



## Clean biofuel production and phytoremediation solutions from contaminated lands worldwide

We are pleased to share the third issue of Phy2Climate newsletter, keeping you up to date with all the latest news and developments from the project. Phy2Climate is a project funded by Horizon 2020 EU's Research and Innovation programme. The overall objective of the Phy2Climate project is to build the bridge between the phytoremediation of contaminated sites with the production of clean drop-in biofuels and bio-coke.

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## Spanish pilot site presented in Barcelona

Leitat has presented the main activities performed at Spanish pilot site at the 1-day conference on "Management of Contaminated Soils at the Port Area" organized by the Grup de Treball de Medi Ambient de la Comunitat Portuària Barcelona Port (Environment Working Group of the Port Community Barcelona Port), held on September 29th at the World Trade Center of Barcelona.

The conference was inaugurated by the General Director of the Port, José Alberto Carbonell and saw the participation of Agència de Residus de Catalunya (Catalan Waste Agency) and Agència Catalana de l'Aigua (Catalan Water Agency) presenting the actual regulatory framework, the Port Community of Barcelona Port presenting the soil management at the Barcelona Port Area and expert technological center (Leitat) and company (Litoclean) in soil decontamination projects.

Leitat has presented an overview of the different activities carried out in the framework of WP2 for remediating the 600 m<sup>2</sup> Spanish Pilot Site mainly contaminated by total petroleum hydrocarbons (TPH).

The results of the first year of field campaign after the application of the best phytoremediation

strategy resulting from preliminary pot tests (rotation of Sorghum sp. and Brassica napus using compost, biochar and Plant Growth Promoting Rhizobacteria, PGPR, as amendments) have been presented.

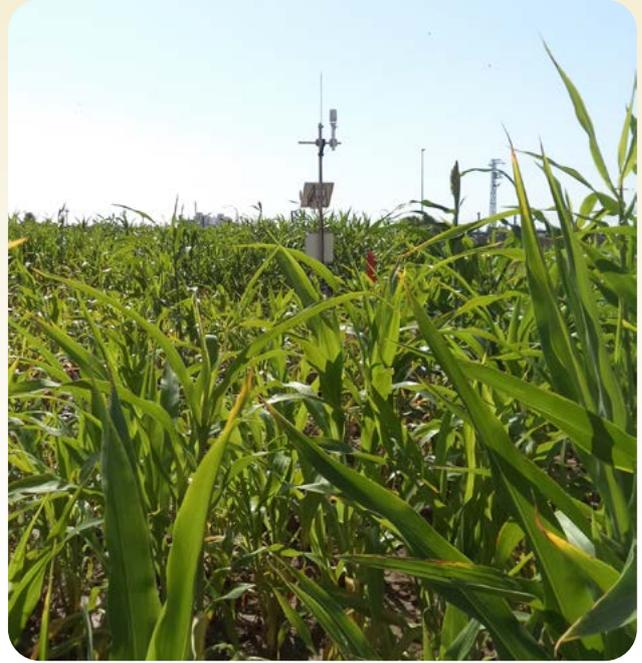


Francesca Audino (LEITAT), Phy2Climate Project: phytoremediation of petroleum hydrocarbons contaminated site in the Mediterranean region, coupled with clean biofuel production. Credit: LEITAT.

The first year of field campaign has started with the seeding of Sorghum sp. mixed with compost, biochar and PGPR, performed on May 4th, 2022. The harvesting of Sorghum sp. has been performed at the end of August 2022 and 2,440 kg of wet biomass have been harvested and will then be dried and pelletised for its future conversion into biofuels. Analysis of soil and biomass are on-going to estimate the TPH removal rate and mechanism. Just after harvesting of Sorghum sp., on September 8th, 2022, Brassica napus has been seeded and first germination has already started.



Spanish contaminated pilot site: phytoremediation strategy based on the use of Sorghum s.p and the mix of amendments (compost + biochar + PGPR). Credit: LEITAT.



Spanish Pilot Site: first germination of *Brassica napus* using compost, biochar and PGPR as amendments. Credit: LEITAT.

## Squaring the circle between phytoremediation and biofuel production: the role of policy and regulation in Europe

On Thursday 12th May 2022, at EUBCE 2022, three similar Horizon 2020 projects: GOLD, Phy2Climate and CERESiS, held a two-hour workshop in which the three projects were presented, as well as hearing from European Commission experts on the subjects of renewable energy, soil protection and policy.

The idea for a joint event with these three projects was originally thought of after project award, as it was realised that the projects have similar, if not the same, objectives. Therefore, through a series of online meetings involving at least one representative from each project, the agenda was formulated to include short presentations from each project, a presentation from a member of the European Commission's Joint Research Centre (EC JRC), and to conclude with a panel discussion. During the first 18 months of the Phy2Climate project, research was carried out for a deliverable on the role of policy and regulation, and the need to identify and eliminate barriers that may hinder the use of contaminated land for biofuel production. This topic was brought forward as the focus for the panel discussion in this workshop, for which additional members of the EC were invited.

The workshop commenced with opening remarks from Maria Georgiadou, Senior Expert, European Commission, DG Research and Innovation, in which she summarised the EU's Green Deal manifesto and the EU's climate and energy policies. The renewable energy commitments for the 'Fit for 55' package and REPowerEU were also presented, concluding with a summary on the Horizon Europe programme.

After the opening remarks the three projects were presented, the aim of which is to remediate contaminated sites through the growth of specific contaminate absorbing crops, and then to use such crops as a feedstock to create biofuels. Each of the three projects is using its own method of conversion and different types of crops, all of which was summarised in this workshop. Matteo Fermeglia, Hasselt University, Belgium, presented Phy2Climate.

To finish the first session of the workshop, Luca Montanarella, EC Joint Research Centre, Land Resources Unit, presented a summary of the EU's Soil Strategy and Soil Observatory. In this informative presentation we hear about the background and history of the EU's legislation and policy regarding soil quality, the importance of soils in the fit against climate change, and the vision the EU has for monitoring and protection. The main goal of the EU soil observatory is to monitor and accurately map contaminated sites throughout Europe, whilst engaging in scientific and citizen working groups.

To conclude, the workshop rounded off with a 45-minute panel discussion, moderated by Matteo Fermeglia, including the following panellists:

Mirco Barbero, EC DG ENV, Policy Officer – Soil protection and sustainable land use

Luca Montanarella, EC JRC, Senior Expert – Sustainable Resources

Marko Perišić, Hasselt University, Belgium

Efthimia Alexopoulou, CRES, Greece

George Vourliotakis, Exergia, Greece

To start with we heard from the three project representatives, of which the discussion revolved mostly around the gaps in policy that would help to bridge the gap between phytoremediation

techniques and the production of biofuels. Marko Perišić mentioned policy gaps have been identified in different aspects of the project, including those for invasive species, waste management and agricultural, to name a few. Whilst George Vourliotakis and Efi Alexopoulou touched upon the need for better mapping of contaminated sites and looking toward investment and premiums for this type of value chain.

We also heard from Luca Montanarella, who gave an overview of the EU's work on soil health, and highlighted the biggest challenge as the lack of clear definitions in regards to contaminated and degradation land. He also expresses a positive opinion towards the research outcomes of these projects, but highlighted his concern that if contamination is just displaced, this type of remediation and fuel production will not be a valid solution.

Mirco Barbero echoed Luca's comments linked to clear definitions, and also expressed challenges of setting new soil laws. One of which is the need to apply laws that are accepted and implementable by all member states, in some cases this could ensue enormous costs associated with the remediation of contaminated land. Therefore, Barbero views cost cutting a positive aspect, but also that all options will be risk assessed for cost and benefits before being considered as applicable.

In conclusion, the panel agreed that there is huge pressure on all land available in Europe, however, to manage it efficiently, not only are clear definitions and mapping of soil status required, but also these value chains should be market driven and economically incentivised.

Finally, the panel discussion finished on a positive note from Luca Montanarella that by starting at a local scale, with living labs and case studies, and by taking note of what is working well, a bigger solution will be achieved that will be easier to scale-up to European level.

A full recording of the workshop can be found [here](#), Youtube Channel of Phy2Climate project.

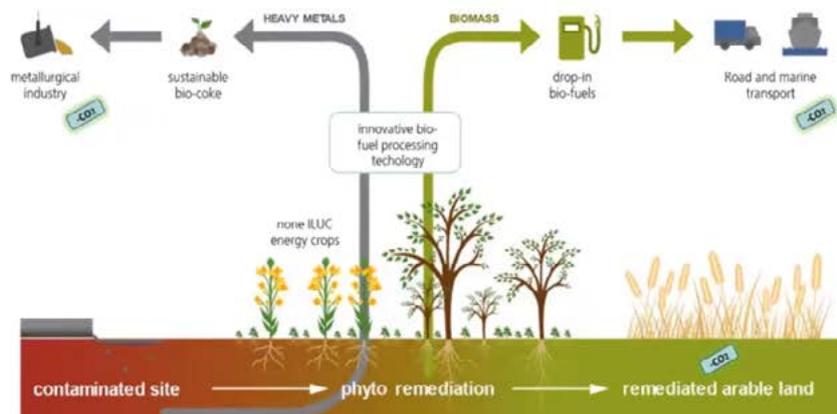
## Phy2Climate in a Nutshell



Duration: 1.1.2021 - 30.06.2025 (54 Months)

Total budget: € 4.151.989,00 (EU contribution: € 4.031.100,00)

Research and Innovation Action (RIA) - H2020-LC-SC3-2020-RES-RIA



## Verifying a functional business model based on the Phy2Climate approach: pitfalls, opportunities and strategies in place

The aim of the workshop was to verify Phy2Climate's approach from a practical and economical point of view. Together with participating experts and stakeholders we had a look at process proposed by Phy2Climate and the draft of an overall business model as well as the models for the contributing parties in the overall process.

It is the implicit goal to identify potential obstacles as well as opportunities that may affect the feasibility of following through this approach. Participants of the workshop were conveyed the projects findings from a process and economic point of view and were invited to share their expertise to improve the realization and pursuit of the Phy2Climate overall goal of combining phytoremediation and the production of biofuels and biochar in a beneficial manner.

Participants of this workshop gained essential insight on the opportunities of the Phy2Climate-approach which joins the benefits of gentle remediation of contaminated soils with production of bio-combustibles with low CO<sub>2</sub>-impact or possibly CO<sub>2</sub> reduction potential.

Workshop was organised as follows:

Part 1, 40 minutes

Sharing of status quo of the Phy2Climate process and implications regarding the economic value of the steps of the Phy2Climate approach through expert inputs

Status quo – Process and value chain, by Lukas Brunbauer, ITS Förderberatung GmbH

Practical view on remediation specifically phytoremediation, by Zygimantas Kidikas, Biovala Ltd.

Practical view on the TCR-process: Biomass conversion and biofuel production, by Christopher Kick, Fraunhofer UMSICHT GmbH

The social perspective – acceptance and relevance, by Karolina Petela, Silesian University of Technology

Part 2, 50 minutes

Interactive session moderated by ITS

The participants of the workshop together identified, named and discussed pitfalls, opportunities and strategies in place in an interactive online session.

A full recording of the workshop can be found [here](#), Youtube Channel of Phy2Climate project.



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### Who will be guiding through this session?

**Lukas Brunbauer**  
ITS Förderberatung GmbH  
Leader of WorkPackage5 – Phy2Climate „Identification of stakeholders and investigation of potential business models“

**Zygimantas Kidikas**  
Biovala Ltd.  
Co-Founder and chief project officer of biotechnology and remediation company „Biovala“.  
Lithuanian Pilot site leader of Work Package 2 - Design and implementation of phytoremediation pilots“

**Christopher Kick**  
Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT  
Leader of WorkPackage3 – Phy2Climate „Energy crop conversion to drop-in biofuel and bio-coke “

**Karolina Petela**  
Silesian University of Technology  
Leader of WorkPackage4 - Phy2Climate "Environmental and social sustainability"

## Article on phytoextraction of metal(loid)s from the soil

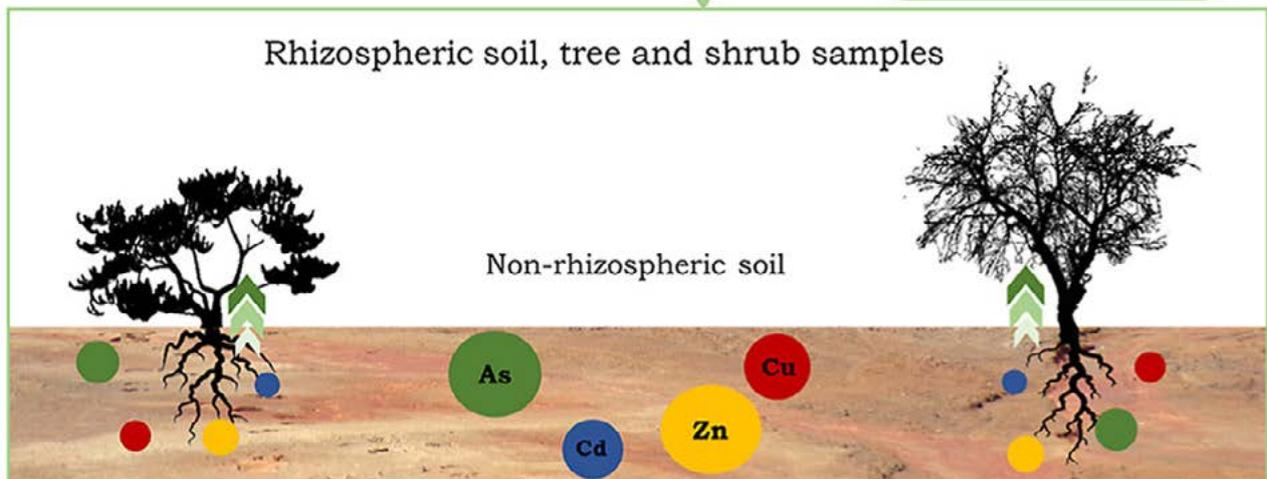
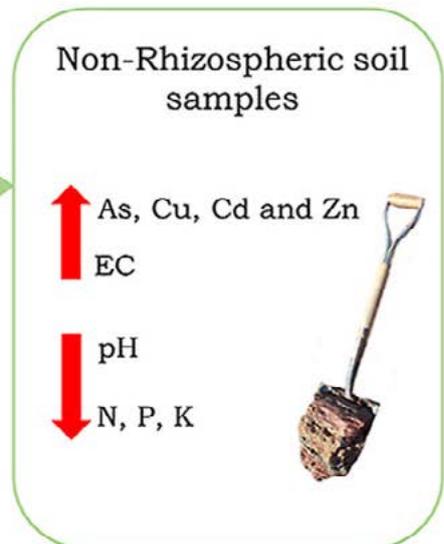
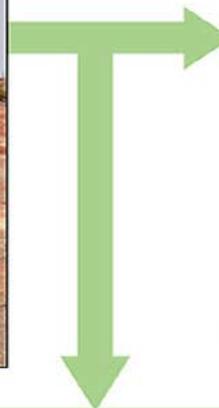
Phy2Climate project partner INTA just published a peer-reviewed and open access article distributed by Elsevier (Chemosphere, Volume 308, Part 2, December 2022, 136146).

In this article, the four native species that could be used in remediation plans for contaminated soil are considered and the study carried out highlights that soil samples were taken from two sites in La Planta, San Juan, Argentina.

Mining activity has degraded large extensions of soil and its waste is composed of metals, anthropogenic chemicals, and sterile rocks. The use of native species in the recovery of polluted soils improves the conditions for the emergence of other species, tending to a process of ecosystem restoration. The objective of this study was to evaluate the bioaccumulation of metal(loid)s in four species of native plants and the effect of their distribution and bioavailability in soil with waste from an abandoned gold mine.

In recent years, phytoremediation technologies have been implemented with the aim of recovering polluted soils. Phytoremediation consists of employing plants in soil decontamination and its effectiveness depends on the plants ability to absorb, transfer, stabilize, concentrate and/or degrade contaminants (Favas et al., 2018, Lam et al., 2017). Plants called metallophytes are used for the remediation of soils contaminated with metal(loid)s.

### Waste from an abandoned gold mine



Phy2Climate pilot site in La Planta, San Juan, Argentina. Credit: INTA and Chemosphere.

The use of native woody species in phytoremediation processes generates advantages due to the growth of their root system and greater biomass production. Particularly, native species of arid zones have developed several adaptations that allow them to resist stress factors. Their implementation for the recovery of polluted soils generates better conditions for the emergence of other species by natural succession, tending to a process of ecosystem restoration (Villagra et al., 2021).

Mining is the main economic activity in the province of San Juan, Argentina. In particular, soil pollution in the town of Planta was caused by an abandoned gold mine, characterized by an inappropriate waste management and lack of implementation of mitigation measures (Calabró et al., 2022). The area is inhabited by a human population, who carry out subsistence economic activities, mainly goat raising. Therefore, the presence of mining waste and their potential dispersion by different erosive agents presents a great risk to human health. Native species of trees and shrubs that grow in this contaminated soil were identified. Given the need to study the soil pollution level to evaluate future phytoremediation strategies in this arid region, the aims of the present study were to evaluate a) the metal(loid)s bioaccumulation capacity of *Larrea cuneifolia*, *Bulnesia retama*, *Plectrocarpa tetracantha*, and *Prosopis flexuosa*, and b) the effect of spatial distribution patterns and the bioavailability of metal(loid)s in soil with (rhizospheric) and without (non-rhizospheric) vegetation.

The adaptations of these tree and shrub species allow them to survive the adverse environmental conditions of the arid and semi-arid ecosystems, such as limited rainfall, high temperatures, and poorly developed soils. These characteristics and the different phytoextraction capacities presented by the four species should be taken as advantages in phytoremediation strategies, as they contribute to ecological restoration. The presence of vegetation would prevent the spread of pollutants by different erosive agents. These plants also provide ecosystem services and improve soil quality, promoting the growth of new species. Considering that the main subsistence productive activity in La Planta is extensive goat farming, a complete remediation of the contaminated site would provide an enlarged area available for livestock feed.

[full article here](#)



# Phy2Climate



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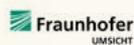
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[www.phy2climate.eu](http://www.phy2climate.eu)

The project consortium has put together 16 partners from 9 countries with long-term expertise in soil remediation, phytoremediation, biofuel technologies and energy processes, environmental and social sustainability, legislative analysis, communication and dissemination as well as business development for innovative technologies.



Phy2Climate is a H2020 project with title "A global approach for recovery of arable land through improved phytoremediation coupled with advanced liquid biofuel production and climate friendly copper smelting process"

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