

CASE STUDY: 15 GUADIAMAR

COUNTRY: ES-G (Spain)

PRINCIPAL SOIL THREAT: Soil contamination

Measure: Phytoremediation

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Experimental design

A contaminated area was cleaned up and soil was remediated. Native tree species were planted in 1999-2000.

The effects of seven tree species (treatments) on the soil underneath were tested 15 years after plantation, and compared with open (without trees) sites. Five replicates were randomly chosen within a site with low soil pH and high concentrations of trace elements.

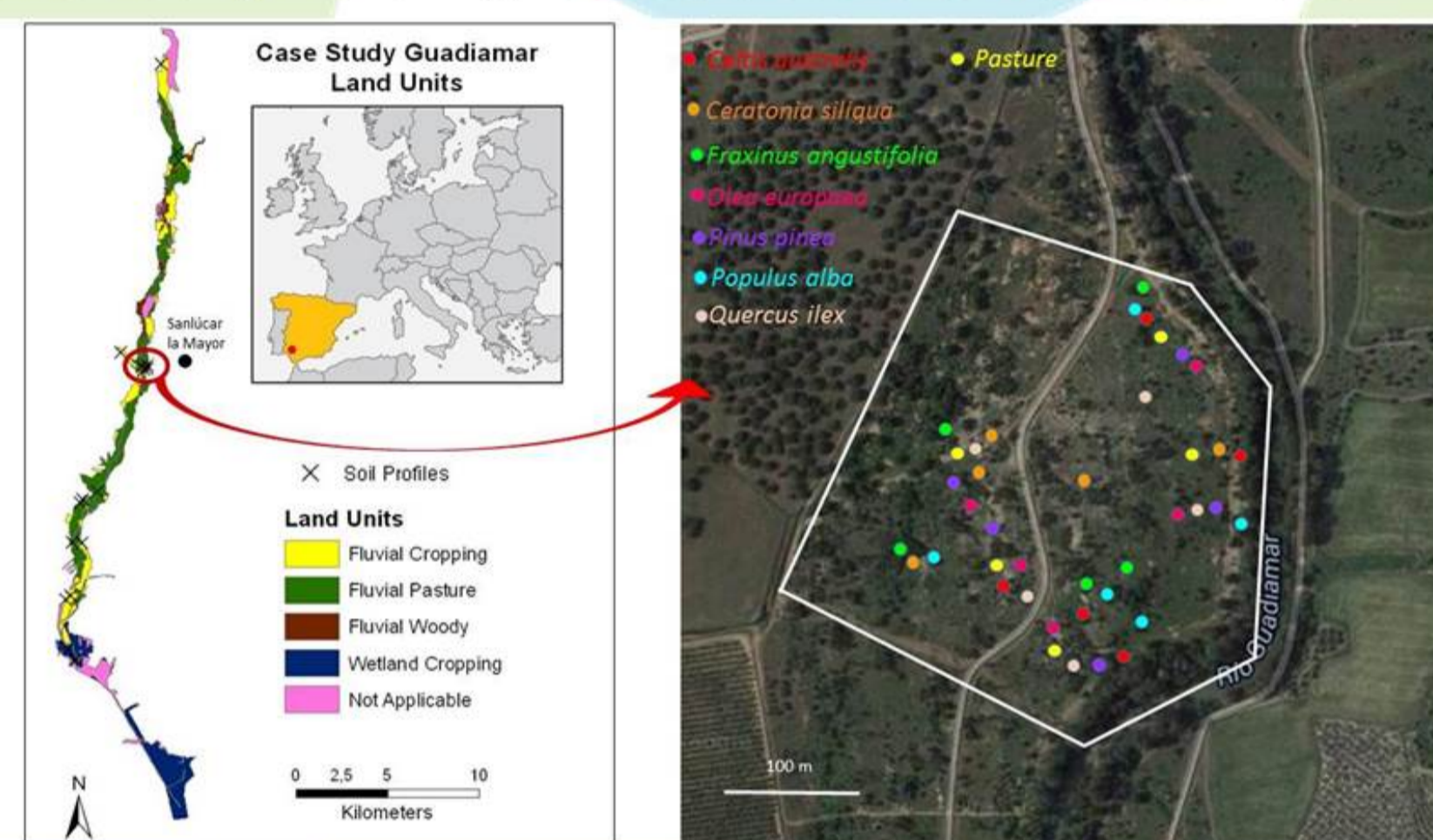


Fig. 1. Map of the Guadiamar River (Spain) and location of the 35 studied trees.

Preliminary results

Effectiveness: variables targetted by treatments

- ✓ There was a differential effect of the contrasted tree species (for example pine vs. poplar) on the phytostabilization capacity.
- ✓ The soil responses to treatments (tree species) differed among chemical elements.

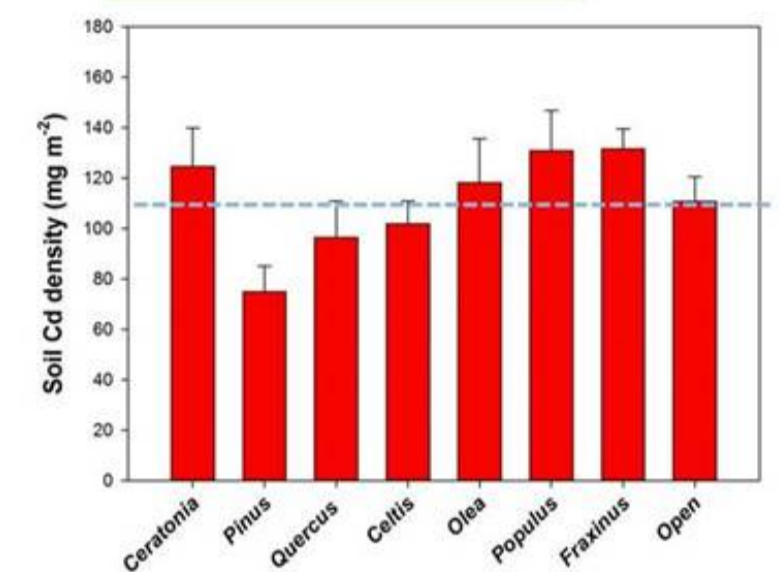


Fig. 2. Soil cadmium under seven tree species, and in open sites.

Effectiveness: indicators of soil threat

On river banks and channels, the cleaning up and remediation measures were not always effective and the soil contamination levels were very high, with up to 2920 mg kg⁻¹ of Pb and 650 mg kg⁻¹ of As.

These sites are barren, exposed to soil erosion, and represent a source of contamination. New soil remediation measures and tree plantation are needed there.



Monitoring variables

Ongoing work

- ✓ Concentration of 23 chemical elements was measured in five ecosystem compartments – tree leaves, forest floor, roots, top soil and deep soil.
- ✓ Total (extracted with aqua regia) and available (extracted with CaCl₂) concentrations of trace elements in soil were compared in each sampling point to assess the capacity of phytostabilization of each tree species.
- ✓ Soil pH, and nitrogen and carbon contents were also measured.

Planned work

- ✓ Multifunctionality of tree species and their provision of ecosystem services will be evaluated.
- ✓ Capacity of carbon sequestration on soil underneath.
- ✓ Mycorrhizal diversity and their role on phytoremediation.
- ✓ Soil biodiversity recovery mediated by tree species.

Stakeholder involvement

Selection of the native tree species to be planted in 1999-2000 was made by the main stakeholder (Andalusian Regional Government).

In the Second RECARE Participatory Workshop (held on February 2016), stakeholders evaluated different phytoremediation alternatives.



Demonstration activities

Field trip to the experimental sites by the students of "Environmental contamination, ecotoxicology and phytoremediation" within the Master of Advanced Biology, University of Seville.



Problems & doubts

- ✓ Phytostabilization of soil trace elements is a slow process.
- ✓ Some tree species, such as poplar, accumulate Cd and Zn in leaves which is a potential risk to the trophic network.
- ✓ Results need to be contrasted under other soil conditions, differing in pH and texture.

References

- Domínguez, M. T., Alegre, J. M., Madejón, P., Madejón, E., Burgos, P., Cabrera, F., Marañón, T., Murillo, J.M. (2016). River banks and channels as hotspots of soil pollution after large-scale remediation of a river basin. *Geoderma* 261: 133-140.
- Marañón, T., C.M. Navarro-Fernández, M.T. Domínguez, P. Madejón, J.M. Murillo (2015). How the chemical composition is affected by seven tree species planted at a contaminated and remediated site. *Web Ecology* 15: 45-48.

