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STUDY PROTOCOL

Soil, Sound, Song, Story, Site: The 5S method for soil literacy - Study protocol for a transdisciplinary participatory action research

[version 1; peer review: 2 approved with reservations]

Ana Fernández-Aballí Altamirano[1], Santiago Sánchez Cifuentes[2], Marta Herreros[3]

[1]Centre for Religion, Conflict and Globalization - Faculty of Religion, Culture and Society, University of Groningen, Groningen, Groningen, 9712 GK, The Netherlands
[2]METRA Asociación para la Innovación en Metodologías Transdisciplinares, Pozohondo, Albacete, 02141, Spain
[3]GSA Cinegética, Albacete, 02005, Spain

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Abstract

This study protocol introduces the 5S Method (Soil, Sound, Song, Story, Site), a transdisciplinary participatory action research framework designed to harness song heritage as a catalyst for soil eco-literacy. By integrating the head-heart-hand eco-literacy model crossed with a pluralist epistemological approach that values ancestral, emotional, and scientific knowledge, the 5S Method seeks to answer a central question: Can song heritage articulate and facilitate a place-based soil eco-literacy process that bridges literacy and stewardship while fostering intercultural and intergenerational bonds? This methodology aims to produce replicable tools for rural communities across Spain and Europe, rescuing field songs – which exist across cultural traditions – to transform soil care into a culturally resonant practice of collective stewardship.

The 5S Method operationalizes this theoretical framework through a two-phase participatory action research design. The first phase, 5S Mapping, employs a triangulated approach, combining archival review, semi-structured interviews, and community workshops to populate the 5S Diagnostic Grid. This grid is populated with data across five thematic domains (Soil, Sound, Song, Story, Site) and three epistemological sources (Ancestral, Emotional/Embodied, Scientific) within the dimensions of Literacy (Head), Heritage (Heart), and Stewardship (Hand). The resulting data is spatialized using QGIS to produce a multilayered territorial map that visualizes the intersection

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1. **Willi E.R. Xylander**, Senckenberg Museum of Natural History Görlitz, Görlitz, Germany

2. **Said Al-Ismaily**, Sultan Qaboos University, Muscat, Oman

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of soil characterization, lived community experience and cultural heritage. The second phase, Co-creation of Cultural Anchors, translates these diagnostic insights into tangible cultural artefacts, such as re-signified field songs and digital storytelling installations. These anchors, co-produced in artist-researcher collaborations, serve as pedagogical tools in local cultural, technical and educational settings, aiming to embed soil literacy into daily life and institutional memory while fostering social cohesion among diverse community groups.

Keywords
Soil literacy; Eco-literacy; Participatory action research; Cultural heritage; Field songs; Agroecology; Rural development; Intercultural dialogue

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Corresponding author: Ana Fernández-Aballí Altamirano (a.fernandez-aballi.altamirano@rug.nl)

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Introduction

This study proTtocol introduces the 5S Method (Soil, Sound, Song, Story, Site), a transdisciplinary participatory action research framework designed to harness song heritage as a catalyst for soil eco-literacy. By integrating the head-heart-hand eco-literacy model crossed with a pluralist epistemological approach that values ancestral, emotional, and scientific knowledge, the 5S Method seeks to answer a central question: Can song heritage articulate and facilitate a place-based soil eco-literacy process that bridges literacy and stewardship while fostering intercultural and intergenerational bonds? This methodology aims to produce replicable tools for rural communities across Spain and Europe, rescuing field songs – which exist across cultural traditions – to transform soil care into a culturally resonant act of collective stewardship.

The 5S Method operationalizes this theoretical framework through a two-phase participatory action research design. The first phase, 5S Mapping, employs a triangulated approach, combining archival review, semi-structured interviews, and community workshops to populate the 5S Diagnostic Grid. This grid is populated with data across five thematic domains (Soil, Sound, Song, Story, Site) and three epistemological sources (Ancestral, Emotional/Embodied, Scientific) within the dimensions of Literacy (Head), Heritage (Heart), and Stewardship (Hand). The resulting data is spatialized using QGIS to produce a multilayered territorial map that visualizes the intersection of soil characterization, lived community experience and cultural heritage. The second phase, Co-creation of Cultural Anchors, translates these diagnostic insights into tangible cultural artefacts, such as re-signified field songs and digital storytelling installations. These anchors, co-produced in artist-researcher collaborations, serve as pedagogical tools in local cultural, technical and educational settings, aiming to embed soil literacy into daily life and institutional memory while fostering social cohesion among diverse community groups.

2. Study protocol

2.1 Gaps in soil literacy

Roca Vallejo et al.[1] have identified significant gaps in current soil literacy programs. Many of these stem from the plurality and complexity of soil literacy itself, as it is intrinsically place-based. To address these gaps, Roca Vallejo et al. highlight several strategies: the central role of municipalities as key articulators of healthy soil ecosystems (also emphasized by the EU HUMUS project); the need to move beyond an anthropocentric ecosystem services paradigm of soils towards an ecocentric paradigm in which soil, as a living entity, has intrinsic value; and the importance of traditional, regenerative, organic, and agroecological practices to establish soil-inclusive interspecies community justice.[2–4] This holistic perspective puts soil awareness as a key component of a complex system built on deep interconnections between planetary, community, human and soil health and well-being. This can be achieved through transdisciplinary approaches that allow for the integration of soil science with complex social phenomena such as cultural heritage.[5] Possible methods include the head-heart-hand eco-literacy model,[6] participatory action research,[7–10] and the weaving of scientific, ancestral and emotional/embodied knowledge inspired by deep ecology-informed practice.[11–13] Methodologically, these paradigms and approaches can respond to the EU Mission Soil and the Mission Soil Manifesto.[14]

Caring for soil requires knowing, loving, and nurturing soil, which together form the key socio-emotional and cognitive processes underpinning regenerative transformation.[15] In Singleton's head-heart-hands approach, if knowing is the head (literacy) and nurturing is the hands (stewardship), we argue that heritage provides a structured source through which love and sense of belonging are woven back into soil: heritage is the heart. Heritage provides meaning-making and acts as cultural glue and anchor connecting generations, articulating space, and fostering intercultural understanding.[16,17] Heritage could provide a valuable way of bridging the gap between soil literacy and soil stewardship identified by Roca Vallejo et al.

2.2 The context

In rural contexts in general, and in the Spanish rural context in particular, field songs are powerful cultural heritage artefacts. Known as *cantes de trilla*, *cantes de laboreo*, *serranas*, among others, field songs from central and southern Spain belong to the Flamenco tradition.[18] Historically, these songs – also known as *cantes primitivos* or primitive songs – structured agricultural rhythms, transmitted practical knowledge, and reinforced community bonds, while also providing emotional relief from physical labour.[19] Though now largely absent from daily life, they hold the potential to be re-signified and fused with the contemporary sonic landscape as living heritage that connects soil with memory, identity, and affect.

The potential of field songs as soil-anchoring and community-building cultural heritage is amplified by the fact that migrant workers now sustain much of Europe's agricultural labour – one in four workers[20] according to an Intermon Oxfam report – yet they remain socially invisible in the cultural fabric of rural communities. These dynamics result in fragile intergenerational and intercultural cohesion. However, field songs are also part of the heritage of many migrants' countries of origin: Berber collective chants from the Moroccan Atlas, Romanian *doine*, *yaravíes* and *arrullos montubios*

from Ecuador, or the Senegalese *bakk.* These traditions, like Spanish field songs, weave together rhythm, memory, and labour, showing how sound has long been a way for rural communities to connect with soil and with one another.

Small rural municipalities in Spain face, alongside soil-related challenges, critical issues such as depopulation and ageing, the loss of cultural and natural heritage, and weak intergenerational and intercultural bonds. Understanding and addressing soil strategies in tandem with social cohesion strategies is therefore essential to ensure meaningful, relevant, and sustainable soil health. Field songs provide a culturally resonant anchor that can integrate elders' memories, migrants' lived experiences, and youth's contemporary expressions, bridging divides across generations and cultures. This makes them both an entry point for soil literacy and stewardship, as well as a catalyst for social cohesion. Leveraging the cultural and educational value of heritage, the 5S Method enables research teams to address rural soil literacy and stewardship in ways that resonate with local communities. This approach encourages stakeholders to adopt science-based and agroecological practices that retain soil moisture, build organic carbon, reduce erosion, support biodiversity, and lower contamination pressures.

2.3 Key research question

Taking the prior into account, this study protocol proposes the following question:

> *Can song heritage articulate and facilitate a place-based and community-based soil eco-literacy process that bridges and reinforces soil literacy and soil stewardship, while fostering intercultural and intergeneration bonds?*

To answer these question, this study protocol proposes a heritage-based, place-based, and community-based soil educational methodology for small rural municipalities, articulated around 5 key elements: soil, sound, song, story, site (the 5S Method). We explain the method in detail in the following section.

2.4 The 5S Method

The 5S Method (soil, sound, song, story, site), built on participatory action research framework and principles,[10] has two key interlinkedphases: 5S mapping and co-creation of cultural artefacts. The method is purpose-built for small rural municipalities, where resident participation in municipal events is common, and typically channelled through public authorities and local organizations.

2.4.1 5S mapping

The first phase – 5S Mapping – combines a) archival and literature review, b) semi-structured interviews, and c) participatory workshops to complete the 5S Diagnostic Grid as shown below in Table 1.

The 5S Diagnostic Grid expands the concept of emotional geographies[21] by moving beyond a singular focus on affect to embrace a pluralist ontological and epistemological framework. Drawing on the metaphor of "drinking from three rivers",[11] Arturo Escobar's (2018)[22] pluriversal design, and Freirean participatory action research's cogno-emotional cycle,[23] the grid recognizes that knowledge about place emerges from the confluence of distinct interconnected streams: ancestral (traditional and intergenerational wisdom), emotional/embodied (lived experience and affective memory), and scientific (empirical and technical data).

Table 1. 5S Diagnostic Grid. A participatory framework for mapping place-based knowledge for soil literacy across Head (Literacy), Heart (Heritage), and Hand (Stewardship) dimensions, integrating ancestral knowledge (A*), emotional/embodied/experiential knowledge (E**), and scientific knowledge (S***). Source: the authors.

	Head (Literacy) ***What do we know?***			**Heart (Heritage)** ***What have we inherited and wish to preserve?***			**Hand (Stewardship)** ***How do we care?***		
	A*	**E****	**S*****	**A**	**E**	**S**	**A**	**E**	**S**
Site									
Soil									
Sound									
Song									
Story									

*ancestral and traditional knowledge;
**emotional, embodied and experiential knowledge; and
***scientific knowledge

By integrating these three epistemologies within each cell of the Head-Heart-Hand matrix, the method validates diverse ways of knowing as equally legitimate sources of truth. This approach challenges the dominance of scientific rationality in environmental governance, positioning ancestral memory and embodied feeling as essential components of soil literacy and stewardship.

To operationalize this framework, the grid structures data along three crossing categories:

1. Thematic Layers: These rows represent the tangible and intangible elements of the rural landscape investigated in the study:
   - Soil: Biophysical properties, health indicators, agricultural practices around soil, as well as any other characterization or use.
   - Sound: The acoustic ecology of the territory, including natural sounds and ambient noise.
   - Song: Musical traditions, field songs (cantes de trilla, etc.), and oral histories transmitted through melody.
   - Story: Narratives, myths, memories, and collective identities tied to the land.
   - Site: Specific geographical locations, landmarks, and spaces of significance.
2. Eco-literacy Layers (Columns): Derived from Singleton's (2015) head-heart-hand model, these columns articulate the dimensions of transformative learning required for sustainable stewardship, framed by guiding questions:
   - Head (Literacy): What do we know? Focuses on cognitive understanding, factual knowledge, and conceptual frameworks.
   - Heart (Heritage): What have we inherited and wish to preserve? Centers on affective connection, emotional resonance, sense of belonging, and cultural identity.
   - Hand (Stewardship): How do we care? Addresses practical action, behavioral practices, skills, and care for the land.
3. Epistemological Layers. Within each of the three competence columns, data is further categorized by the source of knowledge, ensuring that multiple ways of knowing are valued equally:
   - Ancestral/Traditional Knowledge: Indigenous, intergenerational, or locally inherited wisdom passed down through communities.
   - Emotional/Embodied/Experiential Knowledge: Personal lived experience, sensory engagement, intuition, and affective memory.
   - Scientific Knowledge: Formal, empirical, or technical data derived from soil science, ecology, or other academic disciplines.

The 5S Diagnostic Grid is populated through a triangulated approach: archival and literature review, semi-structured interviews, and participatory workshops.

a) **Archival and literature review:** Before engaging with the community, it is important to conduct a systematic review of existing primary and secondary sources, including: soil maps, erosion inventories, biodiversity surveys, and climate data from regional environmental agencies, historical archives, local municipal records, agricultural census data, and historical accounts of land use changes, ethnographic literature, existing studies on local folk traditions, oral histories, and heritage in the region. This phase provides the base for more situated engagement with the community.

b) **Open and semi-structured interviews:** Targeted interviews conducted with key informants who hold specialized or deep-rooted knowledge about the territory complement the documentary research. Participants are selected purposively to represent diverse epistemological positions, including elders, migrant workers, farmers, landowners, scientists, and local historians. The size of the sample varies according the rural community, but 9–17 interviews spanning a diversity of stakeholders will be usually enough to reach information saturation.[24] These interviews explore personal narratives, technical expertise, and specific memories related to the five domains. Interviews are recorded, transcribed, and coded using the 5S Grid framework. Insights are entered into the grid individually, allowing for the capture of nuanced, private, or sensitive information that may not emerge in group settings. Interviews provide depth and specificity, allowing for individual memory to play a crucial role. Interviews can be accompanied by a map of the territory, to aid in territorial elicitation, as well as the grid to fill to elicit specific stories related to the different categories.

c) **Participatory workshops:** Community workshops bring together diverse residents to collaboratively populate and validate the grid. These sessions are designed to be interactive and inclusive, using visual aids, maps, and creative exercises. Sessions should always include a space to welcome participants, explaining and situating the session, and an icebreaker before beginning working on content, as well as a closing or debriefing space. The number of participants will vary depending on the community, but a number anywhere between 5 to 20 people is appropriate, in one or two workshops. Additional workshops can be planned if needed. Offering light snacks and refreshments (water, coffee, tea) during the session are an easy way of making participants feel welcome. Some examples include[21,25–28]:

   – Mapping Exercises: Participants physically mark locations on large-scale maps, associating them with specific soil knowledge or practices, sounds, songs, or stories. This directly links the Site row to other domains. The workshop output is a collectively agreed-upon version of the grid over territorially situated, which serves as the primary dataset for spatial analysis. This process ensures that the final diagnosis reflects a shared community understanding. Elicitation resources can be used (photos, videos, songs, sounds, etc.) to initiate dialogue.

   – Transects: A walk around the community, talking videos or photos, is also a useful way to get the conversation started.

   – Sound walks: A walk in silence around the community, with or without sound cues prepared in advance, can be part of the workshop.

   – Group Discussions: Facilitated dialogues encourage participants to share what they know (Head), feel (Heart), and do (Hand) regarding soil and heritage. Conflicting or complementary viewpoints are discussed openly, highlighting tensions between scientific and traditional knowledge.

By integrating these three methods, the 5S Diagnostic Grid achieves both breadth (through archives and workshops) and depth (through interviews), creating a robust, multi-layered representation of the territory's socio-ecological reality. The information on the grid is then transferred to QGIS, an open source mapping software that allows the creation of layers directly associated to territory, for the systematization of the diagnosis. At this stage, there should be two outputs:

- Completed 5S Grid
- Completed 5S Map on QGIS or any other open source mapping software that allows for layering.

This structured yet flexible format allows for the spatial mapping of complex socio-ecological relationships in QGIS, revealing where different knowledge systems align or diverge across the territory.

2.4.2 Co-creation of cultural anchors

The second phase – cultural soil-anchor co-creation – is a way for researchers to both give back to the community, and increases the impact of soil literacy efforts. In this phase, artists, scientists, public authorities, and community stakeholders to translate the mapping insights into cultural artefacts, especially re-signified field songs, poetry or performance-based production, ideally susceptible to video or audio recording that can be shared easily. This combined

approach bridges participatory mapping with creative expression, offering an original pathway to activate soil literacy, heritage, and stewardship in rural contexts. This phase requires dedicated resources to pay for the expertise of community artists and professional artists, preferably local, who can work together with the research team to design and guide the co-creation process based on the input of the 5S Mapping, into cultural products that are relevant for the community, and that integrate soil literacy knowledge. At this stage, the main output are the cultural soil anchors (videos, photos, songs, poems, posters, guides, etc.), that can be shared and whom community members can relate to. Results of this phase should be integrated and disseminated within community cultural and educational events.

2.5 Exploitation

The exploitation phase focuses on translating the 5S Diagnostic Grid, the QGIS map, and the cultural anchors into tangible actions for soil stewardship and community cohesion. All outputs should be made available publicly, for example, in the website of the City Hall of the rural municipality. Local educational authorities should be presented with the resources, if not yet involved. A meeting to present the results to local authorities and key stakeholders should be held, in order to identify ways in which results can be exploited to impact the community towards improved soil health: cultural and educational interventions, soil literacy and soil health monitoring plans, and technical trainings to key stakeholders.

2.6 Ethical considerations

This study protocol was design in the framework of the MSCA Postdoctoral Fellowship project ODEEN: Ontological Diversity in Environmental Education (ID: 101104953) which received full data and ethics approval by the corresponding data and ethics officers of the Faculty of Religion, Culture and Society of the University of Groningen on the 8th of July 2024 with ethical approval number 2024–07.

2.7 Consent

This study protocol requires the gathering of non-sensitive personal data from participants for purposes of logistics and planning. As the study protocol has not yet been implemented, consent forms are still not available. Consent for this study protocol will be written, and will follow the consent form template for the ODEEN project available at https://doi.org/10.5281/zenodo.21471257, and which was previously cleared by the data and ethics officers of the Faculty of Religion, Culture and Society of the University of Groningen on the 8th of July 2024 with ethical approval number 2024–07.

2.8 Measurement of outcomes

The measurement of outcomes focuses in answering the central research question – whether song heritage can articulate and facilitate a place-based soil eco-literacy process that bridges literacy and stewardship while fostering intercultural and intergenerational bonds. As such, measurement focuses on short term outcomes of the research process. Short term indicators include:

- Quality of the 5S diagnosis and map to generate in-depth multi-epistemic knowledge of local soils
- Quality of the cultural anchors to generate soil awareness
- Capacity of outputs (5S diagnosis, map and anchors) to be integrated in educational, cultural and technical local contexts
- Self-reported impact of participants in terms of increased soil literacy
- Self-reported impact of participants in terms of increased intention for stewardship
- Self-reported impact of participants in terms of increased sense of belonging

Short term indicators can be measured through a variety of tools (i.e. research team observations, pre-post or only post short surveys to participants, evaluation focus group at the end of the process) that can be easily incorporated within the study protocol.

Additional long term indicators can also be contemplated, although these are not necessary for the successful implementation of study protocol, as these require greater infrastructure and time. If possible – that is, if resource and planning allow – it is of value to include:

- ► Effective increase in soil awareness and literacy
- ► Effective increase in soil stewardship
- ► Effective increase in social cohesion
- ► Effective increase in soil health

Baseline measures four these four key indicators can be obtained through the initial application of this study protocol. Effective increase in literacy, stewardship, social cohesion and soil health measures can be obtained through:

a) A survey, administered approximately 2–3 years to a statistically significant sample of the local rural population and/or through in-depth interviews to key stakeholders

b) Soil samples and soil characterization taken during the application of the study protocol, and retaken 2–3 years after the end of the study protocol.

3. Future case study application

The 5S method will be piloted in Pozohondo (Albacete, Spain), where municipal authority over land use, heritage, and community life enables meaningful participation and close impact monitoring, making it an ideal scale to validate the 5S approach. The pilot will take place in the frame a small scale Erasmus+ KA2 partnership for adult education through the project *TIERRAS: Tradición, inclusión y educación rural para la regeneración agroecológica de los suelos* (Tradition, Inclusión, and Rural Education for Agroecological Regeneration of Soils). [1]

Pozohondo, a rural municipality with 1,554 inhabitants,[29] faces the same intertwined pressures affecting many small European villages: soil degradation and biodiversity loss linked to mechanisation, depopulation and aging, and the erosion of cultural traditions once bound to agricultural work. Pozohondo's soils face several interlinked challenges typical of semi-arid Mediterranean farming landscapes. The municipality lies in the southeastern part of Albacete, an area classified as at high to very high risk of desertification due to its semi-arid climate and long-standing land-use pressures. Regional assessments show that topsoil organic-carbon content is relatively low, reflecting both the dry conditions and the predominance of arable farming.[30] Although no site-specific data on soil contamination are publicly available, the intensive use of chemical fertilizers and pesticides in the municipality and surrounding areas due to intensive agriculture poses pressure on soil quality. According to the National Soil Erosion Inventory, Pozohondo lies in a zone where moderate to high erosion affects cultivated slopes, while flatter areas remain relatively stable. At the same time, soil biodiversity remains largely unmeasured locally; and as shown in the maps, surveys and data available in the European Soil Science Centre (ESDAC) and in the Land Use and Cover Area 2018 Survey, as well as the Agrobiodiversity Index for 2021, soil health point to generally low soil-biodiversity levels and relevant soil health challenges in the Albacete region.[31–33][2]

Recommendations for regenerative and organic agriculture and agroecological practices for semi-arid Mediterranean soils suggest that strategies such as maintaining continuous soil cover through mulches or cover crops, integrating organic amendments like compost or manure, diversifying crop rotations with legumes and perennials, reducing deep tillage, optimizing water use with efficient irrigation, limiting chemical inputs, and restoring hedgerows and other vegetative buffers are key to improving soil health and resilience.

The TIERRAS project is led by METRA Association for the Innovation in Transdisciplinary Methodologies (Spain), together with Gestión y Servicios Agrocinegéticos S.L. (Spain), the Pozohondo City Hall (Spain), and two organizations dedicated to eco-acoustics for community-building – Upstream (Poland) – and in rural contexts – La Troupe IPAC (France) – alongside associated researchers from Wageningen University & Research, Universitat Autònoma de Barcelona, and the University of Valencia. The pilot, integrated within the non-formal adult education structure of the municipal Universidad Popular (Popular University), plans to engage approximately 45 adults, strategically sampled to include at least 10 migrant workers, 10 young adults under 25, and 20 women, ensuring intercultural and

[1]Project ID 2026–1-ES01-KA210-ADU-000467303. The proposal is currently under grant agreement preparation.
[2]See the ESDAC soil health convergence map available at: https://esdac.jrc.ec.europa.eu/public_path//Convergence%20of%20evidence%20MAP.png

intergenerational representation. The consortium will apply the 5S Method Study Protocol organized in five structured activities over 18 months:

- A1: Coordination, methodological oversight and ethics;
- A2: 5S Mapping;
- A3: Co-creation of cultural anchors – four field songs, their corresponding videoclips, soil stories and stewardship practices, a photo exhibition, and QRs with street signs on selected sites to access all materials directly on the municipality's web;
- A4: Design and piloting of a structured workshop that integrates all materials within the Universidad Popular, and integration of the workshop within the Universidad Popular's course catalogue;
- A5: Production of open educational and artistic materials, systematizing the experience for replicability, and dissemination of results in the Pozohondo's San Isidro Labrador festival (Patron Saint of Farmers), a methodological exchange event in the French rural municipality of Vosges, as well as municipal, scientific, agroecological and heritage networks.

The primary target group comprises Pozohondo residents (youth and elders, native- and foreign-born, farmers, landowners, and local authorities), as nearly everyone in town interacts with rural land through farming, smallholdings, or living near unsealed soils. The secondary target group includes soil-related stakeholders (scientists, artists, and policymakers) who can benefit from a tested, innovative soil-literacy methodology (the 5S method) for impactful soil engagement. Key challenges include ageing and declining population, fragmented land ownership, increasing dominance of intensive agriculture by large landowners, fragile intergenerational and intercultural cohesion, limited soil awareness, and the often-invisible role of migrant workers. Needs to consider include inclusive participation across age, gender, origin, and socio-economic groups; building trust among residents; recognising local heritage and practices; and ensuring that project activities are accessible and meaningful to both new-comers and long-term residents, as well as easily integratable within local institutions.

4. Conclusions/Discussion

The 5S Method offers a scalable and adaptable framework for addressing the dual crises of soil degradation and rural social fragmentation. By treating cultural heritage as a dynamic pedagogical tool, the method bridges the gap between abstract scientific literacy and embodied stewardship. The modular nature of the 5S Diagnostic Grid allows facilitators to tailor the thematic domains (Soil, Sound, Song, Story, Site) to local realities while maintaining the core epistemological integrity of integrating ancestral, emotional, and scientific knowledge. This flexibility makes it particularly suitable for diverse European contexts, from the Mediterranean basin to Northern Europe, where varying agricultural histories and migration patterns shape distinct relationships with the land.

Despite its potential, the method has inherent limitations. As a qualitative participatory action research approach, the findings are deeply contextual and may not be statistically generalizable to larger populations. The reliance on subjective self-reporting for outcomes such as "sense of belonging" or "intent to steward" introduces potential bias, although triangulation with observational data and spatial mapping helps mitigate this. Furthermore, the co-creation phase requires significant investment in time and resources to compensate artists and facilitate inclusive dialogue, which may pose barriers for underfunded research teams. Measuring long term impact of the method to effectively improve soil health requires greater resources, infrastructure and time than what is usually available to research teams, and tends to exceed municipal resources. To counteract this aspect, proxy measurements based on observational and longitudinal data and at one, two and three years after the method is introduced in the municipality can be of use. However, this also requires the deployment of resources beyond what might be available for the research teams within the funded timelines. The method also assumes a baseline level of community trust and willingness to engage; in contexts with high social polarization or historical trauma, additional preparatory work on conflict resolution and safety protocols would be necessary before initiating the mapping process.

Future directions for the 5S Method involve expanding its testing across diverse biogeographical and socio-cultural regions to refine its adaptability and validate its impact on long-term behavioral change. An open repository of case studies, sharing detailed implementations, adaptations, and lessons learned from different communities could be of use. This collaborative network could enable practitioners to compare strategies, troubleshoot common challenges, and build

a collective evidence base for heritage-led environmental education. Through these efforts, we hope to contribute to a broader movement that recognizes cultural heritage as essential infrastructure for ecological resilience and social justice.

Data

There is no data associated with this study protocol at this stage.

Extended data

A consent form template is available at: https://doi.org/10.5281/zenodo.21471257.[34] No other extended data is associated with this study protocol at this stage.

Software and code availability

The implementation of this study protocol requires the use of mapping software. We recommend the use of QGIS open mapping software, which is available at https://www.qgis.org/.

No other software or code availability are associated to this study protocol at this stage.

Reporting guidelines

This study protocol was designed taking into account:

- European Committee for Standardization (CEN) Workshop Agreement on 'Guidelines on Action Research for Large Scale Piloting' (https://www.cencenelec.eu/news-events/news/2023/workshop/2023-06-12-action-research/).
- The SAGER guidelines for sex and gender equity in research 6-item checklist (https://openreseurope-files.f1000.com/resources/SAGER_checklist.pdf).

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References

1. Vallejo RR, Krzywoszynska A, Katikas L, *et al.*: **Assessment of Knowledge Gaps Related to Soil Literacy.** *Land.* 2025; **14**(1372): 1–31.
Publisher Full Text
2. Simon-rojo M: **The role of ecosystem services in the design of agroecological transitions in Spain.** *Ecosyst Serv.* 2023; **61**(June 2019): 101531.
Publisher Full Text
3. López-García D, Guzmán Casado GI: **Metodologías participativas para la transición agroecológica.** *Cuadernos Técnicos SEAE – Serie Agroecología y Ecología Agraria. Sociedad Española de Agricultura Ecológica.* 2013.
Reference Source
4. Puig de la Bellacasa M: **Re-animating soils: Transforming human–soil affections through science, culture and community.** *Sociol Rev Monogr.* 2019; **67**(2): 391–407.
Publisher Full Text
5. Fredengren C: **Thinking with soil in heritage matters.** *Landsc Res.* 2025; **50**(2): 274–287.
Publisher Full Text
6. Singleton J: **Head, Heart and Hands Model for Transformative Learning: Place as Context for Changing Sustainability Values.** *J Sustain Educ.* 2015; **9**: 1–16.
Reference Source
7. Freire P: *Pedagogy of the Oppressed.* New York: Continuum; 1970. [cited 2014 Nov 28].
Reference Source
8. Freire P: *¿Extensión o comunicación? La concientización en el medio rural.* Montevideo: Siglo XXI; 1984.
Reference Source
9. Fals BO: *Ciencia, compromiso y cambio social.* Herrera Farfán NA, López Guzmán L, editors. Montevideo: El Colectivo - Lanzas y Letras - Extensión Libros; 2014.
Reference Source
10. Fernández-Aballí A: **The Importance of Paulo Freire to Communication for Development and Social Change.** *Handb Commun Dev Soc Chang.* 2018; 1–19.
Reference Source .
11. Macy J, Brown M: *Coming Back to Life: The Updated Guide to The Work that Reconnects.* Gabriola Island: New Society Publishers; 2014.
Reference Source
12. Curry P: *Ecological Ethics.* Cambridge: Polity Press; 2011.
Reference Source
13. Naess A: *Ecology, community and lifestyle: Outline of an Ecosophy.* Cambridge: Cambridge University Press; 2009.
Reference Source
14. European Commission: *Directorate-General for Research and Innovation. Mission soil manifesto.* Publications Office of the European Union; 2023.
Publisher Full Text
15. Gibbons LV: **Regenerative — The New Sustainable?** *Sustainability.* 2020; **12**(5483): 1–19.
Publisher Full Text

16. Council of Europe: **Council of Europe Framework Convention on the Value of Cultural Heritage for Society.** *Council of Europe Treaty Series.* Faro: 2023; **199**: 2005.
Reference Source

17. Fernández-Aballí A, Weir TH, Irvin AJM, *et al.*: *Creative and Inclusive Heritage Education: Handbook for Teachers and Trainers.* Groningen University Press; 2025.
Reference Source

18. Ortega JF: **Cantos de labranza, de trilla y de recogida de la hoja en cancioneros murcianos del XIX y principios del XX.** *Rev Murc Antropol.* 2008; **15**: 387–409.

19. Sánchez CS: *Primitive Flamenco Songs - Flamenco Rhythm #introduction.* 2026.
Reference Source

20. Ruiz-Ramirez C, Castillo-Rojas-Marcos J, Molinero-Gerbeau Y: **Esenciales, pero invisibles y explotadas: Una revisión bibliográfica de las experiencias de las personas trabajadoras migrantes en el sector agrícola europeo.** *Intermon Oxfam.* 2024.
Reference Source

21. Davidson J, Bondi L, Smith M: *Emotional Geographies.* Routledge; 2016.
Reference Source

22. Escobar A: *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds.* Duke University Press; 2018.
Publisher Full Text

23. Fernández-Aballí AA: **Where is Paulo Freire?** *Int Commun Gaz.* 2016; **78**(7): 677–683.
Publisher Full Text

24. Hennink M, Kaiser BN: **Sample sizes for saturation in qualitative research: A systematic review of empirical tests.** *Soc Sci Med.* 2022; **292**: 1, 114523–10.
PubMed Abstract | **Publisher Full Text**

25. Red CIMAS: **Metodologías participativas.** *Madrid: Red CIMAS.* 2009. [cited 2014 Jun 17].
Reference Source

26. Fernández-Aballí A, Weir TH, Irvin AJM, *et al.*: *Creative and Inclusive Heritage Education: Activity Book with Icebreakers, Lessons, and Intercultural Exercises.* Creative and Inclusive Heritage Education: Activity Book with Icebreakers, Lessons, and Intercultural Exercises. Groningen University Press; 2025.
Publisher Full Text | **Reference Source**

27. Philipp T, Schmohl T: *Handbook Transdisciplinary Learning.* Bielefeld: Transcript; 2023.
Publisher Full Text | **Reference Source**

28. Fuentes CV: *Narradoras-narradas: el Documental Social Participativo para la representación de identidad en una muestra de mujeres nacidas entre 1935 y 1945 en Madrid.* Universitat Pompeu Fabra; 2025.
Reference Source

29. Instituto Nacional de Estadística: **Cifras oficiales de población de los municipios españoles en aplicación de la Ley de Bases del Régimen Local (Art. 17) Detalle municipal Albacete.** *Población por municipios y sexo.* 2025.
Reference Source

30. Del Palacio F-ME, Martín Fernández L, Hernández Álvarez J, *et al.*: *Inventario nacional de erosión de suelos: Albacete, Castilla - La Mancha.* Ministerio de Agricultura, Pesca y Alimentación. Secretaría General Técnica. Centro de Publicaciones; 2017.
Reference Source

31. Orgiazzi A, Liakos L, Broothaerts N, *et al.*: **How the EU Soil Observatory is providing solid science for healthy soils.** *Eur J Soil Sci.* 2024; **75**: 1–19.
Publisher Full Text

32. Zeiss R, Eisenhauer N, Orgiazzi A, *et al.*: **Challenges of and opportunities for protecting European soil biodiversity.** *Conserv Biol.* 2022; **36**(e13930): 1–12.
Publisher Full Text

33. Biodiversity International: *Agrobiodiversity Index Report 2021: Assessing Mediterranean Food Systems.* Rome: Bioversity International; 2022.
Reference Source

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Said Al-Ismaily
Sultan Qaboos University, Muscat, Oman

I found the central idea of this work protocol creative. In particular, the attempt to move soil literacy beyond the transfer of classical scientific information and to connect knowledge (Head), heritage and belonging (Heart), and stewardship (Hand) is of very interesting and valuable for community engagement with soils. This is, indeed, in line with the current call by many soil experts who emphasis on moving knowledge beyond one-way transfer of disciplinary scientific knowledge toward knowledge co-creation, interaction with stakeholders, and connecting soil knowledge with societal action.

The manuscript is also commendable for recognising that people understand and relate to soils through different forms of knowledge, including scientific, experiential, emotional, and traditional knowledge. This broader framing may help soil science reach communities that are not normally engaged through conventional scientific communication.

However, I have several concerns-major comments-recommendations that should be tacked before the protocol can demonstrate its full scientific and educational value.

My overall main concern is that the current MS provides a stronger conceptual framework for engagement with soil than for demonstrating soil literacy and its translation into soil stewardship. The proposed connections among cultural engagement, learning, behavioural change, and measurable improvement in soil management need to be made more explicit.

Major comments
1. Soil literacy is central to the MS, but it remains rather generally or per say “Broadly” defined and operationalised. The authors should state more explicitly what a participant is expected to know, understand, interpret, or be able to do after participating in the 5S process. As an example, what exactly should participants learn about soils? Is it soil functions, degradation, erosion, biodiversity, or sustainable management….? Without clear learning outcomes, it may be difficult to distinguish true soil literacy from simply increased awareness or appreciation. Here, I am suggesting defining measurable outcomes for soil awareness, literacy, and stewardship.

2. The Head–Heart–Hand framework by itself is an attractive concept. But, an important assumption appears to be that strengthening emotional and cultural connections with soil will eventually encourage better soil stewardship. This is plausible, but how will the study demonstrate that this transition actually occurs?
3. For a methodology centred on “Soil Literacy”, I was expecting the soil-science component to be described in greater detail. The MS refers to soil characterization, soil maps, erosion inventories, soil health, and possible soil sampling, but it is not sufficiently clear how scientific observations of soil will be incorporated into the participatory learning process. This need clarification and elaboration.
4. The MS states that the approach validates diverse ways of knowing as “equally legitimate sources of truth.” I understand and appreciate the authors’ intention to avoid automatically privileging scientific knowledge over traditional, experiential, or emotional knowledge. But this statement requires greater conceptual precision. Scientific measurements, traditional knowledge, personal experience, memories, and emotional connections all offer different ways of understanding soils and the environment. They can complement and enrich one another, but they should not necessarily be treated as equivalent forms of knowledge.
5. In reference to the previous point, the authors acknowledges that scientific and traditional knowledge may sometimes conflict, but the protocol does not sufficiently explain how such disagreement will be analysed or resolved.
6. The proposed short-term indicators include self-reported increases in soil literacy, stewardship intention, and sense of belonging. These are good indicators, but self-reporting alone may overestimate educational or behavioural impact.
I suggest including at least a simple before and after intervention assessment based on clearly defined soil-literacy competencies. This is also applied to “stewardship” which could be evaluated not only through intention but, where feasible, through evidence of actual practices or subsequent behavioural change, This would allow us to distinguish between: “I feel that I know more about soil” and “I can demonstrate that I understand soil better.”
7. The MS provides a good rationale for Song, Story, and Site, but I feel the links among the five “S” components could be clearer. For example, Sound and Song seem quite closely related, while Soil covers a much broader area. It would be useful to explain more clearly what each “S” specifically adds to the method. Also, would the 5S approach still work in communities where traditional field songs are limited or no longer exist? I recommend a clarification which will help demonstrate how easily the approach could be adapted to other regions beyond the referenced Spanish case.
8. The authors argued that the 5S method as replicable, but since it is strongly based on local culture and community participation, exact replication may be difficult. Perhaps saying “adaptable” or “transferable” would be more appropriate, as songs, stories, soil issues, and local knowledge will naturally differ from one community or one place to another.
9. The descried protocol proposes a number of short and long-term indicators, ranging from soil awareness and literacy to social cohesion and soil health. This is ambitious, but these outcomes operate at very different temporal and causal scales. Improved soil literacy may be seen within a relatively short time, while changes in stewardship practices and soil health will likely take much longer. I therefore suggest separating the outcomes into short-, medium-, and long-term outcomes, with clear indicators for each.

Finally, the MS could better acknowledge that traditional knowledge and cultural heritage do not always represent sustainable practices. The 5S approach could therefore help identify which traditional practices remain valuable, which need adaptation, and which may no longer be suitable under today’s rapidly changing and unprecedented environmental and socio-economic conditions.

Overall assessment
I consider the 5S Method an original and potentially valuable contribution to soil literacy and community-based environmental education. The manuscript has a merit in attempting to reconnect soil science with culture, heritage, memory, and place.

My reservations concern primarily the need for stronger operationalisation of soil literacy, clearer integration of soil-science measurements and field observations, and a more explicit mechanism linking cultural engagement to measurable stewardship outcomes.

Addressing these points would, in my opinion, strengthen the scientific foundation of the protocol while retaining its innovative transdisciplinary character.

Assessment questions
1. Is the rationale for, and objectives of, the study clearly described?
Yes, with minor clarification needed.
The overall rationale is clear, although the operational meaning of soil literacy and the expected pathway toward stewardship should be more precisely defined.

2. Is the study design appropriate for the research question?
Partly.
The participatory design is appropriate for investigating cultural engagement and place-based learning, but stronger methods are needed to demonstrate changes in soil literacy and subsequent stewardship.

3.Are sufficient details of the methods provided to allow replication by others?
Partly.
The broad procedural stages are described, but additional detail on soil assessment, learning outcomes, analysis of the diagnostic grid, integration of different knowledge systems, and evaluation criteria would improve reproducibility.

4. Are the datasets clearly presented in a useable and accessible format?
Not applicable at this stage.
This is a study protocol and no empirical dataset has yet been generated or presented.

Is the rationale for, and objectives of, the study clearly described?
Yes

Is the study design appropriate for the research question?
Partly

Are sufficient details of the methods provided to allow replication by others?
Partly

Are the datasets clearly presented in a useable and accessible format?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Soil science, hydropedology, Pedo-archeo-geoheritage, soil cultural ecosystem services, traditional soil knowledge and heritage conservation, soil literacy and education, and field-based soil learning.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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Willi E.R. Xylander
Senckenberg Museum of Natural History Görlitz, Görlitz, Germany

This article is a presentation of a project planned for the future without empiric results; no results are available at this stage. The project aims to capture and (re-)vitalise a cultural understanding of the values associated with, and the ecological processes dependent on, soils, using traditional, regional songs (both historical and contemporary) as a medium of communication. In the long term, the concept – developed as a pilot project in Spain – is intended to be rolled out across Europe. This, principally, seems to be an interesting and innovative transdisciplinary approach.

In the regional/local project planning and structure, however, lies what I consider to be a fundamental shortcoming: the restriction to the tiny municipality of Pozohondo (Albacete, Spain), with a population of 1,554, will make it difficult to generalise the findings, even though the local problems will be similar in many places, particularly in southern Europe. The advantages may not compensate the deficit arising from the very specific local perspective and the small community.

A few points remain unclear to me:

- How exactly are the project's requirements for the conservation or regeneration of degraded soils to be implemented? Practical, innovative measures adapted to the demands of climate change are unlikely to feature in the traditional songs.
- TIERRAS has planned knowledge transfer events for practitioners (e.g. led by soil scientists or specialists in sustainable agriculture), but these will only reach a very small group of truly relevant stakeholders. I am not sure whether this group is sufficient and truly suitable for the intended transfer to other regions.
- Are the workshop participants and the interviewees the same people? Or is the group expanded to include workshop participants who were not interviewed?
- What is to be done with the soil samples mentioned in 2.8 as baseline measures? Which parameters will be analyzed? Furthermore, the planned timeframe seems to me far too

short to draw any conclusions about the project's success.
- How large should the sample size be for the follow-up study, and how will the participants be selected (see 2.8)?
- The traditional cultural song repertoire can hardly take into account the current challenges of climate change and the resulting consequences (both in terms of the status quo of soil and soil functions and regarding sustainable management of resources). How can traditional songs be adapted to the requirements of knowledge regarding sustainable land use against the backdrop of current changes and drivers? This should be incorporated into the project planning and the formulation of the research question.

Is the rationale for, and objectives of, the study clearly described?
Partly

Is the study design appropriate for the research question?
Partly

Are sufficient details of the methods provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Soil biodiversity research, conservation, museology, visitor research

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.