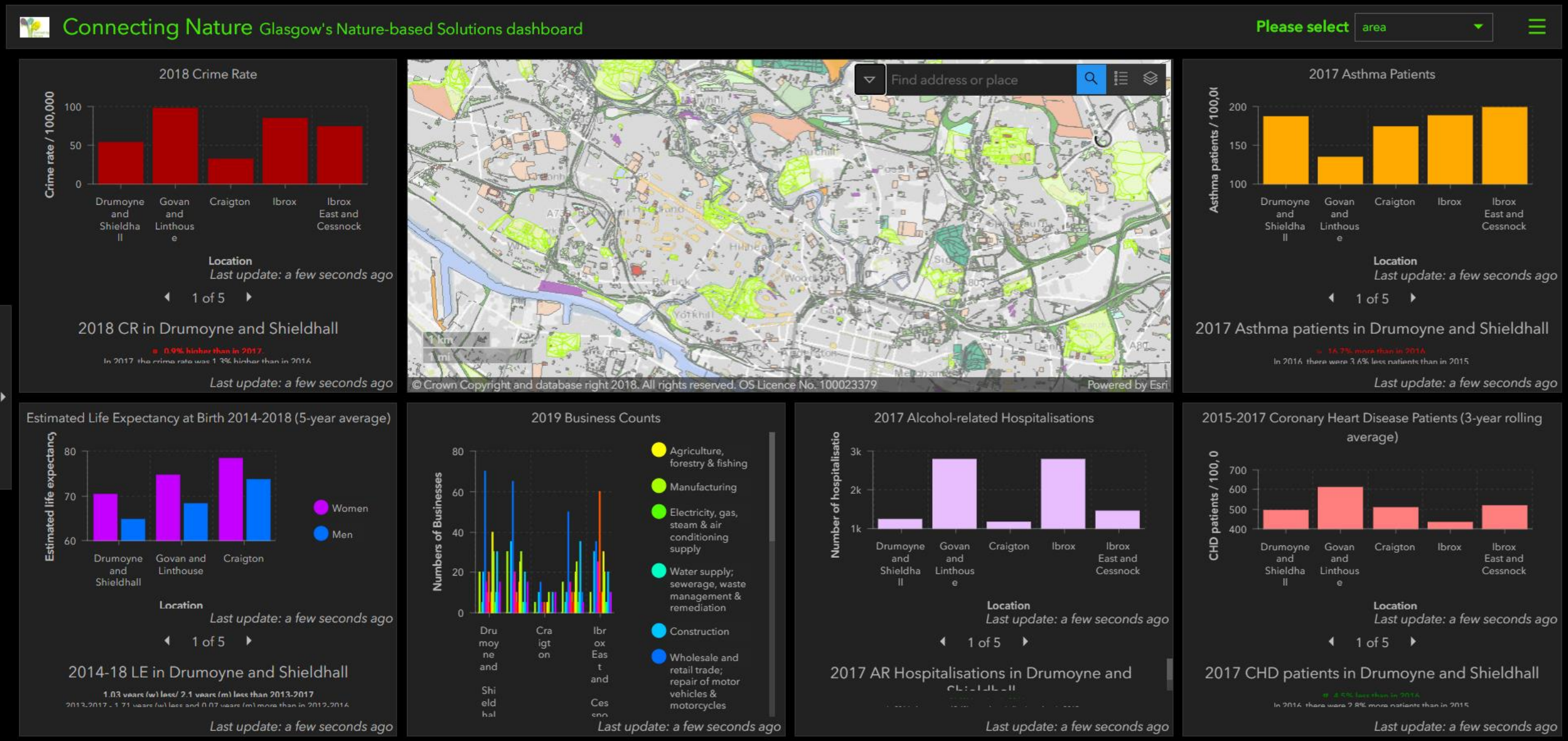

Image: screengrab of the Glasgow City Council Connecting Nature Impact Evaluation Dashboard

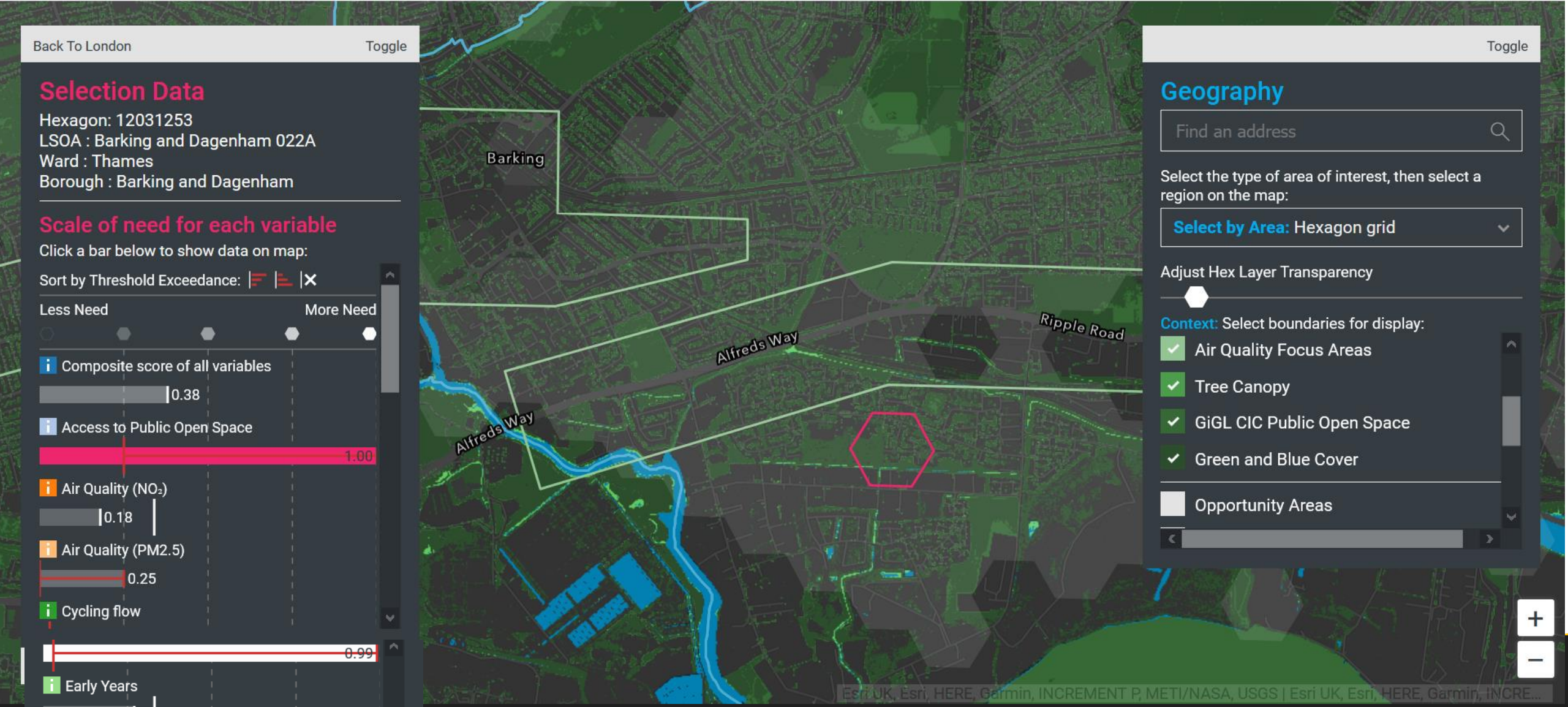

Image: screengrab of the Greater London Authority's Green Infrastructure focus map

3) Integration of Landscape and Place

- How can the design deliver on the needs and local context?
- How are trade-offs dealt with in relation to needs?
- How can flexibility be incorporated into the design to allow for changing needs?
- How will legacy management ensure sustainable delivery of benefits?

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3) Integration of Landscape and Place

- Direct from industry
- Research & Information Associations (e.g. greenroof associations, stormwater drainage associations, etc)
- Case studies (Oppla, Naturvation, Connecting Nature)
- Statutory guidance
- Conservation evidence

GREENER CITIES IN EUROPE

EFB EUROPEAN FEDERATION GREEN ROOFS & WALLS

HELIX®

Connecting Nature

Small-scale: Pocket Parks

Image of Derbyshire St Pocket Park, UK © Stuart Connop

Derbyshire St: Pre-NBS

Derbyshire St Pocket Park

Image of Derbyshire St Pocket Park, UK © Stuart Connop

Ecological

Biodiverse habitats

Urban comfort zone

Water quality

Stormwater management

Image of Derbyshire St Pocket Park, UK © Stuart Connop

Social

Community cohesion

Reduce anti-social behaviour

Active travel

Amenity space

Economic

Improving local businesses

Reduced cost of flooding

Reduced cost - fly-tipping

Large scale: Walthamstow wetlands


Habitat enhancement
Managing stormwater
Water quality improvement
Urban cooling
Ecological
© A.Wise


Forest school
Health
& Wellbeing
Social inclusion
and cohesion
Activities
Social
Image © London Wildlife Trust


Visitor centre and cafe
Events
Parking tariffs
Catalyst for regeneration
Economic
Image © www.kland.co.uk

Thank you for listening

For any further questions/information, please contact:

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Connecting Nature

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