

Landfilling and soil conditioning of dredged sediments: evaluation with a LCA

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Who am I?

- **Doctor in environmental science:**
Circular economy – use of dredged sediments
- **Sustainability:** Life cycle assessment, decision support systems, stakeholder analysis, circular economies
- **Consult in water management and circular economies:** Circular management of materials, dredged sediments management, wastewater treatment



Dredged sediments

Dredged sediments are considered as waste and most are disposed of in open oceans or landfills.

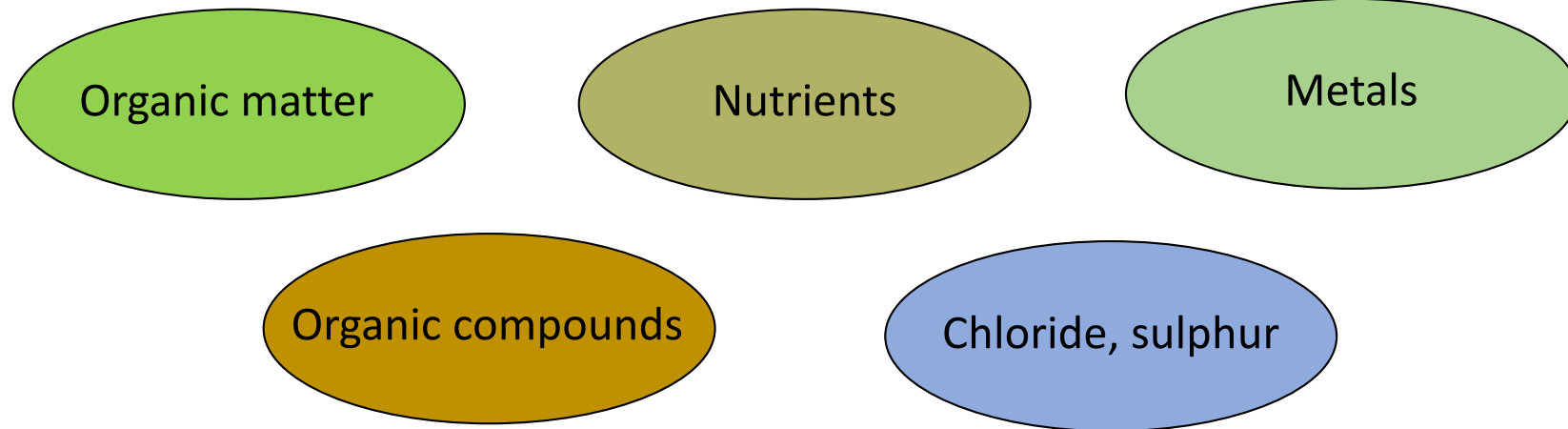


However traditional methods are constricted by environmental and legal reasons.

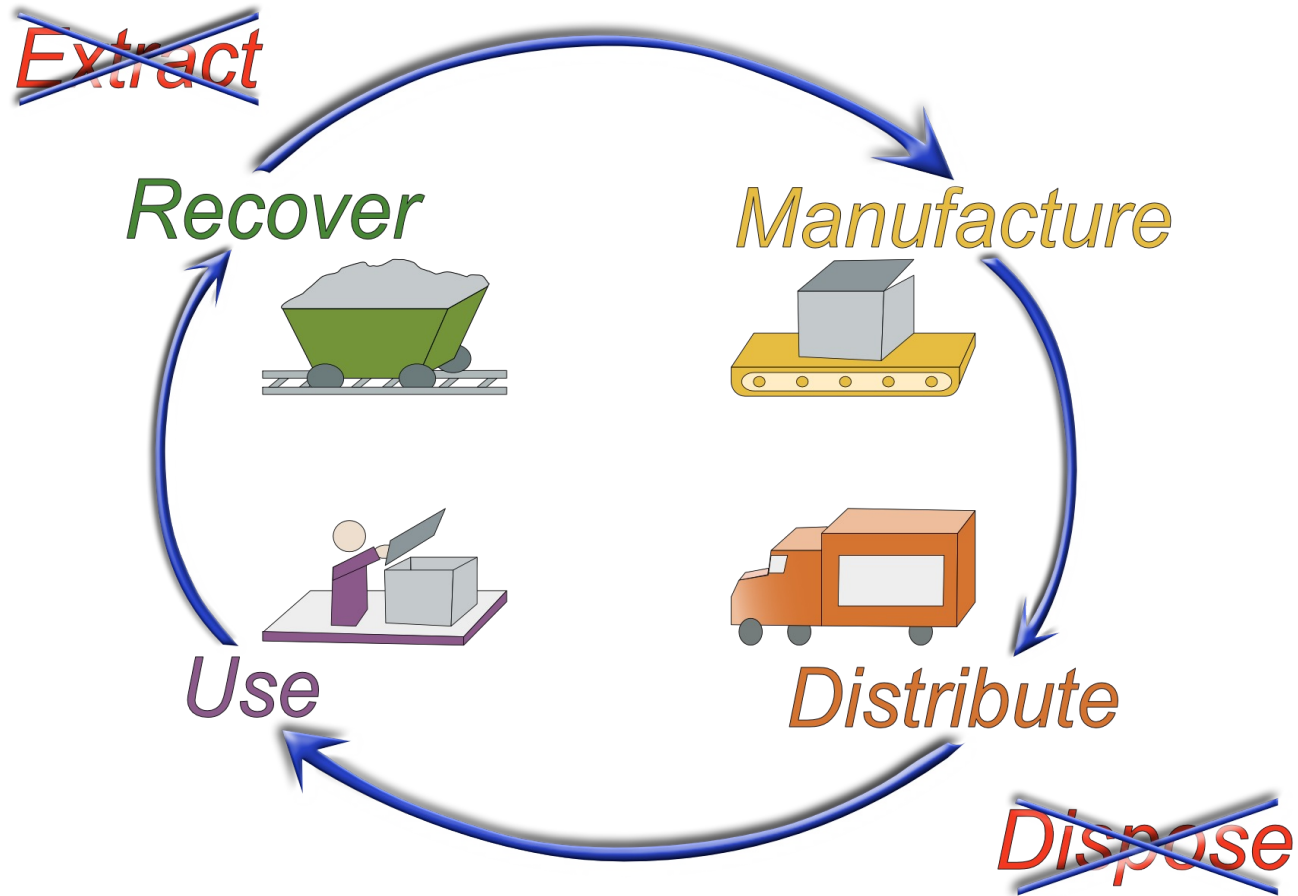


Composition of dredged sediments

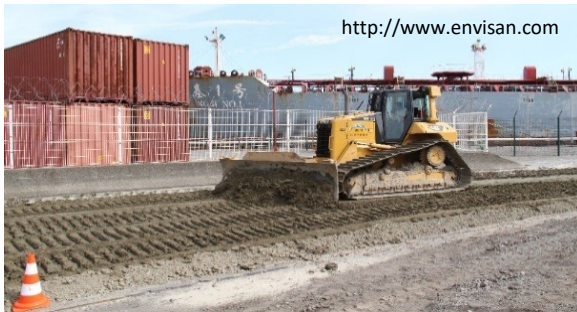
➤ Varies on a case-to-case basis



Circular Economy: Close the cycle of waste



Recycling of sediments is a promising route to avoid traditional disposal methods and reduce depletion of natural resources



Construction



Flood protection



Agriculture

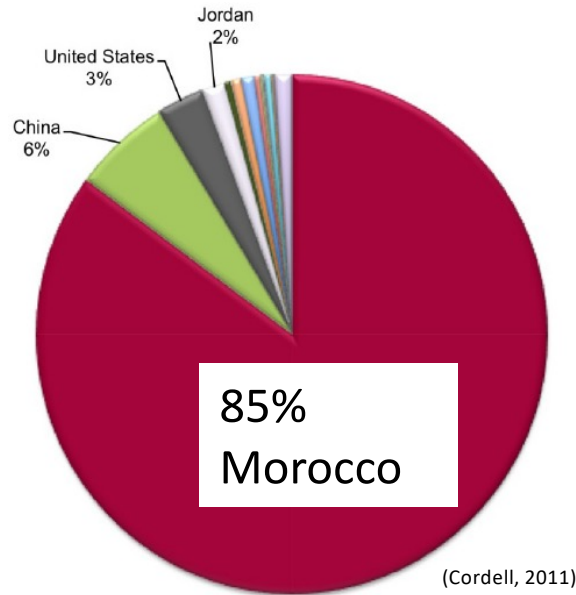


Habitat creation



Importance of nutrients

- **Essential elements** for life, without them we cannot grow food
- **Phosphorous:** Limited on Earth and located only in certain areas



Phosphate rock reserves

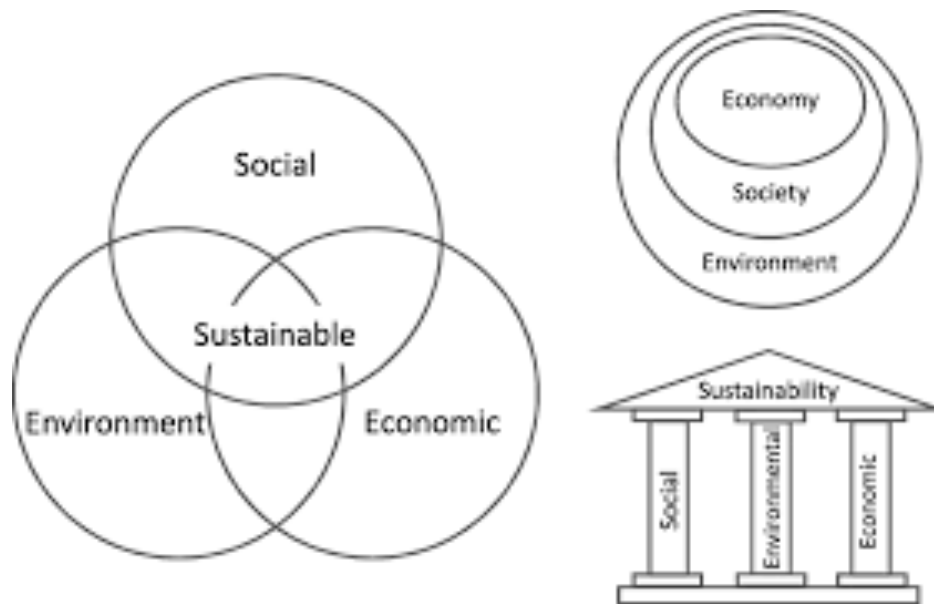


Sustainable sources of P are required!



Assessment of sustainability

- **LCA** (life cycle assessment/ analysis) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process or service.



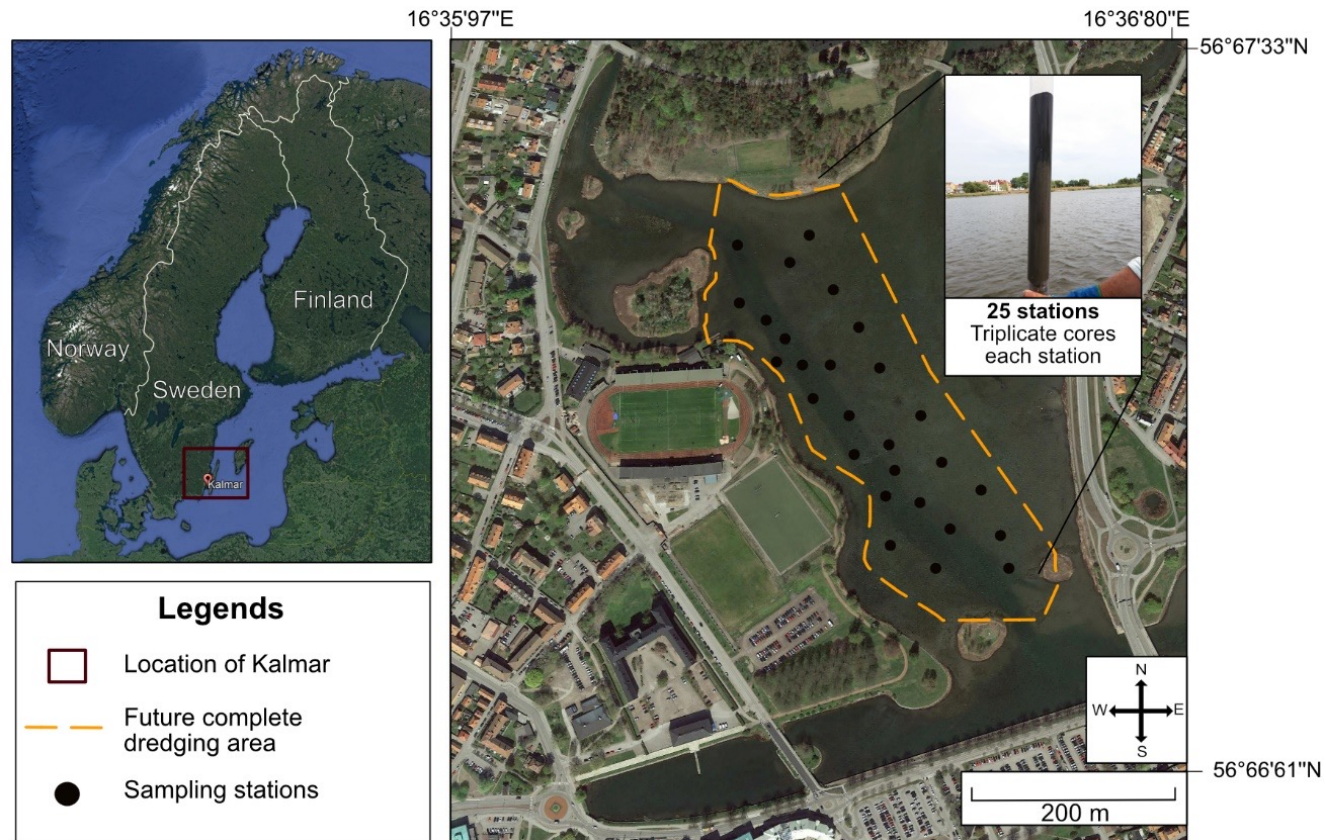
→ Here focus on environment

Assessment is necessary!



LIFE SURE: Malmfjärden Bay

- Ecological dredging
- Beneficial use of sediments

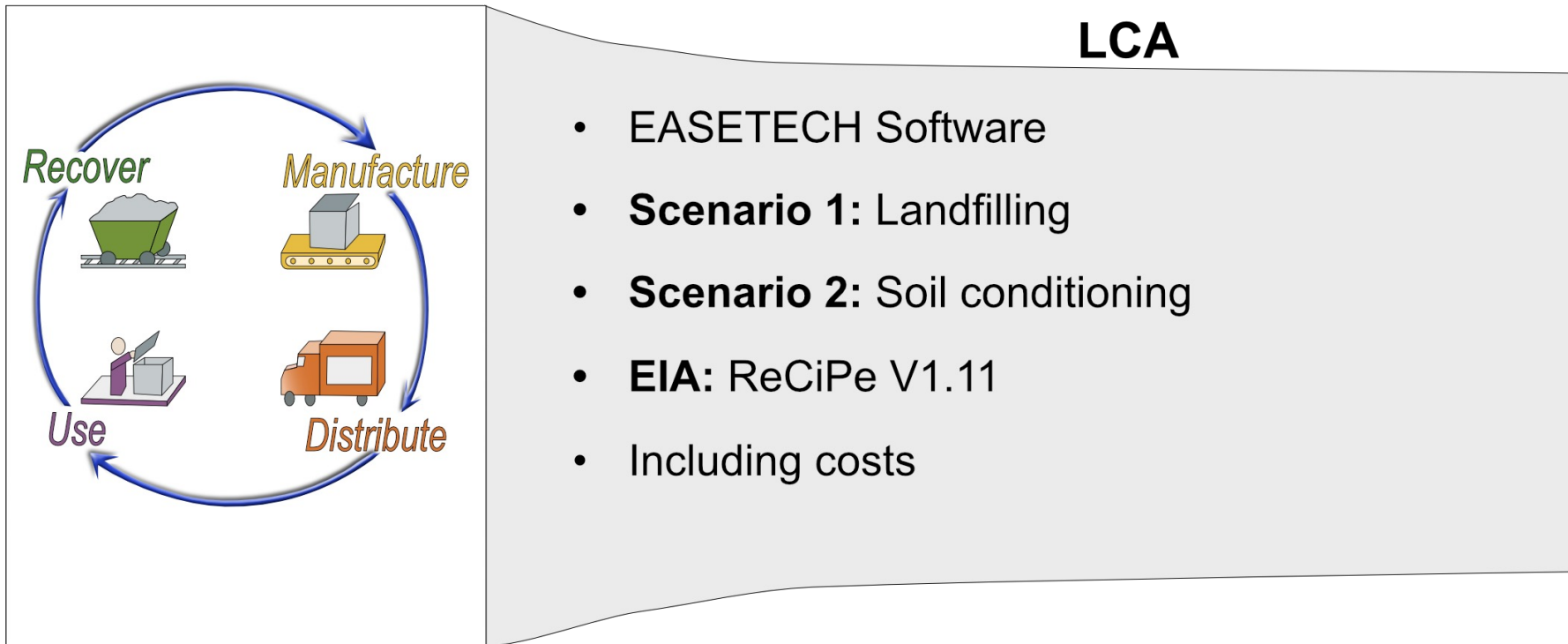


Characteristics Malmfjärden sediments

- **Particle size:** Mainly silt and clay (more than 90%)
- **Nutrients:** High-medium content of nitrogen, organic matter and phosphorous
- **Metals:** Medium-low content of metals (main issue Cd and Pb)
- **Other pollutants:** No presence of organic compounds



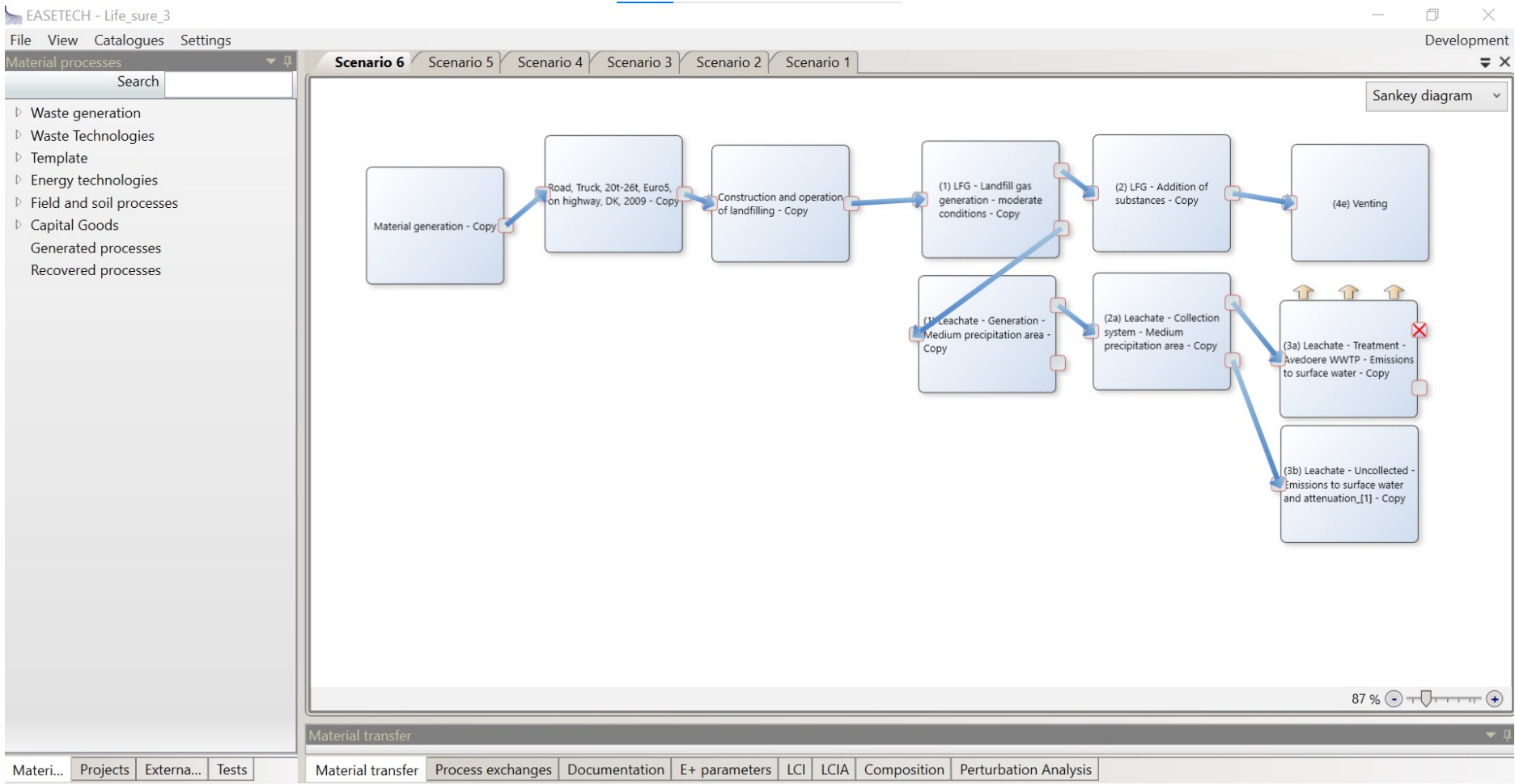
Methods



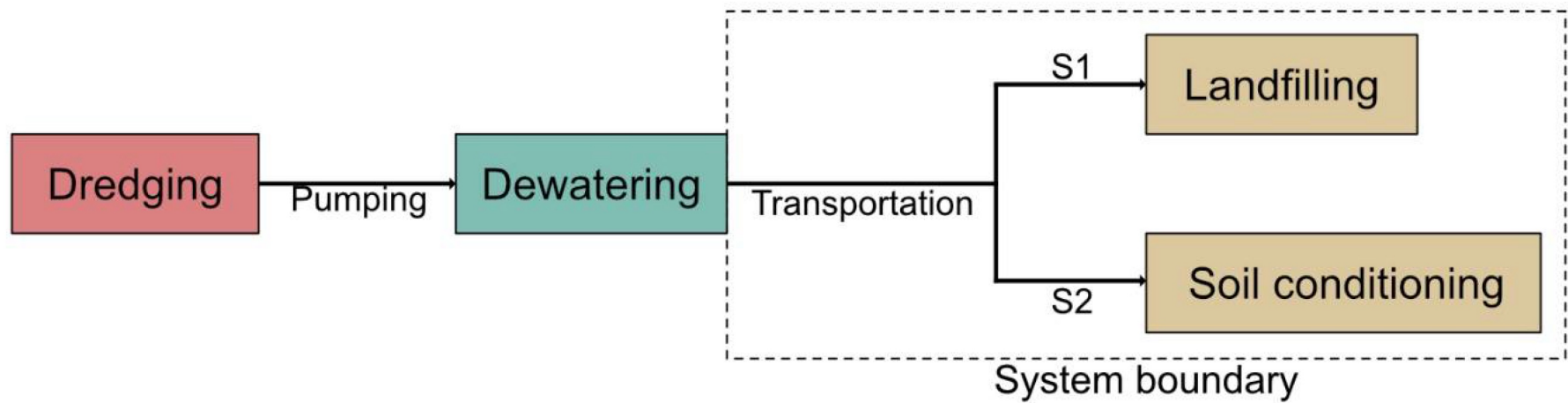
➤ EASETECH: Technical University of Denmark (DTU)



EASETECH



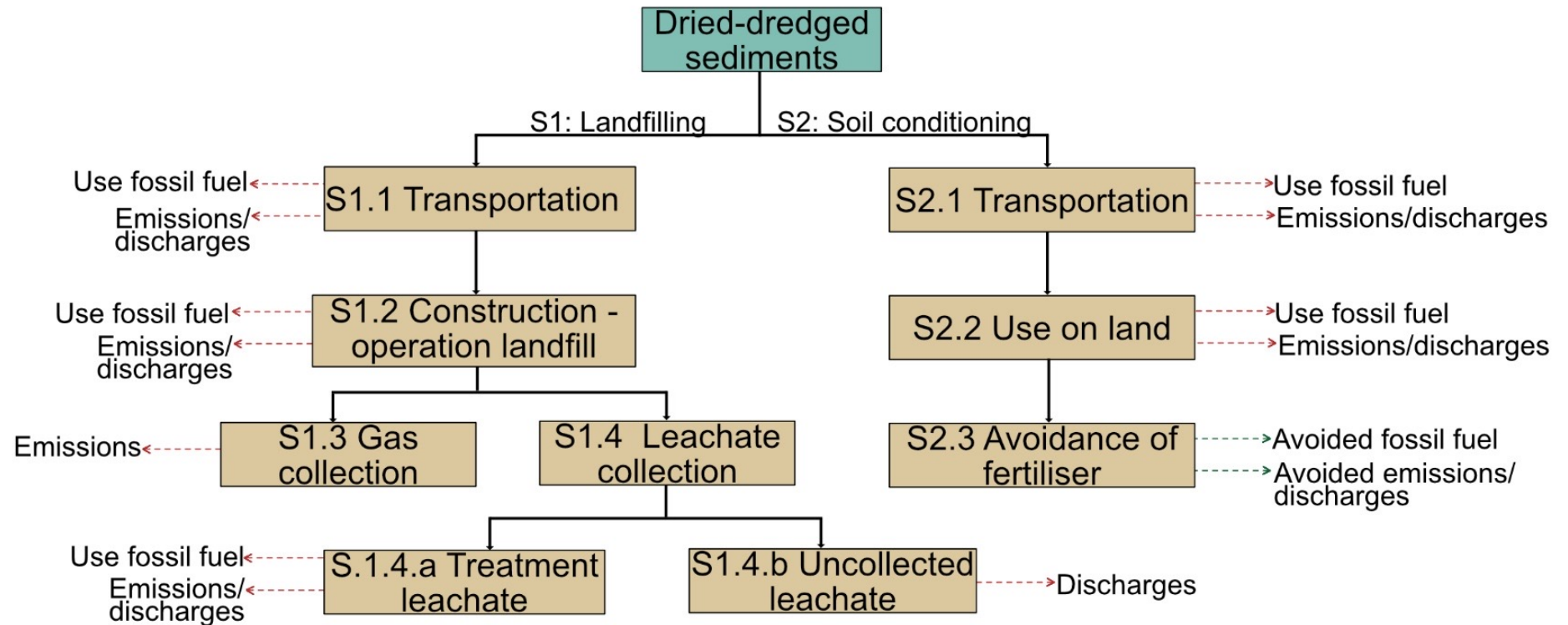
System boundary



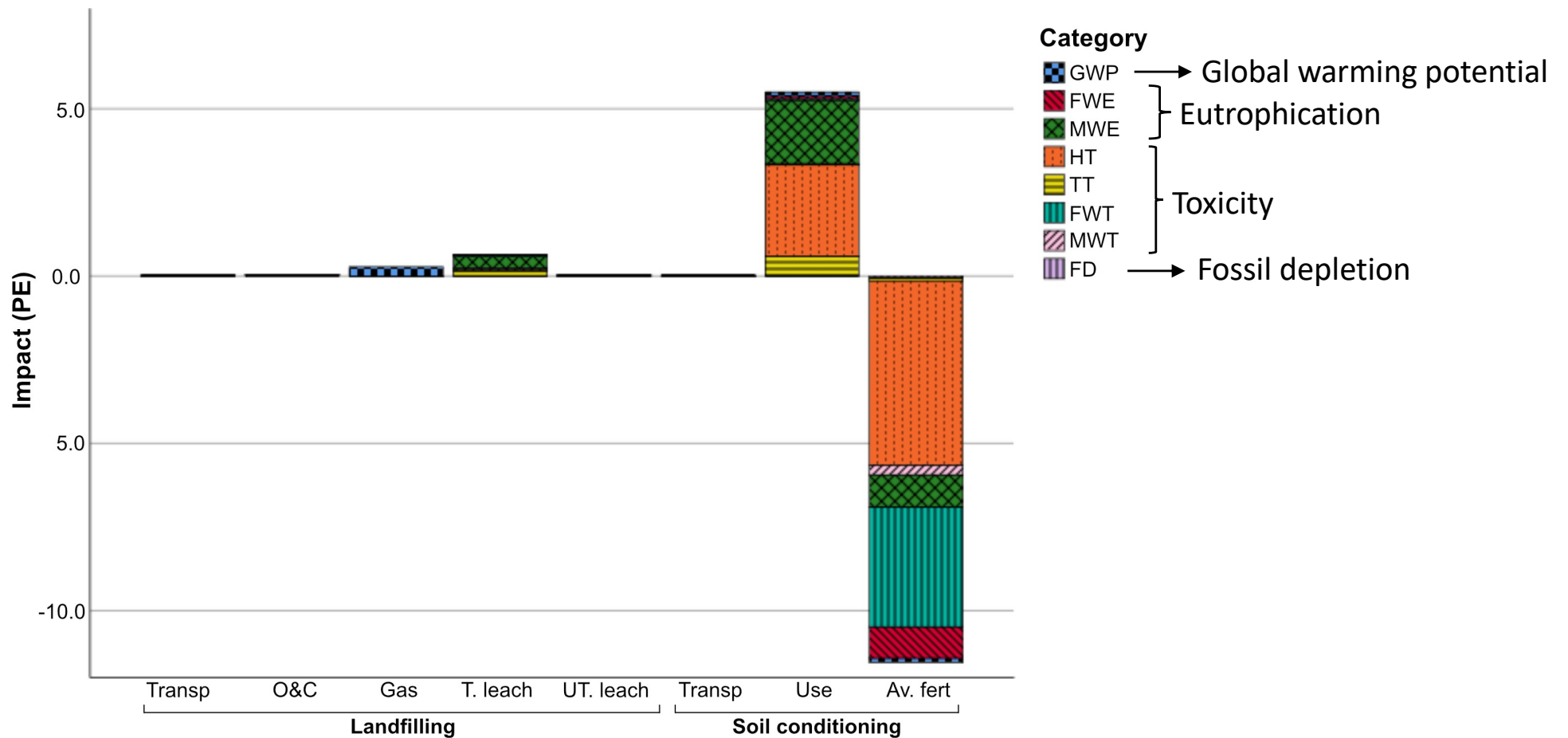
➤ **Functional unit:** 22 ton of sediments



Scenarios



Environmental impacts



S1: Global warming
Eutrophication
Toxicity
1.6 PE

S2: Global warming
Eutrophication
Human and eco-toxicity
-6 PE

Higher savings for avoidance of fertiliser



Costs of scenarios

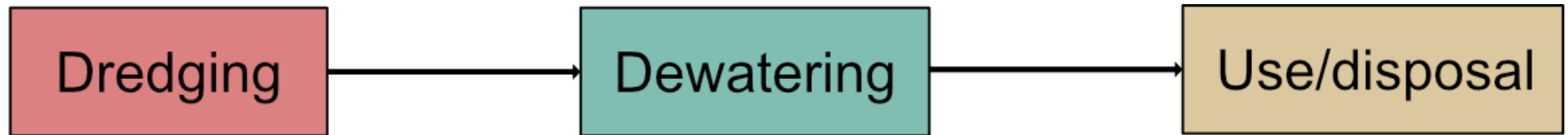
Scenario - activity	Unit cost (kg/Euro)	Total cost (Euro)
S1.1 Transportation	0.005	115
S1.2 – 1.4 Landfilling	0.07	1,540
Total S1	-	1,655
S2.1 Transportation	0.005	115
S2.2 Use on land	0.005	115
S2.3 Avoided fertiliser	-0.04	-780
Total S2	-	-550



S2 best impact:
Lower total cost (savings)



LCA: Important tool



Environmental impacts

Sustainability



Take-home messages

- **Dredged sediments** could be a **resource** contributing to **circular economies**.
- **Nutrients** are essential for life and we need to **find more sustainable sources**.
- **LCA** is important tools to evaluate the **environmental impacts** caused by different scenarios to handle dredged sediments and could help to support the **decision-making process**.



References

[1] Akcil et al. (2015) *J. Clean. Prod.* **86**:24-36;

[2] Renella et al. (2021) *Sustainability* **13**;

[3] Clavreul et al. (2014) *Environ. Model. Softw.* **60**:18-30.



Thanks, questions?

