

Nature-based Solutions in Rotterdam

Integrating soil, water and urban sustainability

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PHysically-based Integrated
Soil HHealth Simulation platform

Predicting soil health to protect ecosystems

Deltares connects water, soil and nature

An independent knowledge institute for applied research on water and the subsurface.

SOIL HEALTH

Integrates knowledge of water, soil and sediment to assess ecosystem services, contaminants and long-term resilience.

NATURE-BASED SOLUTIONS

Combines natural processes with engineering, modelling and adaptive management to make deltas safe, sustainable and liveable.



Nature-based urban greening in Rotterdam

From system understanding to decision-ready solutions

PHISHES Consortium

WP1: PHISHES Digital Platform (PDP)

WP2: Impact of
land use
management on
fate and transport
of contaminants in
soils

WP3: Response
of soil ecosystem
function/services
to soil
contamination

WP5: From
healthy-soil land-
use scenarios to
management
choices

WP4: PHISHES Test cases

WP6:
Communication,
dissemination, &
exploitation

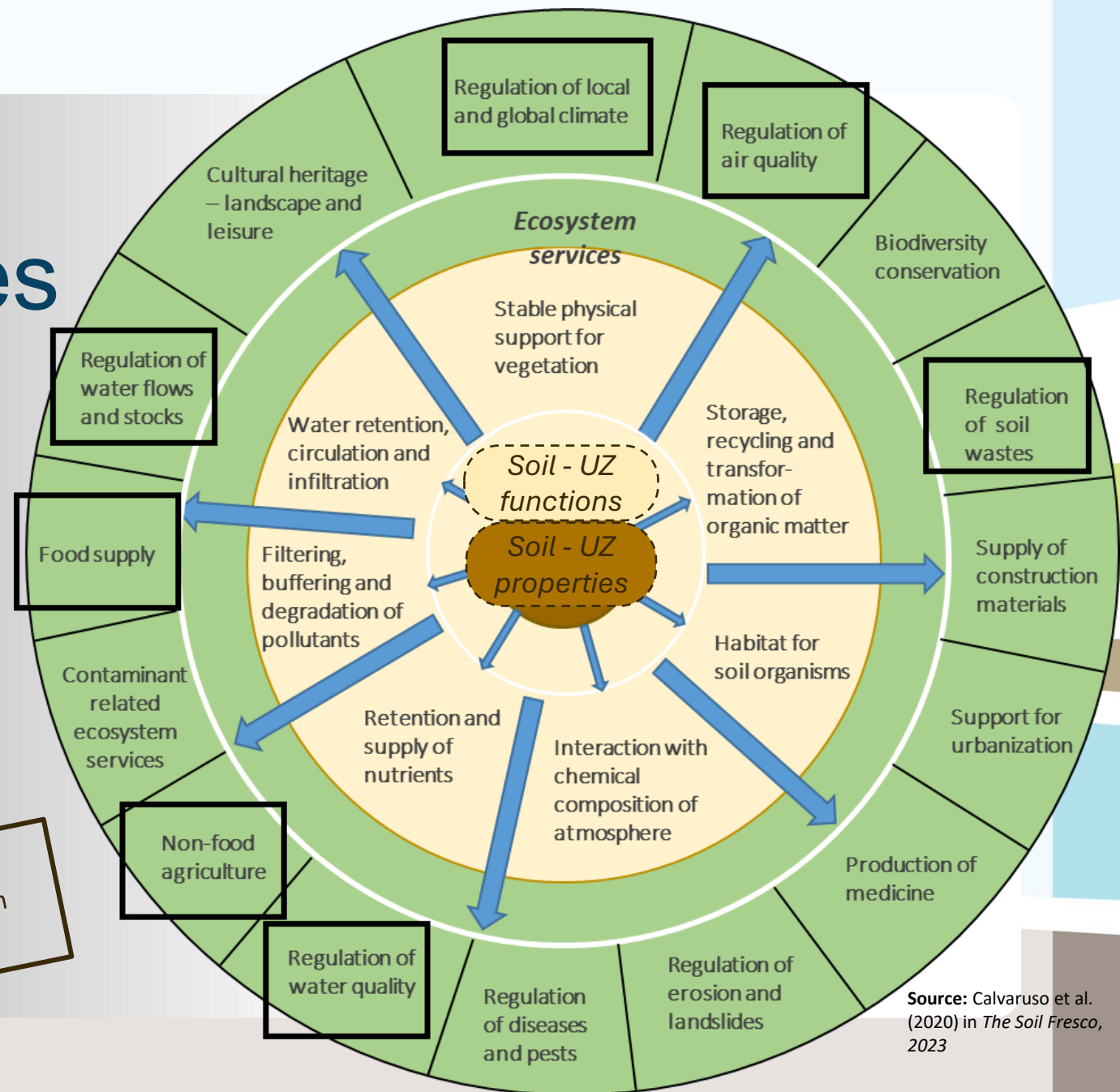
WP7: Project
coordination &
management

Soil Functions & Ecosystem Services

PHISHES approaches soil health within the framework of **soil multifunctionality**

"Predictive quantitative modelling as evidence to inform policy"

Targeted Ecosystem Services





PHISHES scenarios

- Systematically assess how long-term drivers and measures affect soil health and contaminant behaviour.
- Compare performance under the current baseline and contrasting future climate conditions.
- Identify benefits and trade-offs—for example, whether a measure improves soil functions without increasing pollutant spreading or leaching.
- Translate modelling results into site-relevant NBS choices.



From test sites to NBS choices

CLIMATE DRIVERS

3

Baseline
SSP1-2.6
SSP5-8.5

PRIMARY MEASURES

× 15

9 agricultural
3 urban
3 industrial

MODELLED IMPACTS

→ Soil health

NBS CHOICES

Site-relevant

NBS impact on soil health

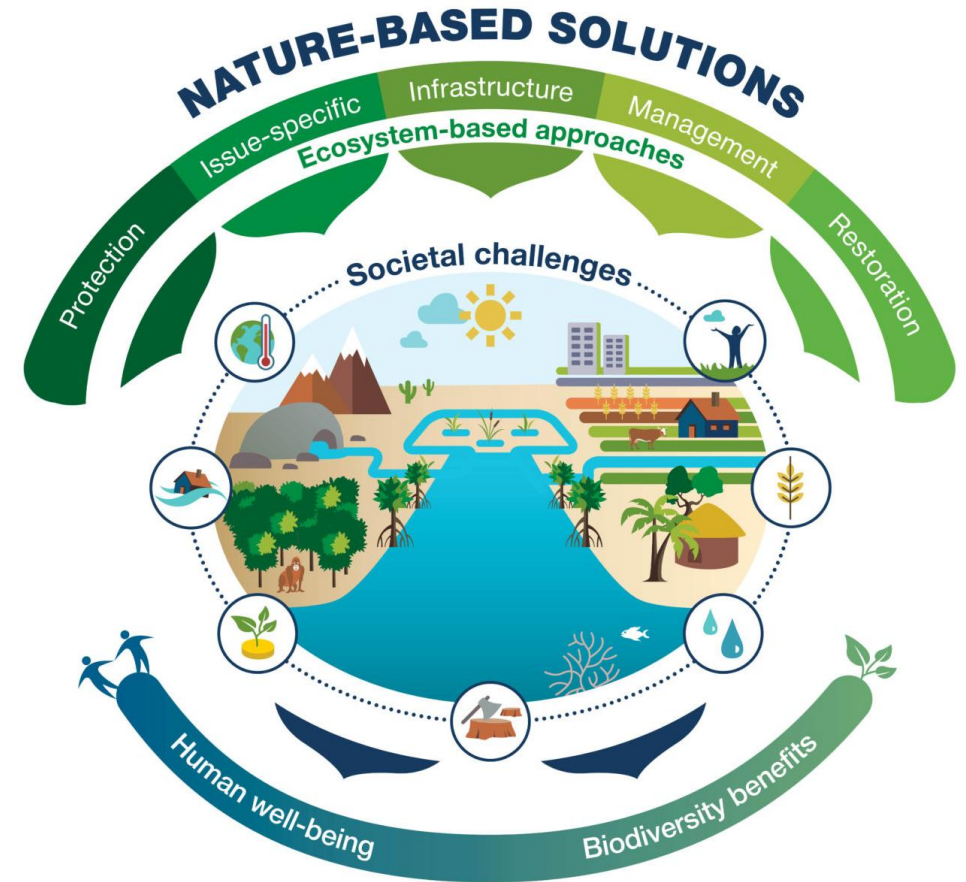
MEASURE SCOPE

- AGRICULTURAL: Changes in agricultural practices, modification of local hydrology, land use change
- URBAN: Urban greening, increased infiltration, biodiversity conservation
- INDUSTRIAL: Injection of non-Newtonian fluid, greening, biochar application



UNEA (2022) definition of Nature based Solutions

- Protect, conserve, restore, sustainably use and manage natural or modified ecosystems.
- Address social, economic and environmental challenges effectively and adaptively.
- Provide human well-being, ecosystem services, resilience and biodiversity benefits.
- The definition covers terrestrial, freshwater, coastal and marine ecosystems.





Rotterdam connects visible urban solutions to the subsurface water system

Water and Climate Adaptation Programme Rotterdam 2027–2030

Rotterdam aims to become a climate-resilient and water-robust city. Rainwater will no longer be treated only as water to be discharged, but as a resource to be retained, infiltrated and reused.

Visible solutions above ground, including urban greening, rainwater capture and climate-adaptive public space, are explicitly linked to the subsurface and the wider urban water system.

How the approach works

RETAIN

Hold rainwater in green and public spaces

INFILTRATE

Route water through soil to subsurface storage

REUSE

Use stored water when the city needs it



Rotterdam tests three core NBS measures

- Urban greening
- Increased infiltration through a drainage–infiltration–transport sewer system (aquifer recharge)
- Biodiversity conservation





Rotterdam Test case 1



Wadi system

1. Nature-based stormwater management feature for temporarily storage and slow drainage of excess rainwater
2. Reduction of local flooding
3. Groundwater infiltration
4. Enhance biodiversity
5. Cooling of local environment in warm periods

Potential risk: transport contaminants into the subsurface





Rotterdam Test case 2



Infiltration (combined with salinity and PFAS)

1. City square with green infrastructure
2. Drought-induced infiltration of saline canal water into the groundwater system
3. Presence of PFAS

Potential risk: salinity and PFAS effect on groundwater quality



Rotterdam Test case 3

1. Vegetated infiltration zones: capture and infiltrate into the subsurface
2. Greening of city square



Potential risk: effect on soil and groundwater quality



Test cases: Modelling Soil health

Effects on:

- Concentrations of heavy metals (Zn, Cu, Pb), PAHs, PFAS, EC/salinity
- Soil texture, organic matter content
- Soil biodiversity



ROTTERDAM SCENARIOS

Scenarios test single measures and combinations

1 SINGLE MEASURES

Urban greening; increased infiltration; biodiversity conservation.

2 COMBINATIONS

Infiltration × urban greening; biodiversity conservation × urban greening.

3 MODEL CONTEXT

Heavy-metal focus tested under baseline, SSP1-2.6 and SSP5-8.5 conditions.



Modelling of test cases/scenarios

Presentation of Hendrik Kok (Deltares) in session part 2:

Assessing Soil Health and Ecosystem Services in Rotterdam: An Integrated Modelling Workflow”

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