

Citizen science initiatives for soil literacy

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Alba Peiro and Francisco Sanz from the Ibercivis Foundation, Claudia Cappello and Tanja Mimmo from the Free University of Bolzano, guide us through citizen science initiatives for soil literacy that are integral to the ECHO project

Citizen science projects offer an effective framework for increasing participants' knowledge in specific scientific fields. They also play a crucial role in reshaping participants' perspectives on the scientific process and attitudes towards science and environmental issues.

To ensure a significant increase in literacy, citizen science initiatives require meticulous design that extends beyond merely involving participants in scientific studies. This involves facilitating interactions with scientists and providing high-quality educational materials (Bonney et al., 2009).

Soil-focused citizen science initiatives only appeared after 2010. Their importance grew due to a broader societal context and, particularly in Europe, due to the increased attention to soil issues in public policy agendas (Panagos, 2022; Gascuel et al., 2023). They are supported by the EU Soil Strategy for 2030 and the Mission 'A Soil Deal for Europe' of Horizon Europe, which is one of the five Research and Innovation Missions to bring concrete solutions in response to major societal challenges, meeting global commitments such as the Sustainable Development Goals. Consequently, using citizen science methods to improve soil literacy represents a relatively novel but well-established approach, highlighted by projects like ECHO.

ECHO stands out as the first citizen science project to focus on addressing the eight soil health indicators outlined in the EU Mission "A Soil Deal for Europe," therefore significantly advancing soil literacy.

This meticulously designed initiative not only prioritises citizens' engagement, interactions, and educational materials, but also encourages proactive participation in data collection, discussions in both formal and informal settings, and addressing specific challenges as well as broader real-world issues. It introduces innovative approaches to cultivating a more inclusive scientific community by harnessing emotional engagement, social incentives, and structured participation frameworks.

Significantly enhancing soil literacy

Alongside numerous other soil-focused citizen science initiatives, ECHO aims to significantly enhance soil literacy and positively shift citizens' attitudes toward soil health for the greater good. Specifically, it seeks to raise awareness of soil threats, explore new

possibilities for soil use, and increase overall soil consciousness. However, assessing this effectiveness poses challenges, as it requires measurement tools that are often not clearly defined within these initiatives. To address this, the ECHO project will conduct a thorough assessment of changes in European citizens' attitudes and knowledge regarding soil value. This examination will span both pre- and post-implementation of the project's citizen initiatives, ensuring a comprehensive understanding of its impact on public perception and awareness.

The profound impact of citizen science

In its first year of development, the ECHO project, in collaboration with the Ibercivis Foundation, conducted a state-of-the-art review on citizen science initiatives for monitoring soil health, analysing over 60 projects. This comprehensive examination not only informs ECHO's efforts to improve citizen soil literacy but also extends its scope beyond this objective.

The findings highlight the profound impact that citizen science can have in supporting both scientific and community stakeholders. It facilitates the collection of field data to monitor various environmental conditions (Silvertown, 2009) and provides a framework that enhances decision-making processes within modern society (Trumbull et al., 2000).

The identified projects were categorised based on the degree of citizen engagement as the primary distinguishing factor. This choice was made because it effectively highlights the main differences between projects. The second distinguishing factor used in our classification is whether the projects have a soil-centric or non-soil-centric main objective. This approach allowed us to classify projects into four main types (A, B, C and D) and evaluate them to provide a clear overview of what each type enables, along with a summary of their respective strengths in promoting soil literacy.

Type D projects encompassed national- scale projects that engage citizens in monitoring various environmental aspects, including soil-related parameters. These initiatives were broader environmental citizen science programmes, with a partial emphasis on soils, aiming to explore biodiversity indicators to gain insights about soil health. Participants typically engaged in simple sample collection or basic data interpretation activities, with target audiences including educational institutions, families, and naturalists. These initiatives yielded educational impacts and could potentially have economic implications, especially in agricultural contexts.

Type C was dedicated to soil-specific citizen science initiatives involving citizens in soil sample collection and/or basic data interpretations. These projects were typically developed on a national or regional scale and focused on conducting educational activities that explored the biological and chemical aspects of soil. Engagement efforts targeted a broad audience, including the educational sector or rural communities, utilising workshops, exhibitions, and online resources. While these projects primarily yielded educational impacts, they provided limited opportunities for fostering trust, community engagement, and broader social outcomes.

Type B projects were regional-scale initiatives primarily focused on non-soil-centric objectives but with a significant emphasis on soil biodiversity. These projects employed citizen-assembled toolkits for independent fieldwork and guideline-driven procedures to explore soil biodiversity. Citizens played a crucial role in these projects, contributing to research design and data analysis. Target audiences were broader and included farmers and policymakers, with diverse engagement strategies such as gamification or interactive events that required resources from citizens. The impacts of these projects extended across scientific, political, economic, social, and educational domains, influencing sustainable land management, urban planning, and agricultural practices.

Finally, type A projects were regional or city-scale initiatives that were collaborative, co-created with academic institutions or driven by growers. These projects focused on analysing chemical soil indicators such as heavy metals, using toolkits that required training or expert assistance. They established strong communities or citizen observatories, where citizens played a significant role in project design and analysis. Target groups included growers, local citizens, researchers, and policymakers, with engagement methods such as collaborative stays and living labs. These projects yielded social, economic, and scientific impacts, influencing political aspects of land and soil management.

Future efforts in citizen science and soil literacy

These comprehensive state-of-the-art soil-focused initiatives provided valuable insights to guide ECHO towards becoming a more inclusive, standardised, and influential initiative. Recommendations were formulated to optimise methodologies, enhance participant engagement, and ultimately ensure that ECHO not only contributes valuably to soil health monitoring but also sets a benchmark for future citizen science projects and soil literacy efforts.

References

- Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.
- Gascuel C., Loiseau-Dubosc P., Auclerc A., Bougon N., Caquet T., Lerouyer V., Pierart A., Ranjard L., Resche- Rigon F., Roturier C., Sauter J., Serin L. (2023a). Sols, sciences et recherches participatives : comment consolider et fédérer le foisonnement d'initiatives en France? *Nat. Sci. Soc.*, 31, 1, 81-89.
- Johnson, K. L., Stone, W., Dominelli, L., Chivasa, S., Clarke, C. E., Gwandu, T., & Appleby, J. (2023). Boosting soil literacy in schools can help improve understanding of soil/human health linkages in Generation Z. *Frontiers in Environmental Science*, 10, 1028839.
- Johnson, K. L., Philip, D., & Engels, C. (2020). The ABC of Soil Literacy-Evidence from Ghana, South Africa and Zimbabwe.

- Panagos, P., Montanarella, L., Barbero, M., Schneegans, A., Aguglia, L., Jones, A. (2022). Soil priorities in the European Union. *Geoderma Regional*, 29, e00510.
- Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.
- Trumbull, D. J., Bonney, R., Bascom, D., Cabral, A. (2000). Thinking scientifically during participation in a citizen-science project. *Science Education*, 84(2), 265-275.

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ECHO Project- Engaging citizens in soil science: Towards healthier soils

ECHO is a Research and Innovation Action co-funded by the European Union through the Horizon Europe program and UK Research and Innovation (UKRI). Its objective is

to more actively involve citizens in the protection and restoration of soils From June 2023 to May 2027, the project aims to involve citizens in the protection and restoration [...]

