RECARE
Preventing and Remediating degradation of soils in Europe through Land Care

Case Study Details

Study Site: **15 Guadiamar**

Country: **Spain**

Soil Threat: **Contamination**

Partner: **19, IRNAS-CSIC**

Phytoremediation of soil contaminated by trace elements: The Guadiamar case study (SW Spain)

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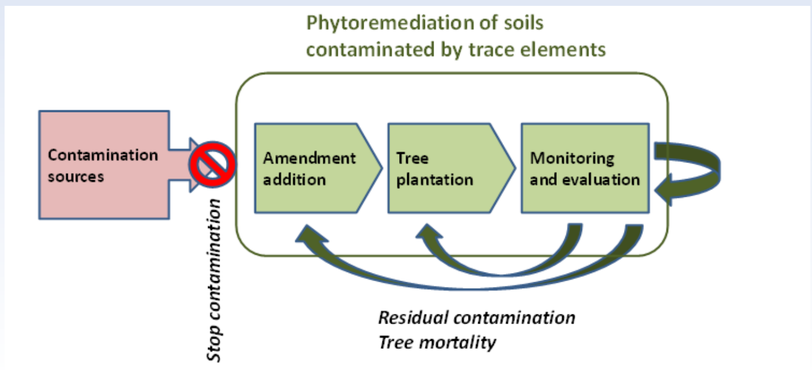
THE PROBLEM

The principal soil threat addressed in the Guadiamar study site (SW Spain) is soil contamination by trace elements due to a toxic mine spill occurred in 1998, affecting about 4,000 ha of cropland and pastures.

THE PROPOSED SOLUTION



EXPERIMENTAL DESIGN: AIM AND OBJECTIVES

Two measures were evaluated:

1) Amendment addition

After sludge was removed, two types of amendments were incorporated into the soil, while some plots were left non-amended for control.

With amendment Without amendment

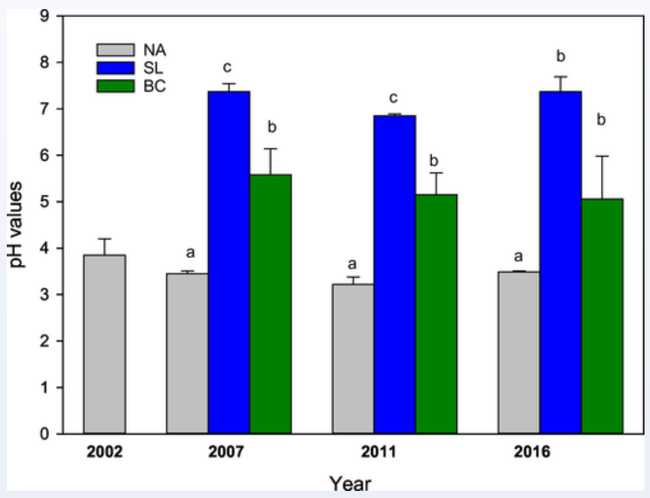
Both amendments – sugar beet lime and biosolid compost– were applied (in 2002) at a rate of 30 Mg ha^{-1}. Soils were sampled and analysed in 2016 and compared with previous data of 2002, 2007 and 2011.

2) Tree planting

After the contaminated soils were cleaned up and remediated, native trees were planted (in 1999-2000). We evaluated the effects of seven tree species (and treeless plots for control) on soil underneath.

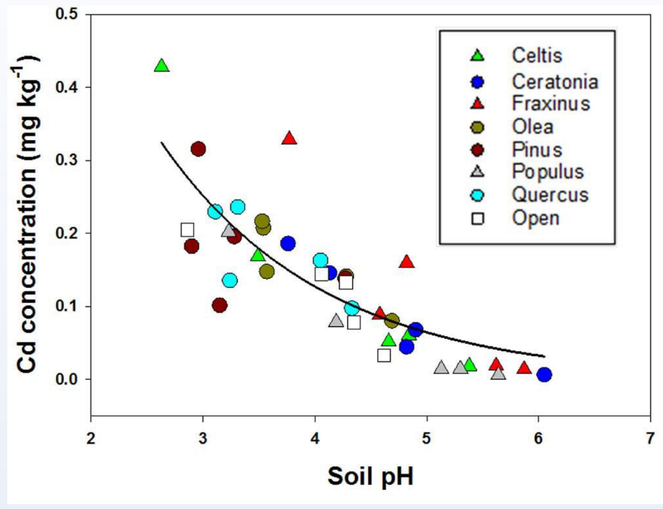
Soils, leaves and roots were sampled and analysed in 2014.

MAIN RESULTS



The addition of sugar beet lime (SL) and biosolid compost (BC) increased pH compared to non-amended soil (NA) and their effects lasted with time.

- The available concentration of trace elements showed a strong decrease in the amended plots. In particular, sugar beet lime reduced Cd, Cu and Zn availability by 99%.
- The initial values of soil carbon were very low, around 1%. The addition of biosolid compost doubled soil carbon.



- The soil pH was negatively and exponentially related with availability of trace elements.
- Carob, ash, and poplar were the tree species most effective at reducing trace elements availability in the soil underneath them.
- Soils underneath trees were richer in organic carbon than those in the treeless sites. The highest values were for carob and ash.

STAKEHOLDER INVOLVEMENT

Stakeholders participated in three workshops to select the remediation measures for testing and evaluation. Because the contaminated and remediated land has been converted in a forested and conservation area, most of the discussion with stakeholders focused on the impact on ecosystem services of regulation (improvement of air, water and soil quality, soil conservation, mitigation of climate change) and cultural services (recreation, nature observation, aesthetics values).

KEY FINDINGS

- Addition of soil amendments and afforestation were very effective in increasing soil pH and reducing availability of trace elements.
- Addition of soil amendments, in particular of biosolid compost, and afforestation, enriched the soil in organic carbon and contributed to climate change mitigation.
- Long- term monitoring of potentially toxic elements in the ecosystem is obligatory in this phytostabilization approach.

Reference

Madejón, P., Domínguez, M. T., Gil-Martínez, M., Navarro-Fernández, C. M., Montiel-Rozas, M. M., Madejón, E., Murillo, J.M., Cabrera, F. & Marañón, T. (2018). Evaluation of amendment addition and tree planting as measures to remediate contaminated soils: The Guadiamar case study (SW Spain). CATENA, 166: 34-43.

The RECARE project was coordinated by Wageningen University & Research, The Netherlands

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