MAINSTREAMING OF BIODIVERSITY IN THE WASTE SECTOR

The Case of Phyto-remediation of Contaminated Agricultural Soil (ECOREMED project)

Case highlights

Phytoremediation, i.e. the use of green plants and associated microorganisms to clean up contaminated soils, preserves soil resources and improves ecosystem services of the soil by a combination of low input soil management techniques (such as soil ripping to reduce soil compaction and compost fertilization) and permanent soil covering by vegetation. It is cost-effective compared to other chemical and physical techniques, whose costs can be 20-50 times higher.

Issue addressed

Soil pollution is an increasing concern for the environment, for water systems and for public health, due to the risk of pollutant accumulation in the food chain.

The project developed an operative protocol for phytoremediation of contaminated agricultural soils and demonstrated its effectiveness on six different pilot sites with different types and levels of contamination:

- physically degraded sites;
- sites contaminated by bioavailable[1], immobile[2] Potentially Toxic Elements (PTEs), in this case copper;
- sites contaminated by PTEs (chromium and zinc) and/or organic contaminants (e.g. oil pollution);
- sites contaminated by mobile/bioavailable PTEs (lead and cadmium).

Approach followed

Depending on the land characteristics and type and level of contamination, different remediation techniques were conducted on the sites, which revealed that:

- in case a site is contaminated by bioavailable PTEs, remediation is necessary since the contaminants are absorbed by crops. Phytoremediation could be used to secure an area and fix contaminants, reducing the risk it may reach people. However, to secure dismissed sites permanently, it is necessary to isolate the pollution sources from other environmental compartments and phytoremediation need to be assisted with other remediation techniques (for example to avoid substances to reach groundwater).
- in case pollution is caused by non-bioavailable PTEs (e.g. chromium) and/or organic compounds (e.g. hydrocarbons, DDT) phytoremediation is used to temporarily secure the area, providing time for bioremediation by bacteria and fungi to degrade organic pollutants. In these cases, harvestable biomass from the site will be not contaminated and can be used without limitation.

[1] Bioavailability, in environmental and soil sciences, represents the amount of an element or compound that is accessible to an organism for uptake or adsorption across its cellular membrane.
[2] Mobility in soil is the potential of a substance, if released to the environment, to move under natural forces to the groundwater or to a distance from the site of release.

- in case of physically degraded land, phytoremediation can be used to restore the environment together with waste disposal and removal. A combination of phytoremediation and agronomic techniques to restore soil fertility is most appropriate.
- if biomass produced on the site is contaminated, contaminants can be removed by pyrolysis[3] while producing so-called biochar. Biochar is somewhat similar to charcoal and can be used for energy production.

Benefits obtained

Direct environmental benefits to sites where the protocol was applied:

- Soils polluted with different contaminants were cleaned up and given back to agricultural use;
- Phyto-remediation plants and trees reduced contaminant movements toward groundwater by 30 % and achieved 65 % efficacy in removing organic pollutants;
- Increase in organic soil matter (carbon storage) was different at each site, but reached up to 2 t/ha (in 30 cm soil layer), contributing to improving soil quality but also to climate change mitigation;
- Trees and underlying grasslands also helped in absorbing nitrates, thus protecting groundwater from pollution;
- Phyto-remediation strategies allow to concentrate contaminants - avoiding their mobility - in biomass, which can be used to produce renewable energy, additionally saving up to 10 t/ha of CO_2 emissions.

Moreover, the socioeconomic advantages of phytoremediation with respect to other high-technology strategies were clear. The protocol proved to be very cost effective compared to the main alternative solutions: € 100,000 /ha compared to € 2-5 million /ha for 'dig and dump' and € 1-2 million/ha for 'capping with cement platforms'.

Best practice lessons

It is vital to determine the sources of contamination, the land uses and the population at risk in order to develop the remediation techniques. Attention must be paid to how the land and its ecosystem services are used by the surrounding population. Since contaminated land usually is a very sensitive topic in local communities, timely and meaningful public communication is necessary for building a climate of confidence and credibility about the innovative approaches for agricultural soil remediation.

[3] Pyrolysis process is the decomposition of materials at high temperatures without oxygen. Best known example is production of charcoal.

Elsewhere: *Greening of Waste processing facility, FRANCE.*

Nantes Métropole has been committed to sustainable development for 15 years, a commitment marked by the award of the European Green Capital title in 2013. Nantes has stepped up and taken a new direction by effectively involving the local area and all its stakeholders in the ecological transition, to reduce greenhouse gas emissions, preserve the environment and its citizens' quality of life.

Arc-en-Ciel in Nantes, north-western France, is home to a waste recovery plant operated on behalf of the Nantes metropolitan authority. Located close to a Natura 2000 protected area. An on-site assessment by an ecologist was used to draw up an action plan to improve the site's environmental performance and create and implement an ecological management plan. In 2016, the waste recovery plant was the first such unit to be certified Biodiversity Commitment by ECOCERT Environment. Some actions put in place included establishment of a large parcel of natural grassland grazed by Ouessant sheep. The presence of sheep, apart from cutting grass naturally, brings with it positive benefits in terms of the arrival of insects and birds formerly discouraged by grass-cutting machinery. Moreover, a compost-enriched zone is established to fertilize the soil in preparation for future tree planting, as well as a picnic area with tables and benches made from recycled waste.

Source: www.veolia.com

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Additional information

- *Assisted phytoremediation for restoring soil fertility in contaminated and degraded land*
- *ECOREMED, LAYMAN REPORT*