Phytoscreening and - remediation of brownfield mega sites

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Phytoscreening and -remediation of brownfield mega-sites

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We need a definition...

Brownfields are sites that are:

- Affected by the former uses of the site and surrounding land
- Are derelict and underused
- Real or perceived contamination
- Mainly in developed urban areas
- Require intervention to bring them back to beneficial use.

(Cabernet, 2015)
Brownfield test site: Szprotawa, Poland
Overview of the site
Site Impressions

Total area: 200 ha
So...

What do you do when brownfields are too large to handle by conventional screening and remediation technologies?
What happens within and around a tree?
Evapotranspiration

Degradation within the tree

Retention in stem, leaves and fruits

Prevents erosion

CO_2/O_2

Volatilization

Root zone degradation

Minimize infiltration

Uptake of contaminant

Lowering GW table

Many other processes

O_2
Phytoscreening by tree coring

- Tree core samples are taken with a small hand drill
- A small tree core represents a large soil volume: Semi-quantitative
- Fast, low-cost and non-invasive → High sampling density

Mainly used to focus other more expensive methods

Nielsen (2015)
Phytoscreening at Szprotawa

Conventional

Nielsen (2015)
Phytoremediation

- **Phytoextraction:** Transfer of pollutants to the vegetation.

- **Phytovolatilization:** Volatilization of components through trunks or stomata of the leaves.

- **Rhizo- and phytodegradation:** Degradation of pollution in the root zone or inside the plants.

- **Hydraulic control and prevent soil corrosion:** Plants binds the soil an minimizing infiltration.

- **Others**
Phytoremediation

- **Phytoextraction**: Transfer of pollutants to the vegetation.

- **Phytovolatilization**: Volatilization of components through trunks or stomata of the leaves.

- **Rhizo- and phytodegradation**: Degradation of contamination in the root zone or inside the plants.

- **Hydraulic control and prevent soil corrosion**: Plants binds the soil an minimizing infiltration.

- **Others**
Time estimate of phytoremediation  
- Szprotawa test site

Change of mass with time = Microbial deg. + Uptake to plants

Microbial deg. >> Plant uptake

Assume that deg. is controlled by $O_2$ accessibility (3.5 mole $O_2$/ mole alkanes)

Phytoremediation takes long time!
Remember (when working with plants)

Phytotoxicity:
If the site conditions are toxic to plants, they are no good.

Depth of pollutants:
The roots needs to get in contact with the pollution.

Physico/chemical properties of pollutants:
Some pollutants sorp too strongly to the soil, making them not available to the plants.

NVTF (2015)
NPL (2015)
Key messages

**Phytoscreening:**
Semi-quantitative
Need plants
False negatives

**Phytoremediation:**
Takes time
May generate new issues

Nielsen (2015)

ROUX (2015)
When dealing with brownfield mega-sites plants might be our best solution
Our thanks goes to...

...and all others that helped us out.
Questions
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