Merging LCA and Ecosystem Services to assess the sustainability of phytoremediation in urban settings

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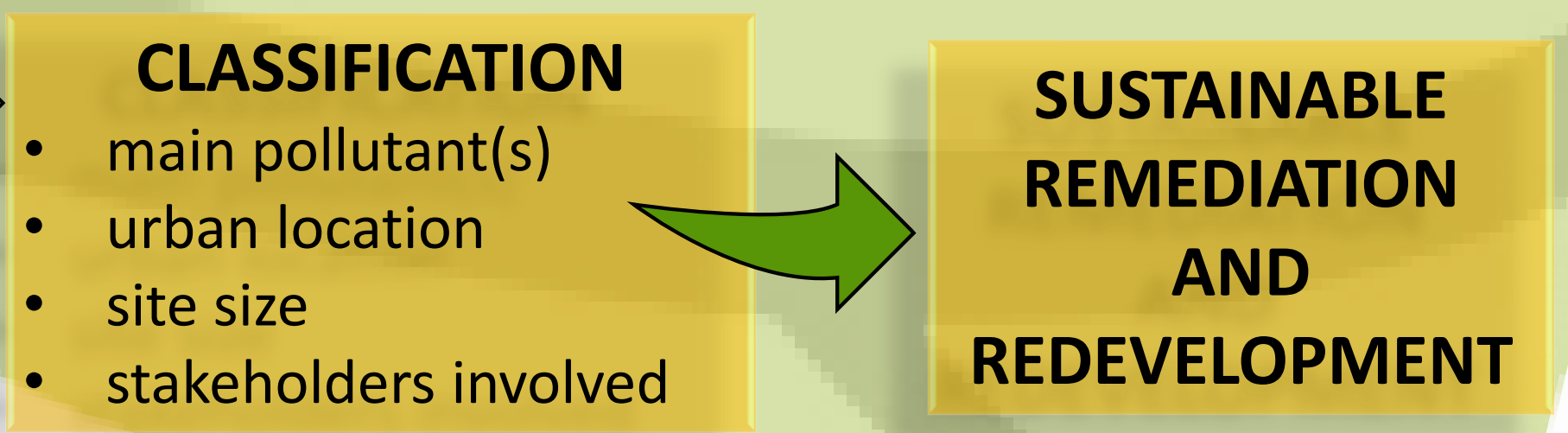**PA124**

URBAN TRENDS AND CHALLENGES

By 2050, **two-thirds** of the world population will be living in **urban areas**.
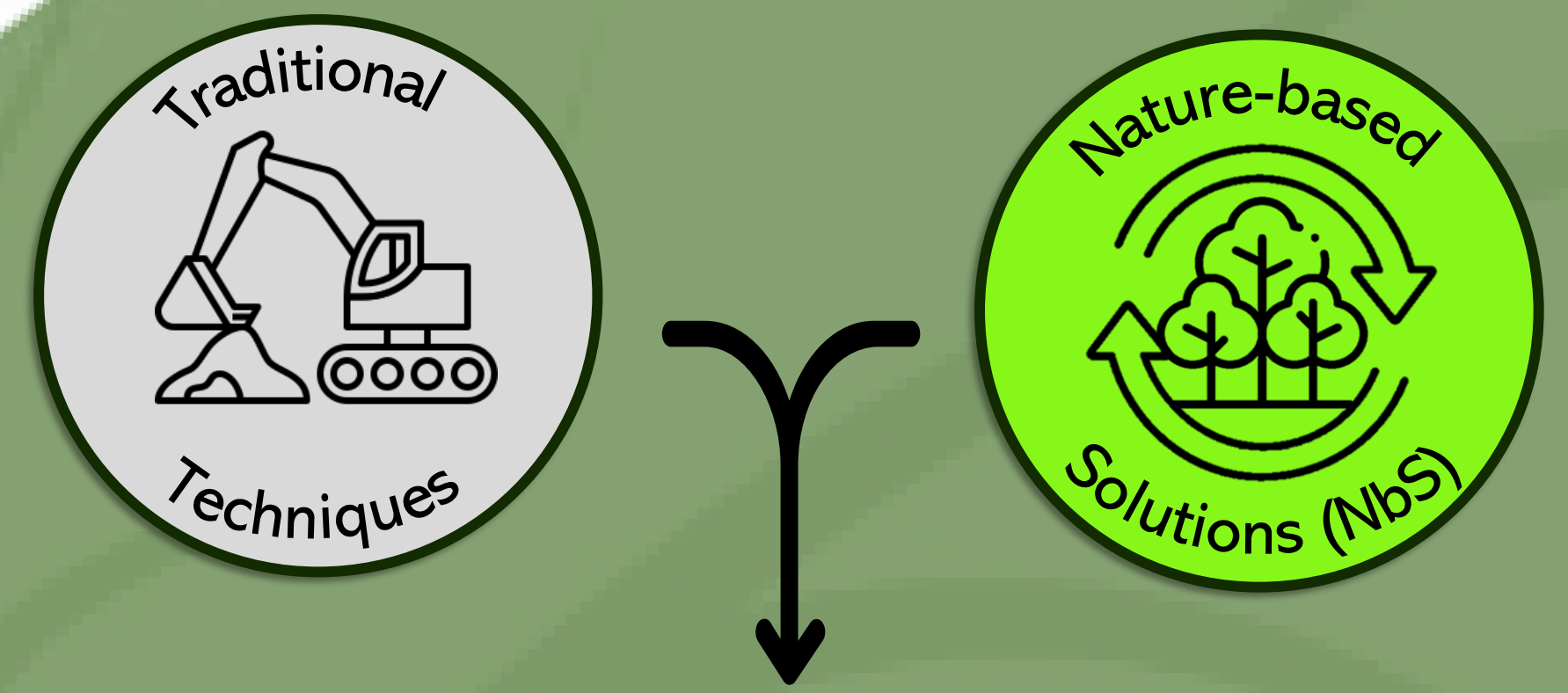
Social pressure for sustainable development.

Many industrial sites in the urban centres are **abandoned**.

CLOSED

BROWNFIELDS

US-EPA: "real property, the expansion, redevelopment, or reuse of which may be **complicated** by the presence or potential presence of a **hazardous** substance, pollutant, or contaminant."

CLASSIFICATION
- main pollutant(s)
- urban location
- site size
- stakeholders involved

SUSTAINABLE REMEDIATION AND REDEVELOPMENT

GREY VS GREEN REMEDIATION TECHNIQUES

Traditional Techniques

Nature-based Solutions (NbS)

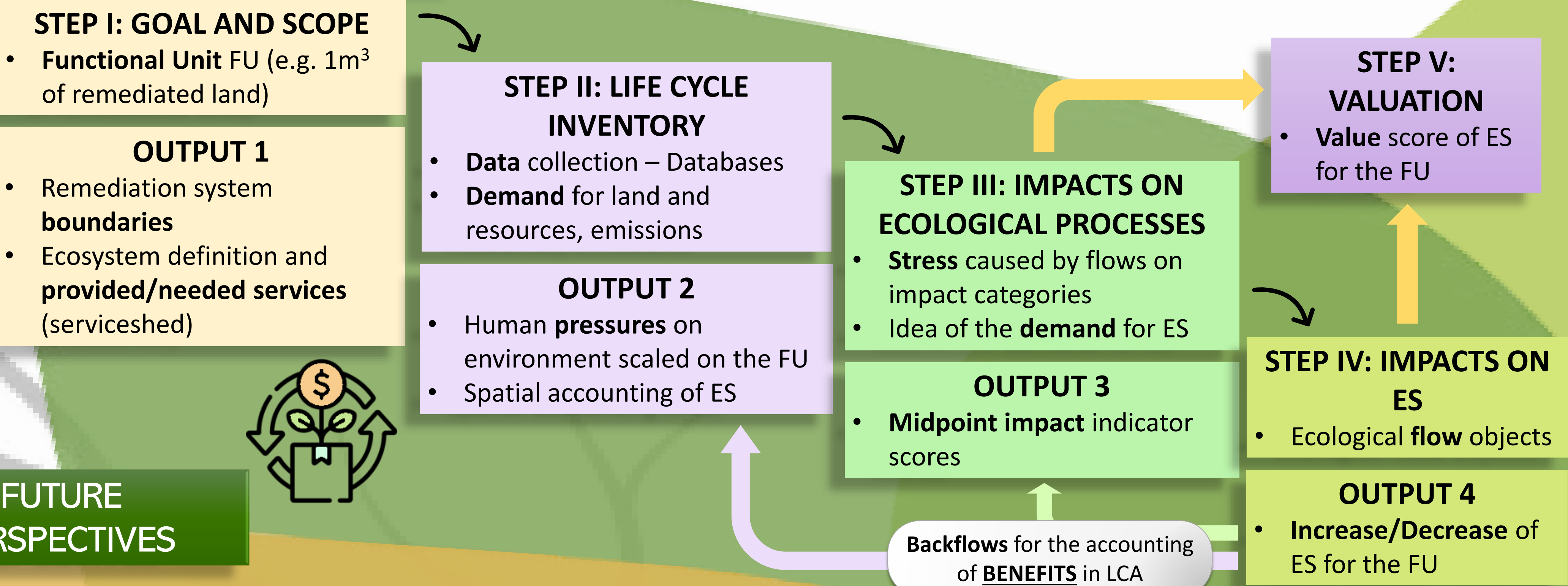Compared using **Life Cycle Assessment (LCA)**

PROBLEM
Ecosystem Services (ES)-accounting is only partially covered in LCA, hence the benefits of NbS are not fully evaluated. Therefore, solutions such as **PHYTOREMEDIATION** are still not appealing for policymakers.

SOLUTION
Integrating the ES framework in the LCA and validating the new model on specific case studies of phytoremediation.

IMPACT ASSESSMENT METHOD: LCA integrated with ES

STEP I: GOAL AND SCOPE
- **Functional Unit** FU (e.g. $1m^3$ of remediated land)

OUTPUT 1
- Remediation system **boundaries**
- Ecosystem definition and **provided/needed services** (serviceshed)

STEP II: LIFE CYCLE INVENTORY
- **Data** collection – Databases
- **Demand** for land and resources, emissions

OUTPUT 2
- Human **pressures** on environment scaled on the FU
- Spatial accounting of ES

STEP III: IMPACTS ON ECOLOGICAL PROCESSES
- **Stress** caused by flows on impact categories
- Idea of the **demand** for ES

OUTPUT 3
- **Midpoint impact** indicator scores

STEP V: VALUATION
- **Value** score of ES for the FU

STEP IV: IMPACTS ON ES
- Ecological **flow** objects

OUTPUT 4
- **Increase/Decrease** of ES for the FU

Backflows for the accounting of **BENEFITS** in LCA

FUTURE PERSPECTIVES

SCENARIO MODELING: definition of the most suitable phytoremediation solution
- Classification of **brownfield** categories
- Identification of suitable **phytoremediation** solutions
- Evaluation of the **ES** of interest
- Foreground **data** collection
- Sampling for the **quantification** of the selected ES
- Impact **assessment** via LCA
- **Validation** of the developed model

DELIVERABLES

Guidelines on the use of phytoremediation in urban areas, highlighting **benefits** and **drawbacks** of the different solutions to the stakeholders involved.

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