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Soil health – Sweden

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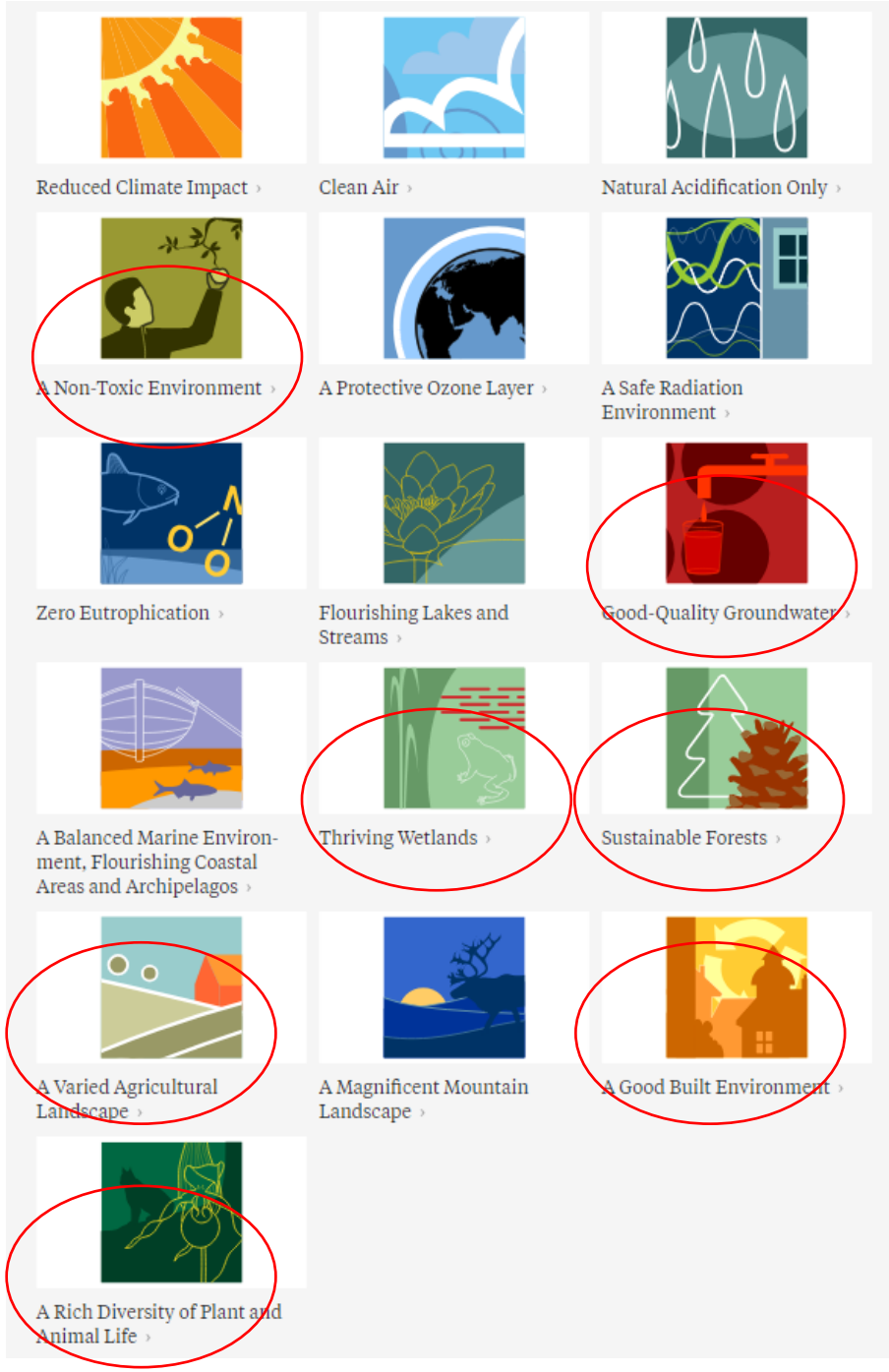
Soil Health related regulatory context

- *No Soil health – or soil - law*
- *No single institution responsible for Soil Health – or soil*
  - *Swedish EPA has coordinated collaboration between soil related authorities for discussions related to the proposal of a SHL*



What's in place?

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The environmental objectives system (1999)

- Sweden's 16 environmental goals are a guiding light in Swedish environmental work and define which environment Swedish policy should steer towards.
- **26** national authorities work to achieve the goals and 8 are responsible for monitoring and evaluating one or more of them.
  - *Many directly or indirectly related to soil quality & health*
  - *Includes e.g. the **functioning** of forest and farmland ecosystems & contaminated sites management*

The Environmental Code (1999), *combined with*
The Planning and Building Act (2011), The Forestry Act (1903)
protects environment, nature and water including provisions for managing contaminated sites, agricultural soils, spatial planning, housing, infrastructure

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Some key regulations

- Ordinance on Serious Environmental Damage (2007:667)
- Ordinance on Environmental Risk Areas (1998:930)
- Ordinance on Environmentally Hazardous Activities and Protection of Public Health (1998:899)
- Ordinance on Government Grants to Fund Measures for Remediating Pollution Damage (2022:98)

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Soil management and Land planning

- Ensuring the **ability** to produce food and other public goods linked to the **preservation of agricultural land** is in the Environmental Code:
  - Agricultural land worthy of use may be used for buildings or facilities *only if it is necessary to meet essential public interests and this need cannot be met in a generally satisfactory manner by using other land.*
- Forest Management Act: the forest owner must manage the forest in a way that provides a long-term good yield *while preserving biodiversity*.
- Integration of urban greenery and ecosystem services into urban environments
  - The majority of the municipalities must utilise and integrate urban greenery and ecosystem services into urban environments in the planning, building and administration of towns and cities and densely populated areas by no later than 2025 (MileStone in the environmental goals)
  - The National Board of Housing, Building and Planning and the Swedish Environmental Protection Agency have together developed a method and *guidance on how ecosystem services and urban greenery can be utilised and integrated into the planning, construction and management of the built environment.*
  - Green infrastructure measures – focus on biological diversity and presumably adds to Soil Health

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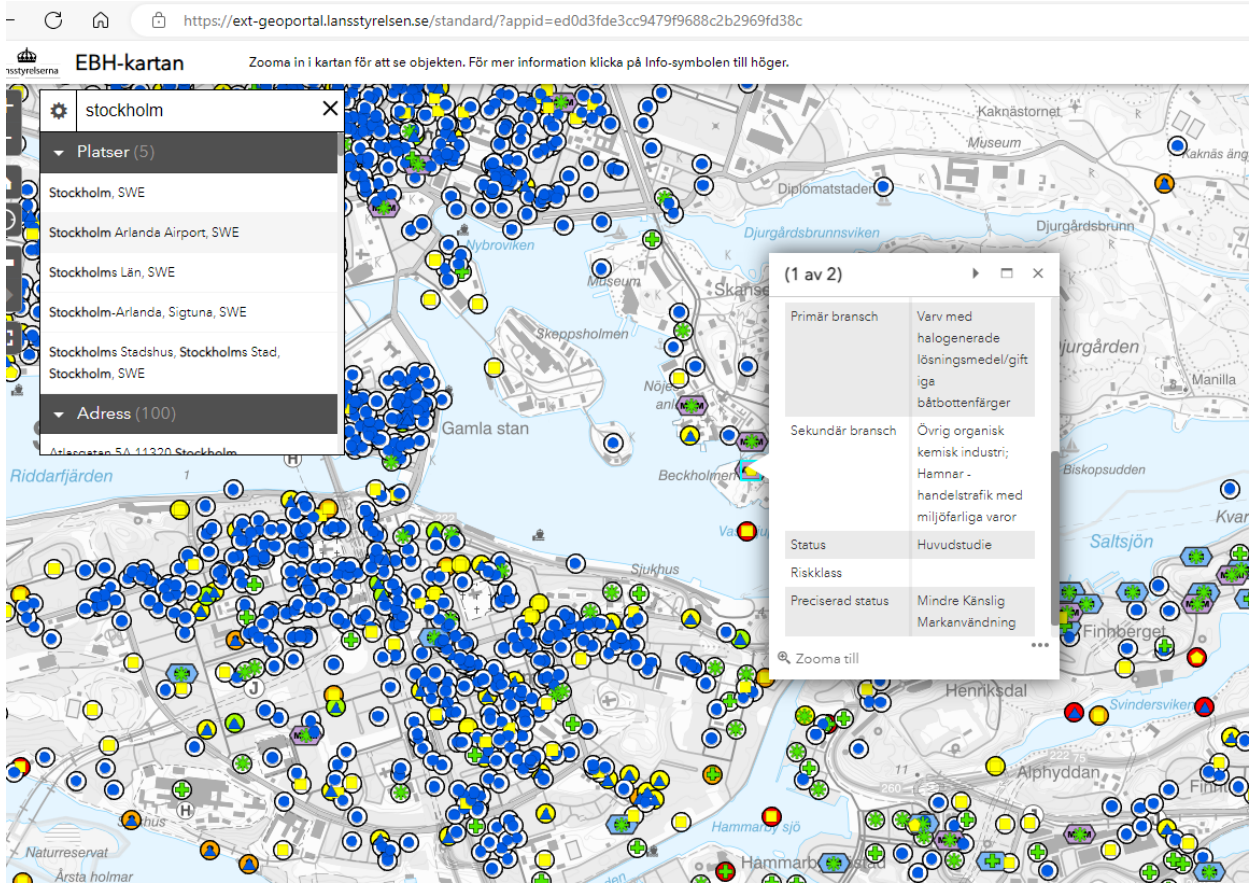
Soil management and Land planning

- Management of contaminated soils (85 000 sites in searchable registry)
  - Guidance provided by the Swedish EPA
- Re-use of excavated soils
  - Swedish EPA provides guidance on how masses that can be used for construction purposes should be handled



Soil management and Land planning

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Example of tool – EkoGeoKalkyl 1.0 (Eco Geo Calculator)

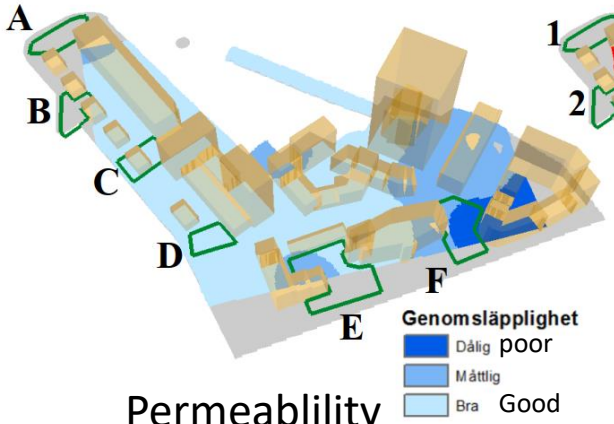
GIS-based tool for physical planning of buildings with regard to ecosystem services.

Two soil functions;

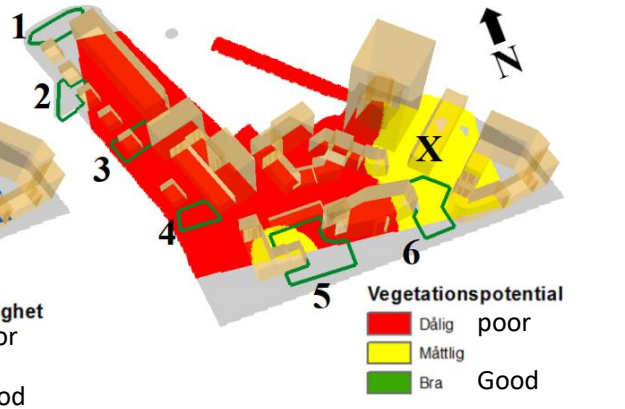
the soil's ability to support vegetation (vegetation potential) and

the soil's ability to infiltrate water (permeability).

Picturer from Report:
”ekoGeokalkyl 1.0
Manual och exempel”



Permeablility



Vegetation potential

1. Are facilities optimally located to utilise the potential of the land to support vegetation?
2. If you build facilities in an optimal location to use the permeability of the soil, in the event of, for example, torrential rain and flooding?

Funded by the Program Smart Built Environment

Data bases, e.g.

- The Swedish National **Forest** inventory (since 1923)
- Swedish Forest **Soil** inventory (1962)
- national monitoring of Swedish landscape (2003)
- **Soil** and Crop Inventory (1990)
- the programme land cover information (2019)
- inventory of potentially contaminated areas (finished 2014) – 85 000 sites

– Guidance & tool for risk assessment in place

Several Data hosts for data related to soil & soil health

Ämne	Typ av data	Ansvarig beställare	Datavärd
Miljögifter	Metaller och organiska miljögifter i biota, sediment samt inom screening	Naturvårdsverket	Sveriges geologiska undersökning, SGU
Hälsa	Hälsorelaterad miljöövervakning	Naturvårdsverket	Institutet för miljömedicin, IMM
Luft	Atmosfärskemiska data. Ozon och spridningsberäkningar.	Naturvårdsverket	SMHI
Luft	Luftdata	Naturvårdsverket	SMHI
Jordbruksmark	Närsalter, bekämpningsmedel och spårämnen. Markpackning.	Naturvårdsverket	SLU, Institutionen för mark och miljö
Våtmarker	Publikation: Våtmarksinventeringen	Naturvårdsverket	Nedladdning av VMI-data kan göras via Miljödata-portalen
Naturdata: Arter	Arter (ej marina/limniska arter)	Naturvårdsverket	SLU Artdatabanken
Naturdata: Fåglar och fjärilar	Fåglar och fjärilar	Naturvårdsverket	Lunds universitet, Biologiska institutionen
Naturdata: Landskap	Landskap	Naturvårdsverket	SLU Umeå, Institutionen för skoglig resurshållning
Sötvatten	Grundvattenkemidata och grundvattennivåer	Havs- och vattenmyndigheten	Sveriges geologiska undersökning, SGU

Toxic substances in the environment

Agricultural land

Wet lands

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PFAS & Emerging Contaminants

Map from Swedish EPA on potential sources

Around 2010 - drinking water at several places in Sweden contain PFAS

Mid 2014 – researchers urged the government to initialize a commission

Swedish Chemicals Agency and the Swedish Food Agency

- 2014 – Start of PFAS-Network for everyone affected by the PFAS problem

Swedish Geotechnical Institute (SGI) (Governmental assignments)

- 2015 – develop guideline values for PFAS in soil and groundwater
- 2022–2026: Research and knowledge dissemination on investigation, assessment, and remediation of PFAS-contaminated areas.

Swedish Environmental Protection Agency (Governmental assignments)

- 2022–2025: Develop and strengthen national coordination and guidance on PFAS-contaminated areas to enhance collaboration and direct efforts forward.
- 2022–2024: Improve knowledge about how PFAS in the environment affects levels in Swedish food and human exposure, with support from the National Food Agency and the Swedish Board of Agriculture. Final report due by February 28, 2025.

County Administrative Boards

- Since 2023: Mapping PFAS presence in soil, surface water, and groundwater to understand the extent of PFAS problems. Reporting findings to the Swedish Environmental Protection Agency.

Several agencies, research institutes, consultants, entreprenerurs involved

Test sites (on-going)

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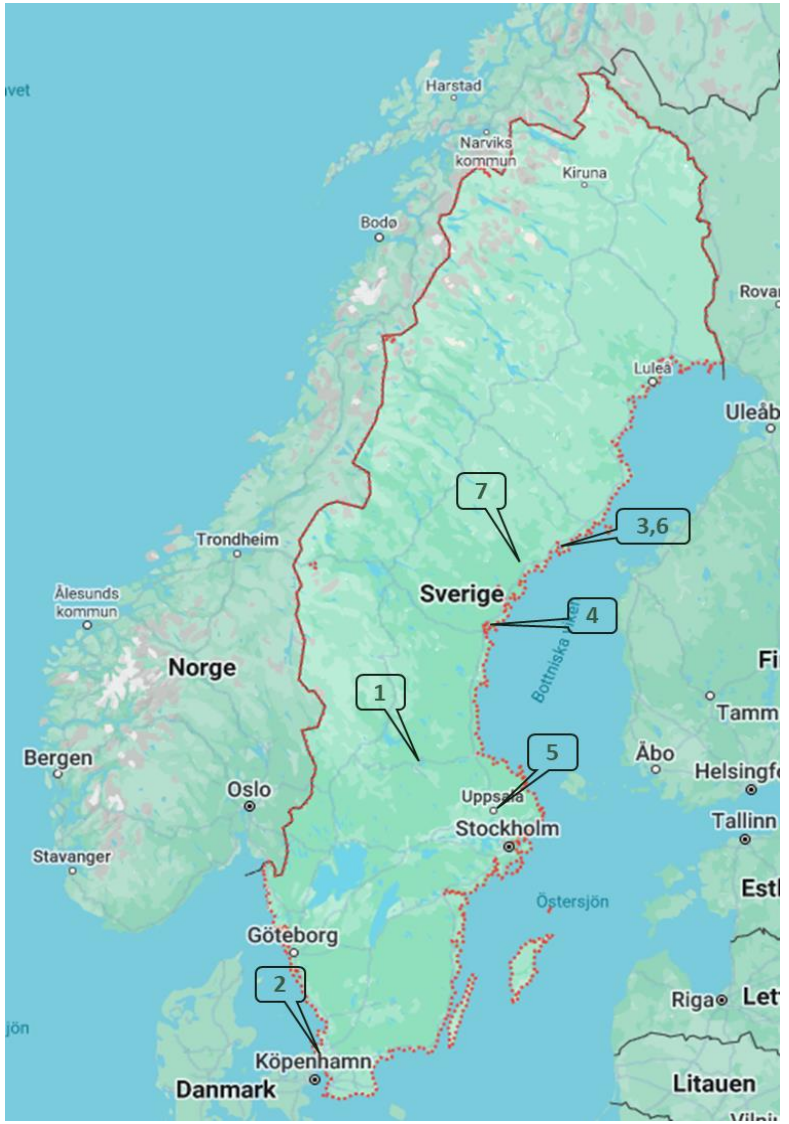
- 1) City of Falun (Exposure & bioavailability, Falun copper mine)
- 2) Helsingborg (Biochar amendment)
- 3) Örnsköldsvik airport (**RU-PFAS, activated carbon barrier**)
- 4) Sundsvall airport (**RU-PFAS source term stabilisation with AC**)
- 5) Uppsala (**Landfill PFAS, SAFF Surface Active Foam Fractionation**)
- 6) Örnsköldsvik (Fibre sediments)
- 7) Kramfors (Fibre sediments)



PFAS Method	Purpose
Soil washing (part of a *treatment train*)	Remediate soil
In situ stabilization (source zone + barrier)	Limit transport to and within groundwater
Thermal treatment	Remediate soil
Air sparging in groundwater	Remediate groundwater

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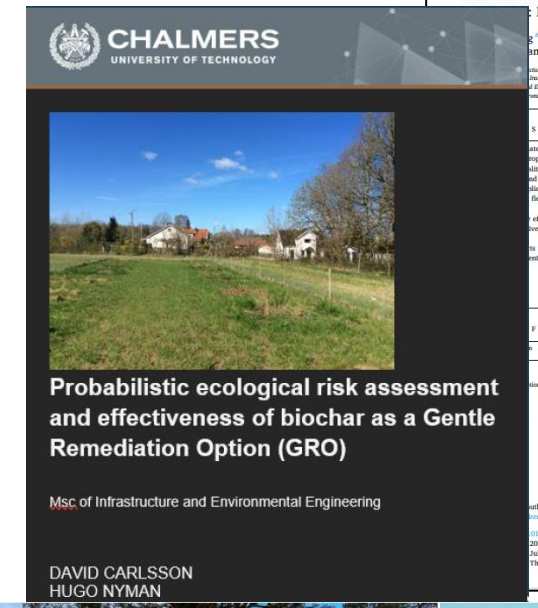
Gentle Remediation Options & Nature Based Solutions

- **Contamination** (A method for evaluating the effects of gentle remediation options (GRO) on soil health: Demonstration at a DDX-contaminated tree nursery in Sweden, Drenning et al oct 2024)
- **Erosion prevention**/coastal erosion
  - Method catalogue in place
  - Citizens involvement (!) Tool: CoastSnap – “contribute to the monitoring of the coastline” Encouraging picture taking



BIOCHAR

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Use of biochar produced from organic waste to

- stabilize contaminants in soil *and*
- improve soil quality

to reduce environmental risks and reduce waste.

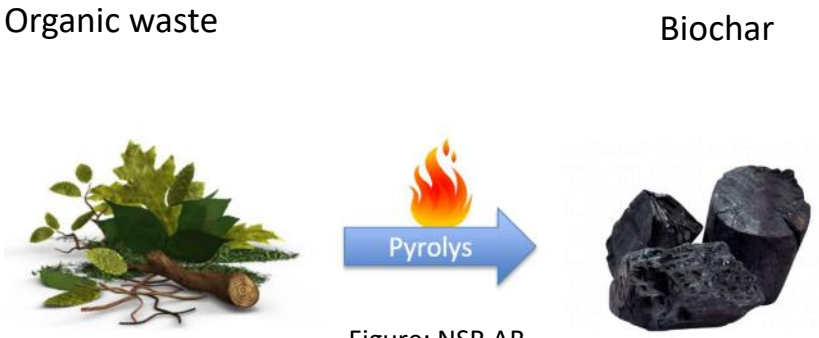
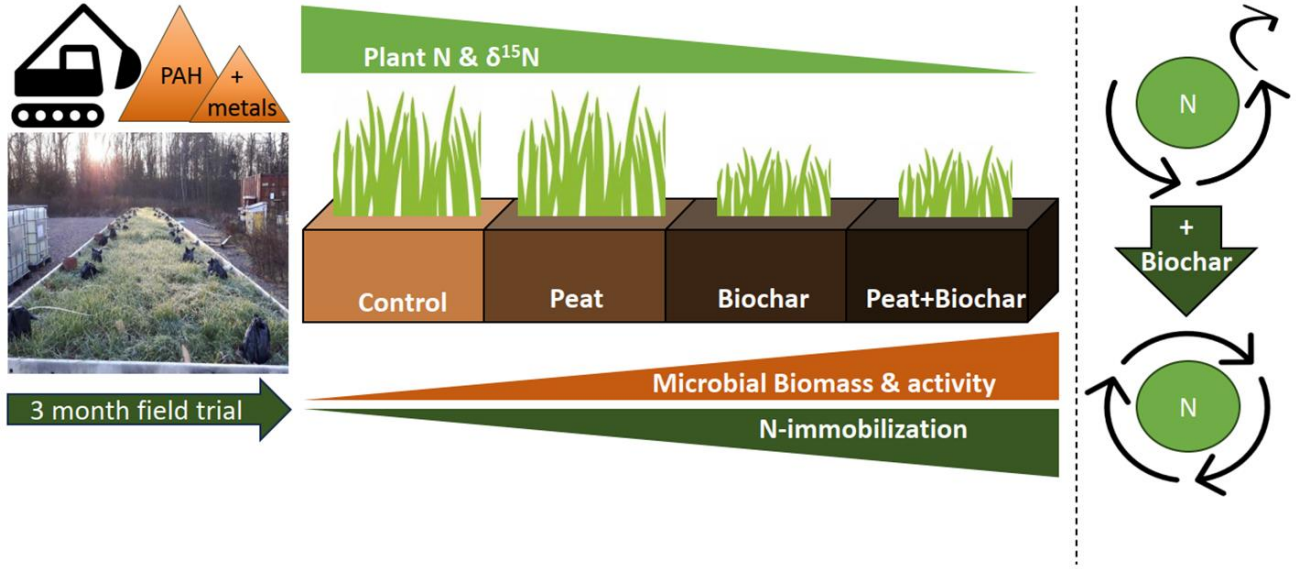


Figure: NSR AB

Graphical Abstract



- The Biochar-RE:Source project: (2018-2020)
- The Balance-project (2022-2025)

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Some challenges?

NO NET LAND TAKE principle

Only about 3% of the land in Sweden is built-up and landscaped land, the principle is difficult to apply in combination with that Sweden is expected to have one of the largest population increases in the EU

Land planning decisions

Further development of planning tools related to soil quality/Soil Health

From de-contamination goals to healthy soil goals

How to address soil health in remediation of contaminated sites. Change the ways of setting remediation goals?

Diffuse Pollution

Not included in existing guidance on contaminated sites management. Where to include?

Emerging contaminants

“Next PFAS”?

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Questions / Remarks?

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