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Thinking with soil in heritage matters

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ABSTRACT

This paper explores what could be learned 'by thinking with soil' in heritage matters, and 'thinking with heritage' in soil matters. Soil is connected to major sustainability issues as it is life-essential to a wide range of beings. Soil is rarely thought of as heritage, despite becoming a scarce resource over time. It is argued that heritage as 'landscapes of human perception' is not enough to meet the challenges at hand, whereas the alternative 'heritage as phenomena' allows for discussing the long-term material/immaterial multi-species interrelations that build up in situated soils. It gives better positions to discuss justice and care between generations and convivial re-generation of landscapes. The paper works with a case study from mid-Sweden to show how different 'agential-cuts' of soil give rise to stakeholder *tensions as different worlds are produced.*

KEYWORDS

Posthumanism; care; soil; sustainability; multispecies; conviviality; extractivism; politics of the longterm; heritage; landscape

Heritage services work with issues of how to manage significant resources from the past, use them in the present, and pass them on to the future. Hence heritage deals with matters and materialisation processes that ties situated relations between generations. This places heritage matters directly in contact with major sustainability issues of how to balance resource use in the present with the needs of future populations. Heritage has been handled in two major discourses, one that deals with cultural heritage and one that deals with natural heritage. This binary may be a hindrance in tracing heritage as a boundary transgressing phenomenon where several relations and agential forces come into play bringing about change and under-articulating connectivities between culture and environment (Fredengren 2021; Harrison, 2015). There have been several efforts to link up the two, for example through the European Landscape Convention, and in academic and practical works (see e.g. Borgerhoff Mulder & Coppolillo, 2005; Lowenthal & Olwig, 2015). However, the landscape concept in heritage policy and planning often leans on notions that privilege immaterial values and human perception over ecological relations, which adds further to the nature: culture divide (Fredengren 2021, 2021). There is a need to discuss relationships between heritage and sustainability in ways that transgress this divide and that take multispecies worlds and temporally evolving materialisation processes seriously. This paper explores what could be learned if agricultural soil, which neither sits easily in the natural or cultural category and rarely is thought of as heritage, were approached through a heritage lens. Drawing on Alaimo (2012) this paper deals with the question of what sustainability wants to sustain and looks at how different sustainability efforts conflict or converge when it comes to soil as heritage and to what extent such sustainability includes multispecies worlds.

The research arose through a visit to the exhibition – the Summer of Soil – held in a rural community in mid-Sweden.[1] The exhibition opened up several aspects of soil, such as the importance of soil for food production, the different materials that soil consists of, and how it

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forms over time. Later on, small farms in the nearby area were visited. People were concerned about the planting of energy forests on good farming land by a risk-capital company. The fieldwork gave rise to ideas for research on what would happen if earth and soil as living ecologies with long histories were to be considered heritage. This paper makes use of material from these visits as well as from information on web pages and media reporting. It uses these as a case study for tying into ongoing research on soil in the environmental humanities. As has been argued by researchers in the project Humus Economicus[2] soil is misrecognised in several societal processes. This paper identifies such soil misrecognition in heritage-making i.e. that soil is disregarded and often forgotten about when heritage is dealt with in future-oriented planning processes. The reasoning applies to several societal decisions about the use of agricultural soil for planting energy forests, as places for solar panels or buildings.

Research history

In 2015 the UN announced the International Year of Soils[3] as it is a resource under threat, often interlinked with issues of development and underdevelopment, with food crises and the over-exhaustion of soil. Shiva (2009) pointed out we have not only reached peak oil but also peak soil. In discussing soil security, several capacities of soil are acknowledged and given value as producing above-ground food and biomass through supporting root systems. It contributes to climate regulation as carbon and nutrient stores and provides habitat for biodiversity. Furthermore, soils are acknowledged for providing recreation for people and cultural heritage services, for example as archives of archaeological artefacts (European Commission 2006[4]). Several museums worldwide deal with soil use and soil qualities.[5] The book *Soil as World Heritage* (Dent, 2014), highlights that there might be a need to deal with soil heritage. However, it becomes clear that it is not primarily the soil itself that is understood as heritage materia. Instead, it is the remains of soil experiments and a variety of agricultural equipment and machines that point towards the technological improvement of the soils that are primarily considered heritage. But there is more to soil and soil heritage than this.

In the Environmental humanities, research has started to engage differently with this materia. By 'thinking with soil' Salazar, Granjou, Krzywoszynska, Tironi, and Kearnes (2020, pp. 6–7) set out to review current discourses, practices, and framings of soil critically. This makes space for other ways of engaging in earth matters. Soil is increasingly appreciated as a living, dynamic materia (Puig de la Bellacasa, 2017; Krzywoszynska & Marchesi, 2020; Lyons, 2020; Meulemans, 2020). It is produced through situated power formations and differently situated soil practices, imaginaries, affectivities and relations. Puig de la Bellacasa, (2017), argues that soil science has served to focus research on the soil as a receiver of crops and soil science is often aligned with productionism and situated within linear techno-scientific timescapes. Such productivity-focus, places soil narratives in an economistic mindset, and more so than studying soil as living multi-species communities, where care is practised. Lyons (2020) points to that human-soil relations can be shaped as resistance. Lyons fieldwork in Columbia highlights how there is a need for other imaginaries of soil that are not bound to production and growth alone. Soil comes about through erosion, decay and regeneration. They develop through relational processes, that also expose formerly unnoticed relationships between labour, politics, and ecologies (Jacobs & Wiens, 2022). Soils are multispecies historical archives, constantly on the move to become something else.

However, the heritage aspects of soil have not yet come centre stage in these discussions on 'Thinking with Soil'. Furthermore, as will be argued here, thinking with soil in heritage offers a way to challenge anthropocentrism in heritage studies and policy-making in ways that move beyond capturing soil as contributing mainly to immaterial values of human perceptions, and engage with soil as a living heritage materia. Also, to encounter situated soils as heritage might be a way to return to and acknowledge the transtemporal connectivities and material

agentialities of them in soil science. It could also open up more convivial soil practices to find ways of living better together in situated places. Conviviality is conditioned on paying more attention and practising care and empathy for the several 'othered' others with whom we share the environment as well as to account for such togetherness in planning for our shared places (Fincher & Iveson, 2015).

The heritage cut of soils

This paper makes use of Critical Feminist Posthumanism and New Materialism to highlight ethics and power-laden relations and adapts these for analysing heritage formation, as earlier explored by Fredengren (2021). In that paper, it was argued that heritage is a material-semiotic relational phenomenon that comes about through *agential cuts* into an interconnected world of more-than-human entwinements. According to Barad (2007) an agential cut is a provisional stabilisation of a worldly entangled phenomenon under study. Hence, a *heritage cut* captures parts of the world provisionally through a heritage designation. Not only does a cut create meaning for humans or produce a heritage representation of the world (as reflected in a group identity, a particular perception, or an ascribed value). An agential heritage cut can also change the world in its materiality, as such labelling often prescribes what routes to take in its future development, in conservation, preservation, or development. Heritage cuts can be observed in material performative statements about stewardship, restoration, regeneration, and re-use that make real-world, material, and immaterial differences. Different *heritage cuts* have both material and immaterial effects and they regulate temporal and intragenerational relations. Heritage designations have real-world-altering effects. By this, they also speak into matters of sustainability and sustainable development and the cuts made, when making use of different lenses to figure out different routes of sustainability.

Importantly, different cuts that shape how the world develops also involve different ethics of how resources-in-relations are passed on from and entangle past, present, and future generations. Thereby heritage can be analysed as agential networks that transgress temporal boundaries. These theories will be applied in this case study to explore how soil comes to matter as a living multi-temporal heritage materiality that ties several human and more-than-human ecologies together, and explores how different soil, sustainability and heritage cuts make a difference in how situated worlds develop. These tools will be used to structure a case study of situated soils in mid-Sweden in three parts; one that deals with soil in a curated exhibition and permaculture, one that deals with soil as risk capital and its use for energy forest plantation, and one that deals with residents and their relationship to soils exposed to change.

Curated soil

The exhibition *Summer of soil* was held in Järna, south of Stockholm, as a part of a collaborative initiative[6] on the soil between the years 2013–2015, linked to the UN initiative on Soils. The webpage of the exhibition replicates its panels and soil is described as 'the plants digestive system' where complex and raw materials are broken down by micro-organisms to support the absorption and metabolism of plants. As many urban people have little experience with soils, their involvement in the landscape is implicated in their need for food. Hence, the curators emphasised the link between soil and nutrition in the online display, and the exhibition explored regenerative farming methods such as permaculture design. Those methods aim to repair and maintain living soils through for example composting. Some farms in the area work the land according to such principles. Composting and soil care features frequently in their practices. This has real material effects on the soil produced in this place.

Some panels focus on what the soil and its worms provide to the environment, such as oxygenising ground, soaking up water, storing carbon and transforming the humus. The exhibit draws on soil scientist Elaine Ingham who describes soil as a living web that can be resilient and capable (2004). This is often described as the food-web model of soil.

Most remarkably, from a heritage perspective is the display text that explains the amount of time it takes for fertile soil to grow. Seemingly it has taken 2000 years to compose such soil to a depth of 10 cm (Figure 1). No reference was given in the exhibition. However, how much soil grows, depends on several different and situated factors, but there is a rule of thumb that topsoil grows 1 cm every 100–300 years (see ReVelle & ReVelle, 1992).

The final panel has the message that there is a need to restore ecology, to preserve soil and its biodiversity (Figure 2). A reference is made to Wilson (1992, p. 340) who proclaimed that

Figure 1. Panel from the exhibition Summer of Soil focusing on soil formation and content. Summer of Soil Exhibition 2013, Ytterjärna, Sweden.

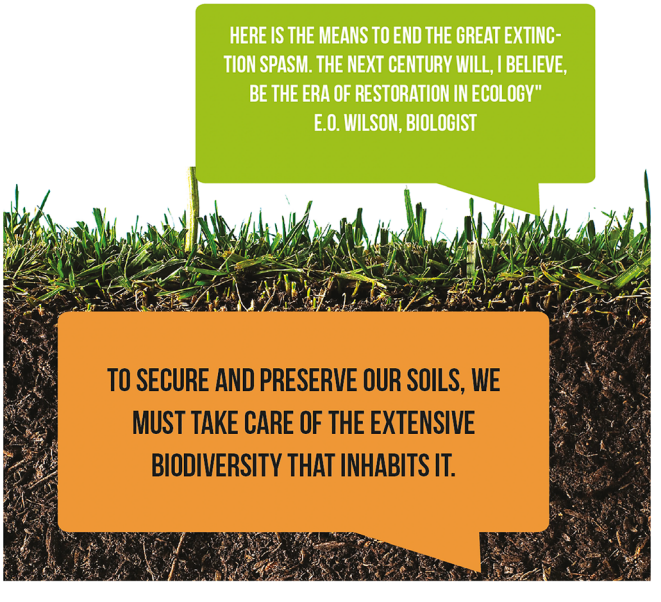

Figure 2. Panel from the exhibition Summer of Soil focusing on soil restoration, preservation and care. Summer of Soil Exhibition 2013, Ytterjärna, Sweden.

'the next century will, I believe, be the era of restoration in ecology'. The web page of Summer of Soil states the aspirations of the exhibition: 'We seek to showcase a win-win-win scenario between, soil stewardship, nutritious food and resilient immune systems and health. Showing that regenerative agriculture does not just benefit soil, but also has the potential to secure more nutritious and tasty food, leading to more resilient immunity and well being'.

The *agential cut* made in the curated exhibition is most akin to the discourse of soil in the 'thinking with soil' research. The exhibition panel does however not qualify what is meant by soil being a living web. It could mean that soil is the habitat for many living beings, such as bugs, worms, microbes, and fungi and that soil with its crops produces nurture for both humans and animals and enables life. Likewise, soil can be analysed both as multispecies habitat, where its inhabitants co-produce living soil, which brings on further transformative powers. Hence situated soils gain agency and aliveness due to the combined action of several relations. Situated soils are entangled collectives where the distinction between what is cultural and what is natural, or alive and dead is not always necessary or possible to make. They can´t be broken down into different components of parent materials, gas, water and microbes as their living and life-altering capacities work across such boundaries (Puig de la Bellacasa, 2017, p. 189). Soils have elsewhere been captured as 'crucibles of life' to underline their life-generating powers (see Given, 2018). Bennett (2010, p. viii) explains how matter can be acknowledged as vital, vibrant, and self-organising existences with powers to interfere in societal events. As a vital matter, soils make out agential landscapes on the move (disregarding if they are perceived as landscapes by humans). The *agential cut* made in the exhibition focuses on soil capacities and what produces healthy soils. It connects to permaculture design that focuses on improving the structure, nutrient content, and biology of soils,[7] albeit with a focus on food production. While a long-time perspective is in focus, and heritage/sustainability-related terms like conservation, regeneration, and restoration are used, the soil is not specifically discussed as heritage and relations that develop over time are not in focus.

Soil extractivism and energy forests

Such cuts of soil can be juxtaposed with developments going on in the vicinity of the exhibitions. A large amount of soil in the landscape is bought up by a company. As stated on their web,[8] they manage land and forestry in Sweden and own 16 000 hectares. This company plants an energy forest of hybrid poplar trees on agricultural land. These mature over some 20[9]–30 years. Energy forest is considered a crop, and hence planning authorities have dealt with them as a form of continued land use, comparable to the crops of traditional agriculture that they replace. The company's sustainability arguments and states that they want to develop its properties with care for nature, reduce environmental destruction, and contribute to long-term sustainable forestry. Their sustainability aims to create value from soil and to have the best forests in the future.[10] Both forests and soils are understood as resources that primarily serve humans. The company anticipates climate change with higher temperatures and shorter winters and proposes to handle this through another selection of hardier plants more resilient to disease, insects and mould

The company argues for the planting of energy forests as they are not in favour of either traditional or ecological farming as it does not provide economically viable ways of saving nature. Also, traditional farming uses fertilisers, toxic substances, and machinery heavy on fuel. The planting of energy forests gives benefits to the environment as it could work as a filter for water and clean toxic ground from for example cadmium. Furthermore, it is argued on the company web page that there is no great need for agricultural food production as people in the Western world are obese. Hence, there are social benefits in reducing agricultural production and turning farming land into forestry. The heritage aspects of the landscape are captured as an intention to keep the landscape open in places due to public demand and also to save some places where there are archaeological sites if the county board asks for it.[11]

The company also challenges political sustainability goals. Among these are the Swedish Miljömål which consists of one generational goal, with the promise to hand over a society with major environmental problems solved to the next generations, and 16 goals for environmental quality. To achieve this society needs to have a rich cultivation landscape[12] where the values of agricultural lands, biodiversity and heritage values are protected. However, the company informs that they do not abide by what they call Naturmål, instead, they have set up their own premises for sustainability. Furthermore, an argument is made that if the state wants sustainability services for the common good from a private landowner, they need to pay companies for the service. According to the company, societýs sustainability goals should be met through the vast amount of publicly owned forests in Sweden and not by the private companies themselves. Furthermore, if the company were to contribute to these goals, it ought to be compensated by the state for its use of private capital to supply benefits to society.

The agential cut made in these soils by the company is to frame them in an extractive land-owning perspective as creators of value for the investor. Their ownership of soil also makes a temporal cut into a materia that has formatted over considerable periods, long before current ownership legislation was in place. In this cut, the soil itself is not considered heritage. Heritage is equated with some sites that people may like to visit. The higher goal for sustainability is to sustain income for the company over time. It is less linked to the sustainable use of the soils and more linked to creating forestry products to answer the demands for ecological products within the energy and transport sectors.

Research shows how short-rotation poplar plantations decrease the output of food crops and challenge fodder supply for animals and hence connect the altered use of agricultural land to issues of global food security. It also reduces organic matter in the soil as well as moisture and nutrient content and risks exposing soils to depletion. It affects the compaction and structure of soil, and in effect, poplar plantations could cause land degradation and they consume more water than other crops. The roots stretch into the soil layers and work soil-altering. Together with the decrease in soil fertility, it can be costly to turn the soil back into farming land and restore it. However, this is dependent on the local context (see de Jong, Akselsson, Egnell, Löfgren, & Olsson, 2017; Wang & Xin, 2016, FAO[13]). This company's agential cut does not articulate any particular aspects of soil restoration and regeneration to remedy soil extractivism. To decide on a development as this would from a soil as heritage perspective need to include information on the costs of restoration of lands if they need to go back into farming lands and clarify who takes these costs that otherwise would need to be charged to future generations.

Soil use from community perspectives

The company's use of farming soil has created local turmoil. The contested nature of the activities is demonstrated in letters of complaint sent to local newspapers and in blogposts.[14] In the plantations some trees may grow 15–20 m tall, which will impinge on the open farming landscape in the area and disturb peoplés views.[15] It alters the aesthetic values of the surrounds. The cut of the local residents channels into an argument that have been framed in the landscape convention, where the heritage losses are articulated as a loss of viewsheds in the landscape.[16] This can be a successful route as evidenced in recent court rulings,[17] where arguments around the preservation of long sight lines in the landscape have hindered the planting of forestry on farmland in southern Sweden.

However, this heritage landscape cut only covers a small spectrum of relations with soil. It frames soil as primarily produced through human/anthropocentric immaterial and visual relations to the soil, which underestimates mutual agential and relational powers of soil materia. The landscape as a perception approach hence risks alienating people from their more-than-human collaborative partners, hence not working for a convivial co-habitation of places (Fredengren 2021, Fredengren, 2022; Given, 2018, p. 140).

Figure 3. Drawing that illustrates the tensions around land use provoked by the planting energy forest in this locality, local artist Anna Bohlin.

Community members have also raised the issue that the plantation will affect soils that people have invested in for generations. The illustration above (Figure 3) shows people linking arms with the gold ring (migration period 400–550 AD) found in a treasure hoard near these lands planted with energy forest.[18] The text on the picture says that people want to plough money in the ground for their grandchildren. That is an investment for five generations ahead. Hence, the drawing points towards an argument of intergenerational linkages going back in time and stretching into the future. This is, in the drawing, pitched against the ongoing energy forest developments for the financial gains of a single person. The ongoing soil extractivism is captured in the figure by the text as 'Mina pengar ska växa på träd' i.e. My money will grow on trees and 'Tillfällena gör Mannen' with the 'M' signalling a link to the right-wing market liberal party of Moderaterna. The text 'Land + Skog = Tomt' portrays local male politicians as opportunist developers who want to transform farmland that, under most circumstances, is not allowed to be zoned for housing developments via energy forestry, to land that could be classified as suitable for building houses.

The cut made here is the focus of the open landscape and farming land as an inheritance. It also features how present generations invest in soil for future generations. Furthermore, the drawing shows links between the soil and several human generations, going back to the Iron Age and forward in time to their descendants. While this cut emphasises the long-term relations with soil, it potentially excludes more-than-human generations and how to convivially share place over time with multispecies communities. A production relationship with soil is also present in this cut. At the same time, residents in these communities engage in different soil practices, where the earth is cared for and fed by compost and manure. There are material soil-care practices and the mutualistic weaving of soil-food-soil matrixes.

None of the stakeholders articulates that the soil itself is heritage, nor has the heritage sector entered the discussion claiming that the agricultural soils are heritage. Hence it can be argued that there are several cases of complete and partial soil misrecognition in the heritage field, as the situated soils are not dealt with as the long-term materialising entities, they are.

Thinking with soil in heritage matters

The observations from the case studies show that agricultural soil could potentially be captured as heritage. One route in heritage-making is based on visual arguments and values of open landscapes. However, soil is a vital co-created resource that builds up across time and

more-than-human generations. Several other heritage cuts of soil could be made. In policy documents such as the Miljömål mentioned above, heritage is a value ascribed by humans to the cultural environment. In EU writings, soil gets drawn into heritage discussions as valuable archives of the past. Archaeology has traditionally treated soils as containers for data (see Holtorf, 2022) that provide studies of human history with artefacts, stratigraphy and features. This is also reflected in studies of geoarchaeology and soil micromorphology. Earth materials also hold records of human- and animal remains as well as traces of former vegetation, which gives insights into botanical history as well as soil DNA to indicate what beings were living in the place over time. However, such cuts narrow down soil heritage discussion as they are focused on what soil contains and can be extracted from them and hence disregard soil with all its entangled relations from being heritage.

Recently, the importance of long-term anthropogenic action for the forming of soils has been noted. The black soils of Ukraine, where earthworm activity at the habitations from the Neolithic and onwards as well as their composts have contributed to the build-up of these extraordinarily fertile soils (Dreibrodt et al., 2022). The fertile dark soils of the Amazon, with high-nutrition charcoal content, have been described as anthrosols (Palace et al., 2017). Such soils (IUSS Working Group WRB 2022) are defined as having horizons removed or as modified by humans adding contents or chemicals artefacts or other compounds such as concrete, soot etc. Important to note is that these anthrosols also include archaeological remains, that as in the case of the black soils, clearly affect both multispecies subterranean lifeworlds and interfingers with the worlds above ground.

Lately, the idea of archaeological soil being an artefact has re-entered the stage.[19] However, this approach also carries problems as it overemphasises humans as the maker of soil. Ingold and Hallam (2014) point out that people don´t make things, but they can assist in how they grow. Neither would people alone make situated soils. Landscapes can instead be understood as lived and practiced realities and soil heritage is appreciated for its regenerative capacities (Whatmore & Hinchcliffe, 2010, p. 444, Holtorf, 2022). Hence, the soil in the study area has partly been produced by humans but has also come about through the practices and relations of several non-human others. While the soil in the study area could be captured both as an artefact and an anthrosol, it is more than that. Applying the thinking tool of heritage as a phenomenon would highlight that no human really can claim to have made soil (or any other heritage) on their own, they have only assisted the direction of its growth. This by entering the stage and by re-tying some of all situated soil relations.

Given (2018, pp. 134–139) suggests that local soils can be investigated through how they sustain their nutrient cycles by recruiting different participants such as carbon and nitrogen, rainfall, and compost. It is possible to turn the table and see how soils in the study area both have enrolled the labour of several humans and animals that together cleared the land and fed it, as the geological processes as the land rose from the sea, in a long-term composing and composting. The tracing of the local soil would also mean taking into account if the soil has been cared for or depleted– and what relations it has been tying together and what power politics, justices and injustices, it is produced through. The soil in question has been tended to, appropriated by noblemen and regained by smallholders. Also, microbes and fungi have colonised the lands and nitrogen cycles co-created it. Living and dying vegetation and bodies of humans and animals have been a part of the soil-making and tracings of the situated soils in the study area would also follow how different agential cuts make situated soil entanglements come into being.

To work with soil as a heritage phenomenon would mean paying attention to several more-than-human agencies to acknowledge their work and understand what difference soil makes in their lifeworlds. However, such an argument needs to move carefully and engage with the soil-materia in new ways to navigate through anthropocentrism to understand how human agency is facilitated by different relations that build up the soil. One problem is that soil could

be analysed both as a natural formation and cultural artefact and there is a need to explore soil processes as a boundary-transgressing resource in the making of heritage. Similar problems (as in the soil as artefact argument) would occur if heritage soils were limited to soils produced by traditional farming tools and methods as heritage soils, as that would again centre human agency as the maker of soil, which would disregard long generations of multispecies soil-making agents.

There are different trajectories of soils, that form a part of the resource handed over to future generations as an inheritance. Among these are freak soils, the polluted city soils where plants have colonised disturbed lands (Meulemans, 2020, p. 20). Some soils come about through industrial farming, monocropping, and pesticides. These popularly called 'zombie soils' are nearly dead as unwanted fungi and herbs are killed and the soil is depleted of nutrients. Whether the soils planted with energy forest turn out to be such soils remains to be seen, it depends on what interventions come into place.

An anthropocentric heritage landscape perspective is too narrow to account for the multiple agential relationalities of this materia that stretch out over time. The various cuts as in the use of agricultural lands for energy forests, and community protests do not engage in the soil and its multispecies communities – and they are not geared towards a convivial world-making and have their own situated versions of what worlds their specific sustainability wants to sustain. 'Thinking with soil' in heritage would acknowledge soil as a material-semiotic phenomenon and as a gathering of several different sources, forces, and cuts. This approach could open up for paying attention to the material and immaterial interlacing's of soil-in-place, but also look at what routes are possible to take in present and future world-making. That means it is important to heed not only what soil represents in history-writing but also what relations situated soils enrol and what they are in the process of becoming.

Thinking with heritage in soil matters

As Krzywoszynska and Marchesi (2020) writes, soil is a complex materiality. Adding to this complexity are soil's underarticulated and undertheorized temporal relations and implications. The case study also shows different temporal relations are activated in the engagement with soil (from the extractivist cycles aimed at near-future gain to the cyclical and relational temporalities of compost care). Discussions of soil as a heritage phenomenon would acknowledge situated soils as a coming together of several different agencies that co-work manifestly or latently over time. Soil entangles deep time processes of geological parent materials and long-term processes of decay and withering. Its life cycles stretch over and connect up both human and more-than-human generations in the slow growth of agricultural soils as temporally relational materia (reminding ourselves of the 20 cm of soil growth that takes us back to prehistoric times). While soil microbes have short life cycles, some of them can lie dormant for over 100 years and by forming relations with fungi spring into activity again (Joergensen & Wichern, 2018). As Puig de la Bellacasa (2017, p. 205) writes soil may 'enrich temporal imaginings' and such imaginings can be expanded by highlighting the transtemporal relations involved in growing soil as a heritage in the making and taking.

The exhibition opened up for time perspectives of some 2000 years for fertile farming soils to form, while some people in the local communities referred to several human generations of investors into soil and the risk capitalist involved in cycles of some 20–30 years for the investment to give yield. However, soil is most often not treated as either heritage, or a long-term resource for society. This can be compared with trees and forestry, which are of interest for long-term economics or politics i.e. the politicisation of the long-term (Nordblad, 2017). Neither soil nor heritage is regularly discussed in terms of the politicisation of the long term, while it ought to be given such attention. To think with soil, just as with trees, can give incitement of engaging into longer temporalities, as it means to work with a materia that outlives a single

human life, it also entices deliberations that affect the life potentials for several generations and hence is tied to discussions on sustainability.

One of the core principles of these is that the needs of the present should be met 'without compromising the ability of future generations to meet their own needs' (UN, 1987, p. 54). The phrasing of the generational goal separates the existing future individuals from the future ones in body, space and time. As discussed in such separations between generations have led philosophers to the question if someone who does not yet exist can have rights. The problem can be dealt with by devising the '*intra*'-*generational* as a figurative thinking tool and by arguing that past, present and future generations are entangled with each other. Hence, they can be considered as ethical subjects to care for as they are stretched over time in their virtualities (Fredengren, 2022). This can be a useful move for how to engage in the generational goals of sustainable development differently and see how practices both in the past and present territorialise the future. Also, as in the case study, anthropocentric generational thinking risk excluding several othered others (future generations of humans and non-humans) from being in the negotiations of what future potentialities a particular landscape has and what ethical differences particular cuts leads to (Fredengren, 2022 and Fredengren & Åsberg, 2020) and this is questions that both heritage and sustainability discourses need to deal with.

Engaging in soil and soil care across generations implies getting 'involved with a diversity of timelines' (Puig de la Bellacasa, 2017, p. 171). It also means to become entangled in more-than-human intragenerational relations. As shown in the case study, there is a multitude of material and temporal trajectories involved in the soils. The 30 years or so it takes for the energy forest to mature, the 2000 years of soil care that made them come into place and the even longer temporalities of the geological processes that made the grain formation come into existence. To acknowledge that heritage intervenes in such relational webs might affect how to engage in how to take care of significant resources from the past, use them in the present, and pass them on to future generations (Fredengren, 2022; Fredengren & Åsberg, 2020). Such alterations to heritage making can be read through post-human feminist scholarship to place intra- and intergenerational ethics, response-ability, justice, and care on the agenda, but also to acknowledge how different materialising agencies from the past exercise agencies and entangle the present and future.

Capturing soil as a nature-culture heritage phenomenon could be helpful in identifying new links between heritage, sustainability, and landscape. This means acknowledging a variety of heritage soil trajectories and focusing on tracing life-essential temporal relations woven over time. A crucial question for the heritage sector would then be how this resource that has grown over time could be cared for to nourish present and future more-than-human generations. This would open up for looking at what relations need care for to deal with the several sustainability challenges ahead, and for how to get on better in a damaged world. It would also push for a discussion on how today, neither the needs of the present generations nor those of future generations are met on a global scale, and how the planting of energy forests on farming land serves some human populations, but not others.

Soil care, conviviality and regeneration

This paper asks what could be learned 'by thinking with soil' in heritage matters, and 'thinking with heritage' in soil matters, and the case study as well as the consulted research literature show that the 'landscape as perceptions' is not enough to cover for the several multispecies and transtemporal relations that develop in soil. At the same time, dealing with soil as a heritage phenomenon can open up for acknowledging other agencies that are at stake in soil formation and to add different temporal and materialising relations to think with heritage in soil matters. That means exploring the past/presence of soils and its trajectories into the future. Also, thinking with soils in heritage matters might work for multispecies care in heritage and

sustainability discussions and thereby help us to pay better attention to and care for crucial and nurturing relations for living better in more-than-human worlds and futures i.e. to work for a more convivial co-habitation of place.

If landscape heritage were to work beyond what is captured visually and bridge nature and culture, it would have to reconnect to several more-than-human materialisation processes and relations that matter over time. This is necessary for how to review the links between heritage and sustainability. The case study points towards agential cuts that are quite anthropocentric, where both sustainability ethics as well as situated power differentials and potentials coincide and clash with each other as they are acted out in the landscape.

Here, the planting of energy forest on farming land leads to one type of sustainability, that needs to be juxtaposed with other sustainability efforts and mediated concerning what action possibilities and lifeworlds are opened up and what possibilities are closed down by the change. The reasoning above highlights how different sorts of anthropocentric focus can be challenged by engaging in questions about multi-species participation in the creation of soil, but also to start a discussion on how to format heritage consultation processes where the needs of several more-than-human others can be heard and acknowledged at the negotiation tables of change. This is particularly important for thinking about the afterlife of the soils in the case studies.

Sustainability is often argued through a retro-rhetoric and by the use of heritage concepts such as conservation, restoration and regeneration of resources. For the soils in question, a grand challenge is the amount of repair work needed to get back the agricultural soil and if it is a restoration of soils to monoculture crops that is most urgent or if other futures for this soil bring about more nurture. Just as one needs to ask what sustainability wants to sustain, similar questions about what restoration wants to restore and conservation wants to conserve need to be asked. Increasingly scholars write about soil care as the maintenance work that we do to repair the world so one can live in it as well as possible. This means that care is 'vital in the interweaving in a web of life' (Puig de la Bellacasa, 2017, pp. 3–4, 170). In such care work, a convivial approach might be fruitful to acknowledge the life essential agencies at work in soil heritage. Conviviality is described as both being together and being attentive to the presence of others in our surroundings and to cater for such togetherness in planning and also to make efforts to include and to practice empathy with several othered others, in places that are shared (Fincher & Iveson, 2015). However, with a heritage as phenomena lens, such conviviality and care do not need to be restricted in time to the present, as we share a place transtemporally with past, present, and potential generations. Hence heritage soils need to be treated with care so they can cater for several threads of relations over time.

Conclusion

Soil can be argued to be heritage on different grounds. Soil can contain archaeological material and work as archives for studying history. Furthermore, several soil museums attest to the tools and practices humans made use of in working with soil. However, most often the soil itself is not seen as heritage. This is connected to a separation into cultural and natural heritage, where the human practices of tending to soil is cultural heritage and the soil at best, is considered as natural heritage. As evidenced in the case studies, soil is not regularly classified or argued as heritage of any type, but is more regarded as residual or secondary material and a source of income for the benefit of primarily humans. There are challenges and tensions around soil, where different stakeholders engage with soil and make material and immaterial cuts into interconnected soils in ways that have given rise to conflicts and that will affect the action possibilities for future generations. Soil is in the case studies connected with sustainability, but also here the sustainability goals and action plans for engaging with soil differ, from the protection of the resource for future production to regenerative practices of soil care for the creation of more resilient soils.

There are other ways of 'thinking with soil' (Salazar et al., 2020, pp. 6–7). These works bring about critical soil studies and open up other ways of relating to soil. Also here, heritage matters have been left out of the discussion. The current paper has tried to remedy this by making use of tools from critical feminist posthumanism, discussing soil as a power-infused developing relational heritage. This highlights the transtemporal connectivities and material potentialities of situated soils, which can enable engagement in situated soils as a matter that concerns several human and more-than-human generations. This heritage cut on soils opens the discussions on who is included and represented at the negotiations of soil change and urges for deliberations of intragenerational justice and care, when questions about soil come for societal deliberation and for underlining that such deliberations are most important for dealing with the generational goals of sustainable development. However, such deliberations also hinge on the rationale for how to manage soil as a significant resource that is passed through generations. It needs to be debated if the soil is to be preserved and returned to what it once was, regenerated to regain its production capacity or be dealt with in a convivial manner that strives for multispecies flourishing in localised spaces.

However, foremost soil as heritage is linked to the questions and dilemmas that occur in discussions of how to live better on a damaged planet and to engage in a plethora of temporal relations and care – this is where soil as heritage phenomena matters.

Notes

1. https://www.summerofsoil.se and https://www.fao.org/global-soil-partnership/resources/events/detail/en/c/173536/ Accessed 2015 and again 240325.
2. https://humuseconomicus.se/sv/om/.
3. https://www.fao.org/soils-2015/news/news-detail/en/c/353737/.
4. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0231:FIN:EN:PDF.
5. https://soilsexposed.org.
6. http://www.summerofsoil.se Accessed 150710, 170720, 240325.
7. https://www.permaculture.org.uk/practical-solutions/introduction-soil.
8. http://www.hvalfisken.se.
9. http://www.hvalfisken.se/miljo-och-hallbarhet/jordbruksmark/information-till-myndigheterna-rorande-hedensberg-75 Accessed 2016 and 240319.
10. http://www.hvalfisken.se/verksamheten
11. http://www.hvalfisken.se/miljo-och-hallbarhet/jordbruksmark/information-kommunicerad-med-trosa-kommun-lanstyrelsen-sodermanland-och-narboende-i-trosa.
12. https://www.sverigesmiljomal.se/miljomalen/ett-rikt-odlingslandskap/.
13. http://www.fao.org/docrep/004/ac122e/ac122e02.htm.
14. https://www.realtid.se/knepet-gav-finansmannen-mer-skogsmark-att-avverka-lagen-ar-tandlos; https://sn.se/bli-prenumerant/artikel/rk27mzer/sn-bd-0kr-dp_week; https://sverigesradio.se/artikel/5285316.
15. http://www.osp.nu/energiskog-i-vasterljung/.
    http://www.dagensps.se/pengar/stenrik-finansman-i-svar-grannfejd/.
16. https://sn.se/debatt/artikel/poppelodlingar-forstor-oppna-kulturlandskap/lqywdkdr.
17. Svea Hovrätt, Mark- och miljööverdomstolen 060308, dom 2019-03-07.
    Stockholm Mål M4255-18.
18. https://fargaregardsanna.wordpress.com/tag/vasterljungs-guldring/blogpost from 20150821, visited 2016 and 240320.
19. https://www.ucl.ac.uk/news/2023/may/exhibition-explores-ancient-ukrainian-egalitarian-city.

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