



Clean biofuel production and phytoremediation solutions from contaminated lands worldwide

We are pleased to share the fifth 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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Paper from project activities on regulatory and legal issues

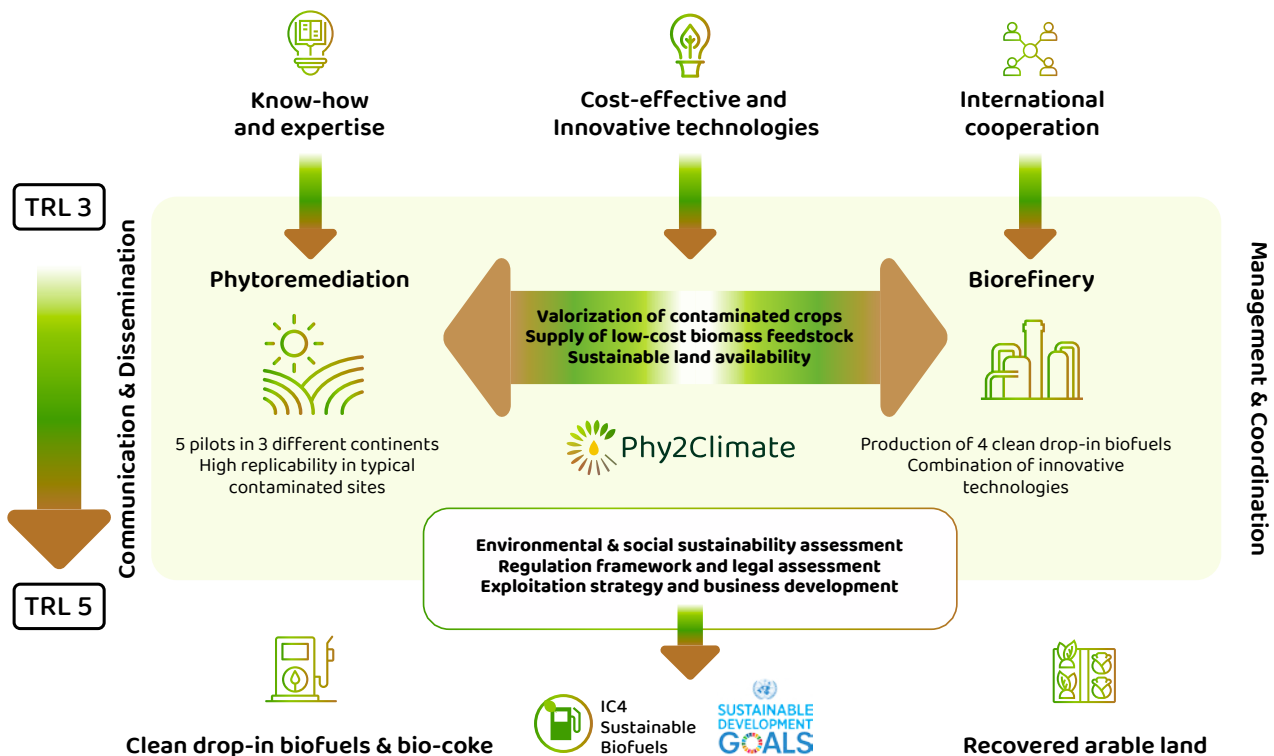
Matteo Fermeglia and Marko Perišić from Hasselt University, Belgium, are the authors of the paper "Nature-Based Solution to Man-Made Problems: Fostering the Uptake of Phytoremediation and Low-ILUC Biofuels in the EU", published online by Brill in "Journal for European Environmental & Planning Law" in June 2023, and divided in five chapters, as follows:

1. Introduction;
2. Phytoremediation as a Viable Nature-Based Solution for Soil Remediation and Biofuels Production;
3. The Policy and Legal Framework for Nature-Based Soil Remediation Solutions Under the EU Green Deal;
4. The Legal Framework for Phytoremediation Techniques and Biofuels Production in the EU;
5. Conclusion.

This paper addresses the policy and legal background surrounding the uptake of phytoremediation and recovery of output materials focusing on existing roadblocks currently hampering the full-scale adoption of such a complex yet inherently circular value chain. The paper concludes that meaningful steps must yet be taken to properly embed nature-based

soil remediation techniques, such as phytoremediation, in the current legal framework and to ensure social ownership of the same to maximise its environmental benefits.

As reported in the Introduction, soil contamination constitutes a major environmental and climate threat worldwide, as well as in the European Union. European soils are under the threat of sealing, erosion, compaction, pollution, salinisation, carbon loss and various effects of climate change (e.g. droughts, fires, storms, floods). Against the long-standing dreadful accounts of the breadth of contamination across the European Union, unsuccessful attempts have been put in place to achieve a good quality status of soils ever since the notorious Soil Framework Directive was withdrawn in 2014. Major pitfalls stand in the way to the adoption of a comprehensive EU governance framework dealing with soil protection to ensure that both its environmental and biodiversity potentials, as well as its positive climate change contribution as a carbon sink can be enhanced. Effective soil governance is a key element to ensure that the EU lives up to its international commitments under the UNCBD and the UNCCD and other voluntary initiatives – such as the 4 per 1000 initiative adopted in the wake of UNFCCC cop21 – to achieve a land degradation-neutral world by 2050 thus protecting soil biodiversity while increasing carbon sinks. Such commitments are in line with the achievement of several UN Sustainable Development Goals (foremost, SDGs no. 7, 13 and 15). Moreover, soil protection has been embraced as one of the key challenges in the European Green Deal, the EU 8th Environmental Action Programme as well as the EU Research and Innovation Missions, thus channelling a great deal of financial resources to advanced techniques for remediation and enhanced soil quality.



The overall approach of Phy2Climate.
Credit: Phy2Climate project.

At the same time, the EU is stepping up its action to address greenhouse gas (GHG) emissions from all relevant sectors, notably the transport sector. The transport sector currently accounts

For approximately 27% of the total GHG emissions in the EU. To this end, an increasingly ambitious policy addressing the use of sustainable biofuels in both the ground, maritime and aviation transport is expected under the Fit for 55 package implementing the commitments under the EU Climate Law and the European Green Deal. More specifically, the EU has set specific targets for the use of biofuels as part of the revision of the Recast Renewable Energy Directive (RED II). This paper advocates for the use of nature-based solutions (NBS) for soil remediation, and more specifically phytoremediation of contaminated soils, also as combined with the generation of non-food, low Indirect Land Use Change (ILUC) feedstock for conversion to advanced biofuels. More specifically, it will analyse the current policy and legislative framework in the EU addressing the adoption of unconventional soil remediation techniques throughout the production of sustainable biofuels to identify specific conducive elements and roadblocks to overcome regulatory silos, thus advancing both the European Green Deal's key objectives and the UN SDGs in the EU.

The article is structured as follows. Section 2 outlines phytoremediation as a NBS for soil remediation while underscoring both its environmental, social and economic benefits also as combined with its use for biofuels conversion. Section 3 charts the current policy and legislation framework under the European Green Deal as relevant for the adoption of phytoremediation and its feedstock conversion. Section 4 delves into specific legal issues entailed in the current EU framework to appraise the existing loopholes with regard to low-ILUC biomass for biofuels production. Section 5 concludes.

For further information and specific references, please see this article:

[Read this](#)

Workshop at EUBCE 2023



CERESiS, GOLD and Phy2Climate project coordinators at EUBCE 2023.
Credit: EUBCE 2023.

The European Biomass Conference & Exhibition (EUBCE, www.eubce.com) combines one of the world's leading R&D conferences with an international exhibition, and represents the leading platform for the collection, exchange and dissemination of scientific know-how in the field of biomass.

During the 31st edition of the European Biomass Conference and Exhibition (EUBCE), organised by ETA in Bologna, Italy (5-8 June 2023), a second workshop was organized on Tuesday 6th June, by ETA for enabling the Phy2Climate project to

engage with the international community of bioenergy engineers and researchers, as well as international industry stakeholders. The event was successful in terms of participation of internal and external audiences, and in terms of workshop outputs.

The workshop was jointly organised and was included under the umbrella of a full day workshop in conjunction with the ETIP bioenergy platform event: 'Bioenergy and renewable fuels projects for the revamping of the SET Plan'. This session title was 'Clean advanced biofuels production from contaminated land', and included its two sister projects, GOLD, and CERESiS, in which all

three projects presented with the focus on the conversion and separation technologies. These three Horizon 2020 projects; GOLD, CERESiS, Phy2Climate are aiming to bridge the gap between remediation of contaminated sites and the production of clean energy. All three projects will use phytoremediation techniques, which uses plants to remove contaminants from soil, and in turn the cultivated energy crops will be used as biomass feedstock and converted to produce clean advanced biofuels.

The aim of the workshop was to enable these three H2020 sister projects to present together, each giving an overview of the individual project and the different conversion and separation technologies that each project is researching.

At the time of the workshop CERESiS was in the final year of the project so was able to present some of the most important results of the project, as well as the conversion and contaminant separation technologies used. Whereas GOLD and Phy2Climate had just completed one year of trial crops in the field, and therefore presented more of the first stages of the conversion process.

Phy2Climate project overview was presented by project coordinator Markus Ortner (ITS, Austria), followed by Christopher Kick (Fraunhofer UMSICHT, Germany) who presented the project's pilot plant and the related TCR® technology. For these presentations an overview of the concept and the technology that will be used during the Phy2Climate project was presented and a summary of the process stages was presented as follows:

First stage: Biomass is broken down into carbonisate and volatile components in a continuously operating auger reactor at medium temperatures (< 500 °Celsius). The formation of tar and other pollutants is prevented by optimized process conditions in the various reactor zones.

Second stage: In a post-reformer, the carbonisate and vapours are catalytically refined to improve gas yield and product quality. The vapours are then cooled. During condensation, oil and process water are separated. The remaining gas is cleaned.

After the three presentations a panel discussion was conducted by Dina Bacovsky (BEST, Austria), under the title 'Common ground and contribution of EU projects to the revamping of the SET Plan Action 8', with a representative from each of the thematic sessions during the day, as well as two external representatives.

During the panel discussion, the panellists discussed about the strategy to transfer results from HEU projects into demonstration, scaling up and deployment of the technologies, and to support viable technologies in the market in the longer term.

Concerning development and implementation of technologies through targeted R&D, the panellists also identified a series of non-technical barriers to overcome and analysed the use of the immense knowledge built through HEU/H2020/FP7 projects to evaluate how projects/research teams/companies can benefit from each other, thus stimulating innovation.

Presentations on project pilots

Related to design and implementation of phytoremediation pilots activities, Serbian partners presented their project activities and contributions in international conferences in the second part of 2022, such as biomass production and translocation of selected metals pollutants from contaminated sediment in above ground plant parts, results obtained in the pot test.

Also INTA and Litoclean presented their project activities and contributions in international

conferences in 2023. In particular, INTA presented at SETAC-Latin America and at the Science Summit of the 78th United Nations General Assembly, for example focusing on acute toxicity of mining environmental waste on *Bulnesia retama* and *Plectrocarpa tetraacantha* seedlings. Litoclean presented at AquaConSoil, September 2023, introducing to the laboratory pot tests and field pilot study to determine the best approach to combine the phytoremediation of TPH contaminated land with the production of clean biofuels.

As a selected EU project, Phy2Climate project joined the European Biomass Conference and Exhibition (EUBCE) in June 2023. Besides the project workshop (see details above), Phy2Climate's results and activities were illustrated in several sessions. Project partners presented their activities in oral and poster presentations in Bologna, as follows:



Litoclean presentation at AquaConSoil 2023.
Credit: Litoclean.

- Alfreda Kasiuliene, Biovala, presented "Expectations and Reality of Upscaled Phytoremediation Field-Trials";
- Markus Ortner, ITS Förderberatung, presented "Phytoremediation of Contaminated Sites to Produce Feedstock for Sustainable Biofuels";
- Christopher Kick, Fraunhofer UMSICHT, presented "Development and Commissioning of an Innovative Biorefinery for the Conversion of Contaminated Biomass into High-quality Energy Carriers";

- Tomasz Simla, The Silesian University of Technology, presented "Phy2Climate Project: Life Cycle Assessment of Phytoremediation and Biofuel Production".

Related papers of the above presentations are included in the full open access conference [proceedings](#) database, free of charge for the final users.

The Scientific Programme of the EUBCE includes several other presentations and sessions dedicated to biomass feedstocks, conversion processes and technologies for advanced biofuels and bio-based materials production.

Moreover, Phy2Climate project hosted a stand in the EU project area.

The collaboration with other H2020 projects on the same topics is progressing very well. For maximising the project impacts, in addition to the workshop at EUBCE 2023, Markus Ortner, ITS Förderberatung, presented Phy2Climate project activities and Žygimantas Kidikas, Biovala, presented "Phytoremediation – different contamination, different approach?" at BIKE project event in March 2023.



Presentation of Alfreda Kasiuliene, Biovala, at EUBCE 2023.
Credit: EUBCE 2023.



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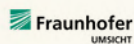
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The project consortium has put together 16 partners from 9 countries with long-term expertise in soil remediation, phytoremediation, biofuel technologies and energy processes, environmental and social sustainability, legislative analysis, communication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