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EDAFOTEC
Solutions from problems

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What is EDAFOTEC?

Private Company using **technologies** with **tailor made solutions**

EDAFOTEC
Consultancy
&
Engineering

Contaminated Soils

Landscape Restoration

Polluted Water

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Where are we?

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What do we do?

Artificial Soils

Biochars

Water Treatment

Other Technologies

Waste Recovery

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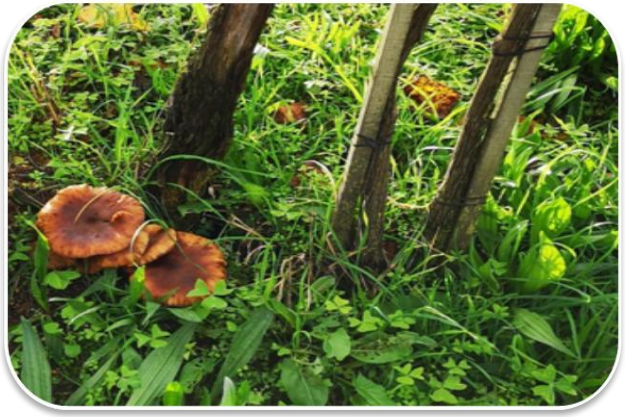
Artificial Soils

Artificial Soils



Mycotechnosoils

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Artificial soil – What is it?

Soils whose properties and paedogenesis are dominated by their technical origin. They are derived from organic and inorganic residues, mixed to produce "tailor made" new soils

Artificial Soils Project, Vitoria Gasteiz, Spain

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Benefits

Designing and producing artificial soils, mimicking natural soils, with environmental and/or productive requirements in soil, water and landscape contribute to:

- ✓ Fulfill required soil functions
- ✓ Stabilizing organic matter
- ✓ Reducing excessive acidity or alkalinity
- ✓ Immobilizing heavy metals and other trace elements of toxic character
- ✓ Modifying undesirable redox conditions generating the most convenient ones
- ✓ Increase or reduce water residence time, filters
- ✓ Controlling the flow and quality of water
- ✓ Having the desired structure

Terra Preta, Amazonia

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Mycotechnosoils

Artificial Soils with inoculated saprophyte fungi and bacteria, which generates oxidant radicals causing:

- ✓ Heavy metal retention
- ✓ Hydrocarbon degradation
- ✓ Soils structure improvement
- ✓ Balancing soils deficiencies
- ✓ Recovering their productive capacity
- ✓ Facilitating the absorption of nutrients by the plants
- ✓ Erosion control, stabilization and ecological and landscape integration

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How are they produced?

FERMENTABLE MATERIALS

- Aerobic muds
- Anaerobic muds
- Aerobic muds with Ca
- Animal manure

+

CONDITIONERS

- Industrial Ashes
- Mining Waters
- Aluminum Gels
- Al polyelectrolyte solutions

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Water Treatment

Reactive Wetlands

DAS

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Reactive Wetlands

Systems composed of artificial soils, microorganisms and water, which eliminate pollutants or improve water quality by means of different physical, chemical and biological mechanisms

Application range:

- ✓ Agro-alimentary industry
- ✓ Waste water treatment

Reactive Wetland in Pazo de Señoráns (Pontevedra, Spain)

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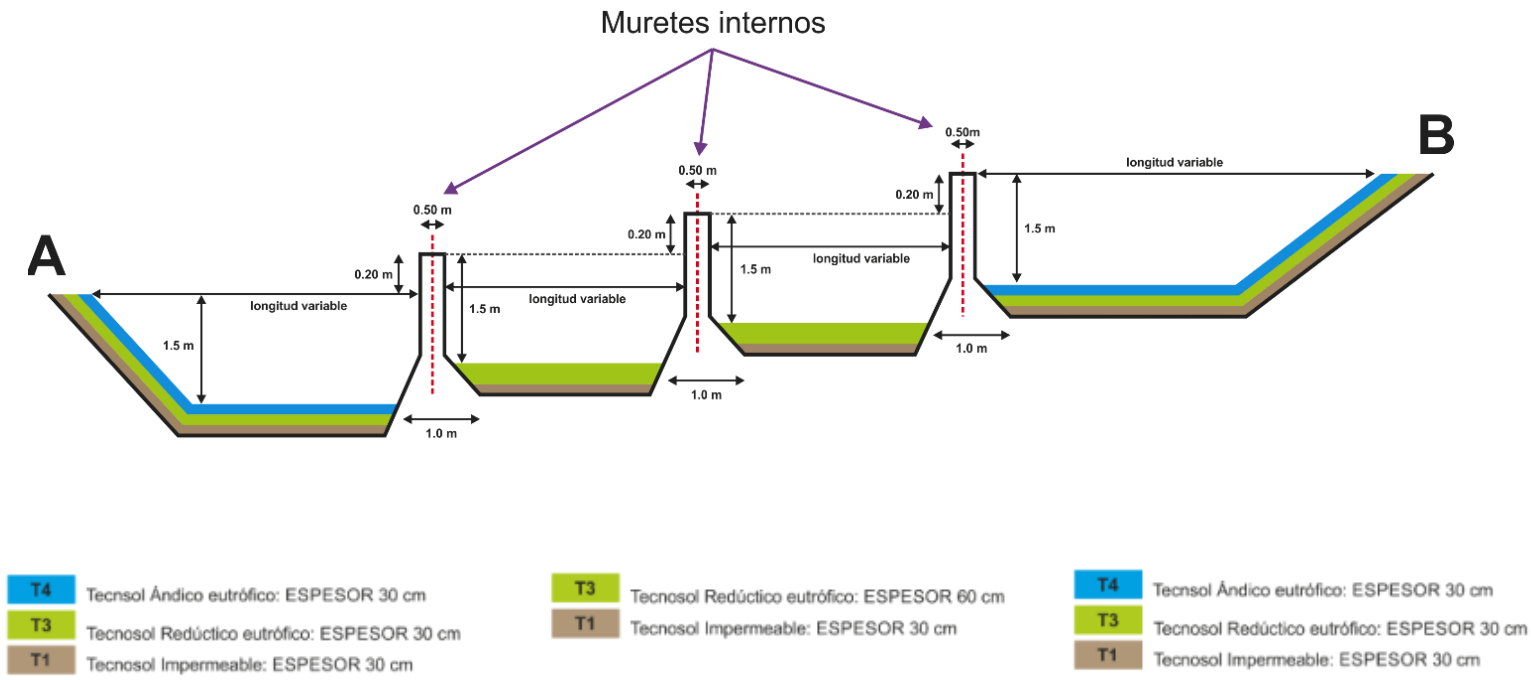
Reactive Wetlands



Reactive Wetland Diagram of La Zanja (Peru)

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Dispersed Alkaline Substrate (DAS)

Fine-grained alkaline reagent ($CaCO_3$, MgO) mixed with an inert, coarse, high-surface material (typically wood shavings, flakes, or chips)

- ✓ Large reactive surface
- ✓ Avoid passivation and clogging
- ✓ Maintenance is not required
- ✓ Support high acidity and metal loads

Column experiment of limestone-DAS

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Biochar

Biochar

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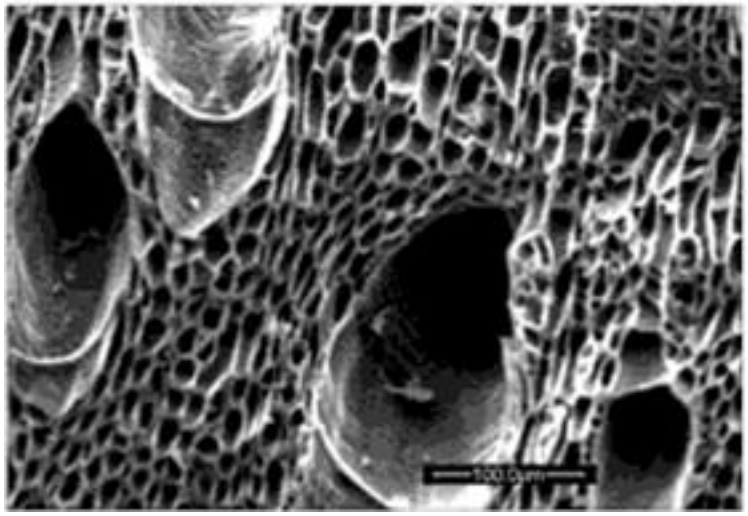
Biochar – What is it?

Finely granulated charcoal with a high organic carbon content, obtained by thermochemical conversion of biomass under anoxic conditions (pyrolysis) (IBI,2013)



Scanning Electron Microscope image of biochar derived from wood obtain by slow pyrolysis (Source: Downie *et al.*, 2009)

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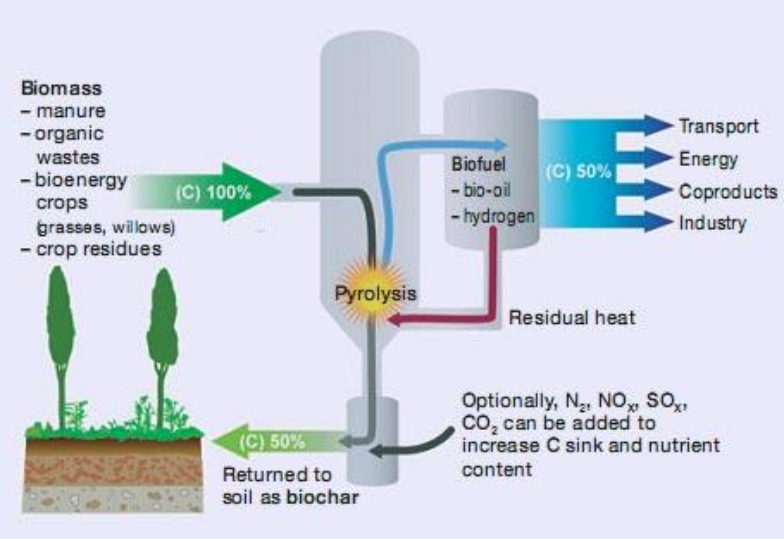
Biochar – How is it made?

Thermal decomposition of biomass in the absence of O_2, eliminating volatiles and leaving a carbonaceous residue

HYDROTHERMAL CARBONIZATION | **PYROLYSIS** | **MICROWAVE CONVERSION**



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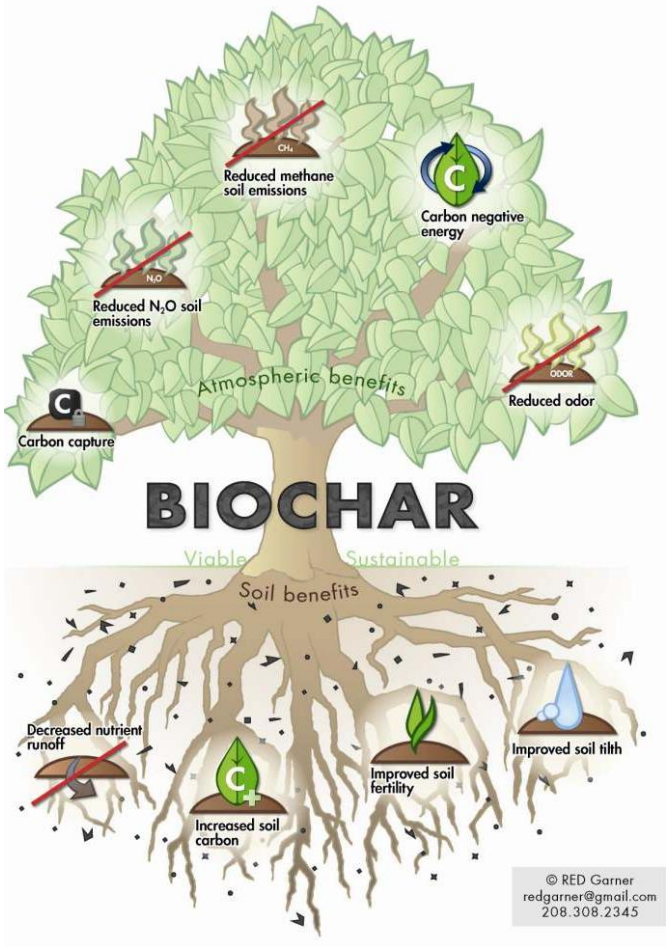
Biochar – Benefits

- Improving soil fertility
- Decrease in soil acidity
- Increased water retention



- Carbon sequestration in soil
- Waste Management
- Energy Production

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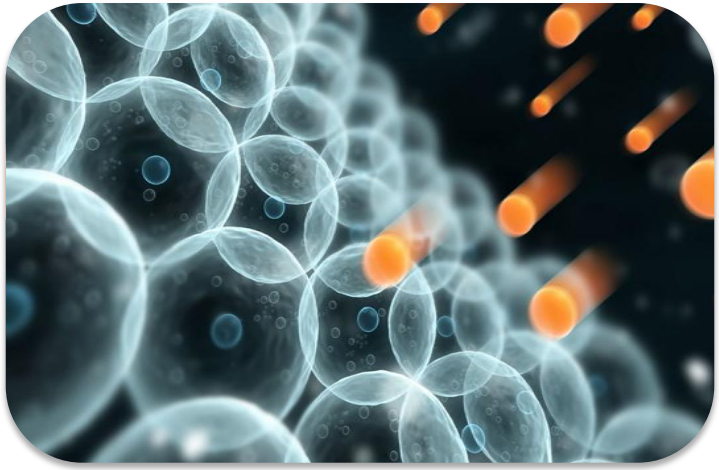
Other Technologies



Iron Nanoparticles

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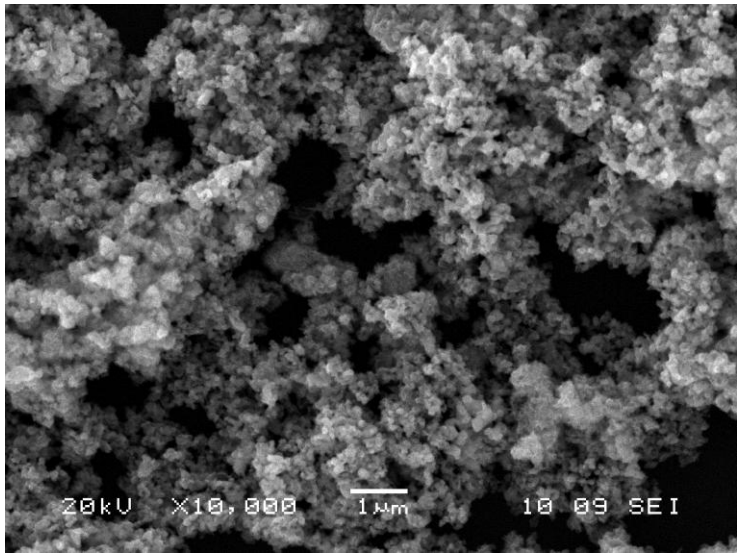
Zero-Valent Iron Nanoparticles (nZVI)

Iron powder of 100nm or less with high specific surface and adsorbent properties

Applicable as adsorbants of **Chlorinated Solvents** (PCE, TCE, DCE); **Heavy Metals** (Arsenic, Hexavalent Chromium); Cyanide, Nitrate, Uranium, Technetium, **Pesticides** (DDT, DDD, and DDE)



Observation by Scanning Electron Microscope (SEM)

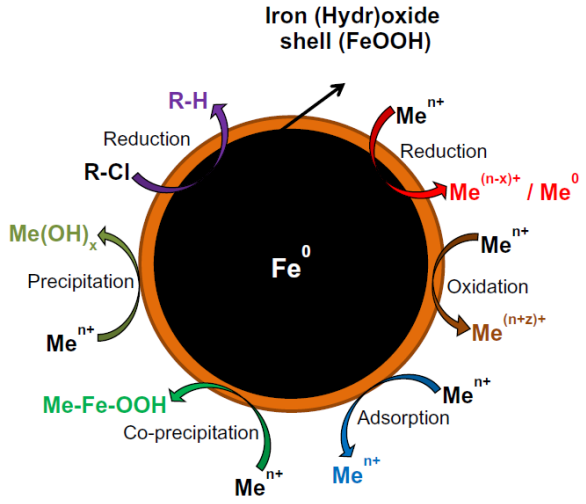


Fig. 1. Core–shell structure of nZVI depicting various mechanisms for the removal of metals and chlorinated compounds. Adapted from Li et al. [62].

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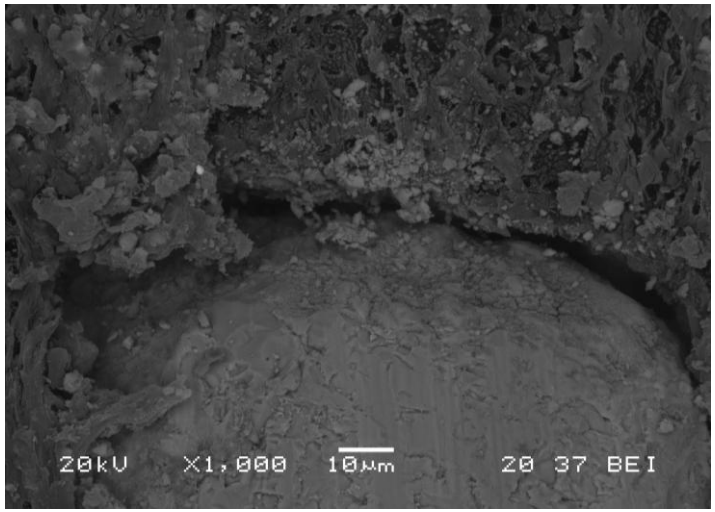
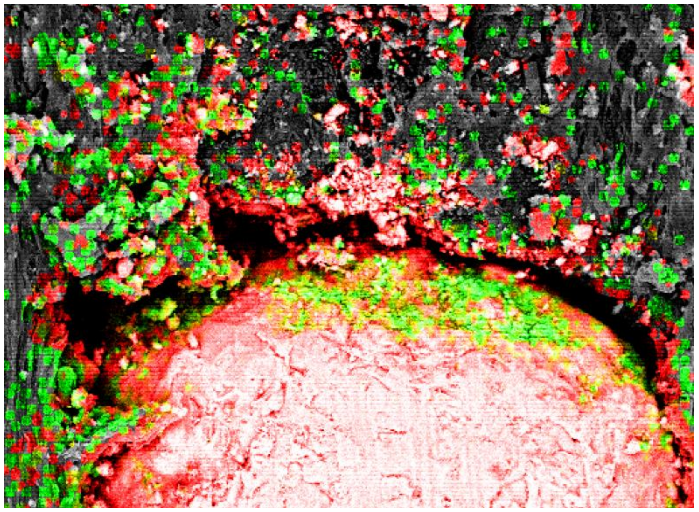
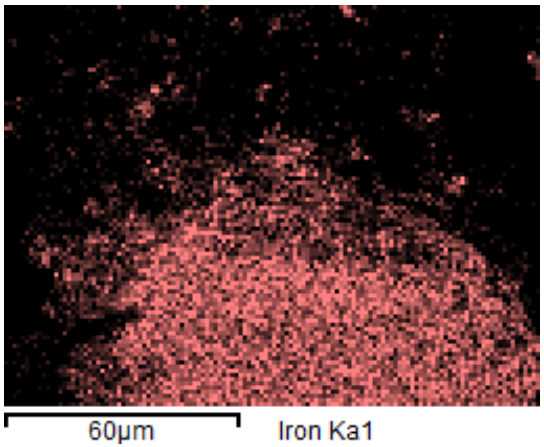
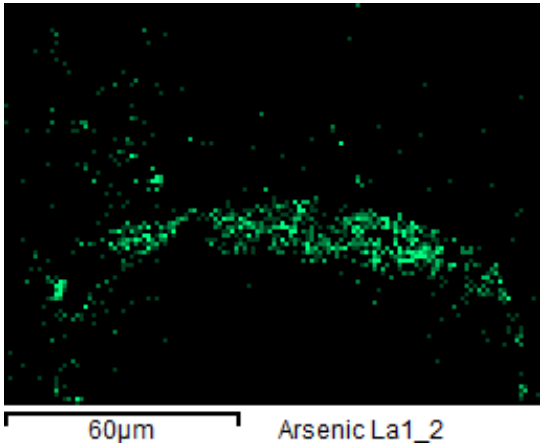
Zero-Valent Iron Nanoparticles (nZVI)









Agglomeration of nanoparticles of zero-valent iron (nZVI) with As adsorbed on its surface. (SEM)

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Efficiency of our solutions

- ✓ Reducing C emissions and **increase C sequestration** in solid, liquid & biotic phases.
- ✓ **Recovering degraded or contaminated soils**, in public works, mining and landscape restoration.
- ✓ **Reutilizing residues** and minimizing GHG emissions.
- ✓ **Weathering labile minerals** and increase the speed of soil formation.
- ✓ Providing **cost effective solutions** in a timely manner, by applying similar mechanisms to those operating in natural soils.

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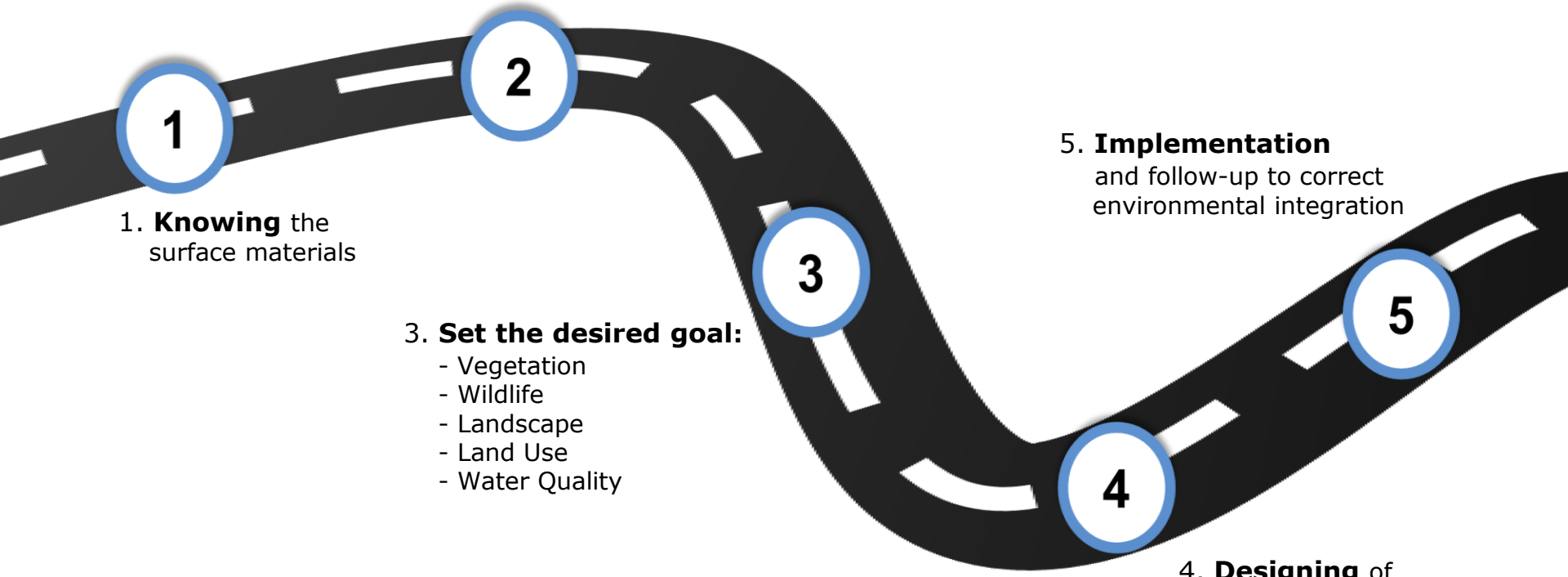
The Roadmap

2. **Study** climatic, water and soil conditions



1. **Knowing** the surface materials

3. **Set the desired goal:**
- Vegetation
- Wildlife
- Landscape
- Land Use
- Water Quality

5. **Implementation** and follow-up to correct environmental integration

4. **Designing** of solutions

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Some cases

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Sterile Coverage. Laza, Spain

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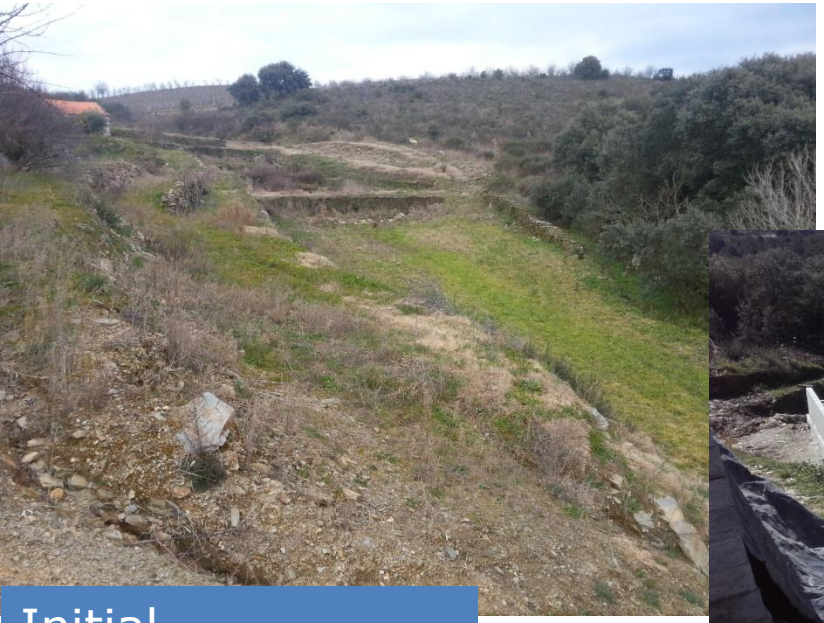
Reactive waterland. Alto Douro, Portugal



Initial

In process

Final

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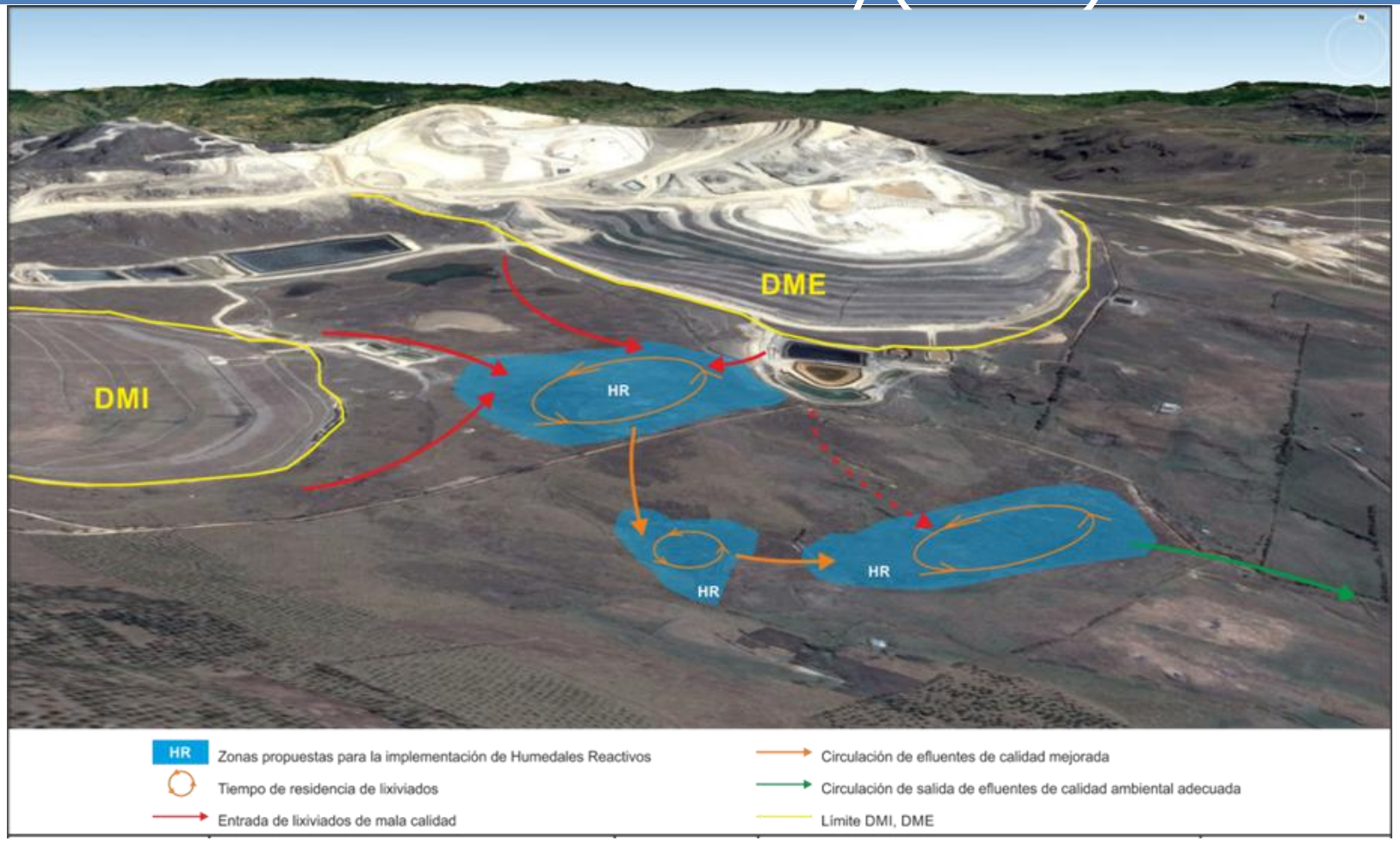
Reactive waterland for acid water treatment. UM Tantahuatay(Peru)



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Other projects:

✔ Ravine caused by working public activities remediation, Uige (Angola)

✔ La Zanja Mine closing Cajamarca (Peru)

✔ Tantahuatay Pilot for mine closing Cajamarca (Peru)

✔ Aznalcóllar Pilot for mine closing, Andalusia (Spain)

✔ Alternatives for uranium mine closing, Salamanca, (Spain)

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R&D Activities

- Founders partners of EIPs: C&D-WRAM and Phmines
- Finished projects:

  - ✓ Mycotecnosoles I (CONECTA 2014-2015, Spain)
  - ✓ "Soils improvement to recuperate ecosystems affected by mine operations." FINCYT, Peru, (2016-2017)
  - ✓ "High Efficiency Reactive waterlands for Acid Water Treatment ", FINCYT, Peru, (2016-2017)
  - ✓ Mycotecnosoles II (CONECTA 2015-2017, Spain)
  - ✓ Sanavid (CDTI 2017-2019, Spain)

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