

# Stepping on invisible land: on the importance to communicate the value of soils

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## Research Article

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# Abstract

Soils play fundamental roles in the functioning of the Earth's ecosystems. Despite numerous initiatives to protect soils, it continues to be generally perceived as dirt or, at best, the surface we walk on. To better understand soil perception by the public, we conducted a survey with 99 participants from Poland and Brazil. We applied an opportunity sampling and conducted semi-structured interviews with 40 respondents from Poland and 30 from Brazil, and 29 unstructured interviews in Brazil. Most of the respondents (53%) of the semi-structured interviews associated soil with the surface where plants grow while 27% said that it is the ground we step on. When asked about pro-environmental campaigns, none of the respondents pointed to soil-related initiative. Most of the respondents (99%) claimed that there is a need to increase the knowledge about the importance of soils, mostly through education (30%). The majority of the respondents of the unstructured interviews in Brazil indicated provision services provided by soils and pointed to the need for youth engagement on soil communication, corroborating the results from the semi-structured interviews. To address this, present the results on artistic workshops as an experimental model for teaching and dissemination. We present two short documentary movies presenting the results from unstructured interviews and the artistic workshops which can be used as data gathering tool, teaching tool and for dissemination purposes. This paper not only presents primary data on the crucial problem of soil recognition but also presents a range of transdisciplinary approaches to help problem solving.

## Introduction

Soils provide several ecosystem functions and services, such as food provision, climate regulation, waste recycling, water purification and recreation [1–3]. Soils host cultural legacies of ancient people, have a spiritual value and are artefact for paintings and handicrafts [4, 5]. Soils relate to several sustainable development goals (SDG's) (SDG 2 - Zero Hunger, SDG 6 - Clean Water and Sanitation, SDG 13 - Climate Action and SDG 15 - Life on Land) [6], and their effective contribution to the 2030 agenda will only occur with efforts involving different decision-makers and society [7].

Various initiatives around the world aim to curb land degradation. The '4 per1000' Initiative, launched in 2015 at the United Nations Conference on Climate Change (COP 21), aims to increase global soil organic carbon stocks from 4 to 1000 (0.4%) per year to offset global emissions of carbon [8]. The Global Soil Partnership, which aims to promote the sustainable management of soil and improve global governance for its protection and sustainable productivity, encourages investment, technical cooperation and promotes research in soil science. In addition, there are some commemorative soil dates, such as April 15th as "National Soil Conservation Day" and December 5th as "World Soil Day". These initiatives represent a concerted effort to bring attention to the importance of soil and prevent further soil degradation.

Notwithstanding fundamental role of soils for nature, its importance is often not recognised beyond academia and among non-scientists [9]. For example, in the survey-based study on the environmental

problems in Poland and Brazil, soil degradation was recognised as the least important problem compared to deforestation, water pollution and climate change [10]. Soil, being often perceived as an inexhaustible resource, undergoes degradation worldwide. Currently, approximately one-third of the world's soils are degraded, and more than 90% can be degraded by 2050 [11, 12]. Decreasing or eliminating land degradation is essential to maintaining ecosystem functions and services and is more cost-effective than rehabilitating land after degradation [11].

Lack of recognition of the value and functions of soil by different stakeholders has historically fostered widespread land degradation [13]. The solutions indicated by the stakeholders may provide effective measures to improve sustainable land management (Campos Tisovec-Dufner et al. 2019). Although increased awareness does not imply immediate behavioural change, understanding stakeholder's perception is a step toward social engagement (Bennett, 2019). Social engagement, in turn, is paramount in the context of land conservation and restoration, an increasingly popular approach to protect biodiversity [15, 16].

Given the vital role of soil in global resource management and decline in the provision of soil ecosystem services, it is paramount to develop mechanisms for communicating scientific knowledge about the value of soils to a wider audience [7, 17]. However, with the abundance of fake news available online, there is a gap between scientists work and accessibility to potential readers (Thaler and Shiffman 2015). Visual contents in scientific papers are ever gaining more importance to address these efforts (Brennan 2021). The recent TikTok boom among so-called Gen-Z shows how visual content is crucial for dissemination of information to the youth. For example, Basch et al. (2022) presents research based on sample of 100 TikTok videos with hashtag #climatechange that they totalled already over 205,5 million views.

To this end, this paper has two principal objectives: i) to investigate, using a survey, the perception of soil importance via opportunity research in Poland and Brazil and ii) to report results on a creative dissemination method we used to show soil importance to wider audience. We produced two videos, which may be applied not only as a tool to understand perceptions about soils but also may be used for dissemination and teaching purposes. Finally, we discuss the need to publicise the importance of soil to society and discuss other awareness-raising practices. We believe this paper will contribute to encouraging the soil scientists to engage with a broader audience about the importance of soil and its functions. Also, through transdisciplinary approach performed throughout this study, we believe the article can reach wider public.

## **Materials And Methods**

### **a. Survey**

The survey aimed to collect and investigate different perceptions and information about the meaning of soil, its importance, and ways to increase awareness about soil value. We applied a semi-structured questionnaire to conduct personal interviews and video-recorded unstructured interviews.

### i. Semi-structured questionnaire

The semi-structured personal interviews were performed over June and July 2021 in Poland and Brazil using accidental (opportunity) and voluntary sampling [18]. In accidental sampling, the respondents are selected based on availability and willingness to participate. It is a non-probabilistic therefore non-representative sampling. The interviews were performed in Polish and Portuguese and consisted of 10 questions:

1. Which recent pro-environmental campaign do you remember?
2. What was the source of it?
3. Where did you encounter it?
4. What is the soil?
5. Do you think soil is important?
6. Why?
7. Do you think it is important to do awareness campaigns about the importance of soil?
8. How can we increase awareness about the importance of soil?
9. What do you think about the app 'what can you do for the earth'?
10. Would you take part in this app?

The list of the original questions in Polish and Portuguese is included in appendix 1. While asking question 9, we explained our idea to develop a mobile application, which in principle could encourage users to be more 'soil friendly' by explaining how everyday activities link to either damaging or improving soil. For each activity that could contribute to soil degradation but is replaced and reported by the user with soil-improving activity, the user would gain a point. When reaching a certain threshold there would be a reward. A monitoring system would also be applied to verify compliance.

The responses were transcribed to excel and analysed using content analysis and descriptive statistics.

### ii. Video-recorded unstructured interviews

In September 2021, we performed unstructured interviews in different ecosystems within the Atlantic Forest biome, in the state of Rio de Janeiro, Brazil (Figure 1): i) coastal ecosystem in Cabo Frio municipality (22° 52' 55" S, 42° 0' 36" W with a distinct presence of a 'Sambaqui' (see below)); ii) Atlantic Forest 'sensu stricto' vegetation- in the "Serra dos Órgãos" National Park (PARNASO; 22° 29' 35" S, 43° 4' 24" W) and in Araras, both in Petrópolis municipality; iii) coastal tropical moist broadleaf forest - 'Restinga'- in Grumari Environmental Protection Area (APA Grumari) in Rio de Janeiro municipality (23° 2' 32" S, 43° 32' 10" W); and iv) mangrove forest in the Guapimirim Environmental Protected Area (APA Guapi-Mirim) in the Itaboraí municipality (22° 39' 30" S, 42° 57' 0" W). Sambaquis, which in indigenous Tupi language means "assembled of shells", are categorized as a rounded hill that can reach over 30m high. They are composed of food residues such as seeds, shells, animal bones (mostly fish), and other

artefacts demonstrating its use for burial rituals [19]. They represent one of the major and more diverse archaeological heritage of the Brazilian territory.

In each site we approached local visitors, including residents, tourists, tourist guides, conservation-unit employees and scientists. The questions asked were "What soil means for you?", "Do you consider the soil important?", "Why?". Considering the particular importance and the specific term of 'sambaquis' we asked additional question 'Do you know what sambaqui is?' during the field visit in Cabo Frio.

We also conducted two artistic workshops, one in Cabo Frio and the second one in Petropolis, with diverse audiences: collaborators of this project, tourists and local residents, including children. The participants were asked to express their perceptions about the soil through painting with soils. They could also collect leaves, petals, stones, shells, plants and other elements that represent for them the meaning of soil. At the end of the workshop, we collected and filmed the testimonials from each participant about soil perception.

We used soil ecosystem services framework from [20] to categorise the perceptions from unstructured interviews. This framework defines soil ecosystem services as the benefits people demand from soils for their quality of life. Furthermore, it differentiates this concept from others associated with soil science, such as soil properties, soil processes and soil functions, which have sometimes been used synonymously with soil ecosystem services. In this framework, soil ecosystem services are classified into regulation, provision and cultural.

#### b. Video capture and editing settings

The video interviews and the artistic workshops were compiled in two short documentary movies regarding soil importance to be used for teaching and dissemination purposes. These videos were recorded using a SONY ALPHA 6500 camera, a CANON 80D camera, CANON 5D MK3 camera, a MAVIC PRO 2 drone, and a Boya By-m1 microphone. It resulted in more than 12 hours of raw filming. The most representative answers were added into the script. The final videos were edited with the Adobe softwares: Premiere, After Effects, Lightroom e Photoshop.

## Results

#### a. Survey

##### i. Semi-structured interviews

We interviewed 70 respondents: 40 from Poland (57%) and 30 from Brazil (43%). Of these, 61% (N=43) were women, 38% were men (N=26) and one respondent was identified as other (Figure 2). Regarding the age of respondents: 46% (N=32) were between 19 and 29 years old; 34% (N=24) were between 30 and 39 years old; 9% (N=7) were between 40 and 49 years old; and seven respondents were above 50 years old. Regarding the level of educational background of interviewees: 51% (N=36) have higher education - meaning bachelor or master's degree - or are still at the university; 13% (N=9) completed high school; 7%

(N=5) completed PhD or are coursing PhD studies; 4% (N=3) completed primary school. Seventeen respondents did not disclose their education level. All respondents were living in urban areas.

In response to the question 'Which recent pro-environmental campaign do you remember?', 16% (N=11) were familiar with campaigns about pollution with plastic, especially related to the use of plastic straws; 11% (N=8) of respondents were not able to recall any; 7% (N=5) were about the Amazon rainforest; 7% (N=5) about campaigns for garbage treatment; 4% (N=3) recalled a "Clean Air" campaign; 4 (N = 3) % pointed to "Earth Hour"; and 4% (N=3) "On the side of the nature" campaigns. The remaining 46% (N=32) of answers have been categorized as miscellaneous and are listed in appendix 2. One Polish and seven Brazilian respondents did not remember any campaign.

Regarding organisations responsible for the campaigns, government units, for example the Ministry of Climate and Environment, were pointed by seven respondents, WWF was pointed by five respondents, Greenpeace by four. The rest of the interviewees did not remember the name of the organization or recall what type it was, did not remember any campaign or did not provide an answer. In the response to the question where the campaign was encountered, the respondents could indicate more than one source and therefore the total number of answers is 85.

The most recurrent answers of Polish and Brazilian interviewees were internet (45% for Polish, 39% for Brazilians) and TV (27% of Polish respondents and 22% of Brazilians). Twelve percent of Polish interviewees and 11% of Brazilians encountered campaigns on posters. While six percent of Polish respondents cited newspapers or magazines, none of the Brazilian respondents indicated this source. Likewise, 6% of Polish interviewees cited other sources. News from the member of the family, university, and scientific papers were some among them. For Brazilian interviewees it was 3% of answers, church was one of the examples. Miscellaneous answers are in appendix 3 (N=10; 12%). Differences in responses between Polish and Brazilian interviewees are presented in Figure 3a.

For both, Brazilian and Polish respondents, the most recurring answer was internet, which also included social media. In that, for Polish interviewees, the most common answer was social media in general, Facebook and Instagram (Figure 3b). Brazilian respondents indicated Instagram as the most recurring answer, while there were no answers neither for Facebook, nor YouTube.

Regarding the question: 'What is soil', the respondents were asked to describe in their own words the perceptions they had about what the soil is, without being tied to pre-defined concepts. Most of the respondents (N=37, 53%) associated it with the surface where plants grow and develop, 27% (N=19) believe that the soil is the ground we step on; seven respondents (10%) said that soil is life, 7% mentioned several different aspects related to the soil and 3% did not answer (N=2). Figure 4 presents the distribution of the answers between the two nationalities.

All participants responded that the soil is important. The majority (N=45; 64%) reported that the soil was important because of food provision and water regulation. For 27% (N = 19) soil is life and a survival

resource for the planet. If the respondent included a mixture of these aspects in the response, the response was categorised as 'miscellaneous - many aspects'. For example:

"Soil generates life in several aspects, if we don't protect the soil, we won't have its products. There is also what we consume directly and not directly, sometimes it is a raw material used for something, or there is water, which can only be filtered because it has passed through the ground. Soil is much more than what we don't see than what we see."

In relation to the participants' opinion regarding increasing awareness about soil, one respondent replied that she/he did not think it was important. In response to the question 'why we should raise awareness about the value of soils', the most recurring answer was that it is needed for education (37%, N=26) and because of pollution (16%, N=11). Four respondents indicated that awareness campaigns are important for future generations and one respondent claimed that because our lives depend on soil. Selected citations:

"I think it should be done more for people who are connected to the soil, farmers or families who live in rural areas. Also educate people who work in government or work indirectly. It is also important so that public is interested and can demand actions from politicians in case of violation of nature-protection laws."

"To inform and raise awareness among the population."

"To make the public aware that soil and caring for its quality is important for the natural environment and for the life of fauna and flora."

Regarding the question: how to raise awareness about the importance of soil, education was the most recurring answer (N = 21; 30%). This should be done through lectures, workshops, and videos to address the youth. Campaigns were also indicated to increase awareness (N=15; 21%) and 17% (N=12) replied that there should be a mixture of campaigns with education in schools or TV commercials with dissemination in social media.

"Webinars, lectures with scientists / biologists / farmers, scientific articles."

"(...) school education is very important, but it would also be good to focus on open communication channels such as TV or social media."

"Influencers should increasingly take a stance on environmental issues, as their voice is of particular importance to the young generation, who must be properly educated to be able to prevent soil destruction from an early age."

Regarding the question about the app, 76% (N=53) of interviewees found it an interesting or a good idea. For example:

'it's best to start with the youngest, they will be interested in it, something like Pokémon and there is a reward that can motivate people in the younger age.'

or

'I think this type of application would be more intended for children and good, because from an early age you have to learn how to care about our environment.'

Among the limitations regarding the application, interviewees questioned for which group of society it would be destined and how to choose the targeted group. Also, interviewees had concerns about how to promote the app and get to the broader public and how to monitor the activities registered in the app. Three respondents stated that a different approach like events, campaigns would be more beneficial than a new mobile application. About the interest in using app, 51% (N=36) of the respondents indicated that they would use such an app, while 30% (N=21) answered 'no'. Twelve respondents were not sure, as they had concerns whether they would be in targeted group, or because of lack of time, lack of space on mobile phone, or what would be the prize for using the app. One respondent did not answer the question.

## ii. Video-recorded unstructured interviews

We interviewed four respondents in Cabo Frio area, four in the PARNASO's Forest, five in the APA Grumari 'restinga' and two in the APA Guapi-Mirim mangrove. Furthermore, we recorded perceptions about soil from the participants of both artistic workshops, conducted in Cabo Frio (N=9) and Petrópolis (N=5). This resulted in 29 unstructured interviews and registered 69 comments considering to soil ecosystem services. Most of the comments (N=34) related to provision services, cultural (N=31) and four indicated regulation services and per classification of [20], Table 1. Notably, in the Cabo Frio, only one interviewee was aware of the existence of sambaqui and described it as an indigenous cemetery.

A total of 11 participants (collaborators of this project and local residents), including three children (3 years old, 4 years old and 9 years old) took part in the artistic workshop conducted in Cabo Frio (Figure 5). Participants painted on canvas with soil and raw materials collected in the area - roots, litter, grass, and flowers, as well as with acrylic coloured paint. The artwork produced expressed the meaning of soils and participants' relationship with soil. We repeated this activity in Petrópolis with five tourists.

Table 1 Categorisation of soil ecosystem services according to the framework of [20].

Soil ecosystem services classification	Type of service	Number of indications	Site	Example
Provision	Water	5	Petrópolis (Atlantic Forest)	Youths and a scientist recognised the importance of soil for water
	Wood	5	Petrópolis (Atlantic Forest)	Youths and a scientist indicated the importance of soil for forests
	Physical support	2	Grumari (Restinga)	Restoration employees recognised the importance of soil for seedlings to grow
	Physical support	1	Grumari (Restinga)	Local worker mentioned that animals depend on soil to survive
	Physical support / Food / Water / Fibre / Wood	6	Cabo Frio (Artistic workshop)	Scientists associate the soil with life
	Physical support	4	Petrópolis (Atlantic Forest)	Youths listed animals that live in the park
	Minerals	1	Petrópolis (Atlantic Forest)	Tourist associated soil as a mineral source (gold)
	Food	2	Grumari (Restinga)	A surfer and a local worker associated soil with plantation and food provision
	Food	5	Petrópolis (Atlantic Forest)	Youths and a tourist associated soil with plantation and food
	Wood	1	Guapimirim (Mangroove)	Local guide mentioned firewood extraction in the 70-60's to feed bakery ovens in the city
	Food	2	Guapimirim (Mangroove)	Crab's hunting is a source of food and income for hundreds of local residents
Regulation	Water purification	2	Guapimirim (Mangrove)	Tourist guides mentioned that mangroves 'filter' water
	Water purification	1	Petrópolis (Atlantic Forest)	Tourist associated soil with water quality
	Carbon stock	1	Petrópolis (Atlantic Forest)	Tourist associated soil with air quality

Forest)

Cultural	Aesthetic / Recreational / Spiritual	4	Petropolis (Atlantic Forest)	Tourists explained why they search for natural sites to feel relaxed and alleviate from stress
		3	Grumari (Restinga)	Local workers mentioned how their work of restoring native vegetation, removing invasive species, and collecting garbage enhances the natural beauty of the place
		4	Petrópolis (Atlantic Forest)	Young local residents related how they feel energised and relaxed after visiting the park and its waterfalls, that is the only recreational option in their neighbourhood
		1	Cabo Frio (Sambaqui)	“Every time I come here (to the Sambaqui) to collect garbage, the next day the pitangua’s (fruit) tree is loaded! It feel like that the nature is thanking me for taking care of her” - by local resident
		1	Cabo Frio (Artistic workshop)	Artist expresses in painting that soil is a “portal and everything in the universe is connected and shares energy through soil”
		1	Petrópolis (Artistic workshop)	Tourist associated the soil with human essence
		1	Cabo Frio (Sambaqui)	Local resident uses Sambaqui for recreational purposes
		1	Petrópolis (Atlantic Forest)	A tourist related soil with faith
		1	Petrópolis (Atlantic Forest)	A tourist mentioned that living in the city, the contact with soil and nature is missed
		1	Cabo Frio (Sambaqui)	Local resident related the importance of that archaeological site to preserve history and the feeling of connection with ancestors
		2	Grumari (Restinga)	Surfer and local worker associate the soil to the connection with nature and with their life itself, in a relationship of interdependence: “If we take care of the soil, we are taking care of ourselves. [...] We are a link in the chain [...]”
		1	Grumari	Surfer related the use of the region’s

		(Restinga)	natural trails
	1	Grumari (Restinga)	Restoration worker said he loves the contact with soil and planting, this is one way that he can express himself
Education and Knowledge	1	Grumari (Restinga)	Restoration worker mentioned he was invited to visit a primary school to teach students about conservation and restoration
	2	Cabo Frio (Artistic workshop)	Scientists talk about soil analysis and its elements
	2	Cabo Frio (Artistic workshop)	Scientists associates life cycles with soil cycles and other philosophical insights
	4	Cabo Frio (Sambaqui)	Scientists explained that Sambaquis are pre-historical cultural deposits encompassing accumulations with a range of functions and origins.

#### b. Video recordings and communication products

We recorded two videos: The first video is a 15' short documentary called "Soil and society" (supplementary material 1) featuring testimonials of local residents (workers, students and youth), tourists and visiting scientists about their perception of what is soil and their personal relation with soil in four different ecosystems in Rio de Janeiro. The second video is a 13' short documentary called "Artistic Activity with Soils" based on the two artistic workshops (supplementary material 2). It explains how the artistic workshop with soil paints was conceived and conducted, how the soil and other natural materials were collected and how the paints were prepared. The videos also show the testimonials of the participants about the value of soil. The paintings are also used for exhibitions at universities, botanical garden, schools, and research institutions related to soil education in Rio de Janeiro.

## Discussion

The quality of soil resources affects human's well-being in multiple ways (MEA, 2005; Rodrigues et al., 2021). Soil has however historically received less attention than other natural resources like water in the context of conservation. It is important to acknowledge this gap and address it to incentivise and inform better soil use and adoption of better land management practices [16, 21, 22].

Given the increasing environmental impacts generated by soil degradation, it is necessary to raise awareness in society about the importance of conserving global soils [13]: the soil must be considered an integral part of the human-nature relationship and as indispensable to the natural processes that allow life on Earth. However, soil degradation is perceived as least important of current environmental problems [17] and the concept of ecosystem services related to soil quality receive less attention when

compared, for example, to biodiversity [23]. There are also gaps in implementation of soil science in restoration studies [20, 24].

Our results confirmed the need to increase awareness about a variety of ecosystem services that soils provide. In our survey soil was mostly perceived in the context of food provision and water regulation. Furthermore, although all respondents claimed that soil is important, none of the environmental campaigns that the respondents were familiar with considered soils. Similarly, the study from Brazil by [25] with children from the 5th year in elementary school shows that the majority (97%) of 29 participants stated that the soil is important for the conservation of the planet. Also, although all participating children affirmed the relationship of the soil with nature and the environment but 48% said that there is no life in the soil. When asked if they would like to learn more and if it was important to study the soil, 93% agreed. In a recent paper, [26] calls for improved dialogue between soil scientists and different stakeholders to shape the future soils research agenda. Based on survey, they demonstrate that research priorities in soil science are generally not in line with the needs of key environmental and industrial sectors.

Regarding evaluation of soil ecosystem services, we found that the majority of the respondents from the field visits in Brazil, recognised soil through the perspective of provision services (N=34), which corroborates the results from our semi-structured interviews. Importantly, cultural services were mentioned 31 times, which can be explained by the fact that the interviews were conducted in touristic places that are used for recreational or spiritual purposes. Indeed, cultural, and social valuation that considers values of nature and its benefits that are rooted in individuals and at the same time are shaped by the social and cultural context in which they are embedded [27]. However, in the case of sambaquis, which are often based in touristic places in Brazil, sambaquis areas are not well preserved and overlooked despite its cultural and historical importance (supplementary material 3). We also noticed that the site was neglected, with broken fences, trespassing, and no surveillance.

Our research confirms that a wide-ranging educational policy is needed regarding the importance of the natural

environment. It is important to use new communication channels to reach wide social groups. The use of communication tools that employ methodologies with participatory activities and playful materials, both in urban and rural areas, are needed (Capeche 2010). Indeed, many innovative methodologies in soil education such as theatre plays, games, videos, environmental tracks, soil painting workshops and papier mache increasingly represent educational tools of research institutions (de Lima et al. 2020). For example, The Brazilian Agricultural Research Corporation (Embrapa) & School Program – for more information and watch the institutional videos consult the appendix 4 and 5 -perform workshops with soil painting with teachers and students and the Soil Quality Indicators methodology addresses adults (farmers, students, teachers, and indigenous people) to assess the importance of sustainable soil management. The integration of research and communication increases chances that science become useful to society (Krzic et al. 2013).

Information technology (IT) and web-based multimedia have opened new paths to offer motivating learning alternatives as opposed to traditional static education. It improves motivation to learn, as students are generally interested in having multimedia resources online at hand. Yet, due to daily multitude of information, more dynamic and interactive teaching formats are needed to attract the interest of broader audience, especially young generations [31]. Furthermore, considering that the learning process is not only related to contact with information but also to cognitive and motivational aspects, it is necessary to consider methods that lead to the internalization of knowledge [32]. Scientific articles, lectures and books are being translated into blogs, lives, and videos [33]. In, particular videos are increasingly popular, which opens a new opportunity for researchers to carry out efficient scientific dissemination outside the academy [34]. YouTube, one of the main online video networks in the world and is the preferred platform of Brazilians. This platform has more than 2 billion monthly users in more than 100 countries around the world, which represents a great potential for dissemination Due to its visual characteristics, video content allows contextualizing the most diverse themes with the necessary nuances, details, and emotional appeals, while maintaining an immersive dynamic [34]. This leads to much greater engagement: video is twice as likely to be commented on, shared, and discussed with friends and family than other formats [35]. Furthermore, emotional appeals - i.e. using real people talking about their feelings with pride, hope and joy -; and social influence - i.e. publicly broadcasting who have engaged in desirable behaviour such as restoration or conservation - are powerful leverages to drive behaviour [36]. Therefore, we believe that our videos – more information available on supplementary material- contribute to scientific dissemination of the value of soils to a broader and non-scientific audience and will attract wider interest especially among young generation. We also hope that the results presented here will encourage other soil specialists to disseminate and communicate the importance of conserving soils in an effective and innovative manner.

## **Declarations**

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### **Ethical Statement**

All participants in the recorded interviews, as well as in the photographs, signed an image consent document with an explanation of the research proposal and image use.

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## Data availability

All materials developed and presented in this study are available in the manuscript, appendices and supplementary material.

## Competing Interests

At the time of writing, Agnieszka Ewa Latawiec is a Board Member of Royal Society Open Science, but had no involvement in the review or assessment of the paper.

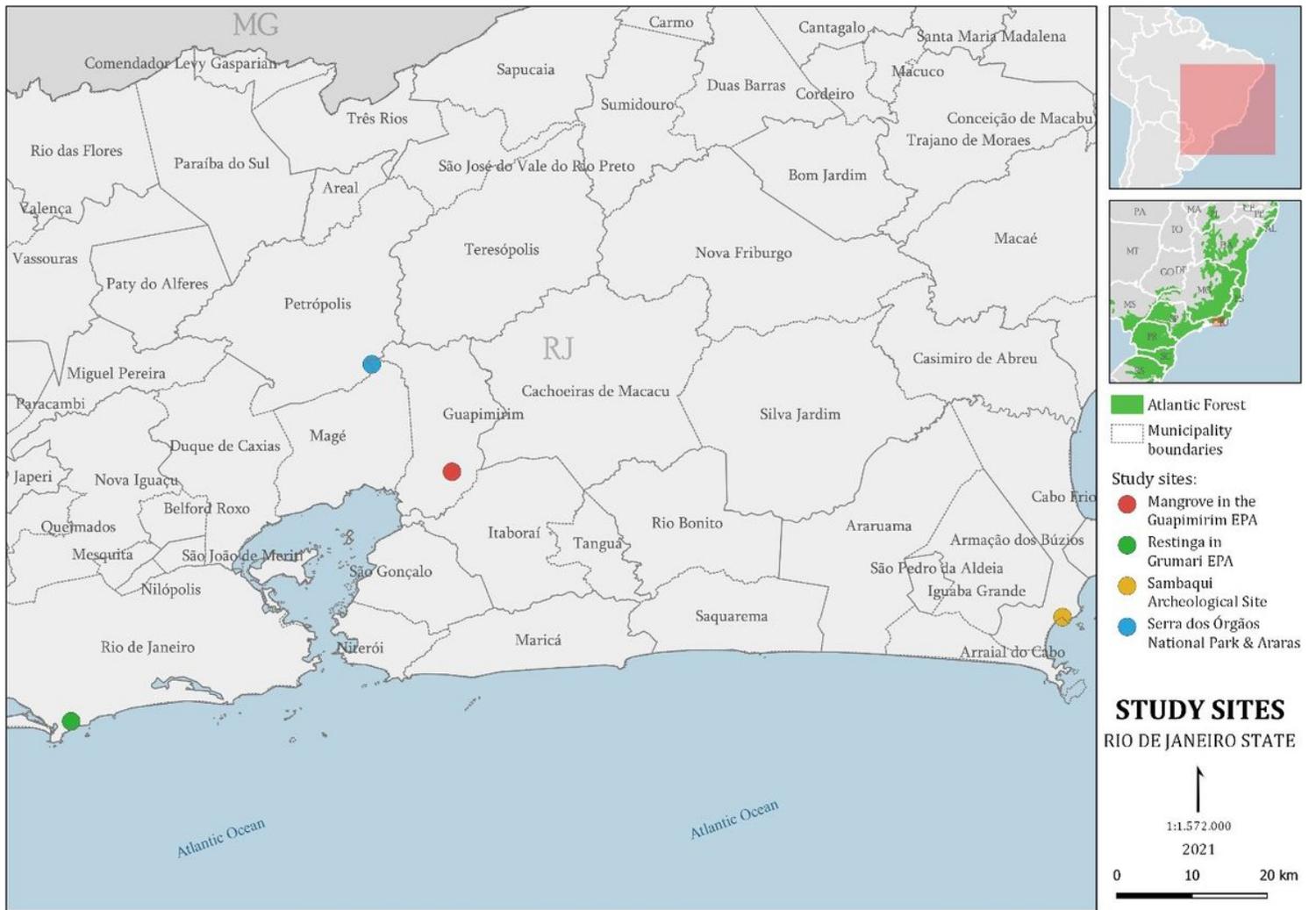
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## Figures



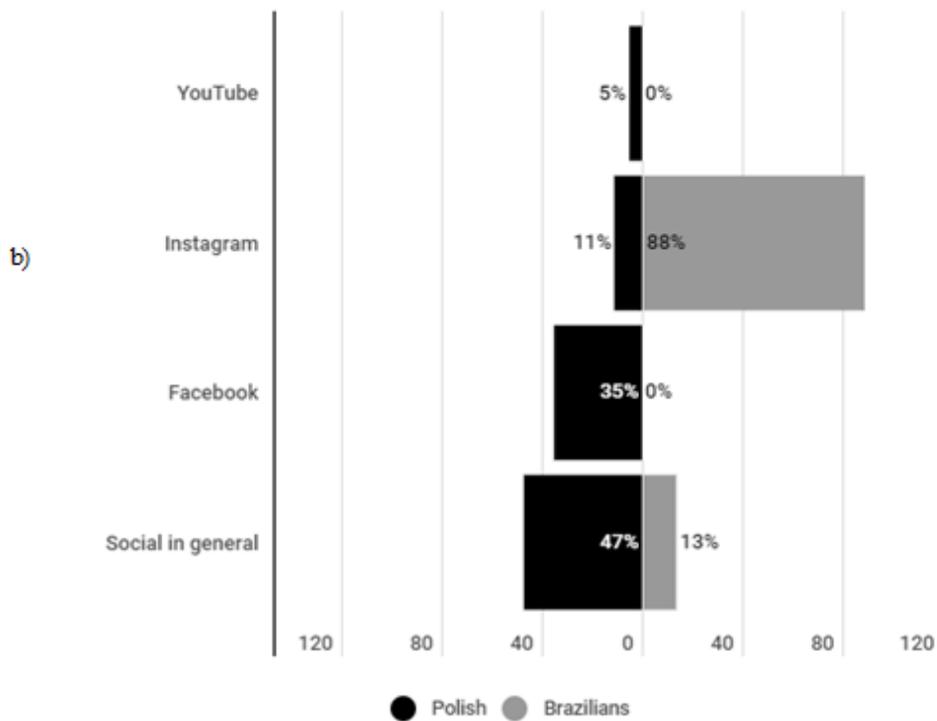
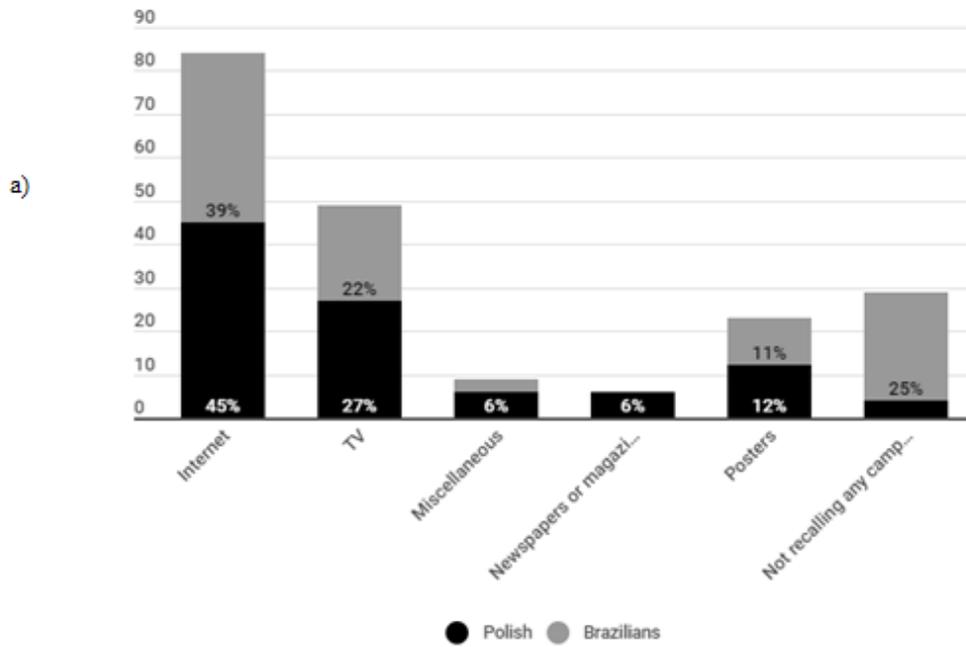
**Figure 1**

Field work sites - state of Rio de Janeiro in the Atlantic Forest biome region.



**Figure 2**

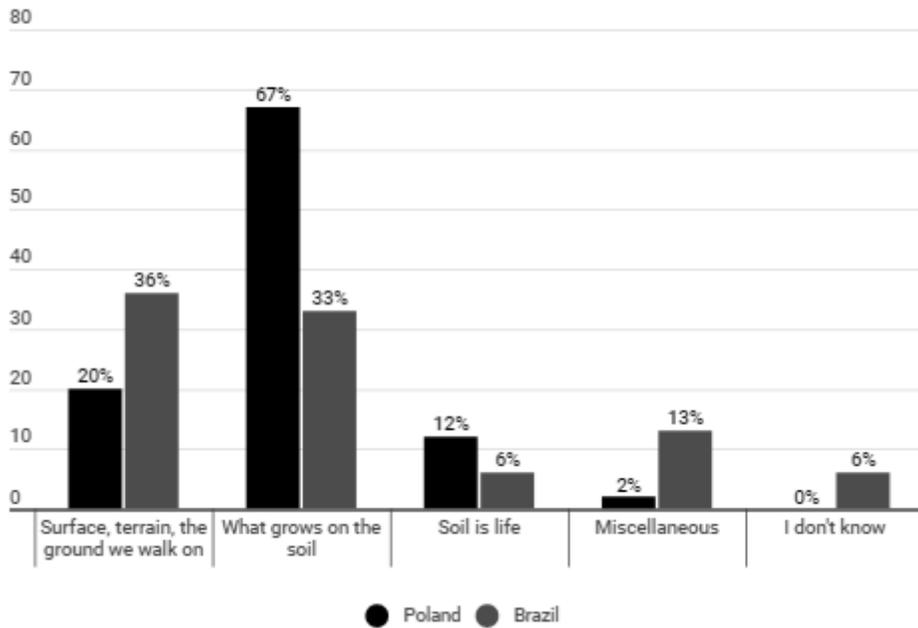
Distribution of nationality and gender of respondents of semi-structured personal interviews.



**Figure 3**

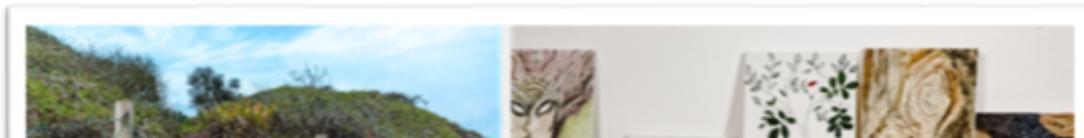
a - Distribution of answers for sources where campaign has been encountered.

b - Differences between social media where the respondents from Poland and Brazil encountered the campaign.



**Figure 4**

Distribution of leading themes from answers of respondents of semi-structured personal interviews to the question 'What is soil?'



**Figure 5**

Pictures from top left: “Sambaqui” archeological site in Cabo Frio; participants of the artistic workshop in Petrópolis; painting with soils; paintings from the artistic workshops in Cabo Frio.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [ATIVIDADEARTISTICAVERSOFINAL1.mp4](#)
- [Appendix.docx](#)