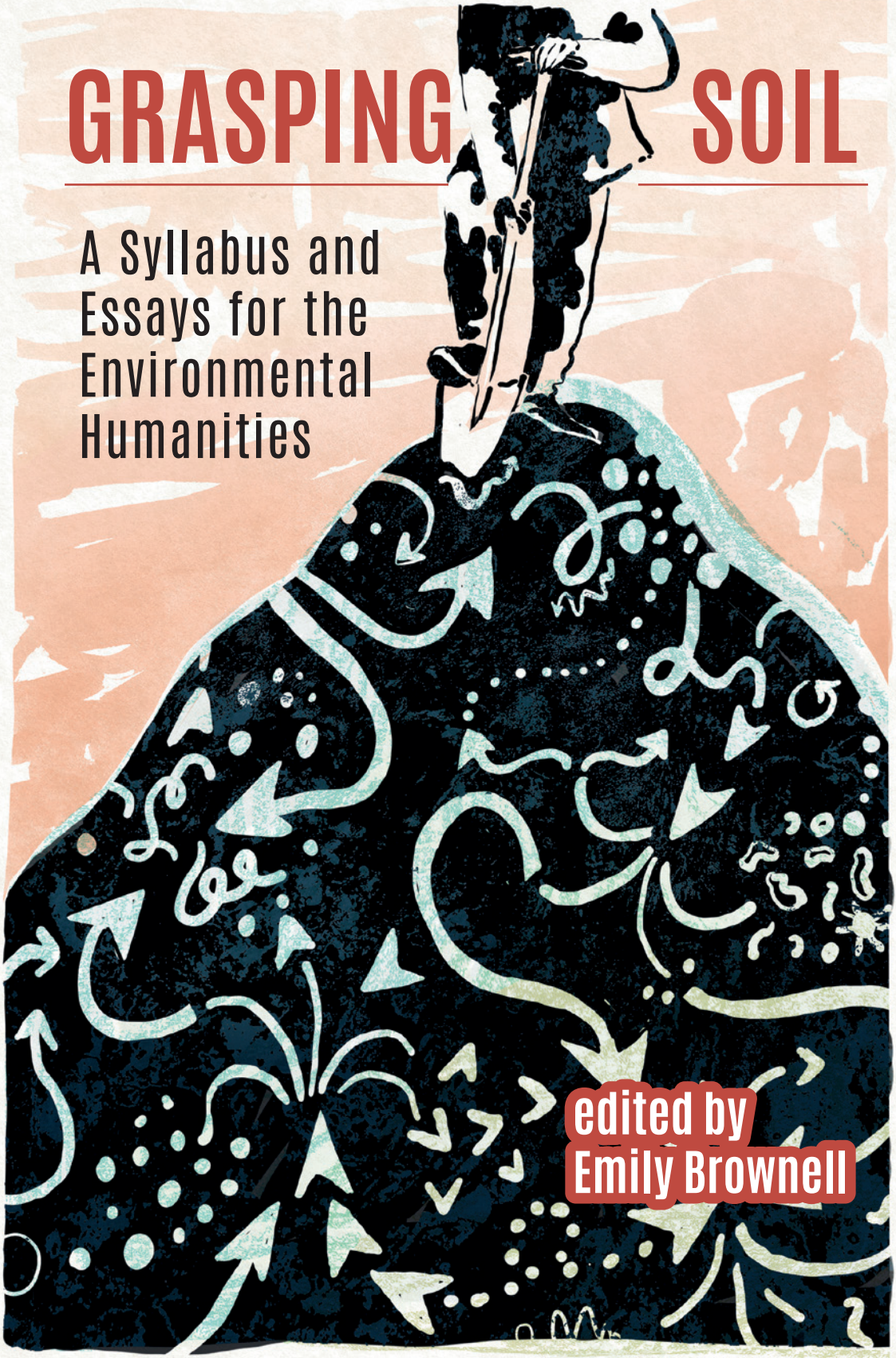
GRASPING SOIL

A Syllabus and Essays for the Environmental Humanities



edited by
Emily Brownell

GRASPING SOIL

GRASPING SOIL

A Syllabus and Essays for the Environmental Humanities

edited by
Emily Brownell

The White Horse Press, The Old Vicarage, Main Street, Winwick,
Cambridgeshire, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN 978-1-917813-02-0 (PB)

978-1-917813-03-7 (Open Access ebook)

https://doi.org/10.63308/63897247289532.book

Cover image by Natasha Russell: www.natasharussell.com

Cover and interior layout by Stefania Bonura Graphics Web & Books

CONTENTS

ACKNOWLEDGEMENTS

This syllabus and book emerged out of a workshop at the Max Planck Institute for the History of Science in Berlin in June of 2024, 'Thinking from the Substrate'. Thank you to everyone who participated and gamely abandoned the usual protocol of an academic workshop to collectively create this syllabus. I am incredibly lucky that Dagmar Schäfer has always been supportive of my work and helped me find a home at Max Planck on several occasions now. Thank you for making these conversations and scholarship possible. Danyang Zhang and Rand El Zein in Department III were generous with their time and support for the workshop. I could not have organised this event without their patient help and expertise. Tilman Musch was essential in planning and conceiving of the event and a great interlocutor.

I am also grateful for a group of scholars at the Max Planck with whom I was in touch leading up to the workshop, particularly Jesse Olszynko-Gryn and Rana Brentjes. They helped me grapple with the ethics of how to put on a workshop at a time of alarming censorship of academic speech in Germany and beyond. The need to build this muscle of conversation is sadly not going away any time soon and I am grateful for the practice.

This workshop was part of a larger project I was able to take on only due to the generous funding of the UK's Arts and Humanities Research Council (project reference number: AH/W007568/1). This funding offered me a once-in-a-lifetime opportunity to mature as a scholar, mentor and collaborator. However, the privileges of that opportunity were always and routinely only made possible by the hard work of my research office in History, Classics and Archaeology at the University of Edinburgh. Particularly the diligence and careful eye of Asad Nazir and Alex Telekova who helped manage my fellowship and coordinate the workshop.

The website and book would not look nearly so beautiful and clever without the hard work of Natasha Russell and Brian Jones. Natasha came along to the workshop in Berlin as we put the syllabus together and changed our mind along the way. Her illustrations capture the topics so well because they reflect her own willingness to be engaged in the process with the rest of us. Thank you for coming along for the ride and bringing the syllabus to life. Brian Jones thinks about all the things I didn't even know to consider in building a sharp and useful website. Thank you for your eye, your patience and your creative solutions.

Finally, I am in debt to the enthusiasm and commitment of Sarah Johnson and James Rice at The White Horse Press. They have been very supportive of a not entirely conventional publishing project, and I'm very grateful that such a press exists.

INTRODUCTION

Emily Brownell

DOI: 10.63308/63897247289532.intro

Two summers ago I was in Nakuru, Kenya to conduct research for a project on soil when I met Helen. She offered to take me to her herbalist, whose shop occupied the sidewalk of a busy street corner in the centre of town. It was a place where casual, yet intimate, consultations unfolded on a small wooden bench. Helen had first sought out the woman's help trying to conceive and then continued to see her for various ailments and aspirations. We stood in line for my own brief consultation on the well-worn bench. Mostly, I was interested in her bags of clay for sale called *munyo* (sometimes also called *udongo,* or *odowa*). Helen was eager to assure me that she herself did not eat clay or soil. At least, not anymore. She understood that women ate it for calcium and iron and to calm their stomachs during pregnancy, but Helen worried that the toxins in the clay often had exacerbating effects rather than salutary ones. The woman in front of me in line inhabited the space with the ease of a regular client. She was helping herself to pinches of clay as she chatted about her health problems. Putting the bag back on the counter as she walked away, she turned to me with a wry smile and said if she took the bag home, it would be gone in a day or two. I broke off a crumbling chunk; the taste was minerally, chalky and slightly salty. When it was my turn, I asked the herbalist where the clay came from and she said it came from no particular place but was often gathered along busy roadsides known for their clay deposits. Its origins didn't seem to hold much significance to her. A few days later, my research assistant, whom I had also recruited into my curiosity about *munyo,* told me it came from a cemetery in the southern part of the city when soil was dug for interring new bodies. Later that day, as I sat down with a young researcher for a conversation on other topics, he laughed when I asked him about *munyo* too. He recalled his mother eating it frequently. 'There's a joke I've heard lately', he said, 'that Kenyans are so poor now, women cannot even afford to eat soil anymore!'

As I travelled around Kenya and later Uganda I noticed bags of clay for sale in most markets. It was usually sold by women alongside a range of herbs. Some described the habit as starting in childhood and for others it was during pregnancy. It was often discussed as an addiction: a desire that would simply arrive at some point and was hard to vanquish. I sensed that craving *munyo* might reveal someone to be 'country' folk, despite the habit's overwhelming ubiquity. My friend in Kampala (where it is called *bumba*) explained that it was social for her: a pleasurable habit amongst friends. But when she had feared someone might suspect she was pregnant if they caught her eating soil, she worked hard to curb her appetite. When we went to a busy market so I could buy some, she promptly broke off a piece, popping it in her mouth gleefully. While scholars often discuss eating soil as a sign of poor health or a

disordered compulsion (geophagy or pica), this language leaves so much out of the picture.[1] *Munyo/Bumba* was a source of connection to a particular place and an abiding pleasure. Some women described how they preferred the taste of the soil from their home, priding themselves on their ability to distinguish its particular flavor. Young children can even be in the habit of peeling dried mud off the side of their huts, literally ingesting their home.[2]

There is nothing unique about East Africans for eating clay or soil; it happens on every continent. And yet the particularities of its practice are certainly locally determined and debated. The jokes are local, too. While I was working on other things that summer in East Africa, *munyo* became my preoccupation. My larger project was framed as an examination of how soil offers a starting point and a point of view from which to write the region's history. The practice of eating clay captured something essential about what makes soil a compelling material for considering the intersections of our social and ecological worlds. Soil is always multiple and in excess of its role in planetary ecosystems. It is both this material excess (the fact that it is a truly heterodox substance) and its affective excess (many different things are invoked when soil is invoked), that make it a rich subject. In this instance, *munyo* was many things at once: a compulsion, a gendered pleasure, a nutritional supplement and a source of potential harm. It was also a link to home and to the dead, a marker of class, a rite of passage, a social relation. I do not think my brief conversations even really scratched the surface, to choose a relevant aphorism. *Munyo* demonstrated so explicitly that we humans are of the soil – our fates bound to its ability to sustain and harm – always hungering for the connections it fosters. And, likewise, soil is in our thrall, vulnerable to our care and transgressions. At some point for us all, the distinction will attenuate: the eater becomes the eaten and we will become soil.

This edited volume advocates for soil to become a germane topic for the humanities and social sciences. Soil is a medium in the most elemental sense of the word – both container and conduit – for telling stories about human life. This is not our revelation alone; a recent profusion of thinking about soil beyond the domain of the physical sciences is reflected within the syllabus that makes up Part I of this book. For a substance that sustains much of life on earth, this attention should be unsurprising.[3] And yet, despite a rich history of art and writing that makes reference to it, soil as an object of study has mostly remained the purview of biologists, chemists, geologists, engineers and

1 Young 2012; Abrahams and Parsons 1996; Hunter 1993.

2 Geissler 1999.

3 Salazar et al.

agronomists.[4] The recent renaissance in soil studies that has pushed beyond these disciplines reflects a growing effort within the humanities and social sciences to develop new frameworks and terms of art for grappling with the existential stakes of how humans and nature shape one another (and to dispense with such unhelpful binaries in the first place).[5]

When soil enters into these new research registers, what has been understood as biological processes and functions is interrogated in new ways. What was erosion or soil exhaustion comes into focus as the demands of capitalist agriculture systems, the byproduct of racial inequality, and the consequences of unremitting growth.[6] What might have been reported in anxious calculations of soil fertility might now be considered in terms of regimes of care and risks of exposure.[7] To point out this new language is not to suggest that all scientists have entirely elided the social and political life of soil.[8] I am oversimplifying to make a point: when new disciplines move into ongoing conversations, they provoke moments when the subject at hand can be seen anew. And, in return, those who might have written off the biological for the cultural are forced to confront the liveliness and materiality of the soil itself. Soil is not an inert material to be acted upon. Its capacity to have a life and sustain life far beyond that which we humans prescribe for it is increasingly apparent. As Maria Puig de la Bellacasa writes, soil has shifted in both scientific and social registers from being a 'receptacle for crops' to being a 'living community' that humans may meddle in by augmenting, depleting and remaking, but do not entirely govern – let alone entirely understand.[9]

The broad, open-ended question that anchors this book is: if soil is a medium for telling important stories, what do we learn about our current historical moment when we start from the ground up? There is rich metaphorical potential

4 For a relevant example of soil's long life in art and writing, here are poems about eating soil: https://thecommontable.eu/eat-dirt/, https://www.poetryfoundation.org/poems/52113/the-dirt-eaters, https://www.poemist.com/meena-kandasamy/eating-dirt, https://poets.org/poem/dirt-eaters

5 This includes work in or on posthumanism, the environmental humanities, the Anthropocene and the climate crisis. To name a few: Worster 1979, Stoll 2002, Sutter, 2015, Cohen, 2019, Rosich and Denizen 2025, Lyons 2020, Zee 2017, Tam 2023.

6 To be clear, there are past examples of scholars making these connections. Worster 1979 is an important example.

7 Krzywoszynska 2019, Lorimer 2016, Puig de la Bellacasa 2017, le Roux and Hecht 2020, Agard-Jones 2013.

8 Montgomery 2007.

9 Puig de la Bellacasa 2015: 691.

here, but I also mean this literally and practically. In the essays that comprise Part 2 of this book, each author explores a moment where people have moved, modified, depleted, measured or remade soil for a particular purpose. These interventions always incur both intended and unintended consequences: what social, political or economic conditions are reflected or created in their wake?

To approach these basic questions, we conceptualise this thin layer of earth that exists between our atmosphere and the subterranean world as most fundamentally a container for life. The agronomist Derek Lynch likens soil to a library, functioning as a repository of memory for landscapes.[10] While this might evoke an intangible relationship between soil and place, the connection is also material. Through the slow accretions of our everyday interventions into the ground, soil contains a chronicle of past lives, both recent and ancient – some historic, some biological, some geological. Soil holds the remainders of human attempts at improving its yields. Soil contains the refuse we bury when we no longer want to account for it – these disquieting reminders of the costs of production. But, soil also houses the incidental material past of human lives that shift between cultural and biological registers and sometimes back.[11] Methodologically, this requires thinking capaciously about what comprises soil and for whom it holds such things. Considering soil as a container for life suggests searching out its many different roles rather than seeing it as just an object of agronomy or science alone. Looking at what comprises it – minerals, parasites, organic matter – and what gets put in or taken out offers both insights into the past and a point of entry for considering the biological constraints that shape our collective future.

With this conceptualisation, there is still a risk of seeing soil too simplistically as a 'receptacle' for things. But it is worth reconsidering what it means to hold things and serve as a medium. I am following here the work of feminist STS scholars, like Zo Sofia who conceptualises containers as technologies that have been left out of a history of science due to their associations of being inert, feminine, and passive in a history that tends to focus on phallo-centric tools. 'Unlike the tool', she writes, 'which needs manipulation to perform its function, the container can perform its holding function automatically: a jar can simply sit there, full, on the shelf and be working to capacity.' Containers are not charismatic. They have not produced much historical inquiry, but that is more revealing of the viewer than the object. Containers are also not necessarily inert. The humble pot on the stove imparts iron into the food it cooks. The clay

10 Lynch 2019.

11 DeSilvey 2006.

jug infuses milk with its earthy tang. Thinking about containers also allows us to move from the mundane vessel on the kitchen counter to human bodies to the biggest container of them all … the environment – the ever feminised 'mother earth'. In addition to being feminised, containers often accompany women's work. Sofia draws in part on Lewis Mumford, who also saw containers as neglected by scholars. He pointed out that containers are the tools of cooking, milking, dyeing, tanning, brewing and gardening. These occupations are all bound up with 'the vital processes of fertilization, growth, and decay, or the life arresting processes of sterilization and preservation', as is soil. This further resonates with the fact that, in many cultures, soil is the domain of feminised work. A container is also not impervious. Soil is almost unbearably vulnerable to transformation and infiltration – being remade constantly from above and below. But, such vulnerability is also a reminder that 'contamination' is essential for life.[12] Or, as Tim Ingold writes, bodies exist only because they are porous and provisional – leakage and containment cannot be pulled apart.[13]

If soil is a container, what does it hold, what passes through it, and what is taken out of it? An older model within Western scientific discourses has treated soil as predominantly a medium that sustains and delimits biological life.[14] Such conceptions of soil mean it also serves as a reservoir for collective anxiety about civilisational limits and collapse. The history of nineteenth and twentieth century agronomy in large part was an ongoing experiment in measuring the capacities of soil to accommodate increasing demands of crop production and the efforts to stretch this capacity through the emergence of an immense industry of soil inputs (fertilisers and pesticides). Alongside such efforts, soil became a litmus test of racial and civilisational superiority.[15] Its relative health or its ailing state was wielded as a critique of both capitalism and state socialism's capricious theft of soil's fertility with little regard for its need for renewal. To put it bluntly: whatever your political persuasion, there was a morality tale to tell about states and soil fertility.

More recent research has shed light on soil's life (and role in planetary health) far beyond industrial agriculture.[16] Non-western epistemologies of

12 Tsing 2015.

13 Ingold 2010.

14 Salazar et al 2020: 2.

15 Davis 2007.

16 For example, the ongoing reappraisal of the peat bog as sink as well as source of energy: Proulx 2022.

soil have, all along, also rendered it visible in these different registers.[17] Our interests here, particularly evident in our syllabus, are to chart this new work on soil. However, we also seek to bring into the conversation an array of ways that soil anchors life (and death) outside its biologically productive capacity to sustain it. In part, we do this by considering substances that might sit on the edges of what soil is definitionally. Some essays in Part 2 describe the engagements around something that is immediately understood to be soil. To be categorised as such, soil must hold not just inert material, but must also contain soil organic matter – a riotous and heterogenous mixture of organisms that give soil its metabolic life. As the soil scientist Johannes Lehman writes in the first essay in this collection, what constitutes soil organic matter (referred to often as 'humus') and how it functions within soil has itself been the subject of centuries of debate.

Other essays, however, push the limits of that definition. For example, Dotan Halevy's essay on the Gaza Strip focuses on sand and the politically volatile question of when sand becomes soil. Paul Kurek's essay looks at glacial till, a substance comprised of sand, silt and clay with very little organic material. In Nazi Germany, when the mutually reinforcing purity of 'blood and soil' was imagined to hold the key to a grand Teutonic future (and past), Kurek uses a chunk of glacial till to interrogate whether the fundamental concreteness of 'place' was even a steady state or fundamentally the product of interminable movement. Steven Stoll's essay is about 'overburden' – rock and soil that barreled downward into Appalachian hollows in the 1970s as a remainder from mountaintop removal mining. Euphemistically called 'valley fill' by the industries that produce it, the detritus literally chokes out life rather than fostering it. Jayson Porter traces arsenic through its life as a toxic remainder from mining to a pesticide for cotton production – extracted out of, and entering back into, soil while enacting cycles of bodily harm to workers. In other words, as a collection of essays, we are interested in soil's constituent parts and its other uses, as well as how the earth's substrate might come in and out of view *as soil*. Furthermore, the parameters of soil's scientific definitions do not always align with the phenomenology of soil, which many people might interchangeably identify as dirt or dust.

Having briefly defined soil, what then do we mean by 'grasping'? This word came out of our workshop in the summer of 2024 at Max Planck History of Science in Berlin where we collectively created the syllabus that comprises

17 Bobbette et al 2021, Cunha 2024, Mabeza 2017.

Part I.[18] To grasp something has at least three meanings and together they capture a range of impulses and relationships that we aim to highlight between people and soil.

First, to grasp something means to take hold of it firmly with your hands. At the most fundamental level, this is what children do when they first explore soil – it is something to grab, taste and manipulate. People who routinely use soil also grasp soil in this way to assess its particular qualities – whether they are a potter, a scientist or a gardener.[19] Holding it in their hands, squeezing it, smelling it and seeing if it crumbles or holds the shape of a closed fist is an appraisal of the material at hand. Soil's malleability might be both its most basic characteristic and its most sacred one. On every continent, there are communities, both in the past and present, who narrate their earthly origins as a moment when a god formed human and animal life out of clay.[20]

Secondly, to grasp means to understand something that has thus far proved a challenge to apprehend. Overcoming this struggle then leads to a practiced mastery. Alternately, if someone has 'lost' their grasp on something, it suggests a cognitive slippage of sorts. That, despite one's best efforts, something has become incomprehensible and elusive: a lost grasp on reality. To speak of grasping soil in this register is to consider centuries of knowledge production about soil that has sought to understand its constituent parts. While in a contemporary register this is called soil science or agronomy, soil's epistemic roots go far beyond the boundaries we might draw around science today. Such genealogies also leave out the knowledge of the practitioner such as the farmer or the builder who have cultivated their own intimate grasp on soil. This reminds me of the opening pages of *The Known World* by Edward P. Jones where Moses, an enslaved man in the America South, leaves the field after a long day of work:

> Moses closed his eyes and bent down and took a pinch of the soil and ate it with no more thought than if it were a spot of cornbread. He worked the dirt around in his mouth and swallowed, leaning his head back and opening his eyes in time to see the strip of sun fade to dark blue and then to nothing … This was July, and July dirt tasted even more like sweetened metal than the dirt of June or May. Something in the growing crops unleashed a metallic life that only began to dissipate in mid-August, and by harvest time that life would be gone altogether, replaced by a sour moldiness he associated with

18 Held at Max Planck Institute for the History of Science, 3–5 June 2024: https://www.mpiwg-berlin.mpg.de/event/thinking-substrate

19 In the first unit of the syllabus, we offer some activities to help practice this embodied relationship with soil.

20 https://en.wikipedia.org/wiki/Creation_of_life_from_clay#:~:text=The%20Book%20of%20Genesis%202,matter%2C%20usually%20clay%20or%20mud

> the coming of fall and winter, the end of a relationship he had begun with the first taste of dirt back in March, before the first hard spring rain.[21]

Moses here is both physically and mentally grasping soil, able to catalogue its qualities from his long history of coaxing life from it, season after season.

A third definition of grasping means that something has come physically under your control. To grasp soil in this way is to claim territory and in doing so, to alienate land (and soil) from others – whether through legal regimes or extralegal violence. This use of the term might invoke an image of an explorer or an exhausted army picking up a handful of earth as a sign of conquest; soil is the 'part' that stands in for the whole in these images. In the Western tradition, the metonymic role of soil here barely needs to be explained; the connection is a familiar symbol. Colonial legacies of claiming territory, not incidentally, are often accompanied by a narrative of settlers being better custodians of the soil. In these instances, claiming territory is justified precisely because settlers have a better 'grasp' on soil science. Dispossession is justified in terms of who can maximise the productivity of the soil within very narrow ecological horizons. Again, we can see how these various modes of grasping soil can be used to corroborate one another.

If grasping in this third definition points to the transformation of human and soil relations through regimes of private property that emerged through enclosure and imperialism, an alternative vision exists through what Sarah Lincoln has called 'fugitive gardening'. Lincoln defines fugitive gardening as 'as a form of 'poaching' or 'resignifying', a 'radical appropriation of hegemonic spaces and practices that both deconstructs the logics of mastery and hygienic possessiveness that underpin colonial culture, and articulates what we might call a fugitive ecology: a dispossession of self in relation to the environment, a refusal to conceive of land, soil, or planet in terms of property'.[22] While Lincoln's work focuses on the fugitive practices of Black gardeners in apartheid South Africa, the term also evokes the earlier work of Sylvia Wynter in the 1970s who wrote about the garden plots cultivated by enslaved women in the Caribbean that existed outside of the logics of plantation accumulation and exploitation.[23] This tradition of resistance to property regimes argues that one cannot make such claims to soil without severing a web of other relationships with humans, nonhumans and the soil.

We do not intend anything overly programmatic by offering these three

21 Jones 2003: 1; see also https://web.archive.org/web/20121017205757/http://www.ediblegeography.com/sweet-and-sour-soils/

22 Lincoln 2018: 132. See also Kate Brown's contribution to Zahra et al. 2023.

23 Wynter 1971.

definitions of 'grasping' soil. However, we do hope you consider the multiple valences of the verb as a helpful heuristic for considering how touching soil, knowing soil, and possessing soil can be consolidating projects of control and ownership or countervailing projects and contested ways of engaging with it.

Structure of the book

Part I: The Syllabus

The first part of this book is a collectively authored syllabus divided into four parts: Soil as Substrate; Soil as Archive; Soil as Health; Soil as Belonging. The syllabus offers a starting point for anyone who might want to learn or teach a course on soil's role as a container for human history. In addition to existing here in book form, the syllabus also lives online where it will continue to be updated, offering links to the material where possible. Each section of the syllabus offers activities and assignments in addition to readings, podcasts and documentaries. The syllabus offers a place to see what is currently happening in this new scholarly turn to the substrate while also gathering from a variety of sources and stories that might be missed in this literature.

Putting together a collective syllabus invites questions about what such a document does. As the first document in a course, a syllabus serves as a roadmap and contract for communal learning. And yet it also captures the moment before the class unfolds in real time, where a teacher might fleetingly and foolishly still feel they have control over the endeavour of learning. For busy scholars, syllabi represent an aspirational list of books they haven't had time to read; a slice of their research they are still trying to get a handle on; a list of questions they hope students take up seriously. Ideally, a syllabus is a living document and not a settled appraisal of a topic or field. The syllabus is an ethical endeavour too; building a syllabus represents an opportunity to reconsider who one reads and cites and thus how one fundamentally thinks.

When the syllabus is handed out, it becomes an invitation to have a shared conversation in a fragmented world. They are inevitably public documents – and thus open to contestation and polemicisation. In their ongoing lives as artefacts as much as teaching tools, they can be conscripted for various purposes, held up by politicians in theatrical contests over what is frivolous or essential knowledge. In more recent years, the syllabus has also emerged as a tool for channelling collective outrage and grief into an exercise in public education. Emerging online, these syllabi became an urgent invitation to learn about police violence and Black lives in the United States or an insistence on

the history and persistence of Palestinian life and suffering, despite concerted efforts to erase both.[24] The online syllabus can also serve as a way to reanimate the internet by drawing people away from the predictable pitstops of social media and back into the warren of delightful and idiosyncratic pathways we might nostalgically recall from web 1.0. This is where the syllabus becomes less a prescriptive list and more an open prompt for curiosity and learning.[25] *Grasping Soil*'s syllabus aims to be both a programme that could be followed and something that can be used ad hoc.

Part II: Essays

The essays that comprise the second part of this book each explore a particular moment where communities have intervened with soil to suit a particular need. In examining these engagements with soil, each essay provides a particular view on the social, political or economic conditions that such engagements in the soil reflect and create. These essays range in their disciplinary disposition and in the scope of the case study. But, somewhat by accident, the collection of essays focuses on Germany, the Levant, the United States and East Africa, offering at least two case studies of each place. While this might seem like a limited geography, they nevertheless capture a range of relations that run through the soil – colonial, industrial, capitalist, socialist, agrarian and fascist. The essays are divided into three different thematic subsections within Part Two, but it should be readily apparent that there is generous cross-over: several essays could be in more than one section. The essays also correlate to parts of the syllabus and are suggested reading on the syllabus where relevant.

The essays in the first section capture a variety of efforts to understand, intervene in or remake soil's metabolism. To take something out of or put something into soil is to remake its metabolic life. Sometimes this is done explicitly and other times the renovation of soil's metabolism is an unintentional effect. The accumulation of these interventions reveals how soil is used for multiple things and how such uses run up against one another. In these moments where things enter or exit soil, we can see that soil's capacity for sustaining life sits right alongside its capacity to accumulate harm. In a contaminated world that

24 See for example: https://archive-it.org/collections/9674, https://librarianswithpalestine.org/wp-content/uploads/2021/12/Palestine-Archives-Syllabus.pdf, https://brittlepaper.com/2024/11/palestine-from-africa-a-syllabus/

25 This website offers a curated set of syllabi with a similar spirit of exploration of the internet in mind: https://syllabusproject.org/

also is sustained through renewal, we are hard pressed to have one without the other. Soil's metabolic life in turn remakes the metabolic lives of humans and animals whose lives are dependent on soil's affordances in a multitude of ways.

If soil is a container, Johannes Lehmann's essay would insist that we understand it not as a place of inert relegation. Lehmann is a soil scientist who has also helped create the soil factory in Ithaca, New York.[26] Among other things, his research has worked to redefine how scientists understand soil organic matter. As Lehmann lays out, soil organic matter is the most important aspect of soil health. It is responsible for nutrient and water retention as well as sustaining soil biota. This organic matter has for centuries within Western science been characterised by the term 'humus' and a process identified as humification. Lehmann argues, though, that, despite the compelling notion of a particular 'humic' substance at the heart of soil fertility, the concept does not stand up to the scrutiny of modern spectroscopy. Over the past two decades, the humic paradigm has given way to a notion of functional complexity as the basis of why organic carbon accumulates in soil. Lehmann argues that this new model for soil organic matter means we cannot simply see soil as a 'storage container' for sequestering carbon, which we can lock up and walk away from. In other words, the notion of a homogenous, essential substance has been replaced with a riotous, complicated and variable community of microbes and minerals that is particularly bound to place and circumstance.

Tamar Novick's essay chronicles the experimental efforts to foster composting in British Mandate Palestine and the role these efforts played in consolidating the legitimacy of the global organic farming movement in the twentieth century. Novick points to the fact that not only can the roots of the movement be found in far-right agricultural politics and fascism in Europe, but they also emerge quite explicitly from colonial contexts too. Places such as Palestine and India served as experimental laboratories for a variety of practices. Within the context of British-ruled Palestine and later Israel, the politics of composting reveal how government bureaucrats thought about the waste of different populations and how it should be managed. Such concerns also reveal a longer running anxiety that coursed through both administrations around the relative fertility of Jews and Arabs both in terms of human populations and their agricultural practices, a topic explored more fully in Novick's recent monograph.[27]

Emily Brownell's essay examines the connections between the parasites that soil can harbour and their effect on human metabolisms. In the 1970s, Kenya

26 https://thesoilfactory.org/

27 Novick 2023.

inaugurated a programme to employ thousands of rural Kenyans to build over 3,000 kilometres of roads across the nation without the aid of machines. Soon, the project took on international dimensions as an experiment in the viability of appropriate technology as a way to expand infrastructure in developing countries. The scale and scope of the project also made it a particularly good site for other researchers to cohabitate. Most notably, nutrition researchers began visiting the building sites to investigate the relationship between worker productivity and anemia. By drawing blood and taking faecal samples from workers, researchers measured their parasitic 'worm burden'. The essay uses this development project to consider the meeting points of blood and soil in Kenyan history as an ongoing metabolic struggle to capture the energy of workers from competing parasites.

The second section, Residual Histories, explores the many lives of residues – both biological and social – that make their way in and out of the soil. The essays consider residues from generations of agriculture and mining – sometimes in the same area. Together, they capture moments where physical debris and toxic remainders in soil can no longer go unnoticed – they have produced health problems, buried neighbourhoods, killed the microbial life of the soil – and the question hangs in the air: what do we do about this? Do we get rid of the problem or do we effectively bury certain ways of life and accept the necropolitics of such residual afterlives? And most fundamentally, what are the human limits of intervention in the first place?

Jayson Porter's essay follows the creation of the element arsenic in volcanic activity long before life on earth, to its oxidation into a more bioavailable form and finally its various pathways, 'natural and unnatural', in more recent human history in the Americas. The distribution of arsenic within the earth's crust was the fate of plate tectonics and the creation of the geologic formation known as the 'Ring of Fire'. But the distribution of human exposure to arsenic and its alarming toxic effects was determined by the history of empire and racism in the Americas. Porter's essay importantly traces arsenic's trajectory in a way that places mining and monocrop agriculture within the same frame. While arsenic was first seen primarily as a hazardous side effect of the mining industry, it then became a valuable commodity in its own right to use on cotton plantations. When arsenic was discovered to be effective on the boll weevil that was decimating cotton production in the South, Mexican mines became the major supplier. Porter's essay elegantly shows how the legacies of geologic time and combustion were remade into the violent temporalities of extractive capitalism – cutting short the lives of those seen us disposable.

Steven Stoll's piece takes us to Appalachia to reckon with the aftermath

of generations of destruction from coal mining. The 'holler', a landscape that is synonymous with this region and is home to generations of coal mining families, has shaped Appalachian culture as much as its topography also reflects the region's subterranean coal deposits. In the 1980s, when corporations turned to 'mountain top removal' as a cheaper form of extraction, these domestic landscapes became inundated with 'overburden', the industry term for dirt that was displaced to access the bituminous coal below. Stoll's essay considers what it means for such communities to be submerged in soil and also to lose their ancestors as mountain top cemeteries are either ruined or become effectively inaccessible to the families that have cared for their dead. 'Strip mining is a kind of politics, a form of powerlessness for those subject to it, and a sacrificial economy that would never be tolerated in other locations. It's a distinctive relationship of land – the wasteland.'

Lulu Tessua's essay traces the 'afterlives' of different toxic regimes in the small village of Ndungu, Tanzania. Due to the nature of colonial and postcolonial development interventions, particular places often become palimpsests of experimental efforts once they are first enrolled in an agricultural project. Thus, they accumulate a legacy of pesticide and fertiliser use over generations. Even nearby villages might have very different development trajectories or relationships with soil inputs from those of their neighbors. Tessua writes about what this means for villagers and farmers who are left with what they now see as dead soil and a regime of soil care that demands the constant reapplication of expensive and toxic inputs. Tessua introduces us to farmers and a 'pesticide intellectual' she met during her fieldwork to consider what it means to revive a soil when you don't really know what healthy soil is because it has not existed within your lifetime.

Cynthia Browne's essay traces the transformation of soil matter under the surface in the aftermath of the industrialisation of lignite mining in Germany in the twentieth century. Browne excavates the histories and temporalities that can be found within one patch of substrate engineered as the 'zero point' or 'punkt null' of a new ecosystem. This starting point is an attempt to chronologically reset the clock, designating the rebirth of a destroyed creek. Encounters with scientists systematically observing the site offer Browne insight into the surprises and accidents that punctuate the biographical life of the area following the inauguration of point zero. These unpredictable events call into question how and in what ways legal and scientific responsibility for ecological restoration of the substrate in the wake of industrial surface mining is possible.

In the final section of Part II, the essays explore three moments where soil is wrapped up with the politics and poetics of 'home'. Who gets to claim the

right to certain territory is often articulated as a connection to the very soil itself. At the scalar level, nation states are not simply the product of arbitrary geographical boundaries, but they are justified as fortifying natal connections between particular folk and a particular quality of land and soil. While such connections are often expressed in an affective register of love, they are justified through exclusionary projects of knowledge production about race, ethnicity and heritage. These essays can be read alongside the fourth section of our syllabus which also focuses on how soil becomes a metonym for belonging – in affective, political and legal registers.

Paul Kurek's piece takes us from a chunk of glacial till to outer space and back. He takes us on this journey to think through the possibilities and problems of both national and earthly belonging. Kurek's chunk of glacial till comes from the site where the Nazi architect, Albert Speer began in 1941 to build a massive load bearing cylinder (*Schwerbelastungskörper*). The cylinder was built to assess whether the marshy ground in Germany's capital city would be able to support the load of a triumphal arch three times the size of the Arc de Triomphe, which would announce the victorious Nazi capital 'Germania'. While victory and Germania never came to be, the massive cylinder remains in a leafy Berlin neighborhood. Its lurking presence offers an enticing point of entry for pulling apart the ideology of National Socialism that sought fascist renewal through connecting the purification of German blood to a reclamation of the soil. As Kurek points out, glacial till is itself the result of movement and migration through time. How 'German' then, is this chunk of earth that was designated to hold up proof of fascism's triumph?

In the final essay of this section, Dotan Halevy works through layers of history, sand and soil in the Gaza Strip. In the summer of 1976, an expedition of students and volunteers led by archaeologist Trude Dothan set out to uncover a Canaanite cemetery on the outskirts of Deir al-Balah in the occupied Gaza Strip. In carefully chronicling the aftermath of this archaeological discovery, Halevy is able to show the complex ways in which the substrate is both physically and legally manipulated to both sustain life in a dry environment and dispossess Arabs from their land. One of the central questions that Halevy's piece asks is, what is the distinction between sand and soil and to what end are the two distinguished? While such distinctions serve a scientific role in defining the properties of each, they also have a long and consequential political life as well, particularly in arid places.

In closing, we hope this project can have a living, ongoing life. As you read the essays and engage with the syllabus, please reach out to us on the website and let us know what else we should include. We aim to maintain a reading

list as new work emerges and hopefully renews and revises how we consider soil and its component parts.

Bibliography

Abrahams, Peter W. and Julia A. Parsons. 1996. 'Geophagy in the Tropics: A Literature Review'. *The Geographical Journal* **162** (1): 63–72.

Agard-Jones, Vanessa. 2013. 'Bodies in the System'. *Small Axe: A Caribbean Journal of Criticism* **17** (3) (42): 182–92.

Bobbette, Adam, Ruth Gamble, Cin-Ty Lee and Christopher Wilson. 2021. 'Decolonizing Geology: A Discussion'. *GeoHumanities* (June): 1–9.

Christopher, Munyaradzi Mabeza. 2017. *Water and Soil in Holy Matrimony?: A Smallholder Farmer's Innovative Agricultural Practices for Adapting to Climate in Rural Zimbabwe*. Langaa RPCIG.

Cohen, Benjamin R. 2009. *Notes from the Ground: Science, Soil, and Society in the American Countryside*. Yale University Press.

Cunha, Olívia Maria Gomes Da. 2024. 'The Earth Is Sweet. On Cottica Ndyuka (De)'. *Comparative Studies in Society and History* (February): 1–25.

Davis, Diana K. 2007. *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa*. 1st edition. Athens: Ohio University Press.

DeSilvey, Caitlin. 2006. 'Observed Decay: Telling Stories with Mutable Things'. *Journal of Material Culture* **11** (3): 318–38.

Geissler, P. Wenzel. 2000. 'The Significance of Earth-Eating: Social and Cultural Aspects of Geophagy among Luo Children'. *Africa* (Pre-2011 series) **70** (4): 653–82.

Hunter, John M. 1993. 'Macroterme Geophagy and Pregnancy Clays in Southern Africa'. *Journal of Cultural Geography* **14** (1): 69–92.

Ingold, Tim. 2010. 'Bringing Things to Life: Creative Entanglements in a World of Materials'. *NCRM Working Papers Series, ESRC National Centre for Research Methods*.

Jones, Edward P. 2003. *The Known World*. New York: Amistad.

Krzywoszynska, Anna. 2019. 'Caring for Soil Life in the Anthropocene: The Role of Attentiveness in More-than-Human Ethics'. *Transactions of the Institute of British Geographers* **44** (4): 661–75.

Le Roux, Hannah and Gabrielle Hecht. 2020. Bad Earth, E-Flux, August: https://www.e-flux.com/architecture/accumulation/345106/bad-earth/

Lincoln, Sarah L. 2018. 'Notes from Underground: Fugitive Ecology and the Ethics of Place'. *Social Dynamics* **44** (1): 128–45.

Lorimer, Jamie. 2016. 'Gut Buddies: Multispecies Studies and the Microbiome'. *Environmental Humanities* **8** (1): 57–76.

Lynch, Derek. 2019. 'Soil is the Key to our Planet's History and Future'. *The Conversation*, 20 May 20: https://theconversation.com/soil-is-the-key-to-our-planets-history-and-future-116330

Lyons, Kristina M. 2020. *Vital Decomposition: Soil Practitioners and Life Politics*. Durham: Duke University Press Books.

Montgomery, David R. 2007. *Dirt: The Erosion of Civilizations*. Berkeley: University of Cali-

fornia Press.

Novick, Tamar. 2023. *Milk and Honey: Technologies of Plenty in the Making of a Holy Land*. Cambridge, Massachusetts: MIT Press.

Proulx, Annie. 2022. *Fen Bog and Swamp: A Short History of Peatland Destruction and Its Role in the Climate Crisis*. London: Fourth Estate.

Puig de la Bellacasa, Maria. 2017. *Matters of Care: Speculative Ethics in More than Human Worlds*. Minneapolis, MN: University of Minnesota Press.

Puig de la Bellacasa, Maria. 2015. 'Making Time for Soil: Technoscientific Futurity and the Pace of Care'. *Social Studies of Science* **45** (5): 691–716.

Rosich, Montserrat Bonvehi Bonvehi and Seth Denizen. 2025. *Thinking Through Soil: Wastewater Agriculture in the Mezquital Valley*. Cambridge, MA: Harvard University Press.

Salazar, Juan Francisco, Céline Granjou, Matthew Kearnes, Anna Krzywoszynska and Manuel Tironi (eds). 2020. *Thinking with Soils: Material Politics and Social Theory*. London: Bloomsbury Academic.

Stoll, Steven. 2002. *Larding the Lean Earth: Soil and Society in Nineteenth-Century America*. New York: Hill and Wang.

Sutter, Paul S. 2015. *Let Us Now Praise Famous Gullies: Providence Canyon and the Soils of the South*. Athens: University of Georgia Press.

Tam, Mankei. 2023. '"Skin of the Earth": On Soil, Collaboration, and Temporality after Fukushima'. *Environmental Humanities* **15** (2): 39–61.

Tsing, Anna Lowenhaupt. 2015. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton: Princeton University Press.

Worster, Donald. 1979. *Dust Bowl: The Southern Plains in the 1930s*. Oxford: Oxford University Press.

Wynter, Sylvia. 1971. 'Novel and History, Plot and Plantation'. *Savacou* 5: 95–102.

Young, Sera Lewise. 2012. *Craving Earth: Understanding Pica—the Urge to Eat Clay, Starch, Ice, and Chalk*. New York: Columbia University Press.

Zahra, Tara, Peter Becker, Kate Brown, Zachary Doleshal, Jamie Martin, Małgorzata Mazurek, David Petruccelli, Máté Rigó and Carolyn D. Taratko. 2023. 'A World of Contradictions: Globalization and Deglobalization in Interwar Europe'. *The American Historical Review* **128** (2): 703–881.

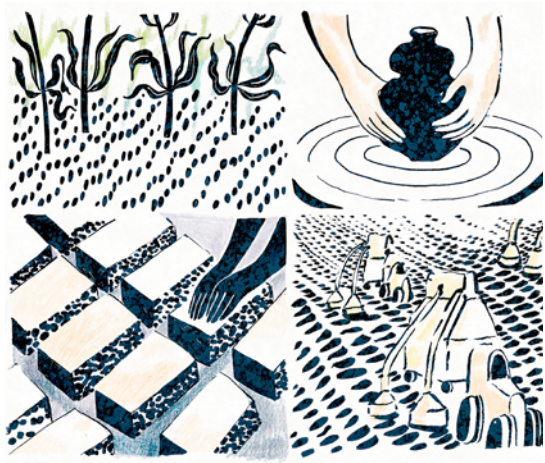
Zee, Jerry C. 2017. 'Holding Patterns: Sand and Political Time at China's Desert Shores'. *Cultural Anthropology* **32** (2): 215–41.

Part I

SYLLABUS

DOI: 10.63308/63897247289532.syllabus

Syllabus also available online at
https://graspingsoil.org



UNIT 1: SOIL AS SUBSTRATE

Cynthia Browne and Johannes Lehmann

In this unit, we approach soil as an active material that contributes to composing (and decomposing!) our lifeworlds. Doing so asks us to consider how the composition of soil is linked to flows of energy and materials and dynamically intertwined with perception and response of various living and non-living processes. We borrow Tim Ingold's notion of the 'ecology of material' to help us think through soil as 'matter that is always already historical' and how its material properties become a matter of concern for present communities and future generations. This unit seeks to answer these questions through 1) introductory overview to the material composition of soil and its relation to use; 2) a review of the 'metabolic' turn in soil studies; and 3) an exercise to think through the composition of soil as a form of material memory that shapes future growth.

See the source list at the end of the syllabus for full details of suggested reading and viewing materials.

DOI: 10.63308/63897247289532.unit1

Day 1: Who cares about (and for) soil?

To serve as a broad introduction to the course, today's readings and activities aim to orient us towards seeing soil as a material always in relation to its user and thus shaped by how it is cared for or neglected with that use in mind.

Beginning exercise

> Can you think of a community or group involved with improving or caring for soil? What activities do they undertake with that soil? To what extent are those activities also interventions aimed at altering or affecting the composition of soil? Does this investment into creating soil also map onto generating new possibilities of growth? How is the ecology of soil linked with an ecology of social relationships and hopes for the future? How are soil and ideas of care linked?

Recommended reading

Tim Ingold, 'Toward an Ecology of Materials'.

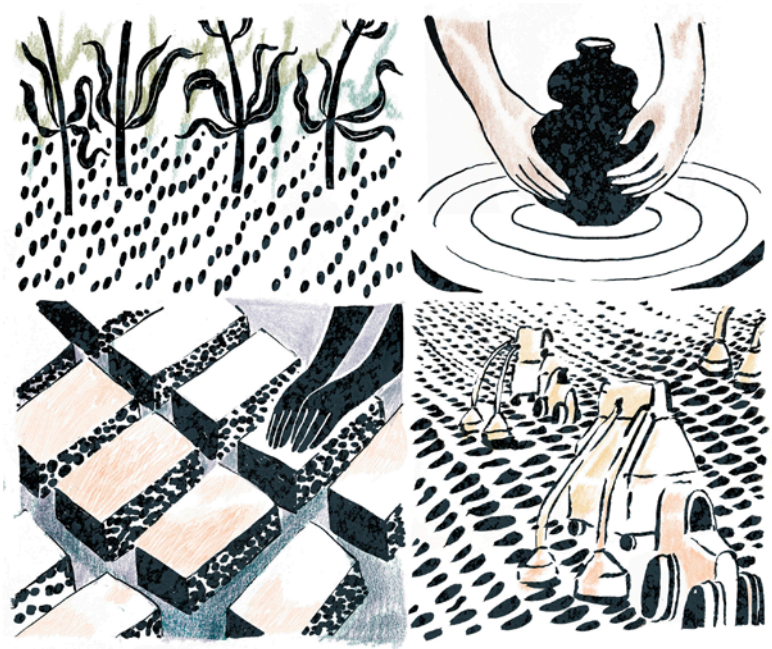
Maria Puig de la Bellacasa, 'Re-Animating Soils: Transforming Human–Soil Affections through Science, Culture and Community'.

Recommended viewing

Ruderal Ecologies – Radical Care Practices

Re-Enchantment: Environmental Law and Ruderal Ecologies

Day 2: Assessing soil's properties and uses



Soil is a substrate viewed and evaluated in different ways depending on who is using it for what: it might be a source of medicine, a medium for growing crops, a place to store carbon, a filtration system for water or source of clay for bricks, adobe or pottery. Soil is weathered from rock, influenced by plants, soil biota and climate over time. Its properties depend on the interplay of all these factors in such a way that it is difficult to say whether the soil determines the plant or microbial community or vice versa. Rock-derived minerals such as phyllosilicates (smectite, vermiculite, etc.) or quartz are the inorganic building blocks of soil that are separated by size classes (texture) into rocks (>2mm), sand (0.02–2mm), silt (0.002–0.02mm) and clay (<0.002mm); organic matter is mostly composed of decomposition products of plant and animal residues remaining from the activity of soil biota; and the resulting soil structure distinguishes soil from other substrates. Soil structure is the formation of aggregates as organic matter, especially from microbial products, which glues together clay-, silt- and sand-sized minerals. Most plant nutrients are released by weathering rock, except for nitrogen, which, evolutionarily, is a result of microbial fixation of atmospheric N_2 gas.

Activity

How can we assess certain properties of soil in our own neighbourhood, garden or park? There are some very easy field methods for learning some basic properties of your soil quickly.

1. Use the flow chart in the sources list to assess soil texture. Once you know what your soil texture category is, you can look it up to learn more about its particular qualities.
2. Watch the two videos in the sources list that explain how to assess aggregation.

Based on these tests, do you think the soil you have chosen to sample is 'good' or 'bad' and whose judgements are you using to determine this?

These videos and classification systems are made by soil scientists but who else uses the substrate and for what purposes beyond what you discussed in day one?

How might they assess the soil differently?

What processes does the substrate need to undergo for these different uses? I.e. what Ingold calls a 'gestural dance with the modulation of the material' (p. 434). For example, there is a video in the sources list showing the process in Ghana for making pottery from soil, which you might use as a starting point for discussion.

Day 3: Soil organic matter (not humus) and the metabolic life of soil: What are we getting wrong?

Historically, organic matter in soil has been called humus. Humic substances were understood to be created by microorganisms through humification, a process where recalcitrant material such as dead leaves and roots break down and become part of the soil. The level of organic matter is often seen as a barometer for soil health and the 'fuel' feeding soil's fertility. Organic matter tends to make up about two to ten per cent of soil but it determines its ability to retain moisture, sequester carbon, decompose pollutants and retain nutrients. A quick look online reveals it is easy to buy a bag of 'humus' to improve your garden's soil. However, when scientists use the term humic substances (HSs) they are referring to something more specific:

a particular transformed substance that for centuries now has been theorised as fundamentally different from what it was derived from. More recently, soil scientists have moved away from such a model and towards understanding soil organic matter through a soil continuum model. In this model, plant residues are decomposed and the microbial residues of this decomposition persist in soil longer than predicted from their molecular properties, because they exist within and even interact with a complex soil architecture. This also means that plant materials that decompose more rapidly generate more persistent organic matter if they generate more microbial matter.

> Metabolomics, or the science of what substances microorganisms produce, can tell us more about whether greater diversity of metabolites in a given soil leads to persistence and whether decomposition generates a more diverse molecular composition. In this feedback loop, fast decomposition of organic matter creates more diverse metabolites, which then in turn slow decomposition. For example, if a microorganism requires a different enzyme to eat each different organic compound around it, then it has to make a choice as to whether it is worth making that costly enzyme to eat that one compound. Imagine you have to have a different spoon for each food item on your plate, and making those spoons cost you more energy than the food contains that you can eat with it, what would you do? More organic carbon therefore accrues not by accumulation of what cannot be decomposed because it is inedible, but by accumulation of what is produced as a result of decomposition. These materials are eminently edible, but are not eaten for a variety of reasons, including spatial heterogeneity (because the microbe cannot invest the energy to swim around the corner in the hope of finding some food), temporal variability (because getting used to cold or warm, wet or dry conditions takes time and, if conditions change very quickly and every day, microbes that could eat organic carbon cannot adapt) and molecular diversity (as explained above) that also affect how molecules interact with mineral surfaces (e.g., organic matter adsorbed to clay minerals are more difficult to eat by microorganisms) and whether they are located in aggregates (e.g., organic matter within aggregates is not reachable by microorganisms), both of which that makes them less accessible to microorganisms that would eat these molecules to produce carbon dioxide.

Lesson plan

Directions: Take a spoon and dig up the first 5 cm (2 inches) of soil and place it on a white sheet of paper. Take a photo and share where it is from; what can you see, what do you recognise? Beyond our previous assessments of texture and aggregation, this exercise helps us consider all the different components of soil in their various states – some perhaps recognisable while much might seem homogenous to the naked eye. What about under a microscope? You might not be able to do that, but you can look at a lot of images of soil under a microscope online (a general google search will also bring up plenty more!). While one of the primary reasons why scientists might be interested in putting soil under the microscope is to consider the relationship between its microbial life and organic matter, soil has also been home to our most important antibiotics and the search for more is ongoing.

Readings / other media

History of Humification (e.g., Kleber and Lehmann, 2019)

For a historical example of trying to understand soil, consider Darwin's obsession with earth worms: The Importance of Earthworms: Darwin's Last Manuscript

Or listen a bit more about worms: Soil Stories with Nic and Leanna

See also Johannes Lehmann's essay in Part 2

Questions

How does being aware of the vast array of living and non-living things that constitute soil change your view of it?

How does your thinking about soil change if the durability of organic matter is the interplay of biota and environment and that, perhaps counter-intuitively, eating results in preserving? What is lost or gained in this shift away from humus as a particular substance?

Is such a view of soil carbon cycles more in line with Donna Haraway's thinking about humus as a substrate to inspire humans' being in the world? Here are two different readings to consider:

Sarah Franklin, 'Staying with the Manifesto: An Interview with Donna Haraway'.
Donna Haraway, 'Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene'.

Why might the idea (and metaphor) of humus be such a hard one to abandon despite science that suggests it might be outdated?

Day 4: Approaching soil as a repository of historical metabolism

The turn towards a metabolic understanding of soil compositions also opens up possibilities for thinking about the metabolic flows shaping soil in relation to human history, in particular due to technological changes and industrial processes. Alterations in the material world following the emergence of synthetic chemistry and its

manufacture of new chemical compounds, as well as the adaptive re-use of industrial by-products (i.e 'waste') are but a few ways in which these anthropogenic histories show up in the properties and make-up of soil. As knowledge systems change, so do the assessment of the dangers and harm these histories entail, generating new regulations that unequally affect communities and users of soil.

Lesson plan: PFAS in agricultural soil in the United States

Introduction: Short for Per- and polyfluoroalkyl substances, PFAS stands for a large, complex group of synthetic chemicals that have been used in consumer products around the world since about the 1950s. Used in a wide range of products, including preventing food from sticking to packaging or cookware, or to manufacture carpets resistant to stains, they contain a chain of linked carbon and fluorine atoms that prevent them from being degraded. This resistance to degradation has lent them the moniker of 'forever chemicals', meaning that they continue to cycle through biochemical processes, migrating out of industry into soil, land and water as part of a 'metabolic history of manufacturing waste'. (Landecker 2019). There are many places currently confronting the immense clean up problems of dealing with PFAS in the environment and one of the most dramatic examples is Maine. The state of Maine previously supported the re-use of wastewater sludge as fertiliser for rural farmsteads, but new forms of detection and knowledge concerning the harmful effects of exposure to PFAS for human health (see also Unit 3) have resulted in new environmental regulations. These regulations, which designate the soil as contaminated, are generating a crisis for rural farmers and landowners who use that soil.

To read and discuss

Hannah Landecker, 'A Metabolic History of Manufacturing Waste: Food Commodities and Their Outsides'.

Sharon Lerner, 'How 3M Discovered, Then Concealed, the Dangers of Forever Chemicals'.

Zoë Schlanger, 'Maine Is a Warning for America's PFAS Future', The Atlantic.

Watch: Toxic Disaster of PFAS Contamination a Nightmare for Maine Farmers

Day 5: Materialising future horizons through soil

The problem of industrial metabolites and synthetic compounds in soil as an historical remainder and reminder of globalised industry and science leads to different kinds of practices of problem-solving depending on the sites of the soil. In some cases, the proposed solutions may involve remediation practices, removal and containment strategies, manufactured ignorance, or a combination

of approaches. These histories and approaches generate what (following Tsing) we might call 'patches' in the landscape. They also shape the kinds of designed interventions and regulatory frameworks put in place for the future. Particular regulatory frameworks that differ by nation or state may delimit what sorts of uses are now safe, or designate particular clean-up strategies that may involve new approaches to landscape's substrate that harness the metabolic properties of certain plants to help 'clean' that soil.

Readings to discuss

Niall Kirkwood, Manufactured Sites: Rethinking the Post-Industrial Landscape.

Kate Kennen and Niall Kirkwood, 'Site Programs and Land Use'.

Cynthia Browne's essay in the Part 2.

Additional material

Film: Irene Lustzig, Richland

Art Installation: Mel Chin, Revival Field

- Interview with Mel Chin, Art21
- Mike Curran, What Can't Be Buried: Unearthing Revival Field, Mn Artists, Walker Art Center

Assignment

Step 1

Read section 1.1 of 'Farming the Patchy Anthropocene' and consider what a 'patch' is.
You can also listen to this to learn a bit more about patches: Anna Tsing, 'Anthropocene Patches – Space, Time and Position' (discussion of patches starts at minute 6:00)
Identify and attune yourself with a landscape patch to discern how its qualities relate to its soil substrate. If possible, make studied observations of the substrate's material qualities and properties using tools from Day 1. Experiment with drawing visible attributes of the patch in an exercise of 'landscape ethnography' (Recommended Reading: Andrew S. Mathews, 'Landscapes and Throughscapes in Italian Forest Worlds: Thinking Dramatically about the Anthropocene'.)
If you cannot find a good landscape patch to examine, you might think about postindustrial parks and their attempts at remaking polluted spaces into public parks. Examples: Gas Works Park and, more generally, Palimpsestous Landscapes: Post-Industrial Parks.

Step 2
Couple these observations and drawings with internet research to see if you can discern its ecological qualities and potentialities. What sorts of vegetation and growth does this patch support? How might its material qualities and properties be related to histories of use?

Step 3
What sort of use is possible in the future? Would you wish for the soil of this patch to be different and if, so, what sort of changes or 'cleaning' does it require based on desired uses and the regulatory framework in place and whom does it most affect? (Hint: Part of the strategy of dealing with the PFAS crisis is the removal of soil containing PFAS to landfills. However, a critical environmental justice question to then ask is: what communities live in proximity to those landfills?)

Step 4
What do these practices of remediation soil tell us about what it means to 'clean' the soil? (Reading: Shannon Cram, 'Trespassing'. Alternately, if you cannot access the article: Shannon Cram, 'Here, in the Plutonium'. For additional reading on how people learn to live within frameworks of toxic risk, see Chloe Ahmann, 'Toxic Disavowal'.)

UNIT 2: SOIL AS ARCHIVE

Amiel Bize, Seth Denizen and Jayson Maurice Porter

How does soil speak? What are its silences? In this unit we consider the histories that are embedded in, revealed by and erased by soil.

Michel-Rolph Trouillot writes:

> Silences enter the process of historical production at four crucial moments: the moment of fact creation (the making of *sources*); the moment of fact assembly (the making of *archives*); the moment of fact retrieval (the making of *narratives*); and the moment of introspective significance (the making of *history* in the final instance) (pp. 26–27)

This unit builds on the previous unit's exploration of soil's ability to hold and reflect historical metabolisms to consider its role in holding, reflecting or obscuring history more broadly. We ask the following questions to frame this unit's activities and readings:

- How can we envision soil as an archive – what does this help us see? What silences are embedded in this archive?
- How have soil archives been created and used and in the service of what projects? What erasures are embedded in this process?
- How can we reimagine soil as an archive – one that materialises the lasting legacies of imperial histories and racialised social relations?

Understanding how social and historical processes manifest materially in the soil can both help us to understand how we live with the legacies of past and ongoing processes, and to take control of the archive – to better understand what those legacies are and how we might reshape them.

DOI: 10.63308/63897247289532.unit2

Day 1: Archives of soil

Today we continue some of the work we did in the prior unit on building our skills of assessment and judgement of soil while also considering what values such practices reflect and reproduce. These activities and readings aim to replicate and interrogate how scientists create and collect soil monoliths.

Lesson argument: Soil collections are archives in the sense that they bring together materials and organise them; in the sense that they further certain (violent) classification projects; in the sense that they tell historical stories; and in the sense that they have afterlives.

Questions

How have soil archives been created and used and in the service of what projects?

What are the implications of the typologies that have been created for understanding and archiving soil?

Activity: Creating soil monoliths

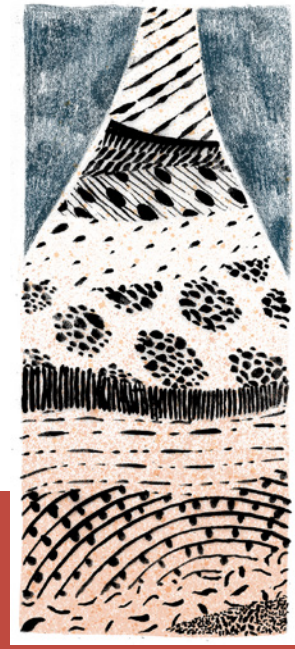
Find two sites near you where there is soil – in each, take a sample of the top soil using a clear cup. Compare them and try to describe the features you are comparing. What do the layers look like? If you don't see any layers, add dish detergent and water and shake it up, then wait for the sediments to fall. Look at the ratio of different layers: soil, silt, sand, clay.

Questions

Are you comparing based on colour? Based on texture? How would you make a classification system? To see one of these collections visit: https://wsm.isric.org/WSRC.html

Scientists have collections of these monoliths. Is making a monolith of your own considered an archive? If so, what is it archiving? What makes something an archive?

Reference:
Mounting-your-soil-monolith-Oct-2020_MW_Generic-for-MSSS-website22163.pdf



Assignment: Explore FAO/UNESCO Soil Map and discuss with questions

Look at the legend – consider the note on nomenclature on page 2. What do these naming choices suggest about the goals of this map?
Read Lyons and Guldi excerpts. Thinking with Lyons, what are some of the broader implications of categorizing in this way?

Readings / other media:

FAO/UNESCO Soil Map of the World | FAO SOILS PORTAL | Food and Agriculture Organization of the United Nations

US National Soil Archive

Kristina Lyons, Vital Decomposition, Introduction

Michel Rolph Trouillot, Silencing the Past, Chapter 1. 'The Power in the Story'.

Bowker and Star, Sorting Things Out (excerpt)

Guldi, The Long Land War Ch. 5 – 'On Failing to Make a Map in Time'.

Bruno Latour, Circulating Reference

See also the links in the Soil Collections section of Shannon Mattern's 'Library Field' Syllabus

Day 2: Archives conspicuously without soils

Some archives are about soil, and intentionally index soil within archival frameworks. Some archives go to elaborate lengths to remove soil – we might say, following Michel-Rolph Trouillot, to silence soil – and we can see an example of this in the modern herbarium. Plant collectors laboriously disentangle plants from soil, using chemical washes and dehydrators in order to mount plants flat on a piece of paper. These herbarium sheets are then archived and organised according to evolutionary relationships. Soil information is very rarely included, except for in one herbarium, which is called the 'Codex Badiano'. This is the oldest extant medicinal text in the Americas, and its illustrations

of plants always include roots and soil. Clearly, its authors thought that soil was an important part of how plants should be described. In this lesson, we will consider what the silencing of soil in botanical archives has meant historically, and what it might teach us about the metaphysics of our contemporary empirical practices.

Activity

Let's follow Michel-Rolph Trouillot's four moments through the botanical garden to examine the silences that may or may not be produced.

Step 1

Trouillot's first moment is the moment a plant is collected. In this moment, the plant is pulled out of the ground, meticulously disentangled from the soil, and made into a 'type'. Before the plant was pulled from the ground it was just another plant in a world full of plants, but in the moment it is 'collected' it begins to stand in for the species in general. It is no longer specific to that piece of ground, to that soil or to its relationship with sun and shade in the place it grew. It is now a specimen. Let's examine this moment of fact creation in the Missouri Botanical Garden archive.

Go to the Missouri Botanical Garden archival database.

Find a plant in the Missouri Botanic Garden (any plant) that you would like to explore. For example, try searching: '*Fraxinus americana*'.

To find Trouillot's first moment for this plant, go to one of the plant's herbarium sheets and look at it closely. Who collected this plant? What was their name? Where did they collect it? Next, explore the links associated with the plant. How many different ways has this plant (and plant species) been entered into this database? As you explore the archive, you are now exploring Trouillot's second moment: the moment where the collected plant becomes part of a larger archive.

Step 2

Trouillot's third moment is when we start to do things with the archive. This is when narratives are constructed through the ability to retrieve information that the archive has made available to our thinking.

Directly next to the species name (maybe *Fraxinus americana*) of your plant in the Living Collections Management System there will be a small Missouri Botanical Garden Logo. Click on this small logo. This will take you to Tropicos, the MOBOT taxonomic database. What can you learn about the plant here? Does the plant have an 'author'? Who is this person? What other plants did they identify?

In the case of *Fraxinus americana*, the author is Linneaus himself, meaning that Linnaeus was the first one to name this species. You'll also find citation information for the text in which the species first appeared in writing. In this case, Tropicos tells us that *Fraxinus americana* was first identified by Linneaus in the book *Species Plantarum* (1753). Next to this citation you'll see some more small logos ... one of them has the letters 'BHL'. Click on this link, which will take you to the Biodiversity Heritage Library site.

Here, you will see a digital scan of the physical book from 1753 where *Fraxinus americana* first appeared.

Step 3

Trouillot's final step is the making of history. This is where many narratives are considered and analysed in order to construct an account of the past. In this case, the plant was collected in 1941 by Jonathan Wright as part of a collection he called 'Plants of Indian Territory'. Could we think of this plant's history as exclusively taxonomic, or might we think of the legacy of settler colonialism as an important dimension of this plant's 'territory'?

In the final step, you will research and write your own history of this plant. Consider what aspects of this plant's history may have been left out of its presentation in the herbarium – for instance, more about the person who collected it and the circumstances under which they did so; or alternative contexts in which that plant may have gained meaning (e.g. within Indigenous knowledge systems). Drawing on this research, write a blurb for this plant that 'includes the soil'– that is, situates it within a political, historical, ecological and social context.

Readings / other media:

Robin Wall Kimmerer, 'Hearing the Language of Trees'.

Seth Denizen, 'Where is the Earth in the Herbarium'

Or watch: Seth Denizen: Where is the Earth in the herbarium? (Earth Writing, Faculty Workshop)

Camile Dungy, 'From Dirt'.

Maura Flannery, 'How to Read an Herbarium Specimen'.

Day 3: Soil as an archive of historical relations

Soils are created by many forms of circulation. Understanding soils and their mineral substrates, such as arsenic ore, help us tell histories of racism, empire, capitalism and landscape. Learn how chemical-intensive agriculture emerged, in part, through the social relations with and within soils.

Activity 1

Read Jayson Porter's essay in the essays section and consider it alongside the Ring of Fire map.

Activity 2

First, use EJScreen to see how close you live to a superfund site, hazardous waste or other toxins. Second, explore the 'Socioeconomic Indicators' tab to see how these indicators overlap toxic regions. Lastly, explore the 'Health Disparities' tab to further investigate the connections between toxicity, socioeconomic difference and health disparities.
Read about counter mapping:
– 'Counter Mapping', Emergence Magazine
– 'Counter-mapping: Cartography that Lets the Powerless Speak', The Guardian

Discuss: If counter mapping challenges 'dominant power structures to further seemingly progressive goals', how might counter-archiving require alternate forms of Trouillot's 'moment of fact retrieval'? Do you think the essay does the work of counter-archiving, and if so, how? Consider the historical case of arsenic. How might a soil archive of toxicity challenge power, counter dominant narratives in society and provide hope for the future?

Additional readings / other media

Max Liboiron, 'Pollution is Colonialism, Introduction'.
Adam Romero, 'Economic Poisoning', (excerpt, A Letter to Rachel Carson)
Rachel Carson, Silent Spring

Day 4: Soil as a living archive of social relations

Different people have different ideas of what is desirable (in the soil), and static concepts of soil health, fertility and even toxicity do not necessarily help us understand how soil works for or against people. This lesson asks us to imagine soil as a 'living archive' – a collection of different components – that is shaped by social and economic relations and which then shapes social possibilities. Students will also create their own archives to show that we can also use them to produce the knowledge we want.

Activity

Explore the Thinking Through Soil project's representations of soil, discuss with questions.

Assignment: Your soil archive

All waste passes through the soil at some point. Garbage, construction debris, bodily fluids, pharmaceuticals, nuclear fuel rods and socks with holes in them will one day make a soil somewhere. For a visualisation of this, please take a look at Seth Denizen's soil images. In this exercise, consider a day and your waste during that time, including human waste and the waste of materials you used or interacted with – what have you added to the soil?

- Write a list of the materials you discarded (or excreted) during the day
- Think about where these materials came from as well as where they go
- Consider how your own practices are shaped by the economic and social context you are a part of and are manifested in the soil that will be created

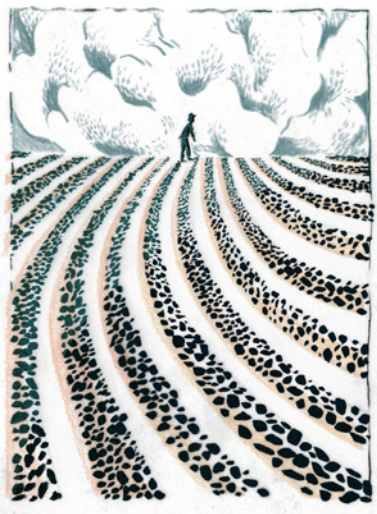
Readings / other media

Nicola Twilley, 'Soil Archive'.

Seth Denizen, 'Soil Contains Social Relations (and It's Our External Gut): Thinking Through Soil'.

Vanessa Agard-Jones, 'Bodies in the System'.

Thinking Through Soil



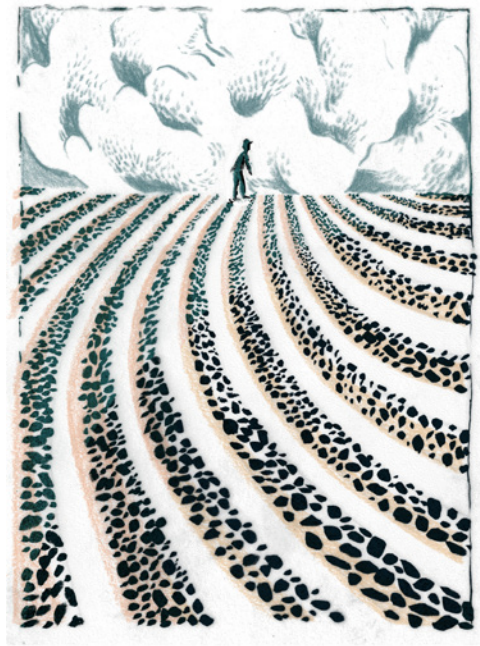
UNIT 3: SOIL AS HEALTH

Emily Brownell, Tamar Novick and Lulu Tessua

What is a healthy soil? Across time and cultures, soil health has often been used as a barometer for societal health. The now predictable argument is that if civilisations do not tend to the health and fertility of their own soil, they will eventually fall. The geologist David Montgomery's book, *Dirt: The Erosion of Civilizations*, tracks this argument from Mesopotamia to the present while also providing a history of how scientists have come to understand the importance of soil as the 'skin of the earth'. And yet, the question remains: what is a healthy soil, who gets to decide such things in any given place and time and what measures of coercion or freedom are taken to cultivate 'healthy' soil? We might look back and in retrospect see that what was considered healthy was actually harming. Thus, health is a historically and culturally constructed judgement of soil that is never without debate. This unit aims to construct a more nuanced conversation about how human health and soil health have been intertwined at different historical moments. We argue that societies have defined and intervened in soil health in a variety of ways and that we are now living out the legacies of these various definitions. The unit starts by considering how we evaluate soil, building on some of the readings and exercises from Unit 1. We then look at how humans intervene to change soil health, and how soil health changes human health. The final day considers how soil is often seen as a reflection not just of individual bodies, but of the body politic, mirroring some of the topics discussed in the fourth and final unit on soil and belonging.

DOI: 10.63308/63897247289532.unit3

Day 1: Dust



People in a variety of historical and social contexts have developed different judgments and methods to understand what a healthy or good soil might be. Often, it is only after soil becomes infertile that communities are left to grapple with how the value of the soil relates to one's own wellbeing as well as the quality of other life forms or products. Today's activities and readings will consider how people determine and intervene in soil when it mostly shows up as dust, revealing histories of erosion or pollution. How do people and communities deal with dust when they deem it unhealthy and unruly, and how have these assessments changed over time?

Opening activity

Interview a friend/family member (gardener, wine lover, compost producer, etc.) about how they evaluate a good soil.

Questions

What senses and means do they use to understand their soil?

Where do judgments of soil come from? Or have they developed over time?

If they don't think they know the difference between good or bad soil, what information do they feel they lack to make that judgment?

Activity: Experiencing the Dust Bowl, USA

The Dust Bowl was a series of dust storms that destroyed farmlands in the Great Plains throughout the 1930s. It is often considered the worst man-made ecological disaster in American history. Read the excerpt from the letter of Caroline A. Henderson, a farmer in Oklahoma, to her friend in Maryland during the dust bowl, from 30 June 1935. Consider the following questions:

Questions

How did Henderson understand the state of her soil?

How did these environmental circumstances affect people's lives, wellbeing and choices?

Does Henderson seem to wrestle with what caused these problems?

Activity 2: Soil erosion, soil conservation and settler colonialism

Soil conservationists of the 1930s and 1940s were deeply concerned with the problem of soil erosion, particularly in colonial contexts. Much of their research was dedicated to historicising global processes of desertification during periods in which European powers were attempting to strengthen their hold on arid and semi-arid territories. Read the following excerpts from soil conservationists and the suggested readings below. Consider the following questions:

Questions

How did soil experts understand the state of the soil?

How did soil erosion relate to people's lives, behaviour and choices?

Who is considered responsible for the state of the soil, and what are the solutions to environmental problems?

What sort of relationships between states and citizens (or colonial subjects) emerge around soil interventions?

1. G.V. Jacks and R.O. Whyte, The Rape of the Earth: A World Survey of Soil Erosion:

Erosion is a modern symptom of maladjustment between human society and its environment. It is a warning that Nature is in full revolt against the sudden incursion of an exotic civilization into her ordered domains. Men are permitted to dominate Nature on precisely the same condition as trees and plants, namely on conditions that they improve the soil and leave it a little better for their posterity than they found it.'

2. G.N. Sale, the Conservator of Forests of the British Government in Palestine, 'Afforestation and Soil Conservation' lecture at the *Palestine Economic Society*, 28 Dec. 1942, Israel State Archives/M-3/4188, 3-10:

In our conservation work we have to ally ourselves with nature … nature herself is anxious to avoid such phenomenon, and we can count on her assistance in our effort … we must not only prevent further damage to land still capable of production, but we must take steps to repair the ravages of past neglect, and to restore the fertility of land which has been ruined by erosion.

Readings / other media

Diana K Davis, 'Introduction: Imperialism, Orientalism, and the Environment in the Middle East History, Policy, Power, and Practice'.

Jumana Manna, 'Where Nature Ends and Settlements Begin'.

Arvind Dalawar, 'How Israel Weaponizes Tree Planting to Displace Palestinians'.

Dotan Halevy, 'Sands, Lupines and the Ecology of the Uncultivable'.

Sarah Smarsh, 'rotecting the Prairie'.

Activity 3: Seeing contaminated soil – mining waste, South-Africa

South-Africa's long-lasting gold and uranium mining industries left a wide-scale disastrous mark on the soil and on people's bodies.

- Read Chapter 1, 'You Can See Apartheid from Space', pp. 19–46 (particularly pp. 19–23) in Gabrielle Hecht's *Residual Governance: How South Africa Foretells Planetary Futures*.
- Hannah le Roux and Gabrielle Hecht, 'Accumulation'.

Questions

How is the contaminated soil experienced and evaluated?

How is unhealthy soil related to human life trajectories?

Who is considered responsible for the state of the soil and for mine workers' health?

Day 2: Forms of care for the soil (interventions)

Caring for soil is a practice contingent on the diverse ways in which people relate to land. Care for soil is related to care for bodies, about practices that variously connect humans to 'tradition' or 'modernity'. These interventions can draw on or erase historical

relations to the soil as well as determine futures. When things fail – financially, ecologically – this can provoke changing regimes of care. In some cases, this leads to quick-fix solutions such as the use of agrochemicals to revitalise the dying land. In other cases, this has been a call to abandon agrochemicals and 'return' to older traditions of stewarding soil. Caring for soil therefore ranges from composting to applying toxins, all forms being the reflection of a relationship an individual or community has with soil, as well as the capitalist pressures facing these actors.

> For example, farmers in Pare, Tanzania use pesticides and agrochemicals to treat infertile soil in the rice farms while natural manure is used outside the project for ginger farming. The demands of the crops and the history of those crops command different ways of caring for the soil as well as for the crops, and thus different relationships between different farmers and soil emerge. For more on farmers in Pare and their chemical regimes, read Lulu Tessua's essay in Part 2.

Questions

What can be done to take care of (un)healthy soil?

What makes the methods of caring for soil so diverse?

Lesson Plan

'In response to an agrarian crisis, small-scale farmers in South India are experimenting with the application of agricultural ferments to their degraded soils' (Munster, 2021)

Think of any plant of your choice and find out what type of soil it grows in. Research information about how it grows best and determine how you would take care of the plant and the surrounding soil.

Readings / other media

Watch Daniel Munster's lecture on agrarian crisis in India and different forms of care for the soil employed by farmers (there's transcript as well). Start video around 6 minute mark.

Or read Munster's article on 'Nectar of Life: Fermentation, Soil Health, and Bionativism in Indian Natural Farming'.

Further Information: G.V. Ramanjaneyulu, 'The Imminent Crisis of Indian Agriculture'

How does the way we choose to use land and soil lead to a series of other events and effects? How we choose to use and care for land and soil can lead to a series of other events and effects e.g. Hyderabad India chooses to grow paddy in a once dry and useless land. They built a

dam and investment in rice, greenhouse emissions from rice and pesticide dependency have triggered many other environmental, political and social issues in India.

Read also *The Government of Beans* (2020) by Kregg Hetherington to consider how the imposition of capitalist agricultural systems (monocrops) particularly since the 'Green Revolution' has equated soil care with pesticide use and fertiliser inputs. These have, paradoxically, often destroyed soil health as well as imperilling human health, and have then sought solutions to the problems they have created rather than avoiding the problems in the first place:

- Kregg Hetherington *The Government of Beans: Regulating Life in the Age of Monocrops*. (Might focus on Chapter 2, Chapter 10, Chapter 13 and Chapter 16, all short.)
- Or listen to the podcast: 'Kregg Hetherington: The Paradox of Destroying lands in the name of Social Welfare'.
- Or read the short essay 'When Plants Farm Themselves'.

Further reading

Vanessa Agard Jones, 'Spray'.

Linda, Nash, 'The Fruits of Ill-Health: Pesticides and Workers' Bodies in Post-World War II California'.

'India's Farmer Suicides: Are Deaths Linked to GM Cotton?', *The Guardian.*

New Books Network Podcast: Vincanne Adams, 'Glyphosate and the Swirl: An Agroindustrial Chemical on the Move'.

See essays by Jayson Porter, Lulu Tessua and Tamar Novick in Part 2.

The podcast 'Story of Nitrogen' from the University of Minnesota Extension office looks at the role of nitrogen in farming.

For another historical example of the intertwined nature of soil and human health, Molly Reed, 'Morbidly Excited Soil: Sylvester Graham and the Environmental Ethos of Antebellum Reform'.

To consider the two fundamental choices that emerge when soil becomes degraded (improvement or migration), read Steven Stoll's *Larding the Lean Earth*, about nineteenth century American farmers in the northeast.

Stacey Ann Langwick. 'A Politics of Habitability: Plants, Healing, and Sovereignty in a Toxic World'.

Fraser MacDonald, 'On Compost'.

To consider a much older historical example of soil health and civilisation:

The Nevelibka Hypothesis, David Wengrow and Forensic Architecture (there is also a video version)

Assignment 2

Browse through the collection of pesticide containers at https://digital.sciencehistory.org/collections/mg74qm28w and take notes on the following for discussion:

Questions

What are some of the design and language choices used for marketing pesticides?

Take note of dates: are there differences across time in how pesticides have been labeled and marketed?

Who are the companies making these products?

What else do you notice that surprises or intrigues you?

In addition, read 'Chapter 11: Beyond the Dreams of the Borgias' in Rachel Carson, *Silent Spring*.

Day 3: Intimacies of the soil and the body

This week we continue to look at how human health and soil health are intertwined, particularly through the labouring body. Moving away from soil as a medium for agriculture (and its inputs), we look instead at how soil also serves as a medium for parasitic life as well as a site of an immense amount of human (and animal) labour. Indeed, microbial life constitutes soil inasmuch as soil is also a reservoir for such life. Thus, working with soil is also exposing oneself – for better or worse – to the living things it harbours. First, we will look at how hookworm epidemics have historically traced the contours of capitalism's expansion and in the process helped establish major institutions of public health. Such campaigns against soil-based parasites also fit into a longer narrative of soil as unclean and regimes of bodily hygiene. Proximity to soil (or dirt) and not being able to escape the toil of such labour has often been a marker of class, race and gender, marking such bodies as dirty and diseased. Shifting our terms from soil to dirt in this section, dirt nearly always marks something or someone suspect and malign, suggesting those who labour in it are also dirty or 'soiled'.

Lesson Plan: Soil, labour and hookworm

Watch

Tropical Hookworm
Unhooking the Hookworm

Questions

If we understand each video as a public health message shown to a population vulnerable to hookworm, how do they address each of these audiences?

How does each video explain or otherwise show the cause of hookworm infection?

If you were to critically respond to these videos, what is left out of the story here?

Read:

- Rockefeller Archive Center: Public Health: How the Fight Against Hookworm Helped Build a System.
- Norman Stoll, 'This Wormy World'.
- Chapter 7 in Nandini Bhattacharya, *Contagion and Enclaves: Tropical Medicine in Colonial India*.
- Warwick Anderson, 'Excremental Colonialism: Public Health and the Poetics of Pollution'.
- P. Wenzel Geissler, '"Worms are our Life", Part I: Understandings of Worms and the Body among the Luo of Western Kenya.'
- Jamie Lorimer, 'Hookworms Make Us Human: The Microbiome, Eco-immunology, and a Probiotic Turn in Western Health Care'.

Listen: 'As The Worm Turns'.
See also Emily Brownell's essay in Part 2.

Scientists in the late nineteenth century had seen the hookworm under a microscope and understood its lifecycle passing from soil to humans. As you can see from the Rockefeller archive and Norman Stoll, by the early twentieth century, the hookworm was seen as a major obstacle to development and progress at the same time as we can see that it is precisely the spaces of capitalist agricultural expansion (such as tea plantations) where hookworm most quickly reaches epidemic levels. Indeed, many people have and continue to suffer from the effects of hookworm infections.

Questions

How do hookworm and soil help us put labour and health in the same analytical frame?

Outside of a developmentalist framework, how do other cultures understand and live with worms?

How might western biomedicine also be coming around to hookworm as an essential companion species for humans? And does this challenge the normative assessment of soil as dirty and even dangerous to our health?

Day 4: The labours of the body (politic)

In the aftermath of slavery and Jim Crow in the United States and at the end of colonial rule, African and African American communities often sought healing through restoring a relationship with land and soil on their own terms. You can find this articulated at the level of the small rural community up to the scale of the new nation state. To do so became a claim to sovereignty and a way to honour an ancestry that had shaped the modern world through their knowledge and skills often only to be meted out violence and historic erasure in return. The soil and the field then became sites of both communal anguish and renewal, burial and rebirth. Today we will take a look at some of the ways in which ambitions for a healthy body politic were often enunciated as care for the soil.

Assignment

Find and watch some videos about black farmers in the US.

How do they situate themselves and their practice of gardening or farming? How does history figure in their relationship with the land? Do they articulate a connection between land and health? How do they articulate the benefits of farming beyond a food harvest?

Here are some videos to start you off:
- A Black Farmer Preserving History, Feed the People.
- Leah Penniman, Farming While Black, TEDxBoston.
- The Young Black Farmers Defying a Legacy of Discrimination, VICE News.
- Marsh View Community Farm, Bill Green's Gullah Cooking.

Supplemental reading:
- 'Black Gardeners Find Refuge in the Soil', *The New York Times*.
- A brief Twitter (X) thread on the history of Black farming in the American South.
- Camille T. Dungy, *Soil: The Story of a Black Mother's Garden*.

Or, to listen:
– Interview with Camille T. Dungy, 'The Afro Beets Podcast'.

Reading and discussion

Filipa César, METEORISATIONS Reading Amílcar Cabral's agronomy of liberation.

Filipe Carreira da Silva and Monica Brito Vieira, 'Amílcar Cabral, Colonial Soil and the Politics of Insubmission'.

Joe P.L. Davidson and Filipe Carreira da Silva, 'Decolonising the Earth: Anticolonial Environmentalism and the Soil of Empire'.

Ankit Bhardwaj, 'The Soils of Black Folk: W.E.B. Du Bois's Theories of Environmental Racialization'.

Monica M. White and LaDonna Redmond. *Freedom Farmers: Agricultural Resistance and the Black Freedom Movement*.

Sarah L. Lincoln, 'Notes from Underground: Fugitive Ecology and the Ethics of Place'.

Priscilla McCutcheon, 'Fannie Lou Hamer's Freedom Farms and Black Agrarian Geographies'.

'The Coloniality of Planting with Ros Gray & Shela Sheikh'.

Finally, soil is also a place where the violence of the past can linger on. Here are a few examples where artists and communities are working with soil as a medium for healing from racial violence and dispossession. Why do you think soil has emerged as such a popular medium for such work?

Leanna First-Arai, 'How Soil Acts as a Living Witness to Racial Violence'.

Ama Codjoe, 'This Land was Made'.

Hannah Hutchings-Georgiou, 'Daughters of the Dust: The Radical Soil-Based Work of Contemporary Women Artists'.

Nkhensani Mkhari, 'Earthbound: Soil and Memory in Contemporary South African Art'.

'On Art and Soil: Artist Talk with Kiyan Williams'.

UNIT 4: SOIL AS BELONGING

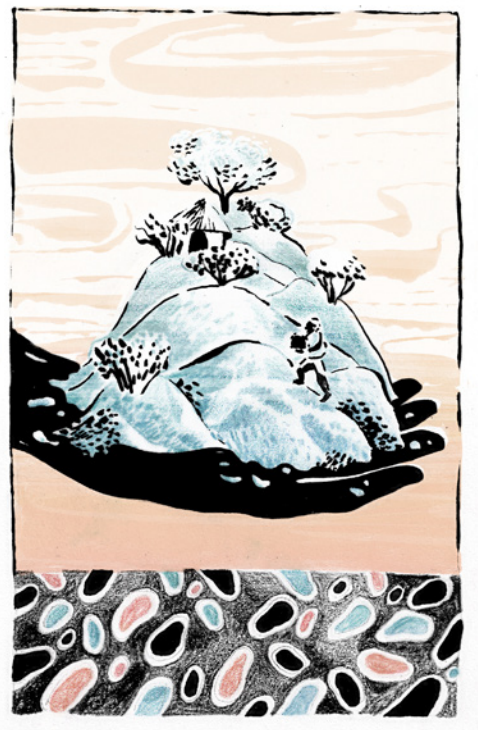
Dotan Halevy, Basil Ibrahim, Paul Kurek, Steven Stoll

Soil underlies human activity and society in a very physical and biological sense. It's the literal foundation for any kind of be(long)ing, because the cultivation of land feeds our bodies. However, human attachment to soil often includes a series of abstractions, transforming soils from a physical substrate into ownership (like property in land), or place (homeland, locality). Both senses relate to the words *belong* and *belonging*, which come from older Dutch and German words for demand, obtain, reach for and long for. What is the circular feedback between the conception of land as an object of belonging and soil as a container and enabler of life? How do we grapple with the differences or similarities between feeling tied to a particular place on earth and a political project that aims to tie belonging to the soil through a rhetoric of blood, purity, and ultimately violence?

DOI: 10.63308/63897247289532.unit4

Day 1: Soil and sense of place

Today's focus is on thinking and reading about how soil and our sensorial experience of it can often evoke a feeling of home.



Questions

Do you see soil somewhere around where you live?

Can you define what kind of soil it is? What is its texture? Smell? Taste?

Do you consider soil part of your sense of home?

Lesson plan: Get down on the ground

We tend to avoid the ground. It's fine to walk on and maybe to dig with a shovel, but most people who are not farmers avoid contact with the soils that sustain all the grass, trees and other plants all around us. While in Unit 1 we took a more removed eye to assessing soil's textures and components, now it's time to use the other senses as well. What does the smell or even taste of soil evoke for you?

One of the members of our seminar had this experience:
I was on the ground playing with my child when I smelled something deeply familiar. It was the soil, which I had known when I was her age. Time and the growth of my body had distanced me from interacting with soil, its texture, its smell, all of its properties, as intimately as I once did. Understanding soil in all the ways expressed in this syllabus must begin with the stuff itself. It's not an idea – it's a substance made up of living and non-living things. The first assignment is to smell it, taste it and feel it wherever you live.

Some examples of what engaging with soil in this way might evoke:

The artist Laura Parker suggests tasting soil and created an interactive-installation called *Taste of Place* in which she held soil tastings with samples from 86 farms. Taste your soils and write a paragraph about the experience.

Or, read the first two pages of *The Known World* to consider the tangled ways in which tasting soil can evoke a lifetime of accrued knowledge of a place.

Another article that helps reconnect with what it is like to dig in the dirt: Emma Marris, 'Tending Soil'.

Assignment: Soils and home

How does soil type help to define your place in the world? It's a strange question because you probably had no idea what your local soil is called or what it's made of but it certainly has played a role in what makes up the ecology of your region.
Take a look at the World Soil Explorer, which allows you to see soil types in any country, city and even locality. If you live in the United States, you can look up your state's official soil: the soil most common in your state.
The American naturalist and philosopher Henry David Thoreau engaged in a kind of experiment in 1845. He built a very small house and lived on the shore of Walden Pond for two years, two months and two days. In *Walden*, Thoreau writes about the entire environment of the pond. One of the things he did in those years was to grow acres of beans for himself and to exchange for other locally-grown products.
Read the first few pages of 'The Beanfield' from *Walden*. How does cultivating the soils of Concord, Massachusetts, deepen Thoreau's relationship to his native town? Where would you live to be close to your soils and how do you think the experience would change you?

Day 2: Blood and soil, race and nation

Romantic illustrations of soil, landscapes, vegetation, forests, light, plants, flowers, crosses and ruins encapsulate the human longing for connecting to the land and nature as *locus amoenus* (idealised place) of their origin. Cultivating the land in the agricultural sense but also recreationally, e.g. in the form of *Wandervereine* (hiking organisations). This desire to connect to the land is prone to being manipulated to form a rigid collective identity, as prominently happened during German fascism and its blood and soil fantasies that fed off the emergence of race theory in the

nineteenth century and its subsequent proliferation in Europe and the rest of the world. Going back to the old Germanic tribes, National Socialists claimed that their intimate connection to the farmland boosted the eugenic potency of their blood and furthermore enabled them to ultimately dominate over soil. While the intimate relationship between soil and people can be weaponised to put a racial claim on the land, the mobile and fluid nature of soil can help us to deconstruct these claims.

Questions

How/when does soil become an object of collective identity?

What are the added layers of meaning attached to soil for it to become part of one's identity formation?

What role does art – or other types of media – play in establishing this connection between blood and soil?

Assignment

In 2024, the Alte Nationalgalerie in Berlin showcased an exhibit by famous romantic painter Caspar David Friedrich (1774–1840) named Infinite Landscapes. The painter, known for depictions of endless landscapes such as 'Wanderer Above the Sea of Fog', continues to spark the imagination of today's visitors and connection to a communal longing for nature. At the same time, it was romantic painters like Friedrich who showed the beauty of the German landscape that the Nazis then instrumentalised to illustrate the ideological connection between blood and soil. It helped them make the case that the German soil had to be defended via bloodshed. First, take a look at the exhibition website and write down your initial thoughts. How do these paintings make you feel about your place in nature and the world? Then, in a second step, give us your thoughts about how you think idealising nature as national territory distorts or weaponises the sentimental feeling nature might trigger for its own purpose?
These readings might be helpful to consider and explore:

- David Haney, *Architecture and the Nazi Cultural Landscape: Blood, Soil, Building*.
- Peter Staudenmaeier, 'Organic Farming in Nazi Germany: The Politics of Biodynamic Agriculture, 1933–1945'.
- Tiago Saraiva, *Fascist Pigs, Technoscientific Organisms and the History of Fascism*.
- Christy Wampole, *Rootedness: The Ramifications of a Metaphor*.
- Dubravka Sekulić, Milica Tomić and Philipp Sattler, 'Digging Ip the Past: Soil as Archive'.
- Sally McGrane, '"Are the Bricks Evil?" In a Village Built for Nazis, Darkness Lingers'.
- Dig Where You Stand Movement

Then, read Chapter 4 of Primo Levi's *Survival in Auschwitz*. Here he describes an instance where the blood of his foot drips on the soil of the camp. How is the concrete relationship he describes

here different from the fascist blood and soil fantasies of purity? Are there any other instances you know where soil and ground stand in for political ideas? For example, 'the word "solidarity" comes from the French *solidarité*, originating in the Latin *solum,* which means "ground" and, more recognizable to the amateur philologist, "soil"', from Gil Anidjar, 'Solid Ground ('Idioms of the Left")'. This article about Kenyan politics of the soil also captures how idioms of the soil and belonging are not unique to European history: Jeremy Prestholdt, 'Politics of the Soil: Separatism, Authocthony, and Decolonization at the Kenyan Coast'.

Also, please check out this other online syllabus – 'Science in Dark Times: A Syllabus on Science, Technology, and Medicine Under Illiberal Political Regimes' – for more readings on how fascism is enacted through many forms.

Day 3: Soil as property and the properties of soil

What are the connections between the properties of soil and the conditions of making soil into someone's 'property'? This day explores to whom soil belongs by asking how soil is created, defined, conceptualised and historicised. The first two reading items under 'Making Soil' supply one type of answer. Both suggest that human efforts turn land into soil, which in turn compels the right to claim land as property. Both describe an ahistorical condition relying on universal law or morality. The following two items under 'Unmaking Soil' describe an opposite process: how soil is eroded, who is to blame for this process and, by extension, what are the consequences for historical rights for certain groups/societies. In contrast to the previous section, the process described here is historical and geographical. The closing section exemplifies the implication of the above questions in a relatively uncommon arena: the relations between soil, taste and property. The first item introduces the idea of 'terroir' – the expression of soil's properties in the taste of

agricultural products cultivated upon it. Terroir may be taken as an 'experiential' aspect of soil properties.

The second text, the one closing this day, ties together all previous discussions by tying claims for a unique terroir to the question of indigeneity in Israel and Palestine.

Readings / other media

Making property / making soil

John Locke, *Second Treatise of Government (1689)*, Chapter 5.

'Dead Land' (Mevat) in the Ottoman Land Code, 1858 (p. 54).

Brenna Bhandar and Alberto Toscano, 'Representing Palestinian Dispossession: Land, Property and Photography in the Settler Colony'. This article offers a particular example of how the notion of 'dead land' has been used to claim land.

Additional reading on colonial dispossession of land: Robert Nichols, *Theft is Property!*

See also Dotan Halevy's essay in Part 2.

Unmaking soil: How claims of erosion and harm are also used to dispossess

Hugh H. Bennett and W.C. Lowdermilk, 'General Aspects of the Soil-Erosion Problem', p. 581.

Adolf Reifenberg, *The Struggle between the Desert and the Sown; Rise and Fall of Agriculture in the Levant*.

Questions

What makes land into property? Law? Boundaries? Power? What else? What is the role of soil within each of these categories?

How is soil made, and by whom? How is soil destroyed and by whom? What ties the making/ destruction of soil to the question of who owns it?

What changes with improvement/ reclamation/ removal/toxification/covering of land?

What is being propertied in a private property? The land? The territory? The soil? The location?

Activity: The properties of soil

> Search 'what is terroir?' on the internet and watch 2–3 videos where someone defines it. Most likely it will be a video about wine. How do they describe the relationship between wine and soil? What is your reaction? Do they articulate it in terms of science? Or an 'art' of wine making? What sort of sense of taste does developing a sense of terroir require cultivating? Do you believe that terroir exists? How does the notion of terroir fit within modern agricultural systems?

Follow up this initial search with these readings:
– Heather Paxson, 'Locating Value in Artisan Cheese: Reverse Engineering Terroir for New-World Landscapes'.
– Brad Weiss, 'Making Pigs Local: Discerning the Sensory Character of Place'.
– Daniel Monterescu and Ariel Handel, 'Indigenous Wine and Settler Colonialism in Israel and Palestine'.

Does food, taste and the notion of 'terroir' lead us to any new way of reconciling the challenges of how attachment to place is both essential to earthly flourishing and essentialising? We can see throughout this unit that claiming the particularities of soil as an expression of identity and belonging can run the political spectrum. One text you might consider for discussing this further is Bruno Latour's *Down to Earth*. Here is an excerpt:

> It is the uprooting that is illegitimate, not the belonging. To belong to a land, to want to stay put and keep on working one's plot of land, to be attached to it, has become 'reactionary', as we have seen, only by contrast with the headlong flight forward imposed by modernization. If we stop fleeing, what does the desire for attachment look like? The negotiation – the fraternization? – between supporters of the Local and supporters of the Terrestrial has to bear on the importance, the legitimacy, even the necessity of belonging to a land, but – and here lies the whole difficulty – without immediately confusing it with what the Local has added to it: ethnic homogeneity, a focus on patrimony, historicism, nostalgia, inauthentic authenticity. On the contrary, there is nothing more innovative, nothing more present, subtle, technical, and artificial (in the positive sense of the word), nothing less rustic and rural, nothing more creative, nothing more contemporary than to negotiate landing on some ground (p. 53).

Day 4: Ashes to ashes: Cemeteries and burial ground

Graves and burial sites combine the two notions discussed in previous sections: ownership and ideological/emotional attachment. They are also the ultimate subsumption in the soil and what makes the soil. For example, the Nazis monumentalised the death of the soldier in their state architecture to remind the people of their duty to sacrifice their body for something higher and

had extensive plans for massive military cemeteries. In Appalachia, Israel and Palestine things were handled (not) so differently. Today's activity and readings look at two overlapping processes: the burial of bodies, which gives burial sites meaning and significance, and the conditions in which these sites themselves are being desecrated, buried and erased by other processes.

Assignment

Go to the local cemetery. Ask yourself the question: who belongs here? Is it the people buried here, is it the squirrels roaming over the property, is it the people mourning for their lost ones, or the gardener preparing the landscape or digging around? Is it the trees and other types of vegetation growing? Is it everyone feeding off the land? What is the role of land here? What are the different layers of belonging and what is the role of the soil here in cooperation with the dead, the inanimate, and the living? Draw a mind-map that helps you visualise the different layers of belonging in relationship with the soil and write a paragraph that explains your thought process.
Then, read the entry on the website of the MET about fascist architect Wilhelm Kreis. You will learn that the Nazis dedicated an immense amount of planning in monuments mourning dead soldiers and cemeteries in general. Obviously they used the people's emotional connection to death and mourning to cement their agenda in people's hearts. Why do you think this is so effective, and do you know any other times and places where this tactic has been used? Is it the inevitability of our own death and that we know that one day we will be part of the soil as well? Rural burial grounds can also be destroyed. In Appalachia, they are often located in hollows, where they can be easily buried by overburden from strip mines. Local people respond with moral outrage to the desecration of graves. Also consider our examples from Israel and Palestine. What makes every case different? What is similar?

Questions

What are the relations between soil and society in these images?

What is soil doing in this image/context?

How does our emotional connection to death and mourning provide the basis for collective manipulation?

Readings / other media

Mahmud Darwish, 'Those Who Pass Between Fleeting Words'. You can see the author read the poem via https://www.youtube.com/watch?v=dmk9FFTp_9Y

'Family Says Mountaintop Removal Mine Damaging Cemetery', *West Virginia Record*.

Anna Jozefacka, 'Wilhelm Kreis'.

Rashid Kahlidi, 'The Case of the Mamilla Cemetery: Delegitimization or Desecration?'

The entire syllabus on grave gardening at https://syllabusproject.org/dead-head-on-grave-gardening/

A film on dirt and death: https://ilikedirtfilm.com/

A book on dirt and death: https://tif.ssrc.org/2024/06/26/earth/

Nicola Twilley, 'The Dust of our Ancestors'.

Eleanor Cummins, 'Inside One of the World's First Human Composting Facilities'.

See also Steven Stoll's essay in Part 2.

Syllabus

REFERENCES

Unit I. Soil as Substrate

Day 1: Who cares about (and for) soil?

Recommended Reading

Ingold, Tim. 'Toward an Ecology of Materials', *Annual Review of Anthropology* **41** (2012): 427–42.
https://anthro.vancouver.wsu.edu/documents/603/Ingold_on_ecology_and_materiality.pdf

Puig de la Bellacasa, Maria. 'Re-Animating Soils: Transforming Human–Soil Affections through Science, Culture and Community'. *The Sociological Review* **67** (2) (2019): 391–407.
https://wrap.warwick.ac.uk/id/eprint/114796/

Recommended Viewing

Ruderal Ecologies-Radical Care Practices
https://www.youtube.com/watch?v=XgiTOC9oGrM

Re-Enchantment: Environmental Law and Ruderal Ecologies
https://www.youtube.com/watch?v=x-I6qpvflfA

Day 2: Assessing soil's properties and uses

Activity

Soil Texture Flow Chart
https://ahdb.org.uk/knowledge-library/how-to-determine-soil-texture

Two videos on how to assess soil aggregation
https://www.youtube.com/watch?v=7OYq6-_GW5Q
https://www.youtube.com/watch?v=CEOyC_tGH64

Day 3: Soil organic matter (not humus) and the metabolic life of soil: What are we getting wrong?

Lesson Plan

Soil under a microscope
https://www.botanicgardens.org/blog/microscopic-world-soil

The search for antibiotics in soil
https://imb.uq.edu.au/blog/2022/01/under-microscope-unearthing-soils-science-gallery

Readings/other media

History of Humification
Kleber, M. and J. Lehmann. 'Humic Substances Extracted by Alkali Are Invalid Proxies for the Dynamics and Functions of Organic Matter in Terrestrial and Aquatic Ecosystems'. *Journal of Environmental Quality* **48** (2): 207:16
https://pubmed.ncbi.nlm.nih.gov/30951127/

Darwin's Obsession with Earthworms

The Importance of Earthworms: Darwin's Last Manuscript
https://www.nypl.org/blog/2012/04/19/earthworms-darwins-last-manuscript

Soil Stories with Nic and Leanna
https://www.podchaser.com/podcasts/soil-stories-with-nic-and-lean-1136307

Questions

Donna Haraway's thinking about humus

'Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene'. *E-flux Journal* 75 (2016).
https://www.e-flux.com/journal/75/67125/tentacular-thinking-anthropocene-capitalocene-chthulucene/

Till, Dwayne. 'Embracing Humus: A Re-enchantment of Nature through Donna Haraway's Vision'.
https://tillwell.ca/embracing-humus-donna-haraway-vision/

Franklin, Sarah. 'Staying with the Manifesto: An Interview with Donna Haraway'. *Theory, Culture and Society* (2017). https://monoskop.org/images/9/9f/Franklin_Sarah_2017_Staying_with_the_Manifesto_An_Interview_with_Donna_Haraway.pdf

Day 4: Approaching soil as a repository of historical metabolism

To read and discuss

Landecker, Hannah. 2019. 'A Metabolic History of Manufacturing Waste: Food Commodities and their Outsides'. *Food, Culture, and Society* **22** (2019): 530–47.
https://www.tandfonline.com/doi/full/10.1080/15528014.2019.1638110

Lerner, Sharon. 'How 3M Discovered, Then Concealed, the Dangers of Forever Chemicals' *The New Yorker*, 20 May 2024.
https://www.newyorker.com/magazine/2024/05/27/3m-forever-chemicals-pfas-pfos-toxic

Schlanger, Zoe. 'Maine Is a Warning for America's PFAS Future'. *The Atlantic.*
https://www.theatlantic.com/science/archive/2024/04/pfas-drinking-water-maine/678040/

Perkins, Tom. 'I Don't Know How We'll Survive: The Farmers Facing Ruin in America's Forever Chemical Crisis'. *The Guardian*, 22 March 2022.
https://www.theguardian.com/environment/2022/mar/22/i-dont-know-how-well-survive-the-farmers-facing-ruin-in-americas-forever-chemicals-crisis

Watch

Toxic disaster of PFAS contamination a nightmare for Maine farmers
https://www.youtube.com/watch?v=qMBhBuPtEfI

Day 5: Materialising future horizons through soil

Readings to discuss

Kirkwood, Niall. 2001. *Manufactured Sites: Rethinking the Post-Industrial Landscape*. London; New York: Spon Press.
https://books.google.vu/books?id=x6jFOKILvM4C&printsec=frontcover&source=gbs_vpt_read#v=onepage&q&f=false

Kennen, Kate and Niall Kirkwood. 2015. 'Site Programs and Land Use'. In *Phyto:* Principles and Resources for Site Remediation and Landscape Design, pp. 247–98. United Kingdom: Routledge.
https://vdoc.pub/documents/phyto-principles-and-resources-for-site-remediation-and-landscape-design-15pn43v3p568

Additional Material

Film: Irene Lustzig, *Richland*
https://richlandfilm.com/screenings/

Art Installation: Mel Chin, *Revival Field*
https://melchin.org/oeuvre/revival-field/

Interview with Mel Chin, Art21
https://art21.org/read/mel-chin-revival-field/

Mike Curran, What Can't Be Buried: Unearthing *Revival Field*, Mn Artists, Walker Art Center
https://mnartists.walkerart.org/what-cant-be-buried-unearthing-revival-field

Assignment

Step 1

Cusworth, George, Jamie Lorimer and E.A. Welden. 'Farming the Patchy Anthropocene'. *The Geographical Journal* **190** (3) (2024): e12558.
https://rgs-ibg.onlinelibrary.wiley.com/doi/epdf/10.1111/geoj.12558

Anna Tsing, 'Anthropocene Patches—Space, Time and Position' (discussion of patches starts at minute 6:00)
https://www.youtube.com/watch?v=gsaCmwHT1Xc&t=360s

Mathews, Andrew S. 2018. 'Landscapes and Throughscapes in Italian Forest Worlds: Thinking Dramatically about the Anthropocene'. *Cultural Anthropology* **33** (3) (2018).
https://doi.org/10.14506/ca33.3.05

Gas Works Park
https://www.historylink.org/File/20978#:~:text=designed%20the%20masterplan

Škerl, Urška. 'Palimpsestous Landscapes: Post-Industrial Parks'. *Landezine*.
https://landezine.com/palimpsestous-landscapes-post-industrial-parks/

Step 4

Cram, Shannon. 2023. 'Trespassing'. In *Unmaking the Bomb*. Berkeley: University of California Press. pp. 107–19.
https://www.degruyterbrill.com/document/doi/10.1525/9780520395138-006/html?srsltid=AfmBOorCykX4Nv5zvCLZrO74oHsriPbrg9sFV3HEb_AVu90DW3HNl4iQ_

Cram, Shannon. 'Here, in the Plutonium'. *Moss* (2023).
https://mosslit.com/Shannon-Cram-Here-in-the-Plutonium

Ahmann, Chloe. 'Toxic Disavowal'. *Somatosphere* (2020).
https://somatosphere.com/2020/toxic-disavowal.html

Unit 2: Soil as Archive

Day 1: Archives of Soil

Questions

World Soil Museum Soil Reference Collection
https://wsm.isric.org/WSRC.html

Soil Monolith Collection
https://www.youtube.com/watch?v=b2IIv6WmrEc

How to extract, prepare and mount a monolith:
https://www.mbsoils.ca/wp-content/uploads/Mounting-your-soil-monolith-Oct-2020_MW_Generic-for-MSSS-website22163.pdf

Readings / other media

Food and Agriculture Organization of the United Nations. FAO/UNESCO Soil Map of the World. FAO SOILS PORTAL.
https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/faounesco-soil-map-of-the-world/en/

US National Soil Archive
https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/national-soil-archive

Lyons, Kristina. 'Introduction'. In *Vital Decomposition: Soil Practitioners and Life Politics*. Durham, NC: Duke Unversity Press, 2020.
https://assets-us-01.kc-usercontent.com/f7ca9afb-82c2-002a-a423-84e111d5b498/f7695797-8d5c-47f8-b50b-2071a9d58e1a/978-1-4780-0816-3_601.pdf?fm=webp&auto=format&lossless=true

Trouillot, Michel Rolph. 'The Power in the Story', Ch. 1 of *Silencing the* Past: Power and the Production of History. Boston: Beacon Press, 1995.
https://archive.org/details/silencingpastpow0000trou/mode/2up

Bowker, Geoffrey C. and Susan L. Star. 'Introduction'. In *Sorting Things Out: Classification and its Consequences*. Cambridge, MA: MIT Press, 2000.
https://hcommons.org/app/uploads/sites/1001532/2020/03/Bowker-1999-Sorting-Things-Out-Classification-and-Its-Consequences.pdf

Guldi, Jo. 'On Failing to Make a Map in Time'. Ch. 5 of *The Long Land War. The Global Struggle for Occupancy Rights*. New Haven: Yale University Press, 2021.
https://www.google.co.uk/books/edition/The_Long_Land_War/g4xhEAAAQBAJ?hl=en&gbpv=1&printsec=frontcover

Latour, Bruno. 'Circulating Reference. Sampling the Soil in the Amazon Forest'. Ch. 2 of *Pandora's Hope. Essays on the Reality of Science Studies*. Cambridge, MA: Harvard Universityh Press, 1999.
http://www.bruno-latour.fr/sites/default/files/downloads/53-PANDORA-TOPOFIL-pdf.pdf

See also the links in the Soil Collections section of Shannon Mattern's 'Library Field' Syllabus
https://syllabusproject.org/library-field/#soil

Day 2: Archives conspicuously without Soils

Codex Badiano
https://tischlibrary.tufts.edu/special-collections-badianus-manuscript

Activity

Missouri Botanical Garden archival database
https://livingcollections.org/home

Biodiversity Heritage Library
https://www.biodiversitylibrary.org/

Readings/other media

Kimmerer, Robin Wall. 'Hearing the Language of Trees'. *Yes*, 29 Oct. 2021.
https://www.yesmagazine.org/environment/2021/10/29/hearing-the-language-of-trees

Denizen, Seth. 'Where is the Earth in the Herbarium'. In Carin Kuoni and Wilma Lukatsch (eds), *Maria Theresa Alves: Seeds of Change*. Amherst, MA: Amherst College Press, 2022.
https://www.jstor.org/stable/10.3998/mpub.12762617.6

Seth Denizen (watch): Where is the Earth in the Herbarium? (Earth Writing, Faculty Workshop)
https://www.youtube.com/watch?v=CnG-E_fLAFQ

Camile Dungy, 'From Dirt'
https://www.youtube.com/watch?v=CnG-E_fLAFQ

Maura Flannery, 'How to Read an Herbarium Specimen'
https://lab.plant-humanities.org/educational/five-specimens/

Day 3: Soil as an archive of historical relations

Activity 1

Ring of Fire map
https://en.wikipedia.org/wiki/Ring_of_Fire

Activity 2

EJScreen
https://pedp-ejscreen.azurewebsites.net/

Steinauer-Scudder, Chelsea. 'Counter Mapping'. *Emergence Magazine* (2018).
https://emergencemagazine.org/feature/counter-mapping/

O'Dwyer, Laurence. 'Counter-mapping: Cartography that Lets the Powerless Speak'. *The Guardian*, 6 March 2018.
https://www.theguardian.com/science/blog/2018/mar/06/counter-mapping-cartography-that-lets-the-powerless-speak

Additional readings / other media

Liboiron, Max. Introduction. In *Pollution is Colonialism*. Durham, NC: Duke Universityh Press, 2021.
https://assets-us-01.kc-usercontent.com/f7ca9afb-82c2-002a-a423-84e111d5b498/fae6cb9f-84fc-4929-aa23-84c7f120fcd7/978-1-4780-1413-3_601.pdf?fm=webp&auto=format&lossless=true

Romero, Adam. *Economic Poisoning: Industrial Waste and the Chemicalization of American Agriculture*. Berkeley: University of California Press, 2021 (excerpt, 'A Letter to Rachel Carson').
https://www-degruyter-com.eux.idm.oclc.org/document/doi/10.1525/9780520381575-002/html

Carson, Rachel. *Silent Spring – Part I*, *The New Yorker*, 9 June 1962.
https://www.newyorker.com/magazine/1962/06/16/silent-spring-part-1

Day 4: Soil as a living archive of social relations

Thinking Through Soil (soil images)
https://thinkingthroughsoil.studio/

Twilley, Nicola. 'Soil Archive'. *Edible Geography* (2012).
https://web.archive.org/web/20120818162158/https://www.ediblegeography.com/soil-archive/

Denizen, S. 'Soil Contains Social Relations (and It's Our External Gut): Thinking Through Soil'. *Landezine*
https://landezine.com/soil-contains-social-relations-and-its-our-external-gut-thinking-through-soil-by-seth-denizen/

Agard-Jones, Vanessa. 'Bodies in the System'. *Small Axe* **17** (3) (42): 182–92.
https://doi.org/10.1215/07990537-2378991

Unit 3: Soil as Health

Montgomery, David. R. *Dirt: The Erosion of Civilizations*. Berkeley: University of California Press, 2007.
https://www.google.co.uk/books/edition/Dirt/HSu8r15-nnoC?hl=en

Day 1: Dust

Activity 1

Henderson, Carolyn A. 'Letters from the Dust Bowl'. *The Atlantic*, May 1936.
https://www.theatlantic.com/magazine/archive/1936/05/letters-from-the-dust-bowl/308897/

Activity 2

Jacks, G.V. and R.O. Whyte, *The Rape of the Earth.* London: Faber, 1939.
https://archive.org/details/rapeofearth0000gvja/page/10/mode/2up

Readings / other media

Davis, Diana K. and Edmund Burke III (eds). *Environmental Imaginaries of the Middle East.* Athens, OH: Ohio University Press, 2011.
https://library.oapen.org/bitstream/handle/20.500.12657/51086/1/external_content.pdf

Manna, Jumana. 'Where Nature Ends and Settlements Begin', *E-flux* 113 (2010).
https://www.e-flux.com/journal/113/360006/where-nature-ends-and-settlements-begin/

Dalawar, Arvind. 'How Israel Weaponizes Tree Planting to Displace Palestinians'. *Jacobin*, 15 March 2024.
https://jacobin.com/2024/03/israel-afforestation-jnf-naqab-displacement

Halevy, Dotan. 'Sands, Lupines and the Ecology of the Uncultivable'.
https://whitehorsepress.blog/2023/02/23/sands-lupines-and-the-ecology-of-the-uncultivable/

Smarsh, Sarah. 'Protecting the Prairie'. *Orion*, 27 August 2024.
https://orionmagazine.org/article/prairie-grassland-restoration-north-america/

Activity 3

Hecht, Gabrielle. 'You Can See Apartheid from Space'. In *Residual Governance: How South Africa Foretells Planetary Futures*. Durham, NC: Duke University Press, 2023. pp. 19–46 (esp. pp. 19–23)
https://library.oapen.org/handle/20.500.12657/85660

le Roux, Hannah and Gabrielle Hecht, 'Accumulation'. *E-flux* Architecture, 31 August 2020.
https://www.e-flux.com/architecture/accumulation/345106/bad-earth/

Day 2: Forms of care for the soil (interventions)

Readings / other media

Daniel Munster's Lecture
https://www.youtube.com/watch?v=1-CR5t_9kBg&t=360s

Munster, Daniel. 'Nectar of Life'. *Current Anthropology* **62** (S24) (2021).
https://www.journals.uchicago.edu/doi/10.1086/715477

G.V. Ramanjaneyulu
https://www.youtube.com/watch?v=XJc5wqj06DY

Hetherington, Kregg. *The Government of Beans: Regulating Life in the Age of Monocrops*. Durham, NC: Duke University Press, 2020. (Might focus on Chapter 2, Chapter 10, Chapter 13, and Chapter 16, all short.)
https://doi.org/10.1215/9781478007487

Listen: Hetherington, Kregg. 'The Paradox of Destroying Lands in the Name of Social Welfare'. Episode 348, Green Dreamer.
https://www.greendreamer.com/podcast/kregg-hetherington-government-of-beans

Hetherington, Kregg. 'When Plants Farm Themselves' (2016).
https://culanth.org/fieldsights/when-plants-farm-themselves

Further reading

Agard Jones, Vanessa. 'Spray'. *Somatosphere*, 27 May 2014.
https://somatosphere.com/2014/spray.html/

Nash, Linda. 'The Fruits of Ill-Health: Pesticides and Workers' Bodies in Post-World War II California'. *Osiris* **19** (2004): 203–19.
https://www.jstor.org/stable/3655240

Laird, Linda. 'India's Farmer Suicides: Are Deaths Linked to GM Cotton?' *The Guardian.*
https://www.theguardian.com/global-development/gallery/2014/may/05/india-cotton-suicides-farmer-deaths-gm-seeds

New Books Network Podcast: Vincanne Adams, 'Glyphosate and the Swirl: An Agroindustrial Chemical on the Move'
https://newbooksnetwork.com/glyphosate-and-the-swirl

Podcast: Story of Nitrogen
https://storyofn.transistor.fm/episodes

Reed, Molly. 'Morbidly Excited Soil: Sylvester Graham and the Environmental Ethos of Antebellum Reform'. *Environmental History* **26** (2) (2021).
https://doi.org/10.1093/envhis/emaa083

Stoll, Steven. *Larding the Lean Earth.* New York: Farrar, Straus and Giroux, 2003.
https://www.google.co.uk/books/edition/Larding_the_Lean_Earth/qYqD2tj7kK8C?hl=en

Langwick, Stacey Ann. 'A Politics of Habitability: Plants, Healing, and Sovereignty in a Toxic World'. *Cultural Anthropology* **33** (3) (2018).
https://doi.org/10.14506/ca33.3.06

MacDonald, Fraser. 'On Compost'. *London Review of Books*, April 2025.

https://longreads.com/2025/04/24/on-compost/

Wengrow, David and Forensic Architecture. *The Nevelibka Hypothesis*. https://content.forensic-architecture.org/wp-content/uploads/2023/04/The-Nebelivka-Hypothesis_FA-Wengrow_Book.pdf

Video version of Nevelibka Hypothesis
https://vimeo.com/827712952

Assignment 2

Collection of Pesticide Containers
https://digital.sciencehistory.org/collections/mg74qm28w

Carson, Rachel. Silent Spring. Boston: Houghton Mifflin, 1962.
https://library.uniteddiversity.coop/More_Books_and_Reports/Silent_Spring-Rachel_Carson-1962.pdf

Day 3: Intimacies of the soil and the body

Tropical Hookworm video
http://www.colonialfilm.org.uk/node/735

Unhooking the Hookworm video
https://www.youtube.com/watch?v=OD-sDlSDrKk

Rockefeller Archive Center. 'Public Health: How the Fight Against Hookworm Helped Build a System' (2020).
https://resource.rockarch.org/story/public-health-how-the-fight-against-hookworm-helped-build-a-system/

Stoll, Norman. 'This Wormy World'. *Journal of Parasitology* **33** (1947).
https://www.jstor.org/stable/pdf/3273613.pdf?refreqid=excelsior%3A57155c657a2fca917ed9c11bd68a789a&ab_segments=&origin=&acceptTC=1

Bhattacharya, Nandini. *Contagion and Enclaves: Tropical Medicine in Colonial India*. Liverpool: Liverpool University Press, 2012. Ch. 7.
https://muse.jhu.edu/pub/105/oa_monograph/chapter/2493025

Anderson, Warwick. 'Excremental Colonialism: Public Health and the Poetics of Pollution'. *Critical Inquiry* **21** (3) (1995): 640–69.
https://people.stfx.ca/rsemple/Courses%202019/Medicine,%20Belief%20and%20Identity/Readings/Anderson%20Excremental%20Imperialism.pdf

Wenzel Geissler, P. (1998) "'Worms Are Our Life", Part I: Understandings of Worms and the Body among the Luo of Western Kenya'. *Anthropology & Medicine* **5** (1) (1998): 63–79.
https://www.tandfonline.com/doi/abs/10.1080/13648470.1998.9964549

Lorimer, Jamie. 'Hookworms Make Us Human: The Microbiome, Eco-immunology, and a Probiotic Turn in Western Health Care'. *Medical Anthropology Quarterly* (2018).
https://anthrosource.onlinelibrary.wiley.com/doi/full/10.1111/maq.12466

Listen: 'As The Worm Turns'. This American Life (2010).
https://www.thisamericanlife.org/404/enemy-camp-2010/act-three-0

Day 4: The labours of the body (politic)

Assignment

A Black Farmer Preserving History, Feed the People
https://www.youtube.com/watch?v=n2ab8zdr0dU

Leah Penniman, Farming While Black, TEDxBoston
https://www.youtube.com/watch?v=9QYDXtMiV80

The Young Black Farmers Defying a Legacy of Discrimination, VICE News
https://www.youtube.com/watch?v=Cxbdwsy88V4

Marsh View Community Farm, Bill Green's Gullah Cooking
https://www.youtube.com/watch?v=D-P9SNhExmw

'Black Gardeners Find Refuge in the Soil'. *The New York Times,* 26 Oct. 2021.
https://www.nytimes.com/2021/10/26/special-series/black-gardeners-pandemic.html

A brief Twitter (X) thread on the history of Black farming in the American South
https://x.com/Federation1967/status/1283109513248243714

Dungy, Camille T. *Soil: The Story of a Black Mother's Garden*. New York: Simon and Schuster, 2023.
https://camilledungy.com/soil/

Interview with Camille T. Dungy, The Afro Beets Podcast
https://www.christinriddick.org/podcast/episode/22443223/47-addressing-trauma-and-privilege-of-the-land-feat-camille-t-dungy

César, Filipa. 'METEORISATIONS Reading Amílcar Cabral's Agronomy of Liberation'. BUALA
https://www.buala.org/en/afroscreen/meteorisations-reading-amilcar-cabral-s-agronomy-of-liberation

da Silva, Filipe Carreira and Monica Brito Vieira. 'Amílcar Cabral, Colonial Soil and the Politics of Insubmission'. *Theory, Culture & Society* **42** (1) (2024).
https://journals.sagepub.com/doi/10.1177/02632764241253752

Davidson, Joe P.L. and Filipe Carreira da Silva. 'Decolonising the Earth: Anticolonial Environmentalism and the Soil of Empire'. *Theory, Culture & Society* **41** (6) (2024).
https://journals.sagepub.com/doi/full/10.1177/02632764241242380

Bhardwaj, Ankit. 'The Soils of Black Folk: W.E.B. Du Bois's Theories of Environmental Racialization'. *Sociological Theory* **41** (2) (2023).
https://journals.sagepub.com/doi/full/10.1177/07352751231164999

White, Monica M. and LaDonna Redmond. *Freedom Farmers: Agricultural Resistance and the Black Freedom Movement*. Chapel Hill: The University of North Carolina Press, 2018.
https://uncpress.org/book/9781469643700/freedom-farmers/

Lincoln, Sarah L. 'Notes from Underground: Fugitive Ecology and the Ethics of Place'. *Social Dynamics* **44** (2018).
https://www.tandfonline.com/doi/full/10.1080/02533952.2018.1430476

McCutcheon, Priscilla. 'Fannie Lou Hamer's Freedom Farms and Black Agrarian Geographies'. *Antipode* **51** (1) 2019.
https://onlinelibrary-wiley-com.eux.idm.oclc.org/doi/full/10.1111/anti.12500

Listen: 'The Coloniality of Planting with Ros Gray & Shela Sheikh'. The Botanical Mind

podcast, Camden Art Centre.
https://www.botanicalmind.online/podcasts/the-coloniality-of-planting

First-Arai, Leanna. 'How Soil Acts as a Living Witness to Racial Violence'. *YES!,* 27 Feb. 2019.
https://www.yesmagazine.org/issue/dirt/2019/02/27/remembering-our-history-of-racial-injustice-through-soil

Codjoe, Ama. 'This Land was Made'. *Orion Magazine*, 9 Feb. 2021.
https://orionmagazine.org/article/this-land-was-made/

Hutchings-Georgiou, Hannah. 'Daughters of the Dust: The Radical Soil-Based Work of Contemporary Women Artists'. *Elephant*, 2 Feb. 2024.
https://elephant.art/daughters-of-the-dust-the-radical-soil-based-work-of-contemporary-women-artists/#:~:text=Hayv%20Kahraman's%20work%20speaks%20into,which%20are%20created%20on%20flax

Mkhari, Nkhensani. 'Earthbound: Soil and Memory in Contemporary South African Art'. *Latitudes*, 24 July 2024.
https://editorial.latitudes.online/blog/posts/earthbound-soil-and-memory-in-contemporary-south-african-art/

'On Art and Soil: Artist Talk with Kiyan Williams'. At Home, Hirshhorn Museum and Sculpture Garden
https://youtu.be/DzLHN99jn_E

Unit 4: Soil as Belonging

Day 1: Soil and Sense of Place

Lesson Plan

Taste of Place
https://www.lauraparkerstudio.com/taste

Jones, Edward P. *The Known World*. New York: HarperCollins, 2003.
https://www.google.co.uk/books/edition/The_Known_World/CVS9a6lC5CwC?hl=en&gbpv=1&pg=PA1&printsec=frontcover

Marris, Emma. 'Tending Soil'. *Emergence Magazine*, 8 Oct. 2019.
https://emergencemagazine.org/essay/tending-soil/

Assignment 2

World Soil Explorer
https://soilexplorer.net/

States' official soil
https://www.nrcs.usda.gov/resources/education-and-teaching-materials/state-soils

Thoreau, Henry David. 'The Beanfield'. In *Walden* (1854).
https://www.gutenberg.org/files/205/205-h/205-h.htm

Day 2: Blood and Soil, Race and Nation

Assignment

Infinite Landscapes Exhibit
https://www.smb.museum/en/exhibitions/detail/caspar-david-friedrich/

Wanderer Above the Sea of Fog
https://www.hamburger-kunsthalle.de/en/wanderer-travel

Haney, David. *Architecture and the Nazi Cultural Landscape: Blood, Soil, Building.* New York: Routledge, 2023.
https://www.google.co.uk/books/edition/_/POR9EAAAQBAJ?hl=en&gbpv=1

Staudenmaeier, Peter. 'Organic Farming in Nazi Germany: The Politics of Biodynamic Agriculture, 1933–1945'. *Environmental History* **18** (2) (2013).
https://www.journals.uchicago.edu/doi/abs/10.1093/envhis/ems154

Saraiva, Tiago. *Fascist Pigs, Technoscientific Organisms and the History of Fascism.* Cambridge, MA: MIT Press, 2018.
https://mitpress.mit.edu/9780262536158/fascist-pigs/

Wampole, Christy. *Rootedness: The Ramifications of a Metaphor.* Chicago: University of Chicago Press, 2016.
https://press.uchicago.edu/ucp/books/book/chicago/R/bo22891000.html

Sekulić, Dubravka, Milica Tomić and Philipp Sattler. 'Digging up the Past: Soil as Archive'. *The Architectural Review*, 12 Feb. 2020.
https://www.architectural-review.com/essays/digging-up-the-past-soil-as-archive

McGrane, Sally. '"Are the Bricks Evil?" In a Village Built for Nazis, Darkness Lingers'. *The New York Times*, 27 May 2025.
https://www.nytimes.com/2025/05/27/realestate/berlin-holocaust-nazis-neighborhood.html

Dig Where You Stand Movement
https://en.wikipedia.org/wiki/Dig_Where_You_Stand_movement

Primo Levi. *Survival in Auschwitz*. New York: Simon and Schuster, 1996.
https://archive.org/details/survivalinauschw00levi_0

Anidjar, Gil. 'Solid Ground: Idioms of the Left'. The Immanent Frame, SSRC, 3 June 2020.
https://tif.ssrc.org/2020/06/03/solid-ground-idioms-of-the-left/

Prestholdt, Jeremy. 'Politics of the Soil: Separatism, Authocthony, and Decolonization at the Kenyan Coast'. *The Journal of African History* 55 (2) (2014): 249–70.
https://www.jstor.org/stable/43305188

Science in Dark Times Syllabus
https://somatosphere.com/2020/science-in-dark-times-a-syllabus-on-science-technology-and-medicine-under-illiberal-political-regimes.html/

Day 3: Soil as property and the properties of soil

Readings / other media

Locke, John. *Second Treatise of Government* (1689), Chapter 5.
https://ccb.ff6.mwp.accessdomain.com/C/Locke_chpt5.pdf

Mevat, Arazi. 'Dead Land'. In *The Ottoman Land Code* (1858), p. 54.
https://archive.org/details/ottomanlandcode00turkuoft/page/54/mode/2up?view=theater

Bhandar, Brenna and Alberto Toscano. 'Representing Palestinian Dispossession. Land, Property and Photography in the Settler Colony. *Settler Colonial Studies* **7** (1): 1–18.
https://eprints.soas.ac.uk/21913/1/Bhandar_Toscano_Representing_Palestinian_Dispossession_FINAL.pdf

Nichols, Robert. *Theft is Property! Dispossession and Critical Theory.* Durham, NC: Duke University Press, 2020.
https://cominsitu.wordpress.com/wp-content/uploads/2023/04/theft-is-property-book-nichols.pdf

Bennett, Hugh H. and W.C. Lowdermilk. 'General Aspects of the Soil-Erosion Problem'. *Soils and Men* (1938).
https://archive.org/details/yoa1938/page/581/mode/2up

Reifenberg, Adolf. *The Struggle between the Desert and the Sown. Rise and Fall of Agriculture in the Levant*. Publishing Department of the Jewish Agecy, 1955.
https://books.google.co.il/books/about/The_Struggle_Between_the_Desert_and_the.html?id=RdhOAAAAMAAJ&redir_esc=y

Paxson, Heather. 'Locating Value in Artisan Cheese: Reverse Engineering Terroir for New-World Landscapes'. *American Anthropologist* **112** (3) (2010): 444–57.
https://anthropology.mit.edu/sites/default/files/documents/paxson_locating_value_in_artisan_cheese.pdf

Weiss, Brad. 'Making Pigs Local: Discerning the Sensory Character of Place'. *Cultural Anthropology* **26** (3) (2011): 438–61.
https://doi.org/10.1111/j.1548-1360.2011.01106.x

Monterescu, Daniel and Ariel Handel. 'Indigenous Wine and Settler Colonialism in Israel and Palestine'. *MERIP* 302 (Spring 2022).
https://merip.org/2022/05/indigenous-wine-and-settler-colonialism-in-israel-and-palestine/

Latour, Bruno. *Down to Earth. Politics in the New Climatic Regime.* Cambridge: Polity, 2018.
https://www.are.na/block/22813640

Day 4: Ashes to ashes: Cemeteries and burial ground

Assignment

Mind map
https://loridrakeauthor.com/2020/06/19/mind-mapping/

References

Met Museum, Wilhelm Kreis
https://www.metmuseum.org/research-centers/leonard-a-lauder-research-center/research-resources/modern-art-index-project/kreis

Readings / other media

'Family Says Mountaintop Removal Mine Damaging Cemetery'. *West Virginia Record*, 2013.
https://wvrecord.com/stories/510605988-family-says-mountaintop-removal-mine-damaging-cemetery

Kahlidi, Rashid. 'The Case of the Mamilla Cemetery: Delegitimization or Desecration?'
https://palestine.mei.columbia.edu/event-extras/2017/5/22/the-case-of-the-mamilla-cemetery-delgitimization-or-desecration

Here is an entire syllabus on grave gardening!
https://syllabusproject.org/dead-head-on-grave-gardening/

A film on dirt and death
https://ilikedirtfilm.com/

A book on dirt and death
https://tif.ssrc.org/2024/06/26/earth/

Twilley, Nicola. 'The Dust of our Ancestors'. *Edible Geography*, 1 June 2010.
https://web.archive.org/web/20121017205206/http://www.ediblegeography.com/the-dust-of-our-ancestors/

Cummins, Eleanor. 'Inside One of the World's First Human Composting Facilities'. *The Verge*, 3 Oct. 2022.
https://www.theverge.com/c/23307867/human-composting-process-return-home

Part II

ESSAYS

SOIL'S METABOLISMS

Ithaca, New York:

Behaviour instead of Identity: Functional Complexity of Organic Matter as an Organising Principle in Soil Ecosystems

Johannes Lehmann

Organic matter in soil possesses an enduring allure. This is not only because soil houses the largest pool of carbon in terrestrial ecosystems – more than all plants on earth and the global atmosphere together. Nor is it solely because organic matter is the most important indicator of soil health. Organic matter is also alluring because it escapes easy characterisation. After centuries of scientific investigation, the research community is still arguing about what comprises organic matter in soil and why it exists in the first place. The prevailing notion (even though specialised textbooks begin to change their treatment of the subject) is that soil organic matter consists of humus composed of various forms of humic substances and that the identity of these humic substances determines a particular soil's behaviour. Here I critique the idea of 'humus' and the focus on identity that goes along with that idea in favour of a focus on behaviour. Such a shift in perspective allows fundamental questions to be asked about the role of functional complexity between (rather than the identity of) constituents in soils as well as interactions in ecosystems in general, including in the human societies.

In this essay I argue that our questions also hold on to outdated notions of soil: when we ask 'how can we stop losing organic matter?' or 'how can we add more organic carbon to sequester atmospheric carbon dioxide?' we are mobilising an idea of soil as being controlled by a specific chemical identity (i.e., humus) that does not correspond to how soil actually works. I posit that the behaviour of soil organic matter determines its identity, not the other way round.

A leaf added to a Petri dish mixed with soil microorganisms in the lab decomposes remarkably quickly: within days or weeks, the organic carbon in that leaf is fully turned into carbon dioxide. In contrast, the same organic carbon atom from that leaf added to an actual plot of soil may remain detectable in that soil as an organic compound for millennia. What explains this dramatic difference? The historical explanation was 'humification'. Humification was the process by which microorganisms in soil eat (a scientist would say 'metabolise') small bits and pieces of decomposing plant residues to make large and complex

DOI: 10.63308/63897247289532.ess01

molecules (containing many different chemical bonds). In older textbooks these newly-made molecules are called 'humic substances'. And scientists surmised that these humic substances (in some theories, together with 'non-humic substances') comprise 'humus'. Such 'humic substances' accrue over time in soil because they are recalcitrant in both their size and chemical composition: too big or too 'complex' in their identity to be eaten by microorganisms.

Despite its popularity, there were always conceptual and analytical challenges to the humic paradigm: why would microorganisms invest energy in making these large and complex molecules? It made no ecological sense. Secondly, the proof that humic substances existed and their quantification and isolation rested solely on the fact that they were soluble and extractable in an alkaline solution (Kleber and Lehmann 2019). An extraction is a process whereby a certain proportion of matter is brought into solution for further analysis. Think of your tea or coffee, which are extracts of tea leaves or coffee beans. Not all the tea leaves or beans are in the solution, just whatever is soluble in hot water that we drink. Some of the tea leaves or coffee grounds remain in the tea bag or filter paper. This is in some ways selective (*only* what is soluble in hot water) and at the same time general (a lot of different molecules in a tea leaf are soluble in hot water). Extraction on its own may therefore not be a suitable approach for defining a substance (as done using an alkaline extraction to define 'humic substances').

The history of humic substances research is long and not in all its facets sufficiently explored. It is generally assumed that Carl Friedrich Achard is the scientist who came up with the approach of using alkali solution to extract organic matter from soil in the late eighteenth century (Achard 1786). Achard was actually only interested in examining the value of peat as a fuel, and did not use the method he came up with to define humic substances. That happened decades later and we do not need to go into further detail here about how the method of extraction became the definition of humic substances.

With the onset of modern spectroscopy and spectromicroscopy, which allowed us to look more closely into soil, it became clear that we did not need the notion of humic substances to explain soil organic matter. It was sufficient to consider known decomposition products from soil biota. With the tools of spectroscopy and microscopy, we could observe that soil is a complex mixture of compounds that microorganisms make (their own biomass, exudates, enzymes, etc.). We could now understand the reason for their production as a result of a living microbial population, of the need to make enzymes to access nutrients and carbon or to get rid of toxic material, not as a new substance for which the ecological reason remains unexplained. Furthermore, 'humic substances' as defined by extraction using alkali solution do not exist at the molecular scale at which they should occur

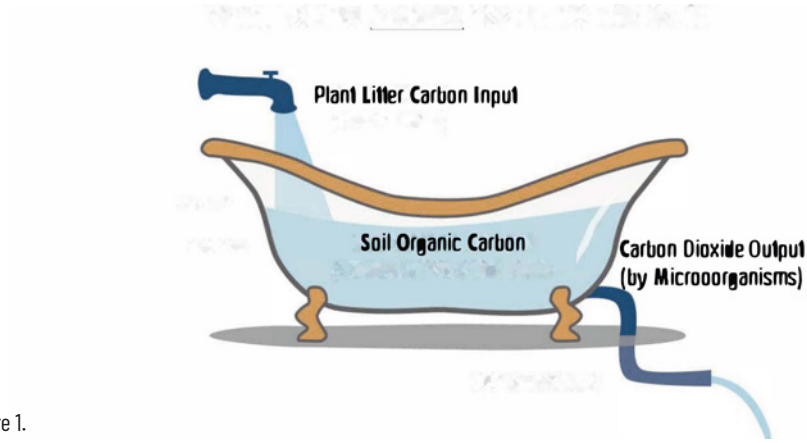


Figure 1.

Bathtub analogy of why there is soil organic carbon as a balance between input (plant input of photosynthetically fixed carbon) and output (carbon dioxide). Soil organic carbon can flow out of the bathtub in principle, but it does not, because the pipe going out is controlling the output.

(Lehmann et al. 2008). When we looked for evidence of the chemical signature of what can be extracted by an alkali solution (and what is then called 'humic substance') with an electron microscope, we came up empty-handed.

Why is it important to know whether 'humic substances' exist or not? If the recalcitrance of a substance (as in, its ability to resist being eaten by microorganisms because of its chemical structure, as described for 'humic substances') is not the reason for the accumulation of organic carbon in soil, what is? Finding the answer to this question helps us also understand how to better manage and care for our soils.

Given contemporary biogeochemical evidence, we should rather think of soil as a spatially and compositionally highly complex ecosystem that is constantly in flux, where temperature and moisture change all the time and often change rapidly. Organic carbon can accrue because it *is not* metabolised to carbon dioxide, and not because it *cannot* be metabolised (Lehmann et al. 2020). Such a shift in thinking would mean that we cannot truly 'sequester' or 'lock up' carbon in soil, akin to using a key that locks a door to store our carbon, and walk away – but have to instead adopt a notion of 'constant care' (Janzen 2024), whereby we curate the inputs and outputs from the soil. This is what Henry Janzen (2024) calls 'stewardship'. By adding more carbon and losing less, we maintain or possibly increase the organic matter in soil that is truly a flow-through reactor of transient carbon rather than a storage container of static carbon (Figure 1).

Another important aspect that must be reassessed when questioning extracted

'humic substances' is that an 'average soil' does not exist. Using very fine-scale investigation with the help of synchrotron radiation (in essence a very powerful electron microscope that not only gives us the spatial features of soil at 10s of nanometres, way finer than a human hair, but also a lot of information about its chemical composition) it became clear that the average composition of soil organic matter cannot be found at a fine spatial scale, where these substances should occur. This is a profound and important insight with far-ranging implications for our understanding of why soil organic matter exists and how we can manage soils for crop production as well as other soil health aspects including carbon accrual and consequent climate change mitigation.

We can visualise this with a simple experiment of making a fruit smoothie: take three different fruits (apple, pear, melon?) and mix them together in a blender (Figure 2). The first question is: have we made a new fruit? No. The smoothie is still a mixture of three fruits, not a new fruit. When we drink the smoothie, we sense a taste that is not only very difficult to identify (try it with your friends), but also has a taste distinct from the three fruits individually – even though we have made no new fruit. We made a taste that in some ways is an average of the three fruits (not exactly, but that is not important for the argument being illustrated here). At the same time, we know that this taste is a mixture of existing tastes, not new fruit. And if someone is allergic to apples, it is important to know that there are still apples in the smoothie. In the same way in soil biogeochemistry, we have to know what compounds are in the complex mixture of soil organic matter, and the average composition is not sufficient to explain interactions between actually existing molecules and minerals or microorganisms, because the average fruit does not exist in a smoothie. Similarly, the average in this situation is a meaningless way of looking at and explaining soil organic carbon properties and behaviour, and 'humic substances' extracts will always be an average of what can be extracted. Since there is no other method to characterise, identify or quantify 'humic substances' than by an alkaline extraction, 'humic substances' are not a helpful way to truly understand soil organic carbon.

The shift in scholarship from sequestering recalcitrant 'humic substances' to caring about feeding and housing diverse actors with diverse substrates is much more in line with Donna Haraway's assertion that 'Human as humus has potential' (Haraway 2016). I read Haraway's essay as a proposal to see humans as a part of an ever-changing ecosystem with numerous interactions between a diverse set of actors, analogous to soil with its myriads of different microbes. In the new scientific view beyond 'humus', the persistence and resilience of soil organic matter is a product of what we called 'functional complexity' (Lehmann

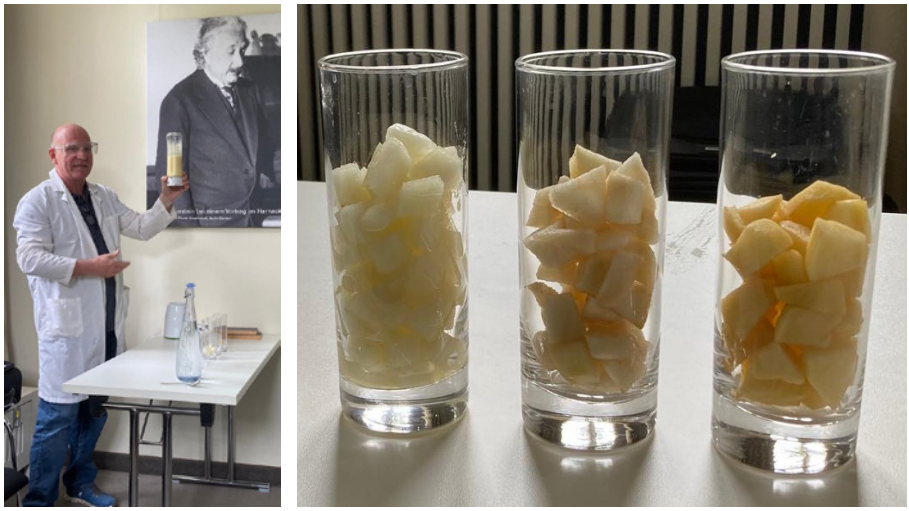


Figure 2.

Fruit smoothie experiment as a performance on 'humic substances' at the workshop 'Thinking from the Substrate', 3–6 June 2024, Harnack House, Max Planck Institute, Berlin, organised by Emily Brownell. Photos: courtesy of Amiel Bize (left); by the author (right).

et al. 2020). This means persistence no longer has to do with material recalcitrance as a result of size (e.g., too big to be eaten by microorganisms); and it also means that there is not a one-time fix with which we can 'lock carbon away'.

This shift to a view consistent with care rather than size or 'strength' not only aligns better with experimental evidence but is also more in line with historical and contemporary attitudes towards soil and soil health. I therefore propose to see organic matter persistence as a question about behaviour rather than identity. What I mean by 'behaviour' includes mineral interaction (such as adsorption) or solubility, as well as the movements of molecules or soil biota that are all known to be pivotal in determining how much organic matter is in soil. By contrast, the 'identity' of soil refers to its molecular size or chemical bonds, or its elemental composition. Behaviour is influenced by identity, but not solely determined by it: the extent of adsorption of a molecule to a clay particle will be strongly influenced by whether the molecule is positively or negatively charged or not charged at all, but also clay properties will matter, such as the amount of their surface area, and whether the soil is dry or wet, cold or warm, all environmental properties (Schmidt et al. 2011). What the persistence of

soil organic matter is, will then be a result of many factors: it is therefore not its property or identity but its behaviour that we need to monitor and curate.

A shift in scholarship is therefore warranted for many reasons. And this proposed shift (Lehmann and Kleber 2015) would not only be based on observational evidence and logic but also allow a more meaningful and forward-looking engagement with soil processes as argued in this essay. Would such a shift also change how we view human identity and behaviour?

References

Achard, F.C. 1786. 'Chemische Untersuchung des Torfs'. *Crell's Chemical Annals* 2: 391–403.

Haraway, D. 2016. 'Tentacular Thinking: Anthropocene, Capitalocene, Chthulucene'. *E-Flux Journal* 75: 8/16.

Janzen, H.H. 2024. 'Soil Carbon Stewardship: Thinking in Circles'. *European Journal of Soil Science* 75: e13536.

Kleber, M. and J. Lehmann. 2019. 'Humic Substances Extracted by Alkali Are Invalid Proxies for the Dynamics and Functions of Organic Matter in Terrestrial and Aquatic Ecosystems'. *Journal of Environmental Quality* 48: 207–16.

Lehmann, J., D. Solomon, J. Kinyangi, L. Dathe, S. Wirick and C. Jacobsen. 2008 'Spatial Complexity of Soil Organic Matter Forms at Nanometre Scales'. *Nature Geoscience* 1: 238–42.

Lehmann, J. and M. Kleber. 2015. 'The Contentious Nature of Soil Organic Matter'. *Nature* 528: 60–68.

Lehmann, J., C.M. Hansel, C. Kaiser, M. Kleber, K. Maher, S. Manzoni, N. Nunan, M. Reichstein, J.P. Schimel, M.S. Torn, W.R.Wieder and I. Kögel-Knabner. 2020. 'Persistence of Soil Organic Carbon Caused by Functional Complexity'. *Nature Geoscience* 13: 529–34.

Schmidt, M.W.I., M.S. Torn, S. Abiven, T. Dittmar, G. Guggenberger, I.A. Janssens, M. Kleber, I. Kögel-Knabner, J. Lehmann, D.A.C. Manning, P. Nannipieri, D.P. Rasse, S. Weiner and S.E. Trumbore. 2011. 'Persistence of Soil Organic Matter as an Ecosystem Property'. *Nature* 478: 49–56.

British Mandate Palestine:

'The Fertility of the Soil is in Your Hand': On Manure and the Colonial Roots and Branches of the Organic Movement

Tamar Novick

To substantiate the ideas he was about to present to the British Royal Society of Arts, the newly knighted Albert Howard, considered the founder – or the twentieth century's most important advocate – of organic farming,[1] needed some data. It was the summer of 1935, and the agricultural scientist and retired colonial botanist promoted his views on soil health among English scientists and farmers. This followed more than twenty years of working in India, where he developed a composting method, known as the Indore process (named after the Indian city in which he directed the Institute for Plant Industry). He then invested in the process' application across colonial contexts as well as at home. Diverse sets of data were necessary to demonstrate the value of this method, to contrast the growing appreciation and desire for artificial fertilisers, and to establish his authority within his professional community in England. In the following months, the text would be published and widely circulated, and, shortly after, Howard would publish a series of books, starting with his 1940 *An Agricultural Testament*, which carried and popularised the message of organic farming across the Anglo-American world and beyond.

As part of his preparation for the Society lecture, Howard turned to British Palestine's Director of Agriculture and Forests. Morley Thomas Dawe, himself a botanist and a collector who held posts in numerous colonial contexts in Africa and Latin-America before arriving in Palestine, had a year earlier voiced interest in applying the Indore process to turn animal, human and vegetable waste into manure. When Howard needed data, he reached out to Dawe, reminding him of his 'interest in the Indore method of converting agricultural waste into humus, and [that that] foreshadow[ed] some actual work on this subject. I should be deeply grateful if you could send me a short account of any work you have in hand and, if possible, of the results so far obtained' Howard also noted that he could 'insert a reference to the Palestine work before the lecture goes to press', and

1 See, for example, Hershey 1992: 267.

DOI: 10.63308/63897247289532.ess02

that in return he would 'send copies of the lecture for distribution in Palestine'.[2]

Dawe's reply, about six weeks later, was rather succinct. He admitted that 'very little has been done in connection with the utilization of agricultural waste in conjunction with night soil' in Palestine. One small experiment was being held at the time in Jerusalem, but there were no results just yet. In principle, he explained, there was a 'dearth of agricultural waste, but in instances where there might be a sufficiency there are not adequate measures for collecting night soil'. Additionally, the Department of Medical Services was examining municipal schemes' plausibility and, in the meantime, a commission was about to travel to Egypt 'to study this question there'.[3] Plans for turning refuse into manure were preliminary, in other words, but the issue was being discussed and examined on several fronts.

Historians of the global organic farming movement have pointed to its entanglements with far-right politics and fascism in Europe,[4] and showed that its early theoreticians and advocates were inspired by East and South Asian agricultural practices of using bodily waste in the fields.[5] Howard in particular repeatedly referred to the long history of Chinese use of night soil, and discussed how witnessing Indian peasant practices inspired the development of his method and ideas. Yet the deep colonial roots of the organic farming movement, the far-reaching colonial circumstances to which it was applied, as well as how these were foundational to the success and credibility of the advocates, have been largely ignored in the literature. Using the case of Palestine, this essay considers the colonial foundations of organic farming and how, in turn, colonial networks and actions shaped local possibilities of relating different bodies to the soil. It demonstrates that, rather than merely a reaction to the industrialisation of agriculture and the proliferation of chemical fertilisers, the organic movement grew out of multi-contextual colonial concerns about soil health, land, urbanisation and political conflicts.

The common story depicts twentieth century organic farming as a marginal movement, which started gaining traction with the growth of the North Ameri-

2 A. Howard, London, to M. T. Dawe, Director of Agriculture & Forests, Jerusalem, 8 Aug. 1935, Israel State Archives [henceforth ISA]/Mem-22/635.

3 Directory of Agriculture and Forests, Jerusalem to Albert Howard, London, 20 Sept. 1935, ISA/Mem-22/635.

4 For the English context see Conford 2001; for Germany see Treitel 2017.

5 Conford 1995. I use 'bodily waste' to refer to bodily excreta of either animal or human source, thereby considering both 'agricultural waste', or animal manure, and 'human waste' along similar lines. Organic farming has relied on bodily waste in its varieties. For further analysis of the category of bodily waste, see Novick and Pirogovskaya 2025.

can environmental movement in the age of Rachel Carson's *Silent Spring*, in the 1960s–1970s. According to the standard narrative, it largely operated as counterculture, an alternative to the capitalist and chemical fertilisers-based food production economy, until the emergence of the large- and global-scale organic food industry of recent decades. As Philip Canford argued for England, however, the early organic farming movement was not ignored or disregarded by state institutions or the public, but was taken seriously, especially by the fertilisers industry, until its marginalsation in the interwar and post-WWII periods.[6] This article goes further to demonstrate that organic farming became central to colonial structures and plans. Moreover, the example of Palestine illustrates that, not only was it not marginalised, but it also endured and became institutionalised by mid-century, even when composting and recycling schemes were ultimately not integrated into large-scale waste management systems. While plans to make use of municipal sewage ultimately failed, the Indore process took hold within Jewish agricultural settlements and in Israeli agricultural schools, and state officials and institutions continued to be occupied with manure and promote its production.

Searching for Night Soil in Palestine

The belief that agricultural waste was scarce, as Dawe put it, was characteristic of the heated discussions held among state officials and Jewish settlers in 1930s Palestine, which was under a British rule (1917–1948). With the intensifying citrus industry, which was gradually and exponentially dominated by Jewish settlers,[7] manure was in high demand, along with the growth in chemical-fertilisers use, which gained prominence by mid-century. As Omri Polatsek has shown, during this transitional period, the British government was very concerned with the 'manure problem', which threatened the success of this industry,[8] so pleasing to the English palate. Settlers were discussing the importance of manuring the soil, noting that 'it has been the common practice to fertilise the Citrus groves with animal manure as the local orchards are closely planted and the Citrus trees withdraw soil'.[9] They turned to Palestinian peasants and Bedouins as a source for manure. While animal droppings were

6 Conford 2002.

7 Kabha and Karlinsky 2021.

8 Polatsek 2023.

9 L. Marcus, Secretary of the Citrus Growers Section (of the Jewish Farmers Federation), to the Director of Agriculture & Forests, 21 Jan. 1934, ISA/Mem-8/648, p. 1. On p. 4, Marcus explains further the meaning of withdrawing soil, noting that 'experience has shown that for

a key component in nourishing the Palestinian subsistence economy, settler argued that Palestinian Arabs were not accustomed to using manure for the benefit of their crops, and that they greatly benefited from settlers' own efforts and knowledge in this matter.[10] Settlers' search for growing amounts of animal manure for the citrus industry created unprecedented movement of waste across the country, a trade which resulted in numerous conflicts and the depletion of the soils from which the droppings were collected or stolen.[11]

As the Ministry of Agriculture and Forestry was trying to deal with this shortage, it operated on several levels. Principally, the government attempted to regulate the movement of manure and initiated a series of limitations and prohibitions on its trade, burning (including for heating) and export. Various importation schemes from Syria, Lebanon and Transjordan were initiated by Palestinian Arabs and Jewish settlers and supported by the government.[12] Additionally, poudrette – a fertiliser made of dried human or animal waste – was imported from Egypt for a while, until the Egyptian government began regulating its own manure trade as well.[13] Within those limiting circumstances, state officials also sought other options, including turning town refuse into manure. As one agricultural office argued, 'all towns that already have a sewage system, should be encouraged to make use of the sewage water for the preparation of organic manure'.[14]

Not only bodily waste, of either animal or human origin, but also knowledge about ways of processing it and putting it to use were in high demand. To examine the possibility of turning refuse into manure, state and municipal officials – many of whom were moving between different British colonial contexts – sought to learn from other, mainly colonial, examples. Throughout the 1930s, two main models were being discussed and examined: the processing of bodily waste into compost outside in the open or, alternatively, within a concrete structure divided into cells. The latter approach, which was developed in Italy, was referred to as the Beccari process, or its later development the Boggiano-

the production of their fruit Citrus trees withdraw great quantities of food materials from the soil which they obtain mostly from the animal manure'.

10 Moshe Smilanskly quoted in Polatsek 2023: 57–58.

11 Polatsek 2023: 65.

12 Ibid. See, for example, M.T. Dawe, Director of Agriculture and Forests, to the Director of Medical Services (copy to the Directior of Customs, Excise and Trade), 2 Oct. 1934, ISA/Mem-3/33.

13 S. Antebi, Agricultural Officer, to M.T. Dawe, Director of Agriculture and Forests, 8 June 1933, ISA/Mem-8/648, p. 1.

14 Ibid, p. 2.

Pico process, centred on constructing an indoor ventilated fermentation plant, and was favoured by public health professionals. According to a 1931 report produced by Yousif Milad of the Egyptian Ministry of Agriculture, and read by his equivalents in Palestine, the process was based on soaking garbage in water and placing it in closed cells that were heated enough 'to kill all pathogenic organisms and to cause a rapid decay in the material'. At the time, it was patented or being trialled in Switzerland, France, Denmark, Sweden, Germany, Spain, the US and Argentina.[15]

In contrast, the first approach, which necessitated little investment in construction or machinery, was based on the use of large plots of land and many working hands, combining animal droppings and vegetable waste with a urine-soaked soil. This was the principle driving the Indore process that Howard developed and promoted, and which Dawe in Palestine sought to learn more about.

Urine Earth: Organic Farming and Colonial Networks

Like other European theoreticians before him, such as Jusus von Liebig with his chemical model of soil fertility, as well as Karl Marx in his notion of the 'metabolic rift',[16] Howard relied on 'the law of return', namely, the idea that living organisms and the soil sustain each other, and that waste materials should return to the soil to nourish it.[17] Separating waste from the soil was increasingly understood as a major indication of the problem inherent to capitalist agriculture. Further, not unlike other Europeans of his time, Howard was deeply inspired by Chinese and other East-Asian composting practices and using human and animal waste for agricultural processes.[18] Interestingly, this fascination with

15 Dr. Yousid Milad, Horticultural Section, Report No. 4: 'Possibilities in making Organic Manure from Garbage and Street-Refuse in Egypt', submitted to the Sub-Committee of the Agricultural Advisory Council, April 1931, ISA/Mem-22/635, pp. 4–5.

16 Marchesi 2020; Foster and Magdoff 1998: 49–50; Davidson and Carreira da Silva 2024: 5–7.

17 See, for example, Barton 2018: 9.

18 Howard referred and paid tribute to US American agricultural scientist Franklin Hiram King, who observed composting and other agricultural pracitces in China, Korea and Japan in an eight-month tour in 1909. See Paull 2001. Jörg Henning Hüsemann discussed early Modern European interest in Chinese manuring practices in '"A Matter Difficult to Handle" – Waste and Value in European Accounts of Chinese Agriculture', paper presented at 'The Waste of the Body' workshop, Max Planck Institute for the History of Science, Berlin, 6 July 2022.

Chinese manuring practices emerged at times when the nationalist and then communist Chinese states were concerned with the health risks that manure posed, and were trying to control and reform the vibrant night-soil industry with the rise of what Ruth Rogaski termed 'hygienic modernity'.[19] This process should also be understood in relation to large-scale colonial forms of bodily control, the racialisation of excretory habits and the emphasis on personal hygiene, or 'excremental colonialism', as Warwick Anderson terms it.[20]

Howard's work during his long colonial tenure in India was fundamentally shaped by this corpus of knowledge, and then by his observations of Indian peasantry practices. These, as he stated explicitly, were the foundations of the Indore process, or as one 1980s report on composting phrased it, during his time in Indore, Howard 'began to systematise the traditional compost procedures'.[21] The Indore process stood on three pillars: animal droppings, vegetable waste and (human or animal) urine. Howard emphasised its simplicity:

> The Indore process itself is very simple. It consists in using the fungi and bacteria, which occur in Nature, as agents to break down suitable mixtures of vegetable and animal wastes - the residues of the operations of the farm itself. By arranging these mixtures in the proper way and in the right proportions, and by controlling by the simplest means, namely, by watering and turning, the supply of moisture and air, these wastes are transformed in about ninety days into finely divided humus, rich in the foods required by growing crops. The process can be adapted to climate by manufacture either in shallow pits or low heaps. No buildings or expensive plant are required, nor are pure cultures of the organisms.[22]

As part of the process, vegetable and animal wastes are piled up and applied with what he termed 'urine earth' – soil soaked with urine – which Howard understood to be the key substance in the manufacture of humus, yet 'much of this vital substance for restoring soil fertility is either wasted or only imperfectly utilised. This fact alone would explain the disintegration of the agriculture of the West.'[23] In the minute details of managing soil fertility lies the drama of civilisation and its decline.

Upon returning to England, Howard was occupied with advocating the Indore processes to a variety of colonial contexts and in his home country. In his correspondence with Dawe in Palestine, in the mid 1930s, he argued that 'the ordinary Indore process for the conversion of agricultural waste into humus

19 Barnes 2023.

20 Anderson 1995.

21 Rabbani et al. 1983.

22 Howard 1935: 28.

23 Howard 1943: 35.

is making very rapid progress in many countries, particularly in the plantation industries (tea, coffee, coconuts, etc.)'.[24] Specifically, as he discussed in a series of publications published during that period, the process was being trialled in many parts of colonial India, such as Travancore (in current-day Kerala), the Rajputana region (current-day Rajasthan), in the north-west, Sakrand (current-day Pakistan) and the rest of the Sindh province, Punjab, the Nizam dominion, Bengal, as well as in colonial Ceylon (today's Sri Lanka). It was also used in several parts of Kenya, near Nairobi and in Taveta, and apparently 'visitors from other parts of Kenya, the Rhodesias, Uganda, Tanganyika [in current-day Tanzania], and the Belgium Kongo' came to witness the process in action.[25]

Governmental officials in Palestine, seeking solutions to the manure problem, inquired about both methods – open-air and closed-cells – as possible approaches to turning refuse into manure. Dawe sent Jaffa's municipal engineer to Nicosia in colonial Cyprus, to examine the British-initiated plant there.[26] He also corresponded with the Brevetti-Beccari-Valtancoli company, who patented the Beccari closed-cell process, to ask for copies of the relevant literature and the patent documents.[27] Dawe then turned to the Institute of Plant Industry with a similar request,[28] but this was after Howard's time there. Palestine's director of medical services explained further that, in comparison to the so-called Italian process, 'attention has been directed to the method adopted in Indore and in Mysore City, India', noting that this method was also being introduced to Suez, Egypt, which was under British control.[29] He then argued that this process fits the context of Palestine better due to its simplicity and affordability, and suggested trialing it in Jaffa.[30] In 1936, the sanitary surveyor of the city of Haifa, was sent to inspect and report on the plant in Suez, where

24 Albert Howard, London, to M.T. Dawe, Director of Agricuture and Forests, Jerusalem, 30 Nov. 1934, ISA/Mem-22/635, p.2.

25 Howard, 1935.

26 M.T. Dawe, Director of Agriculture and Forests, Plaestine, to D.L. Blunt, Director of Agriculture, Nicosia, Cyprus, 23 Jan. 1934, ISA/Mem-22/635.

27 M.T. Dawe to Messes. Societa Anonimal Brevetti 'Beccari-Valtancoli' Co., 23 Jan. 1934, ISA/Mem-22/635.

28 M.T. Dawe to Secretary, Institute for Plant Industry, Indore, Central India, 22 July 1934, ISA/Mem-22/635.

29 Acting Director of Medical Services to Director of Agriculture and Forests, 3 Sept. 1934, ISA/Mem-22/635.

30 Director of Medical Services to Director of Agriculture and Forests, 7 Nov. 1934, ISA/Mem-22/635.

he was accompanied by a member of the Rockefeller Foundation.[31] In addition to these regional plants which representatives were sent to observe, Dawe and his successor, F.R. Mason, collected information about the implementation of the composting method in various other contexts such as Australia, Rhodesia, Germany, Malaysia (from Mason's own experience during his previous colonial post) and England.[32]

In Your (Prisoner's) Hands

In Palestine by the mid 1940s, concrete plans for turning the refuse of Jaffa, Tel-Aviv, Haifa, Rehovot and Jerusalem into manure were being executed or developed.[33] The mayors of Bethlehem and Beit-Jala also voiced their interest.[34] Several private Jewish entrepreneurs proposed their own methods and services as the basis for such municipal plans.[35] One of them was an Italian Jew, an owner of citrus groves in Palestine, who acquired the patent rights for the 'Beccari process' of closed-cells in the country.[36] Additionally, experiences in compost-

31 Sanitary Officer, Haifa to the Director of the Ministry of Agriculture and the Director of the Ministry of Health, 'Town Refuse as a Fertilizer', 16 March 1936, ISA/Mem-23/5082; Also appears in ISA/Mem-22/635.

32 Extract from the *Rhodesia Agricultural Journal* **31** (11) (Nov. 1934), ISA/Mem-22/635; 'A Method of Utilizing Waste Products in(?) Farm Usually Adopted by Australian Farmers', undated, ISA/Mem-22/635; Irrigation Officer to General Agricultural Council, 7 July 1938, 'Utilisation of Sewage for Dry Manure', ISA/Mem-22/635; F.R. Mason, Director of Agriculture and Fisheries, to Chief Secretary, 26 Feb.1942, ISA/Mem-22/635; Colonial Offfice, Westminster, to F.R. Mason, Director of Agriculture and Fisheries, Jerusalem, 2 Aug. 1944, ISA/Mem-22/635.

33 See, for example, J. Green & Co. (Palestine LTD), Tel-Aviv, to Mayor of the Municipal Corporations, Haifa, 'Town of Haifa: Centre for the Treatment of Town Refuse by Biological Fermentaion in Silos by Boggiano Pico Process', 30 Jan. 1947, ISA/Gimel-24/2791.

34 B.C. Gibbs, District Commissioner, Jerusalem, to Director of Medical Services, 'Disposal of Refuse, Bethlehem', 10 Oct. 1933, ISA/Mem-22/635; District Commissioner, Jerusalem, to Director of Agriculture and Fisheries, 14 June 1946, ISA/Gimel-24/2791.

35 'Yakhin' Agricultural Contracting Co-operative Association, Tel-Aviv, to M.T. Dawe, Director of Agriculture and Fisheries, Jerusalem, 10 Feb. 1937, ISA/Mem-22/635; A.L. Estermann and Eng. A. Hausdorff, Tel-Aviv, to Department of Agriculture, Jerusalem, 'Memorandum, relating to the disposal and transformation of gargabe into manure', 29 March 1942, ISA/Mem-22/635; Palestine Industrial Undertakings Ltd. To Director of Agriculture and Fisheries, undated, ISA/Mem-22/635; J. Green & Co. (Palestine) LTD, to Mayor of the Municipal Corporations, Haifa, 30 Jan. 1947, ISA/Gimel-24/2791.

36 Agricultural Officer, Jaffa, to Chief Agricultural Officer, 'Organic Manure', 14 Jan. 1937, ISA/Mem-22/635. The patent rights for the later development, the 'Boggiano-Pico process',

ing within Jewish agricultural settlements, as well as the question of fitting the method to Palestine, were discussed in the Jewish settler agricultural journal, *Hassade*.[37] Palestine's unique political composition, and the settler population's emphasis on enhancing its agricultural economy, had arguably made more room for examining composting alongside other forms of soil fertility enhancement, such as chemical fertilisers.

For over a decade, state officials debated which approach to composting would fit Palestine best. As a bacteriological approach to medicine was strengthening during a period of intensifying urbanisation, public health and soil health were tied in new ways. With a growing concern about health risks, the ventilated closed-cell process, in which pathogenic organisms were supposedly killed, was understood to be the safest. Major G. Howard-Jones, a British agricultural representative in Lebanon, discussed the problem of manure as a regional one, and believed that city refuse held great potential. In a presentation he gave at the 1944 Middle East Agricultural Development Conference, which was held in Cairo, he discussed the establishment of a new closed-cell plant for processing refuse in Beirut, and explained why Middle Eastern cities are particularly prone to challenging refuse:

> Those who are only familiar with Europe will think of town refuse as containing chiefly coal cinders, waste paper, tin, bottles and so one, with comparatively little vegetable and animal matter but it is a well-known fact the further once proceeds south, the higher is the proportion of fermentable material in town waste … Such town waste is very noisome and objectionable, and thought it could be fermented in the open air rather like composting, the mass is so smelly, attractive to rats, mice and flies, and so infected with pathogenic germs that this really could not be considered healthy under any circumstances.[38]

With the closed-cell plant opening in Beirut in 1943, and another planned for Cairo, colonial state officials initiated a regional conversation and exchange of information, materials and experts. Professionals from Egypt, Palestine and Lebanon corresponded about manuring processes, and some visited the new plant.[39] Samples of the manure products were also sent to the Palestine

were Green & Co. Ltd., Tel-Aviv, see 'Note on the Boggiano-Pico Process', undated, ISA/Gimel-24/2791.

37 S. Antebi, Agricultural Officer, Jaffa, to Chief Agricultural Officer, 24 Dec. 1936, ISA/Mem-22/635.

38 Major G. Howard-Jones, M.E.S.C. Agricultural Representative, Lebanon, 'Manure from Town Rubbish by the Boggiano-Pico Process', presentation at the Middle East Agricultural Development Conference, Cairo, Feb. 1944, ISA/Mem-16/662.

39 Stedman Davies, Controller of Agricultural Production, to Chief Secretary, 14 Dec. 1944, ISA/Mem-22/635; R.D. Badcock, Municipal Corporation, Jerusalem, to F.R. Mason, Di-

governmental experimental station in Acre to test their value and potency.[40]

In addition to the tension between public and soil health, the debate about manure was entangled with changing relations between soil and land as well as Palestine's land question more generally. The Indore open-air process was understood as unfitting to the context of Palestine because it required much land and labour, which were both very expensive.[41] Yet, despite that growing preference for the closed-cell approach over composting, especially when municipal refuse was concerned, the Indore process remained under consideration and was applied in Jewish settlements. As the discussions about composting became systematised, the different approaches were examined in relation to one another at the colonial Acre station; the trial compared manure produced in the Beirut plan with 'compost prepared at Acre by the Indore Process' as well as 'Ordinary Farm-yard manure'. The results showed that 'all three organic manures had little or no effect on yield in the presence of chemical fertilisers, but gave marked increase in the absence of the latter'.[42] Not only did chemical fertilisers have an advantage, but the various composting methods did not seem very different from one another.

The Acre station experiment followed a proposal to use the station grounds for turning Acre city's refuse into manure. Noting that the patent holders were unlikely to be interested in erecting a closed-cell plant in Acre (supposedly due to the small scale of its refuse), Mason argued that 'consideration will be given to the possibility of open air composting of the Acre municipal refuse on the Government Farm',[43] thereby solving the problem of land required by the Indore process. To deal with the need for working hands, the Acre farm manager suggested 'the use of selected prison labour so that the work could be done cheaply and at the same time give the village prisoners an excellent

rectory of Agriculture, Jerusalem, 7 Feb. 1945, ISA/Mem-22/635.

40 J.C. Evre, for Director of Agriculture and Fisheries, to Manager of Government Farm Acre, 23 Feb. 1945, ISA/Mem-22/635.

41 See, for example, Minutes of the 36th Meeting of the G.A.C, 10 Feb. 1937, ISA/Mem-22/635. This stands in contrast to debates about the use of manure for mid-19th century US, where labour was expensive but land relatively cheap, in Stoll 2002.

42 Senior Agricultural Assistant, the Governmental Farm, Acre, to Director of Department of Agriculture and Fisheries, 'Results of Manure Trials from Beirut', 23 Aug. 1945, ISA/Gimel-24/279, p. 2.

43 F.R. Mason, Director of Agriculture and Fisheries, to Chief Secretary, 28 Nov.1946, ISA/Gimel-24/279.

opportunity of learning this semi-skilled work'.[44] Reports on the pilot programme of composting of Acre's refuse continued throughout the following year, 1947, highlighting the offensive nature of the fresh material. While no flies or rats were seen around the heaps, 'hungry dogs from the vicinity were a nuisance'.[45] With the end of the British rule in Palestine and the outbreak of the 1948 war, the Acre station and the most concrete composting programme in Palestine were dismantled.

The newly formed Israeli ministry of agriculture continued its preoccupation with manure, and different municipal bodies considered encompassing refuse management plants as part of the construction of urban sewage systems. Many of the same Jewish entrepreneurs, such as the Green & Co., continued proposing different composting methods and the construction of plants. One farmer proposed a method of carrying and distributing cow urine in agricultural fields, which he thought should be particularly valuable in the post-WWII circumstances.[46] S. Kalish, a chemical engineer, proposed his own method of turning urban waste into manure. To his proposal Y. Carmon, a member of the Ministry of Agriculture, answered that it is 'a topical matter and there are a lot of possibilities in this direction'. Not unlike his British predecessors in Acre, Kalish planned to deal with the demand for working hands by using Palestinian captives of the 1948 war and later prisoners. Carmon noted that 'it is impossible to base any industry on such conditions. But as long as there are war captives it is a possibility.'[47]

Plans to turn city refuse into manure were ultimately left out of sewage systems, even if not erased completely.[48] But the connection between working hands, manure and soil fertility, as well as the utility of the Indore process, endured. The Association for Organic Waste Workers, a new Jewish Israeli organisation promoting organic farming, started working in collaboration with

44 Manager, Government Farm Acre, to Director of Agriculture and Fisheries, 17 Dec. 1946, ISA/Gimel-24/279.

45 Assistant Station Superintendent, 'Brief Report on Composting of Acre Municipality Wastes', p. 3, attached to a letter from the Manager, Government Farm Acre, to Director of Department of Agriculture and Fisheries, 27 June 1947, ISA/Gimel-24/279.

46 Moshe Avramovitch, Sarid, to the 'Shlush Prize' Committee, Jewish National Fund, undated, ISA/Gimel-18/2190.

47 Dr. Y. Carmon to Mr. Zisling, Agricultural Research, Guidance, and Education Department, 'Mr. Kalish's Proposal', 5 Nov.1948, ISA/Gimel-18/2190.

48 For the example of the Tel-Aviv sewage system plan, see Balslev 2012: 113, 116; A 1966 analysis of composting methods alludes to the existence of closed-cell plants in both Haifa and Tel Aviv. In Kupchik 1966.

the ministry of agriculture after the war. With the slogan 'The Fertility of the Soil is in Your Hand', the association was supplying guidance to agricultural schools, which have been central to the success of the Jewish settlement for half a century, promoting the Indore process across the country.[49]

Under the wings of the Ministry of Agriculture, the association periodically sent a guide to inspect the compost heaps and the ways in which urine was contained and used. In a letter to the heads of agricultural schools, the main inspector of the ministry of agriculture explained that 'the field of organic farming includes managing farm animal waste (urine), the collection of all yard and settlement refuse and their turning into compost, efficient use of sewage water and human waste for compost'.[50] The travelling guide reported on his impressions from the various agricultural schools, and the extent to which students and staff were adequately managing human and animal waste in their fields. Following one of his visits, and much in line with Howard's agenda set two decades earlier, the guide suggested that 'a slogan should be put in place: there is no waste – there is organic matter that determines the fertility of the soil'.[51] The institutionalisation of the process and the importance of manure has been, in this sense, complete.

Conclusion

The colonial examination and advocacy of organic farming intersected with processes of urbanisation and land appropriation, and became tied to questions of relation between soil health and public health and between soil and land. Rather than a mere critical reaction to the industrialisation of agriculture, and during a transitional period preceding large-scale construction of municipal sewage systems and the age of chemical fertilisers, composting methods occupied a formal colonial position. Organic farming methods were understood as proven, important and available means to enhance soil fertility and battle soil depletion across contexts. In British-ruled Palestine, composting plans and

49 See, for example, Reuven Kadosha, Association for Organic Waste Workers, to Agricultural School, Emek Hefer, 12 June 1955, ISA/Gimel-24/2791; Organic Waste Branch to Gronia Rash, Agricultural Education Section, 'Guidance in the Schools', 14 Aug. 1955, ISA/Gimel-24/2791.

50 D. Gazit, Main Inspector, Ministry of Agriculture, to Agricultural School Managers, 7 Nov. 1956, ISA/Gimel-24/2791.

51 Ya'acov Raz, 'General Summary form the Visits to Agricultural School around the Production and Management of Organic Waste, during the months of January, February, and March, 1956', 18 April 1956, ISA/Gimel-24/2791, p. 2.

experiments served demographic, economic, political and land-management goals and changes. Catering to the particular needs of the Jewish settlement population and its forming agricultural economy, and in close connection to regional initiatives, state- and settler-led composing projects became inherent parts of development plans. While composting was ultimately left out of sewage and industrial agriculture infrastructures, the collection and processing of bodily waste were imperative elements in shaping the colonial soil and in determining who worked it.

References

Anderson, Warwick. 1995. 'Excremental Colonialism: Public Health and the Poetics of Pollution'. *Critical Inquiry* **21** (3): 640–69.

Balslev, Yaron. 2012. 'Contaminating and Purifiying Tel Aviv's Beach, 1909–1982' (Zihum Vetihum Sfat Yama Shel Tel Aviv, 1909–1982). *Ofakim Begeografia* 78: 103–21.

Barnes, Nicole Elizabeth. 2023. 'The Many Values of Night Soil in Wartime China'. *Past and Present* **259** (1): 194–228.

Barton, Gregory A. 2018. *The Global History of Organic Farming*. Oxford: Oxford University Press.

Conford, Philip. 1995. 'The Alchemy of Waste: The Impact of Asian Farming on the British Organic Movement'. *Rural History* **6** (1): 103–14.

Conford, Philip. 2001. *The Origins of the Organic Movement*. Place: Floris Books.

Conford, Philip. 2002. 'The Myth of Neglect: Responses to the Early Organic Movement, 1930–1950'. *The Agricultural History Review* **50** (1): 89–106.

Davidson, Joe P. L. and Filipe Carreira da Silva. 2024. 'Decolonising the Earth: Anticolonial Environmentalism and the Soil of Empire'. *Theory, Culture & Society* **41** (6): 3–19.

Foster, John Bellamy and Fred Magdoff. 1998. 'Liebig, Marx, and the Depletion of Soil Fertility: Relevance for Today's Agriculture'. *Monthly Review* **50** (3): 43–60.

Hershey, David R. 1992. 'Albert Howard and the Indore Process'. *Hort Technology* **2** (2): 267–69.

Howard, Albert. 1935. 'The Manufacture of Humus by the Indore Proces'. *Journal of the Royal Society of Arts* **84** (4331): 26–59.

Howard, Albert. 1943. *An Agricultural Testament*. Oxford: Oxford University Press.

Kabha, Mustafa and Nahum Karlinsky. 2021. *The Lost Orchard: The Palestinian-Arab Citrus Industry, 1850–1949*. New York: Syracuse University Press.

Kupchik, George J. 1966. 'Economics of Composting Municipal Refuse in Europe and Israel, with Special Reference to Possibilities in the USA'. *Journal of the Sanitary Engineering Division, American Society of Civil Engineers* 92: 41–56.

Marchesi, Greta. 2020. 'Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century'. *Environmental Humanities* **12** (1): 205–226.

Novick, Tamar and Maria Pirogovskaya. 2025. 'Vital Waste, or the Body Extended'. *Journal of Material Culture* **30** (1) (2025): 3–19.

Paull, John. 2011. 'The Making of an Agricultural Classic: Farmers of Forty Centuries or Perma-

nent Agriculture in China, Korea and Japan, 1911–2011'. *Agricultural Science* **2** (3): 175–80.

Polatsek, Omri. 2023. Fertilizer, Manure and Citrus in British-Ruled Palestine, 1918–1939. MA Thesis, Freie Universität Berlin.

Rabbani, K.R. et al. 1983. *Environmental Sanitation Reviews: Composting of Domestic Refuse*. Environmental Sanitation Information Center, Asian Institute of Technology.

Stoll, Steven. 2002. *Larding the Lean Earth: Soil and Society in Nineteenth-Century America*. New York: Hill and Wang.

Treitel, Corinna. 2017. *Eating Nature in Modern Germany: Food, Agriculture and Environment, c.1870–2000*. Cambridge: Cambridge University Press.

Kwale District, Kenya:

Building Roads, Counting Worms: Soil as a Medium for Parasitic Relations

Emily Brownell

Figure 1.

Kwale District, Kenya, RARP construction site, 1986.
Photo courtesy of David Crompton.

In the early 1980s, graduate students from Cornell University arrived in the Kwale District of Kenya to assess the health status of road workers.[1] I've seen a few pictures. In one, there's a young chap in a bucket hat with curly hair

1 For more on roads and parasites in Kenya, see Brownell 2026.

DOI: 10.63308/63897247289532.ess03

spilling out and down his neck. He is wearing wide legged green trousers and a button-down shirt. His face is out of view as he turns towards a group of men gathered near a woman who is dispensing food and water. There is a white tin cup being refilled and passed around as they take a break. These men are mostly without shirts and shoes. There is, improbably, a shiny white Volkswagen bug in the background of what is otherwise an expanse of dirt, scrub, and palm trees. 'The beauty of a car like that', laughs David Crompton, a retired parasitologist who is showing me the pictures, 'is that the local people would just lift it out if it got stuck.'[2]

Crompton was one of several scientists traveling between road building sites across Kenya collecting enough biological samples and data to measure helminth (parasitic worm) infection rates, anaemia and the general nutritional status of the road workers. A graduate student, Andrew Hall, was also at the Kwale site where he 'went out with a little microscope' and became the 'worm man' processing faecal samples.[3] To put it bluntly, his was an apprenticeship of shit. At one site in West Pokot where there was no lab nearby to take samples, Andrew had to fashion his own. He dug a hole in the ground to partially shelter himself from the hot sun and everyday would strip down to his shorts and step in. Workers would bring him plastic bags of their 'slowly fermenting faeces' when they showed up for work and he would put the faeces in a sieve and pour water over them from a jerry can, prospecting for worms. 'I did, at one point, wonder if I wanted to be a parasitologist', recalled Andrew.[4] But, 'It all worked out. I made some science out of it.' The researchers there were young and starting their careers, experiencing the excitements and monotony of work in the field.

The others in the picture were men from nearby villages who showed up at the site each morning to their own, more arduous, monotony: with only basic hand tools, they cleared away rocks and brush, hacked away at recalcitrant tree roots, dug up soil, carried it in wheelbarrows, emptied it out and compacted it down until a road took shape. The man with the book behind his back – and another man in another photo, fully dressed with a clipboard in hand, pencil poised – were assigned their own tedious task of counting the wheelbarrow loads of soil that each worker moved in a given amount of time, making sure they filled the barrow just to the line demarcated by a splash of white paint.

These men and women (because, despite the photographs, many women also came to do the manual labour of road building) were part of Kenya's Rural

2 Crompton interview 2023.

3 Hall interview 2023.

4 Hall interview 2023.

Figure 2.

Kwale District, Kenya RARP Construction site, 1986.
Photo courtesy of David Crompton.

Access Roads Programme (RARP). RARP began in 1974 and ran for over a decade through funding from the Kenyan Government and an assortment of international aid organisations including USAID and The World Bank. The project emerged as part of a number of efforts funded by the World Bank in low income countries to examine if 'roads, irrigation works, and other necessary facilities' could be built through labour-intensive means to mitigate rising capital costs. The project was hailed as the 'largest labor intensive project in Africa' and donors were excited by the prospect of its expansion and adaption to other places.[5] It was a foray into the potential benefits and rationale of appropriate technology just as the effects of the oil crisis were reverberating around the developing world. The oil crisis devastated national budgets as not only the price of oil, but of a host of other petroleum-based products, became untenably high. This meant that the men and women who were assembled along the roadside in Kwale were there to replace the need for bulldozers and diggers, graders and compactors. They would be paid in Kenyan shillings rather

5 Brokensha and Riley n.d: 2.

than the dearer economic price of US dollars exacted by heavy machinery. By the 1970s, countries like Kenya were shouldering significant debt in order to finance a national infrastructure where roads were the key conduit. Road building was expensive and often required hiring foreign firms, paying expatriate salaries, in addition to machinery and fuel.[6] In the first decade of independence, these more standard arrangements had led to a system of trunk roads across the new nation and now the state's attentions turned to improving the access that rural communities had to this arterial map of Kenya's economy. The state hoped that building up access to rural communities would increase the production of cash crops and food crops. This required fixing, or building from scratch, segments of roads just a few kilometres long as the final step connecting crops to markets. RARP aimed to employ 15,000 labourers in 25 different rural districts to build 7,600 kilometres of unpaved roads by 1982.[7] Using local labour drawn from nearby villages, RARP was an employment project as much as it was a road building project, aimed to help alleviate the nation's alarming levels of joblessness.

But why were there health researchers there? And what about the man with the clipboard? In short, they were there to ensure that human labour remained cheaper than machines. Not only was the logic of RARP based on this, but it would serve as proof of concept for how to organise labour in similar projects where humans were replacing capital intensive machines. To ensure this cost saving, researchers and supervisors were there to find and close the gaps in the metabolic relationship between the human body and soil. If I am to do a more thorough accounting for these pictures of men and wheelbarrows and clipboards, I have left out the most obvious thing in the frame: soil. Soil in piles, deep horizons of soil exposed from digging, soil compacted, and finally soil in the form of a rural road, having absorbed the exertions of the labourers and been fashioned into something new and hopefully durable. The man with the clipboard recorded how efficiently workers could move and shape different kinds of soil into a road. His data collection captured a calculation of time and cubic metres moved. He was likely hired as part of the International Labor Organization project attached to RARP which aimed to quantify, measure and regiment the daily movements of road building, each task time-adjusted for varying soil types.[8]

The Cornell researchers had arrived to determine how parasites and nutri-

6 World Bank Project Performance Audit Report 1991.

7 Brokensha and Riley n.d.: 2.

8 Veen 1980.

tion affected the labour productivity of the workers.[9] Their work was not to monitor an outward relationship between the exertion of bodies and soil, but an inward one. To what extent did Soil Transmitted Helminths (STHs) such as hookworm enervate the working body, making off with its nutritional inputs and inaugurating a cycle of diminishing returns in the externalised form of roads constructed? These moments of data collection stretched out over years of the project with teams visiting a number of sites across the country. Ultimately, they published dozens of studies on the presence and effect of parasites and poor nutrition on worker productivity.[10] And many of these young researchers went on to long careers in parasitology, nutrition and international development.

Together, these interlocutors were trying to identify the points of leakage in the system of road building at a moment where leakages seemed to proliferate. 'Development' as envisioned at mid-century was not unfolding as imagined: parasites abounded. The aspiration of the seamless global flow of goods from producers to consumers was being subverted by the reality that it was often more profitable to disrupt or feed off such flows. Brokers both big and small found places along the fractured channel of production to divert a portion or facilitate its passage.

At the road building site, the various interlocutors were also making the endeavour of building a road into something else: an ILO handbook, a series of scientific studies, the beginning of a career, an exemplar for other countries. In adopting their own attention to such points of weakness and leakage, we might, in another light, identify other parasites in this story than the hookworm pursued by the scientists. Perhaps a variety of researchers who latched themselves on to the project and quite literally tapped and diverted the bodily flows of the road workers? As parasites so often do, they had found an open channel to cultivate. To point this out is not necessarily to moralise these moments of extraction or to suggest that such work did not generate value, scientific or otherwise, but it is to consider it in the same register as hookworm itself. As the French philosopher Michel Serres has written, we might want to reevaluate the parasite not as a mere fringe mode of harmful extraction that has latched on to otherwise productive systems, but see it instead as central to production itself.[11]

Serres categorises parasites loosely into three camps: biological (hookworm), social (human relations) and informational (the static or noise that jams up a system or network. For example, a road as a system and network). This confluence at the side of the road – of medical research and road building – offers

9 For example, Brooks et al. 1979.

10 Latham et al. 1983a; Latham et al. 1983b, Latham et al. 1982

11 Serres 1980.

a way to consider how soil serves as the medium in each of these types of parasitic relations.

In our collective obsession with soil health as a measure for agricultural productivity, we can miss the more mundane ways that soil shapes our world, to great effect and consequence. Because of all the ways soil acts a container for life, it is constantly being remade by the banal transgressions of human, animal and plant life. In this remaking, microbes enter, or organic matter is leached out. Its unending ability to be remade is soil's promise and its peril. Because soil is always more than one thing, it meets a multitude of human needs while simultaneously confounding them. In this case, the fact that it forms the substrate of roads when shaped through human exertion is confounded because, in such interactions, it also becomes the receptacle of human excretion, creating cycles of helminthic infection that prey on the energies of the workers' bodies shaping those very roads. Perhaps road workers during RARP were not exposed to hookworm nematodes during their working day; I do not know. But they certainly carried hookworm and other parasites in their blood. In a 1974 study that examined the fecal matter of 906 roadworkers across four geographical regions of RARP construction sites, seventy per cent were infected with at least one intestinal helminth.[12] And, despite not knowing rates of infection that occurred at these work sites, they are the sorts of environments where hookworm moves easily from person to person. This transmission usually happens through bare feet. When someone steps on a hookworm larva, it burrows into their circulatory system and eventually into the lungs. As it irritates the lungs, it is coughed up into the throat where it hitches a ride into the digestive system and makes a home in the small intestine, feeding on its host's blood and reproducing. Those worm's eggs pass out of the body through excretion and wait for another foot to pass by. Hookworm is not equally distributed in soil across the world; it instead reflects regimes of labour, sanitation and the politics of development.

Building roads is often described with words that compare it to the circulatory system of the human body. Roads, like blood, bring things into contact and connectivity. They are places ripe for opportunistic transmissions. For example, when another helminth, tapeworm, was hobbling the Kenyan cattle industry in the 1950s, a health campaign was launched to focus on humans as the vector for the parasite. Farmers were asked to dose their workers with anthelminthic medications to curb interspecies infection. But some baulked that the real culprits were gangs of road workers or post and telegraph employees who 'nip over fences and use the nearest convenient bush on the farmer's land

12 Hall et al. 1982: 731.

as a latrine'.[13] Efforts to expand connectivity can ultimately not control who or what comes along for the ride.

But, as I suggested above, soil serves as a site for more than just biological parasites. Roads, for example, are often conduits for parasitic extraction even as they are framed as mediums for exchange. Looking backwards from the postcolonial moment of RARP offers a particular view on how the empire extracted from rural communities through not just roads themselves, but through the labour needed to construct them. As the British East African Company came into existence, the promise of profit for the new colony was bound most closely to the success of the railway. Roads would not serve as the main artery of extraction or delivery of goods. However, the railway heavily indebted the BEAC and building roads with forced communal labour came to subsidise these costs by providing access to the ethnic 'homelands' where Africans were relegated. These pathways, and the unpaid labour exacted to build them, became the necessary substrate for delivering young men into wage labour.[14]

Across historical context, the arduous work of digging out soil, moving it, compacting it into roads, is such a massive undertaking that it is frequently done at the barrel end of a gun or in the shadow of a whip (prison labour, enslaved labour) all while framed as a public good. The same was true in colonial Kenya. If a road could be claimed to 'benefit' a nearby community, the local colonial administrator could recruit unpaid male labourers to both build and maintain those roads as an obligation to the colony.[15] These early transportation infrastructures are often the originary debt which states incur – a different kind of substrate – that then necessitates the further extraction and circulation of value until something resembling an 'economy' emerges. Such debts compel further extraction and exploitation just as dirt roads also compel constant maintenance. Archdeacon D.E. Owen, a perennial thorn in the side of the colonial state, who considered compulsory labour akin to slavery, argued that in just one district in central Kenya, the practice of forced labour saved the state '£50,000 a year' in maintenance.[16]

13 Department of Information, Nakuru to Provincial Medical Officer, 18 Dec 1957. Folder: BY-56-1 Helminthiasis 1946-1956, Kenya National Archives.

14 The roads were often built on top of earlier pathways, capitalising on the knowledge and skill of African communities and their networks of trade. For more on this in the region, see Grace 2022 and Park 2024.

15 See Park 2024, Grace 2022 and Okia 2012. Despite the law specifying men of working age, this was often not who actually had to fulfil such labour obligations. Instead, road building sites were often full of women, children and older men.

16 Okia 2012: 2.

After independence, Kenya's economy was largely dependent on the value cash crops could yield on an international market, particularly coffee, sisal, tea and pyrethrum. By the 1970s, the railway was faltering under political and infrastructural strain. Despite the volatility of relying on cash crops as so many new nations were forced to do, the state hoped to aggressively expand agricultural production into new areas that lay beyond railway lines.[17] Rapidly, the road became king in Kenya. For decades, more of the state's annual budget was allocated to roads than any other budget item, including water, education and health.[18] For the thousands of roads not tarmacked, how did they function as conduits for the economy or connecting communities to resources? Soil as a medium for road building is not all created equal; some soil works better than others. East African soils are highly weathered soils often with a high content of clay. Some clay content is essential for creating hard, smooth surfaces, but too much and a road can compact and shrink dramatically during dry seasons. The surface can crack and fissure, making car journeys over such 'washboard' roads into teeth chattering affairs, if even possible. With the eventual return of heavy rains, puddles of standing water accumulate in the deep wells that have been formed, paralysing vehicles. One only needs to open a regional file from the transport authority to begin filling out a picture of how often roads were sites of blockage and contestation rather than passage. Communities wrote a stream of letters to the authority and local politicians begging for urgent and routine repairs. They appealed by showing how their ability to be good, productive citizens hung in the balance of their thwarted access to markets, schools, families. The Minister for Health in Nyanza province in 1976 wrote urgently to the Minister for Works about an unfolding cholera outbreak and the need for a series of rural roads to be fixed urgently if lives were to be saved.[19] Farmers wrote seeking reassurances that if they bothered to grow a cash crop, they would be able to get it to market. Trucking companies sent tallies of repairs done on their vehicles due to traversing rough roads. They threatened to abandon routes in the face of mounting maintenance costs, leaving crops rotting, milk spoiling. To turn to Serres, poor road surfaces brought more 'noise' into vulnerable postcolonial economies and livelihoods. 'What is work?' writes Serres,

> Undoubtedly, it is a struggle against noise. If we allow things to happen without intervening, stables would fill up with manure, the fox would eat the chickens ... The channel is

17 Another strategy is to increase manufacturing, which many African countries attempted to do in this period as well.

18 Burgess et al. 2015.

19 File AVQ-15-26 Roads Generally Nyanza Province, Kenya National Archives.

> filled with mud. At low tide, you see the port filled with sand. Soon, the ships will not be able to get through. Things mix; don't move, don't stir with the spoon; the sugar will sooner or later dissolve in the water. Sometimes there are convenient, useful mixtures but most of them are obstructions or encumbrances. To work is to sort.[20]

Soil and climate, without such human sorting and working, colluded to fray the warp and weft of Kenya's fragile economy. And in the openings, uninvited guests arrive.

Rural Kenyans were increasingly left to rely on a middleman to find a way around impassable roads. These men and women would take a margin of their profits to broker safe passage of people and goods. Or, without reliable access to markets, rural men and women left behind agricultural production to become brokers themselves. Such 'mediators', writes Mike Degani, 'so long as they restrict themselves to relatively modest interventions, can make a living by bridging gaps'.[21] Kenya's economy (not uniquely) reflects a reliance on soil being made into the smooth surfaces of roads but also that they will never stay that way for too long. To again turn to Serres: 'Systems work because they do not work. Nonfunctioning remains essential for functioning … There are channels, and thus there must be noise.'[22] The impassable road itself became a source of economic activity, if not production, as other avenues were foreclosed.

The blockage can also be unnatural – not a process of climate colluding with soil, but of human intervention to leverage or alternatively halt extraction. When I was in East Africa this past summer, we found ourselves in a car faced with a roadblock on a small rural road. The community was tired of the regional government taking murram (gravel) from a local quarry while neglecting the maintenance of their local roads. The roadblock was a mass of soil piled high in the middle of the road – the very murram the lorries were coming to take away was now blocking access. Its mass, but also its particulate nature (that it was not just a big hulking object) meant it could not be easily pushed aside without construction equipment. Its effectiveness also lay in the fact that so few locals had cars that would require the full width of the road for passage. Thus the blockage was finely targeted to those accessing the quarry (and the unexpected foreigner). In moments of frustration and desperation, blockages disrupt business as usual and compel a remaking of relations. The road becomes the message as much as the medium.[23]

20 Serres 1980: 86.

21 Degani 2022: 176.

22 Serres 1980: 79.

23 Schouten 2022.

Let us briefly return to where we began. Soil, when we scope down to the microscopic (the hookworm) or scope up to the aggregate (the road) can be seen as a haven for parasites. Soil is a rich medium for production, growth and fertility, but soil's other properties shape human relations just as potently. It is a universal material we draw on and expect can be moulded to our needs, but it also harbours its own life and history. Road work crews for RARP even just a few kilometres apart from one another were often revealed to have wildly different rates of parasitic infection for soil transmitted helminths. Those infection rates in part reflect soil environments, which in turn capture a fleeting snapshot of health and development in a particular community at a particular moment in time. In taking its meal of blood, hookworm and other soil transmitted helminths take with them stores of a body's iron. A parasite, when behaving optimally, never takes so much as to destroy its host. And yet, as a host encounters more hookworm larvae, they increase what parasitologists call their 'worm burden' and this can cause serious iron deficiency, particularly for people who are already eating on the margins of health. Iron matters because it is the essential mineral for making hemoglobin, which aids red blood cells in transporting oxygen from a person's lungs to their other organs, jumpstarting the metabolic cycle. Ironically, the iron that is ubiquitous in much of East Africa's dusty red soils – a sign of the leaching of organic matter in hot tropical conditions – is in short supply in the bloodstream. While these are not commensurate forms of iron, it is hard to not see the soil and the body and their exertions on one another – the circulations and decelerations – as some sort of distorted mirror image.

The researchers who showed up at these work sites were seeking evidence of theft: to document the diversions of workers' precious metabolic reserves by biological parasites. While their own individual aspirations might have been to build a career or conduct scientific research, their most immediate goal was to, in concert with the foremen counting wheelbarrow loads of soil, find a way to ensure that manual labour could be more economically efficient than machines. In measuring how much more productive workers could be without such diversions, they were seeking a commensurability of their own, between health and productivity. But any such exercise in naming a culprit gives clemency to others. A biological parasite then comes to stand in for the many other parasitic relations the soil harbours. As one parasitologist told me, it's never *that* straightforward why someone works hard while someone else might not. His comment might have been reflecting on the elusive personal motivation of labouring, or the murkiness that remains in understanding the physiology of bodies. My insistence on a hazy etiology would also point to the historical, the political and the material.

References

Brokensha, David and Bernard W. Riley. N.d. 'Rural Access Roads in Western Kenya: Socio-economic and Environmental Impact Studies, 1979–1983'. n.d.

Brooks, R., M. Latham and D.W.T. Crompton. 1979. 'The Relationship of Nutrition and Worker Productivity in Kenya'. *East African Medical Journal* **56** (October): 413–21.

Brownell, Emily. Forthcoming 2026. 'Roads and Nematodes: Kenya's Colonial Economy as Metabolic Struggle'. *Ethnos: Journal of Anthropology*.

Burgess, Robin et al. 2015. 'The Value of Democracy: Evidence from Road Building in Kenya'. *The American Economic Review* **105** (6) (2015): 1817–51.

Degani, Michael. 2022. *The City Electric: Infrastructure and Ingenuity in Postsocialist Tanzania*. Durham, NC: Duke University Press Books.

Grace, Joshua. 2022. *African Motors: Technology, Gender, and the History of Development*. Durham, NC: Duke University Press Books.

Hall, Andrew, M.C. Latham, D.W.T. Crompton, L.S. Stephenson and J.C. Wolgemuth. 1982. 'Intestinal Parasitic Infections of Men in Four Regions of Rural Kenya'. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **76** (6) (January): 728–33.

Latham, M., L. Stephenson, J. Wolgemuth, T. Elliott, A. Hall, and D. Crompton. 1983. 'Nutritional Status, Parasitic Infections and Health of Roadworkers in 4 Areas of Kenya: Part I Kwale District--Coastal Lowlands'. *East African Medical Journal* **60** (February): 2–10.

Latham, M.C., L.S. Stephenson, A. Hall, J.C. Wolgemuth, T.C. Elliot and D.W.T. Crompton. 1983. 'Parasitic Infections, Anaemia and Nutritional Status: A Study of Their Interrelationships and the Effect of Prophylaxis and Treatment on Workers in Kwale District, Kenya'. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **77** (1): 41–48.

Latham, M.C., L.S. Stephenson, A. Hall, J.C. Wolgemuth, T.C. Elliott and D.W.T. Crompton. 1982. 'A Comparative Study of the Nutritional Status, Parasitic Infections and Health of Male Roadworkers in Four Areas of Kenya'. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **76** (6): 734–40.

Okia, Opolot. 2012. *Communal Labor in Colonial Kenya: The Legitimization of Coercion, 1912–1930*. London: Palgrave Macmillan.

Park, Emma. 2024. *Infrastructural Attachments: Austerity, Sovereignty, and Expertise in Kenya*. Durham, NC: Duke University Press Books.

Schouten, Peer. 2022. *Roadblock Politics: The Origins of Violence in Central Africa*. Cambridge: Cambridge University Press, 2022.

Serres, Michel. 2007 [1980]. *The Parasite*. Minneapolis: University of Minnesota Press.

Tullos, Allen. 1978. 'The Great Hookworm Crusade | Facing South'. *Southern Exposure* **6** (2) *'Sick for Justice: Health Care and Unhealthy Conditions'*: https://www.facingsouth.org/great-hookworm-crusade (Accessed 8 April 2024).

Veen, J.J. de. 1980. *The Rural Access Roads Programme: Appropriate Technology for Kenya*. 4th edition. Geneva: International Labour Office.

World Bank. 1991. Report No. 9560 Project Performance Audit Report Kenya: Rural Access Roads Project: https://documents1.worldbank.org/curated/en/214541468915072663/pdf/multi-page.pdf

Archives

Kenya National Archives, Nairobi, Kenya

Interviews

Crompton, David. Interview with author via Zoom, 17 March 2023.
Hall, Andrew. Interview with author via Zoom, 6 April 2023.

RESIDUAL HISTORIES

USA and Mexico:

Rings of Fire: Arsenic Cycles Through Racism and Empire

Jayson Maurice Porter

Arsenic is a byproduct of Earth bubbling from the inside out. Before there was life, and therefore before the possibility of toxicity, arsenic spewed from holes and crevasses in Earth's crust and bonded with sulphur, iron, and other metals.

Arsenic was an abundant and bioavailable nutrient for organisms that craved metal ions during the anaerobic stages of evolution.[1] It offered biogeochemical pathways for organisms to survive in these environments without oxygen. Some of the earliest microbes on Earth evolved with arsenic released from volcanoes, plate tectonics and deep-sea vents.[2] They breathed the stuff. It's perhaps no coincidence, then, that arsenic sits in group 15 of the periodic table as a metalloid, dualistic in nature: metal and nonmetal, life giver and taker.

Oxidised arsenic became toxic to most living things with the arrival of oxygen-breathing organisms around two billion years ago. During the Great Oxidation Event, cyanobacteria began to fill Earth's atmosphere with oxygen. Life had to develop strategies to combat toxic elements, including arsenic (III), which oxidised into more bioavailable forms, such as arsenate (V). Given the 'broad-scale sensitization of microbial life' to arsenate, 'protective mechanisms' against the metalloid spread throughout the tree of life.[3] Its toxicity now connects life through pathways of resistance.

The cells of cyanobacteria, fungi and plants share many things in common; one of them is an aversion to arsenic. Humans, like other animals, are also biologically wired to reject arsenic. However, our societies began to accept arsenic as an essential element for modern world-building during the Industrial Revolution.

1 A version of this paper was previously published in February 2024 in Science History Institute's online magazine, *Distillations* as 'Rings of Fire: Arsenic cycles through racism and empire in the Americas': https://www.sciencehistory.org/stories/magazine/rings-of-fire/. We are very grateful they have allowed us to republish it here. Hunter 2008.

2 Although it was highly debated, in 2010, scientists thought they discovered microbes in California building parts of themselves with arsenic, which begged the question: what is the role of arsenic in the formation of life itself. Wolfe-Simon et al 2011.

3 Fru Chi et al. 2015.

DOI: 10.63308/63897247289532.ess04

How these industrial societies transformed this geological byproduct into a source of economic and political power had a lot to do with who was exposed to the benefits of arsenic and who was exposed to its harm. In the Americas, unnatural arsenic exposure increased under settler colonialism and slavery.

Arsenic contamination follows natural and unnatural pathways in the region. Geographically, arsenic deposits concentrated along the same geological processes that created the Pacific coastal rim of the Americas, from Alaska to Argentina. Millions of years of magmatic activity from the Ring of Fire volcanoes formed the concentration of arsenic deposits in Latin America, western Canada and the US West.[4] Geologic time fused some arsenic to precious metals and weathered some from bedrock to river basins.

Untold amounts of arsenic from these deposits have slowly seeped and eroded into river basins, mineral ores and alluvial aquifers. While most living things on Earth evolved to resist trace amounts of arsenic, life in this part of the world has encountered even higher concentrations. Did the Ring of Fire and its countless arsenic deposits inform life and death in modern Latin America? Mummified bodies from Chile reveal that people have suffered chronic arsenic poisoning for at least 7,000 years.[5]

When hundreds of arsenic scientists and scholars met in Mexico City in 2006 to discuss 100 years of arsenic contamination in Latin America, they acknowledged naturally occurring arsenic as the principal culprit.[6] They noted how colonial mining for silver and gold created new forms of contamination and exposure.[7] However, they agreed that the historical and persistent use of arsenic pesticides was the region's second primary source of arsenic contamination.

In 500 years, the colonial unearthing of arsenic has continued to put selective pressure on certain organisms in the Americas. The realisation that arsenic killed many of the same pests that monoculture attracted to plantations transformed large-scale agriculture and the global arsenic cycle during the export boom in the Americas that lasted from the 1870s to 1930s. Across the hemisphere, planters and politicians looked to chemistry to maintain agricultural production and white supremacy during the gradual abolition of slavery.

Mining has subsumed the afterlife of many volcanoes. After carrying metals to Earth's crust, fusing them with arsenic and sulphur along the way, dormant volcanoes make a great substratum for mines. Around the turn of the twentieth

4 Masuda 2018.

5 Arriaza et al. 2010.

6 McClintock et al. 2021.

7 Torres 2023.

century, the expansion of mining for semiprecious metals in the defunct volcanoes of Mexico and the US West was coupled with significant damage to the vegetation and animal life surrounding the smelters that extract metals from ores.[8]

After mines physically reduced forests into clearings and mountains into terraced valleys, these smelters used vast energy to further separate rock from metal and metal from byproducts, including sulphur and arsenic. As smelter waste, arsenic and sulphur were 'driven off in the air'; they travelled for miles in every direction, contaminating waterways, killing animals and decimating farmland.[9] Farmers on both sides of the border alerted authorities about arsenic in smelter fumes. Ranchers and foresters were concerned, too. But these concerns went unheeded at first. In 1902, just a year after the United States started collecting white arsenic in Mexico, at least thirty residents died and hundreds more were poisoned in Mapimí, Durango, when a mine's smelter began leaking arsenic into the town's water supply.[10]

Miners loathed arsenic. Smelters penalised them if the arsenic content of ores exceeded the percentage specified in the contract.[11] Farmers and ranchers complaining about the environmental damages caused by arsenic-rich smelter fumes only gave miners another reason to hate arsenic. It diminished the worth of ores and increased the cost of mining.

However, arsenic also held nuisance value from its capacity to cause harm.[12] As Adam Romero argues, insecticides turned industrial byproducts into profits, agriculture a sink for toxic waste.[13] During World War I, arsenic's use in poisonous gases and explosives raised its price and convinced smelter operators to collect the element and sell it to chemical companies. After the war, many of these companies increasingly manufactured insecticides. The entire industry was fed on violence and racist ideas that black labour and Indigenous land also held 'nuisance value' – harmful unless controlled. American business interests pried these first-generation agrochemicals from Mexican and Indigenous lands then cast them at black sharecroppers and tenet farmers back home.

Unlike many insecticides used today, arsenic-based insecticides, such as calcium arsenate, lead arsenate and sodium arsenite, cannot kill insects through

8 Haywood 1909: 43, Swain and Harkins 1909: 43, 'Arsenic Production' 1908: 10.

9 Lindgren 1909: 524.

10 *The Atlanta Constitution* 1902, 1.

11 Michael 1922.

12 Merriam-Webster defines nuisance value as 'value, importance, or usefulness arising from a capacity to annoy, frustrate, harass, or injure'.

13 Romero 2021.

contact alone. They must be eaten, chewed and digested before any insect keels over. And if they don't taste good, insects won't eat them. Arsenic poisoning is a nonstarter if the insect species doesn't chew; it's a miserable defence against mosquitos or scales. But contact can be hazardous for plants.

Raw white arsenic, the base for all arsenic insecticides, is more effective as an herbicide than as an insecticide. Because arsenic's phytotoxicity, or corrosive impact on plant tissues, makes it a tremendous weedkiller, farmers in the early twentieth century had to watch what they dusted. Soap- and nicotine-based concoctions were more common as insecticides for delicate crops, such as strawberries and tomatoes. For cotton growers, however, arsenic was king.

Cotton (*Gossypium*), for all its softness, is not the least bit delicate and is ideal for arsenates. For one thing, cotton is a nonedible crop. For another, the cotton boll's external shell protects its pillowy fibres as they develop. Once harvested, these fibres go through a great deal of processing before reaching consumers. These facts helped chemical promoters convince cotton planters to adopt arsenic poisons.

As a historical product of harsh and inhumane conditions, the cotton plantation was readymade for additional harm. The settler notions that autonomous black labour and Indigenous land were harmful to the economics and politics of the United States helped justify the use of poison to maintain cotton production after slavery. Labour on cotton plantations remained predominantly black and marginalised by the time the boll weevil (*Anthonomus grandis*) arrived in the early 1920s. Weevil infestations destroyed a third of US cotton in 1921 and wiped out $600 million in value (nearly $11 billion in today's dollars). This calamity accelerated arsenic use to protect cotton profits and sustained mechanisms of controlling black labour and land-use patterns after slavery.[14]

The weevil was a funny-looking scapegoat for the decline of cotton profits. Its long snout is perfect for penetrating cotton bolls and hanging excuses for lousy behavior. Southern cotton planters did not blame the exhaustive nature of cotton plantations or the industry's expansion into Northern Mexico for encouraging the weevil to cross into the United States; they criticised Mexico and Mexican farming practices.

One writer described the weevil as an immigrant 'mother [who] crossed the Rio Grande' and raised a big family that 'has spread over a large area of the South'.[15] Naming it the 'Mexican cotton boll weevil' was as derogatory as it was etymological.[16] Depending on the year, between fifty and 75 per cent of the ar-

14 *Wall Street Journal* 1923.

15 Leffman, 1923, *Book Reviews* 1924: 430; Banks 1982: 8.

16 Howard 1896: 5.

senic used to combat weevils in the United States came from mines in Mexico. But did Mexico get any credit for providing the modern chemical 'solution'? No.

For cotton planters, blaming Mexico for weevils was easy, but there was no consensus on how to address the issue. Howard Ambruster, author of *Arsenic, Calcium Arsenate, and the Boll Weevil* (1923), believed that 'in the last twenty years, there have probably been more official and private controversies in the South about the best way to handle the boll weevil than there were about the slavery question and the Civil War'.[17]

Black people made a more common scapegoat for the failures of the South. Anti-black racism was at the heart of many controversies regarding arsenic use on cotton fields. Politicians and planters often disagreed on how to endorse insecticide use with black labour. Some cotton planters blamed the weevil for reducing opportunities for black farmers to grow cotton economically. They saw the cost of arsenates as more of a barrier for black sharecroppers than the poor prices they received for their cotton. Rather than blame the rise of the Ku Klux Klan or racist restrictions on black land ownership, some white Southerners accused the weevil of forcing black people off the land.[18]

In 1925 a researcher for the army's Chemical Warfare Service wrote that a black family with twenty acres could afford to poison their fields if they harvested 250 pounds of cotton per acre. But white landowners rarely allowed black families to hold the most productive land. After the peak of black farming between 1910 and 1920, anti-black policymakers and organised criminals such as the Ku Klux Klan steadily worked to eliminate black land ownership altogether.

As if black people did not have enough to fear, many planters ignored their concerns over using arsenic. To mask and dilute the poison, one Arkansas planter suggested mixing arsenic with molasses because 'the weevil and the negro both like it'.[19] He wasn't alone in his thinking. One of the largest cotton holders from South Carolina, David R. Coker, argued before Congress that using young black children to apply molasses-arsenic spray was the most effective way to combat the weevil.[20] Coker furiously advocated for more arsenic solutions, with little care for black life and health from his seat on the National Boll Weevil Control Association.[21]

While equal in their disregard for black folks' health, many planters did not

17 Ambruster 1923: 13.

18 Leffman 1923: 430.

19 Alexander 1922.

20 Hearings Before Subcommittee of House Committee on Appropriations 1928): 586.

21 https://digital.library.sc.edu/exhibits/coker/battling-the-boll-weevil/

believe black farmers could use arsenic properly. They thought and felt entitled to say that the 'negro tenant and sharecroppers [did] not know how to dust, cannot dust, and will not dust as directed'.[22] They used innumerable phrases and stereotypes to convince themselves that black people were not intelligent enough to poison fields. Some even suggested that since the 'intelligent' black folks fled north, the remaining population wasn't smart enough to use arsenic.

For Ambruster, the leading expert on calcium arsenate use against boll weevils, the education of Southern black people was as big an obstacle to the insecticide industry as chemical engineering and marketing. He did not trust black farmers to educate themselves. He suggested the government and chemical companies teach black folks how to use arsenic. In 1920 the US Department of Agriculture made a film to show planters how to teach their black field hands.[23] A few years later, the Armour Chemical Company of Chicago and Georgia conducted a year-long experiment to see if black farmers could cultivate cotton with calcium arsenate.

The experiment was an exercise in authority and control. The company, in the words of the *Atlanta Constitution*, 'took the attitude toward its sharecroppers and colored tenants that any sensible landlord ought to take'. The chief of research gave 72 black sharecroppers and tenant farmers orders, and they 'either had to follow them or get out'.[24]

The demands were numerous. The company forced the farmers to use specific varieties of cotton and at least 500 pounds of fertiliser per acre. Planting had to start at designated times and in defined ways. The company gave each farmer an arsenate duster, taught them how and when to use it, and provided enough poison for the year.[25]

The chief researcher acknowledged that farmers enjoyed their harvests more than the constant oversight, but controlling production was just as crucial as controlling black farmers. It was not by accident that the only three farmers who did not improve their harvests failed on account of being imprisoned. The company tried to debunk racist notions that black people couldn't use agrochemicals with the equally racist idea that black farmers needed constant surveillance. Armour's demonstration was a violent act of social control that put black lives and land at risk.[26]

22 *The Atlanta Constitution*: 1924.

23 The USDA film was called *Good-Bye Boll Weevil* (1920), Williams 2018.

24 *The Atlanta Constitution*: 1924.

25 Ibid.

26 Ibid.

While volcanic eruptions infrequently release tons of arsenic into the atmosphere, capitalist interests within the United States disrupted the arsenic cycle like a volcano erupting on repeat. Instead of rising magma causing these eruptions, the imperial and racial relations of agrochemical expansion set these new arsenic cycles into motion.

From 1870 to 1914, arsenic was one of the essential substances that connected the Age of Empire and the Second Industrial Revolution. It is unlikely life on Earth has been subjected to this degree of chronic and widespread arsenic exposure since the Great Oxidation Event. But not all life on Earth; the selective pressure of arsenic exposure disproportionately impacted Latin America, where arsenic exposure reached new heights while following newly established pathways during the region's so-called 'export boom' from 1870 to 1930.[27] This era witnessed the expansion of foreign-owned plantation economies to produce sugar, coffee, rubber and other goods for export to the United States and Europe.

Agrochemical arsenic has traveled with settler colonialism and the US empire since the 1870s. During Western expansion in the United States, settlers turned to Paris green (copper [II] acetoarsenite) to combat the Colorado potato beetle (*Leptinotarsa decemlineata*) in the 1860s and Rocky Mountain locust (*Melanoplus spretus*) in the 1870s. Settlers from Kansas to Nebraska used so much Paris green to combat the great locust swarms of 1874–1875 that they eventually drove the entire species into extinction.

Arsenic served as an extension of US empire into many regions. In addition to maintaining the political economy of unjust cotton production in the South, arsenic helped US leaders spread the politics of agrochemical use throughout the Americas. Concurrent with US cotton planters' actions in the post-emancipation South, planters across the Americas started introducing arsenic into their export-oriented plantations and orchards.

The association between arsenic and empire exploded in the early 1920s. The British maintained a global arsenic network that tied colonies and cotton together. They sequestered raw arsenic in Canada, South Africa, Australia and Rhodesia, refined it in the United Kingdom and exported it to Hong Kong, New Zealand and India.[28]

The United States relied on geological deposits in the northeastern edge of the Ring of Fire but quickly outpaced the British arsenic empire. US companies, including the American Smelting and Refining Company (ASARCO) and the American Metals Company, owned some of the most profitable mines

27 Conde 1992.

28 *The Mineral Industry of the British Empire and Foreign Countries* 1923: 1–3.

in Mexico. They began selling raw white arsenic duty-free to a dozen or so chemical companies that manufactured insecticides, exporting it by boat from the Port of Tampico or by rail through Laredo or El Paso.[29]

The United States imported only 272 tons of arsenic in 1922, though the quantity jumped to 1,402 tons in 1923 and 2,551 tons in 1924.[30] For the next two decades, US companies imported between 8,500 and 13,000 tons of arsenic annually, amounting to more than three-fourths of all arsenic processed in the United States. Together, the cotton-arsenate nexus quickly made the United States and Mexico the two largest arsenic producers in the world.[31]

Arsenical insecticides helped US business interests extend farther into Latin America. With a new surplus of arsenic in North America, ASARCO and other US companies established agrochemical trade networks across Central and South America to sell lead arsenate and calcium arsenate for cotton and fruit cultivation. Before the rise of DDT during the Green Revolution, planters in Brazil, Colombia, Argentina, El Salvador, and Nicaragua purchased tons of US arsenates between 1937 and 1944.[32] In the aftermath of World War II, US foreign policy built on these arsenical channels to further export chemical- and capital-intensive modes of industrial agriculture.

Like agrochemical racism in the United States, agrochemical inequality in US foreign policy was born in the nineteenth century. US and Mexican government officials collaborated on pest management as a form of border management in the 1890s. The first walls erected on the US-Mexico border in 1911 aimed to quarantine cattle ticks. But in the context of the Mexican Revolution (1910–1920), these fences were intended to keep out more than cattle and ticks.

US border officials adopted policies for spraying harmful disinfectants on Mexican crops and migrant workers entering the United States. Chemicals enabled the United States to extend white supremacist practices into Mexico and on the border. US officials determined why and how Mexican labourers would be disinfected and expected Mexicans to defer. If Mexican vegetable packers did not spray crops just as US officials taught them, then border officials could reject the produce. Even if Mexicans followed orders, US officials could refuse to pay a fair price.[33]

29 *Tariff Readjustment 1929:* 7646, Tyler and Peter 1934: 28.

30 Franke 1939.

31 Tyler and Peter 1934: 13.

32 'White Arsenic' 1946: 2.

33 Porter 2018.

The US-Mexican arsenic cycle also influenced why the Green Revolution started in Sonora, Mexico. While a surplus of agricultural products led to plummeting prices in most of the United States in the 1920s, the US-Mexican borderlands witnessed sustained population growth in California, Arizona, Sonora and Sinaloa. California's agricultural expansion was the driving force behind this development. Still, it relied heavily on experiments with arsenic-based insecticides performed elsewhere.

California landholders and the US Department of Agriculture conducted a series of tests in Sinaloa in the late 1920s and early 1930s to determine how best to use arsenic on tomatoes and which cotton varieties grew best in the area. Following models from the US South, Californians toyed with aerial dusting in Sinaloa as early as 1926.[34] However, Californians often experimented with more significant quantities of arsenic in Sinaloa than they would at home, helping establish a pattern of agricultural practices in Mexico that would be unacceptable in the United States. And despite blaming Mexico for the cotton boll weevil, Californian interests occasionally introduced agricultural pests from California into Mexico and took no responsibility.[35]

The arsenic-cotton nexus helped normalise agrochemical use. By 1969, 27 of Mexico's 45 insecticide-producing enterprises were in cotton-producing regions.[36] The same areas of Sinaloa dedicated to arsenic experiments in the 1920s and 1930s experienced acute poisonings from subsequent generations of insecticides in the 1970s and 1980s. The pioneering study *Circle of Poison* (1981) highlighted Sinaloa as a site of widespread US-driven agrochemical violence and proved the state held one of the world's highest pesticide poisoning rates.[37] Doctors who tended to workers growing tomatoes for US consumption witnessed two to three poisonings a week from exposure to pesticides. Another report in Mexico suggested that nearly one Indigenous migrant farmer died every day from pesticide exposure.[38]

Although the agrochemical culprit was no longer arsenic, the historical pattern of imperial and racialised arsenic cycles persisted as a defining factor in the social nature of agrochemical inequalities. Arsenic helped US officials assert control over Mexican counterparts and informed power imbalances between the United States and Mexico that persist today. As of 2019, US companies

34 Morrill 1926, Morrill 1925.

35 Morrill 1925.

36 Hertford 1971: 21.

37 Weir and Shapiro 1981.

38 Mártinez 1984.

continue to manufacture and export to Sinaloa more than 100 agrochemicals that are illegal to use in the United States.[39]

Despite its lower market share since the 1940s, arsenic did not simply go away. Arsenic maintained the first and longest monopoly over the insecticide industry, and it never fully relinquished its influence. This is partially because arsenic contamination persists in soil and water for generations, but it is also due to its persistent use as a preservative and herbicide. Railroads and telephone companies still favour arsenic (chromated copper-arsenate) as a wood preservative on railroad ties and utility poles.[40] During the Vietnam War, the US military sprayed an organic arsenic herbicide called Agent Blue (cacodylic acid) on nearly 400,000 hectares of mangrove forests and rice paddies. The commercial form of Agent Blue was so profitable and useful on cotton fields, golf courses and backyards that the EPA deregulated it in 2004. Five years later the agency reversed course and announced it would phase out organic arsenic pesticides by 2013, with the exception of MSMA (monosodium methanearsonate), an herbicide used on cotton plantations.[41]

Biogeochemist Stephen Porder argues in *Elemental* (2023) that humans' relationships with the elemental cycles most important to life – hydrogen, oxygen, carbon, nitrogen and phosphorus – have shaped Earth's past and future. We haven't yet figured out how to enjoy the benefits of our innovations without paying the costs of their harmful byproducts.[42] Arsenic shares a kinship with two of those life-affirming elements on the periodic table, nitrogen and phosphorus. Could something similar be said for the cycles of elements that became most toxic to life, such as arsenic?

The disruption of the global arsenic cycle since the nineteenth century has left a legacy of environmental violence across the Americas.[43] American exceptionalism rarely exists, but the Americas – and the United States in particular – have played an exceptional part in the spread and standardisation of agrochemical use.

Naturally occurring arsenic in the Ring of Fire set the geological stage for its unnatural extraction and extension, but arsenic contamination zones are no longer geological facts alone; many are the historical and living remnants of US empire and racism.

39 Castillo 2019.

40 Parascandola 2012: 139.

41 Bencko and Yan Li Foong 2017: 313.

42 Porder 2023: 115.

43 This thinking on the anthropological disruptions of key elemental cycles on earth is inspired by Porder 2023 and Liboiron 2021.

REFERENCES

Alexander, S.C. 1922. 'He Finds Molasses-Arsenate Treatment Effective'. *New Commerce and Finance*: 1061–62.

Ambruster, Howard W. 1923. *Arsenic, Calcium Arsenate, and the Boll Weevil*. New York: Barr-Erhardt Press.

Arriaza, Bernado et al. 2010. 'Exploring Chronic Arsenic Poisoning in pre-Columbian Chilean Mummies'. *Journal of Archaeological Science* 37: 1274–78.

'Arsenic Production'. 1980. *The Mexican Mining Journal* (Jan.): 10.

Banks, Vera. 1982. 'Black Farmers and Their Farms'. *Rural Development Research Report,* 59.

Bencko, Vladimir and Florence Yan Li Foong. 2017. 'The History of Arsenical Pesticides and Health Risks Related to the use of Agent Blue'. *Annals of Agricultural and Environmental Medicine*.

Bundschuh, Jochen et al. 2021. 'Arsenic in Latin America: New Findings on Source Mobilization and Mobility in Human Environments in 20 Countries Based on Decadal Research, 2010–2020'. *Environmental Science and Technology* 51: 1727–1865.

Cabrera Mártinez, Javier. 1984. '350,000 jornaleros e indígenas, víctimas constantes de los plaguicidas, en Sinaloa'. *El Universal*, 10 March.

Castillo, Karen. 2019. '111 Pesticides Banned in Other Countries Are Used in Mexico'. *The Mazatlán Post*, 3 June.

Conde, Roberto Cortes. 1992. 'Export-Led in Latin America: 1870–1930'. *Journal of Latin American Studies* 24: 163–79.

Franke, Herbert A. 1939. 'Arsenic and Bismuth'. *Minerals Yearbook 1938*: 626–29.

Fru Chi, Ernest al. 2015. 'Arsenic Stress after the Proterozoic Glaciations'. *Scientific Reports*.

Haywood, J.K. 1909. 'Injury to Vegetation and Animal Life by Smelter Wastes'. *Chemical Abstracts* 3 (Jan–Mar): 43.

Hertford, Reed. 1971. *Sources of Change in Mexican Agricultural Production, 1940–1965*. USDA.

House Committee on Appropriations, Congress. 1928. 'Hearings Before Subcommittee of House Committee on Appropriations'. US Government Printing Office.

Howard, L.O. 1896. 'The Mexican Cotton-Boll Weevil (*Anthonomus grandis*)'. US Department of Agriculture.

Hunter, Philip. 2008. 'A Toxic Brew We Cannot Live Without. Micronutrients Give Insights into the Interplay between Geochemistry and Evolutionary Biology'. *EMBO Reports*.

Leffman, Henry. 1924. 'Review of *Arsenic, Calcium Arsenate, and the Boll Weevil* (1923)'. *Book Reviews*.

Liboiron, Max. 2021. *Pollution is Colonialism*. Durham, NC: Duke University Press.

Lindgren, W. 1909. 'Resources of the United States in Gold, Silver, Copper, Lead, and Zinc'. *Report of the National Conservation Commission* 3: 524.

Masuda, H. 2018. 'Arsenic Cycling in the Earth's Crust and Hydrosphere: Interaction between Naturally Occurring Arsenic and Human Activities'. *Progress in Earth and Planetary Science*: 2

McClintock, Tyler R. et al. 2012. 'Arsenic Exposure in Latin America: Biomarkers, Risk Assessments and Related Health Effects'. *Science of the Total Environment* 429 (July): 76–91.

Michael, Paul 1922. 'Startling Situation Appears as to Supply of White Arsenic'. *The Atlanta Constitution*, 27 Nov.

Morrill, A.W. 1926. 'Airplane Dusting for the Control of Vegetable Pests on the Mexican West Coast'. *Journal of Economic Entomology* 19 (October): 696–99.

Morrill, A.W. 1925. 'Commercial Entomology on the West Coast of Mexico'. *Journal of Economic Entomology* 18 (October): 707–16.

Parascandola, John. 2012. *Kings of Poisons: A History of Arsenic*. Lincoln, NE: University of Nebraska.

Porder, Stephen. 2023. *Elemental: How Five Elements Changed Earth's Past and Will Shape Our Future.* Princeton, NJ: Princeton University Press.

Porter, J.M. 2018. 'Plagas, pesticidas y ciencias agrícolas entre revoluciones'. *Boletín FAPECFT* 89 (Sept.–Dec.): 8–10.

Romero, Adam M. 2021. *Economic Poisoning: Industrial Waste and the Chemicalization of American Agriculture.* Berkeley: University of California Press.

Swain, R.E. and W.D. Harkins. 1909. 'Arsenic in Vegetation Exposed to Smelter Smoke'. *Chemical Abstracts* 3 (Jan.–March): 43.

Tariff Readjustment–1929: Hearings before the Committee on Ways and Means. 1929. United States. Congress. House. Committee on Ways and Means US Government Printing Office.

The Atlanta Constitution. 1902. 'Arsenic in the Water Poisons over Four Hundred Persons'. 8 Sept., 1.

The Atlanta Constitution. 1924. 'Negroes Can Successfully Fight the Boll Weevil: Interesting Experiment by Armour Fertilizer Company in Georgia'. 3 Feb.

The Mineral Industry of the British Empire and Foreign Countries, Statistics, 1919–1921–Arsenic. 1923. HMSO.

Torres, James V. 2023. 'Capitalism and Global Mining: Latin American Perspectives, 1500–1914'. *Histórica Crítica* 89 (July): 56–57.

Tyler, Paul M. and Alice V. Peter. 1934. *Arsenic.* US Government Printing Office.

US Department of Commerce. 1946. 'White Arsenic'. May.

Wall Street Journal. 1923. 'Cotton Production Faces Shortage of White Arsenic'. 3 Jan.

Weir, David and Mark Shapiro. 1981. *Circle of Poison: Pesticides and People in a Hungry World.* Oakland, CA: Food First Books.

Williams, Brian S. 2018. Cotton, Chemicals, and the Political Ecologies of Racial Capitalism. Ph.D. diss. Geography, University of Georgia.

Wolfe-Simon, Felisa et al. 2011. 'A Bacterium that Can Grow by Using Arsenic Instead of Phosphorus'. *Science* **332** (6034): 1163–66.

Appalachia, USA:

Mountains Become Wasteland

Steven Stoll

Figure 1.

A dragline in southern West Virginia, 2010. Note the size of the bulldozer and truck in comparison. Photo by Mark's Photo, under licence from Getty Images.

On a spring morning in 1966, a retired coal miner named Ellis Bailey awoke to a rockslide that crushed part of his house, engulfed his car, wrecked his garden and polluted the spring that provided drinking water to his family and cattle. The debris fell from a strip mine 600 feet above his farm on Toney Fork, near the town of Clear Creek in Raleigh County, West Virginia.

In *Before the Mountain Was Moved* (1970), Bailey and his family recreate that day for filmmaker Robert Sharpe, using a pickaxe against the muddy spoil

DOI: 10.63308/63897247289532.ess05

that still trapped their car a year after the event. At 66 years old, living on $94 a month, he resents that coal mining first ruined his lungs, then ruined his farm and those of his neighbours. 'Whole towns gets covered up', says Bailey in the film, 'whole roads gets blocked, whole rivers dammed up. There's no way that I see to stop it. It's a barren land left worthless.'[1]

It begins by clear-cutting and burning the forested landscape. Bulldozers cut a horizontal shelf or bench into the slope where workers pile a series of spoil banks, long berms or ridges of torn-away earth. Then they build the dragline excavator: a colossal walking crane-like machine, 200 feet tall, weighing 10,000 tons, with a bucket that can bite and lug 100 cubic yards of earth, equivalent to the volume of two and a half forty-foot shipping containers. The dragline disgorges this *overburden* into the adjacent hollows, their ferny creeks and shrubby glades never to be seen again.

The burdens extend well beyond the process of 'valley fill', shooting fissures from the substrate into communities. Blasting sends out shockwaves that can crack the foundations of houses. The constant boom and rumble cause anxiety. Clouds from explosions envelop communities in fine dust and chemicals. Rainwater laden with acid, a chemical reaction of sulphur-bearing minerals exposed to oxygen, seeps out of the bottom of entombed hollows into watersheds, turning rivers a burnt shade of orange, killing fish and birds. 'Just a few months ago there were crawfish here, and now there's not a minnow', says one of Bailey's neighbours, 'There's not a living thing in this here creek whatever.' Debris tumbles down creeks, causing flooding. A torrent of boulders came smashing into a woman's yard. She asked a mine worker who would come to remove it and repair the damage. 'He just looked at me and laughed.'[2]

The coal itself causes suffering and conflict. It requires washing and crushing, which leeches a noxious slurry of heavy metals that companies slough off into putrid pools behind impoundment dams. In February 1972, just such a dam collapsed in Logan County, West Virginia, releasing a thirty-foot-high tsunami of sludge down Buffalo Creek. Moving at seven feet per second, it crushed everything in its path for seventeen miles, killing 125 people. Just as carcinoma can spread beyond its lesions, the lethality of mountaintop removal proliferates from mine to hollow to river, from lungs to brains to the next generation.[3]

But everyone who lived in the mountains during those years also told an-

1 Sharpe 1970.

2 Ibid.; Sharpe 1971: 24; Campbell 1970; Montrie 2003: 112; John D. Rockefeller IV, quoted in Burns 2007: 200.

3 West Virginia University Library 2022.

other story about land and soil. Toxic sludge and the debris from strip mines were not only deadly but also a moral insult. They not only destroyed life and property but also buried the rural cemeteries found all over Appalachia. Community burial grounds hold the bodies of ancestors. Headstones record the bare details of lives so that loved ones might not be forgotten. Soil not only fed and employed them but also represented their tenuous hold on the landscape and their final places of rest. Between 1967 and 1977, citizens in southern West Virginia asserted that no amount of money justified the destruction of their homes and cemeteries by flyrock, blasting and toxicity. A working-class coalition of Black and White activists challenged the acquiescence to power that strip mining stood upon. They challenged the strange economy that turned the places they held sacred into waste.

Waste comes from Latin (*vāstum*) by way of Old French and arrived in English by the thirteenth century for places wild, desolate, uncultivated and uninhabited. This sense was most prevalent in England, where *lying in waste* doesn't describe the uselessness of land but only whether it can be cultivated or improved. A waste might be terrific for hunting, foraging and extensive livestock grazing, uses considered inferior by lords but beloved by peasants. The mountains of Appalachia had always been waste in this sense: the land is impossible to cultivate by the standard of commercial agriculture, but productive and invaluable for the wild foods and other gifts it provided.

Over the centuries, a word for something needless or superfluous (fourteenth century) developed into something thrown out or eliminated as worthless (seventeenth century), then denoted an organism's excreta (nineteenth century). Industrialisation introduced *wastewater*, *waste collector* and *waste heap*, along with *waste place*, a neglected or abandoned site. *Wasteland* is more complicated. For a long time, it appeared as two words for waste in the old English sense. It took on a sense of purposeful ruin after 1900, most notably in T.S. Eliot's 1922 poem *The Waste Land*. The term became commonplace. A story in *The Reader's Digest* from 1938 mentions New Jersey as 'a happy hunting ground for industrialists seeking to dodge strict regulatory laws … an industrial wasteland inhabited by immigrants'.[4]

Like organisms, systems produce waste. Frogs eat crickets; draglines consume diesel fuel. Both convert high-order matter into energy, expelling low-order leftover. But frogs and draglines differ in every other way. The energy that powers any technology comes from people interacting with each other and the environment through institutions. There's no better example than coal mining, which requires bankers, corporate managers, workers, politicians and

4 Libroiron and Lepawsky 2022: 71; *Reader's Digest* 1938: 74.

engineers, all brought together to remove a black mineral from deep under the earth. Energy is a social product, not something that comes from the environment as we find it and experience it. And while the environment immediately absorbs a frog's waste, the waste from coal mining generally and the dragline in particular includes chemicals and metals that must be impounded to prevent them from entering rivers and streams where they kill fish and birds.[5]

Beginning in the 1830s, when coal-burning engines overtook waterpower as the prime mover in English manufacturing, the offloading of waste onto society emerged as one of the essential premises of industrial capitalism. No company could internalise smoke, soot, slag and ash, and none considered it. Owners and managers began to regard waste in all its forms as the unavoidable consequence of what they called a civilisational necessity. 'When systems are dominant', explain Liboiron and Lepawsky, 'what they devalue and discard becomes widespread, normalised, and systematic even when some people do not want to participate in those systems.'[6]

For a century before the Civil War, eastern elites bought up hundreds of thousands of acres in the highland counties of Pennsylvania, Virginia, Kentucky and Tennessee, mostly for speculation. The people who lived in the mountains hunted, foraged and gardened at will on endless realms of wooded real estate, regarding these absentee estates as common property. After the Civil War, joint-stock companies began to buy up the old deeds, using courts to eject tens of thousands of Appalachian households to clear their titles and resell the land to logging and mining companies.

Digging a tunnel into a mountain left the landscape mostly intact. But there was always another method. Surface mining (a general term that includes strip mining and mountaintop removal) also caused little damage. Human labour and the first digging machines could only reach shallow veins, leaving pits in the forest like the craters of tiny meteorites. During the crucial decades of the American Industrial Revolution, armies of men descended into the depths of the earth, breathing coal dust and risking tunnel collapse. Then, after the Second World War, surface mining returned. More powerful machinery made it possible, but the economic motive was more consequential: competition from liquid fossil fuels. Oil requires fewer workers than coal. It can be moved through pipes, without trucks or trains. Its relative cheapness undercut underground mining. Mining companies responded

5 This goes for machines powered by solar and wind energy no less than fossil fuels because the mechanism for converting any energy into mechanical power is created and adopted through social relationships of money, exchange, labour, and so on. Hornborg 2023: 17–18.

6 Liboiron and Lepawsky 2022: 77.

to stagnating profits by using bulldozers and dragline excavators to mechanise nearly every facet of extraction, doubling the productivity of each worker.

Strip mining might be the most striking example of how the commodity form of land can serve as a mechanism for taking control away from communities. In most states, towns and counties write their own zoning ordinances. But several states, including West Virginia, can override any local decision. By issuing strip-mining permits, the state of West Virginia allows corporations to operate almost entirely beyond the control of the people who are most affected. Ravaging the landscape seems like a strange strategy for economic growth, but since its founding during the Civil War, West Virginia has behaved like a developing country, selling off its resources and offering up its residents as labour. Its elected officials could participate in a version of modernity, in which they join the industrial world as its source of industrial power. Seldom, if ever, in human history, except during war, have people faced the intentional annihilation of their environment.

***

Figure 2.

A family cemetery in West Virginia. Strip mining operations often bury these burial grounds in debris. Photo by John Nicely (s.d.), public domain from Library of Congress, Prints & Photographs Division, HABS survey.

Early in the film, Ellis Bailey is buying groceries when he confronts a coal worker named Robert Kincaid. People in town knew that Bailey and a few neighbours were soon driving to Charleston to lobby the state Senate for a law to protect them from damage and poisoning. Kincaid tells Bailey that he won't change a thing.[7]

That's when Bailey mentions the cemetery. Burial and the desecration of graves haunt the film, which opens with Bailey pausing at his parents' graves. Rural cemeteries are highly vulnerable to destruction by strip mining, lacking legal protection. The only people who guard and maintain them are families and communities, who, if they look away, might find that the only evidence their ancestors ever lived had been dumped on, crushed by machinery or bulldozed away. Bailey wants the same internment his parents had, the community releasing his body to the earth's embrace, and in a location where his children can visit to remember him. Kincaid says the company can move the cemetery, but Bailey doubts that. 'I don't see how you're going to put a man back in his box and put him in the ground … You may not dig him up, but you'll cover him up so deep that he'll never be got at!'

Another Appalachian activist, the attorney Harry Caudill of Kentucky, captures this sense of violation. 'I lament the utter ruination of the hills of my own homeland and the assault surface mining has made on people of my blood and name … I have seen the shattered roofs, the broken grave-stones.' (By using *homeland* to make this claim, Caudill effaces previous indigenous possessors and *their* graves.) 'In Knott County, Kentucky', wrote Caudill, 'Mrs. Bige Ritchie saw the coffin of her infant son flung up by a bulldozer.' Both Bailey and Caudill regarded cemeteries as a custom, a hold or limit asserted by a community on the wielding of power, a longstanding folk practice that common people assert as having the force of law, in this case, one insisted upon by the living in their care of their dead. Mountain residents often located burial grounds on the tops of mountains and facing east, ready for the rising sun on Easter morning. They're not willing to have their dead forklifted out of the way for someone's convenience, and they consider any disturbance immoral.[8]

The desecration of cemeteries by strip-mine companies might not be intentional, but it represents a more expansive ideological position – the redemptive

7 The film's credits list Kincaid as *portraying* the stripping companies. He is mentioned in an article about the Raleigh County Community Action Association and might have been a member. Sharpe 1971.

8 On the cemeteries of Appalachia, see Maples and East 2013; Caudill 1972: 812; Caudill 1971: 142–43. Caudill testified that Ritchie said, 'I thought my heart would bust in my breast … when I saw the coffins of my children come out of the ground and go over the hill.'

power of industry to wipe away the idiosyncrasies of Appalachia. Nothing, says Kincaid, will stop money and modernity, certainly not the Raleigh County Community Action Association (RCCAA), the anti-poverty civil-rights organization to which Bailey belongs.

> Kincaid: You think we're going to move our machinery out of that holler on account of you? No sir, never happen … We ain't trying to move you; we tried to buy you out and you won't sell ... We offered you jobs … and you won't work! 'No, I got my little farm take care of … My little farm' – that's all you study about … 'My little farm!'
> Bailey: My little farm is going to be there when the stripper is gone! …
> Kincaid: When you and the Community Action get through, we're still gonna be stripping coal – understand that buddy!

Kincaid sees Bailey's sloping pasture along the winding fork as a stubborn remnant, as waste in another sense – misallocated labour, time and land. To the coal companies, it seems, strip mining annihilates the mountains to save them.

Behind Kincaid's argument is an unequal exchange. This is what happens when the little farm in the hollow, the clear-running creek and the family plot are given up for jobs and economic growth. An unequal exchange cannot be made equal with more money, as though Bailey and his neighbours could have bought a new mountain and installed it where the old one stood. When the landscape becomes a commodity, it can be acquired through the market and dis-embedded from communities, rewarding absentee ownership with profit while those under the dragline live in a diminished environment.[9]

***

Bailey and his neighbours drive to the Capitol in Charleston to lobby for a regulatory law. They elect Bailey to address the legislature. 'I'm not an educated man', he began,

> don't know how to speak much, but I'm here to state the facts of what's happening in Raleigh County of West Virginia … I have sixty-five acres of land. This land is almost washed away. The ponds washed full of water, my cattle have nowhere to drink … Our roads are rot in our area, our culverts is filled up, our creek beds is filled up ... Every man should have his own right, but the poor man's right is being destroyed right today. And the strip mine has done more to destroy the poor class of people than anything that's ever hit our area.[10]

9 Hornborg 2023: 40–44.

10 Scott (2010: 174–75) makes a similar point: 'In the coalfields, property rights are stacked in favor of the corporations; the right of an individual to protect his or her little piece of land is tenuous, downright illusory, if the coal company that owns the hills above decides to alter the topography.'

After months of advocacy, poor people in counties throughout the state convinced elected officials to pass the West Virginia Surface Mining Act of 1967. On the face of it, they could claim a significant victory. The legislature determined that strip mining 'destroys or impairs the health, safety, welfare and property rights of the citizens of West Virginia'. The law regulated wastewater and backfilling and further decreed that 'the Department of Natural Resources is hereby vested with jurisdiction over all aspects of surface mining,' including 'restoration and reclamation'. Teams of inspectors would visit every site once a month to 'note all violations of law'. Citizens had overcome industry resistance and shamed the state into redirecting its agencies for the public good.[11]

But a year later, when they danced to Bailey's banjo to reenact their celebration for the end of the film, the citizens of Raleigh County had already lost confidence in the Surface Mining Act. They realised that, while regulation could force coal operators to pile overburden at such and such an angle and plant grass under highwalls like so, it also allowed them to continue blasting mountain after mountain while claiming responsible behaviour, offering them the imprimatur of good citizenship. At last, the public had been served. At last, blasting would be illegal within one hundred feet of any home. Yet they hadn't won much of anything. One hundred feet was still close enough to shatter windows, a sort of metaphor for how regulation can legalise and fortify the thing it claims to control. The reformers realised, in short, that the problem with the surface mining law was surface mining.[12]

They also knew their victory could not be repeated. Before 1967, stripping operations tended to be owned by small companies that lacked the political sway to stop regulation. Many of these failed after the law's passage, and likely because of it, forcing them to sell the most valuable thing they owned: their mineral rights. Absentee corporations bought those rights, subsuming at least thirty small coal operators by 1970. They did this in response to oil prices. From 1957 to 1973, crude fell from $34 to $25 a barrel, which lessened profits. At

11 Congress also investigated strip mining. In 1964, Secretary of the Interior Stewart Udall testified before a House committee that in return for sending coal to homes and industry, Appalachia would be trashed. 'Surface pits … reduce whole drainage basins into a barren wasteland. This, then, is the region's basic dilemma. The resource which must produce its livelihood and can ensure its future has also been its scourge.' The Appalachian Regional Development Act of 1965 included the first federal regulations for the restoration of land stripped for coal. Udall quoted in US Congress, House of Representatives 1964: 51–53.

12 The act is sometimes called the 'regulatory law'. It has no official title. West Virginia Legislature 1967.

the same time, the price for a ton of bituminous coal increased (modestly), which attracted capital and led to further consolidation. The companies that absorbed local operators were themselves absorbed into the Tennessee Valley Authority, Ford Motor Company, Gulf Oil, Duke Power, Kennecott Copper, and other corporations whose combined land holdings produced forty per cent of the nation's coal.[13]

Watching these events and stunned by the toothlessness of reform, a member of the West Virginia Senate introduced a bill to abolish strip mining in January 1970. Lobbyists moved in. They likely spoke privately to legislators the way one explained the industry's position in print. 'It is inconceivable to those of us in the industry that the state of West Virginia would be willing to sacrifice economic considerations of this magnitude for the sake of resolving an aesthetic problem.' They cast the forested landscape as nothing more than scenery atop billions of dollars in fossilised minerals.[14]

Lawmakers buckled under the threat of unemployment, even though coal companies themselves had eliminated thousands of jobs over the previous thirty years by shifting from underground mining to more profitable mountain removal. Politicians might have felt swayed by the ethos of the times. In the emerging logic of neoliberalism, wreckage and misery in the interest of profit resulted in the greatest social benefit, and corporations began to reject responsibility to anyone other than their shareholders.

When the West Virginia Legislature acted, the bill they passed paused new permits for two years, but only in the 22 counties *where strip mining had never existed*. In the other 33 counties, the blasting and valley fill didn't cease. The reformers didn't stop either; they kicked the issue to Congress. A representative from West Virginia introduced a bill to outlaw strip mining throughout the United States. 'I can testify', he told a Senate subcommittee in 1971, 'that strip mining has ripped the guts out of our mountains … and left a trail of utter despair.' Six years after the Buffalo Creek disaster, President Jimmy Carter signed the Surface Mining Control and Reclamation Act of 1977. It set standards for impoundment dams, but it protected those exposed to strip mining no better than previous laws.[15]

13 *The Highlands Voice* (May 1970 and February 1970). For oil prices, see https://www.macrotrends.net/1369/crude-oil-price-history-chart

14 Testimony of Norman Williams reported by the *Charleston Gazette* (27 Feb. 1971), reprinted in *The Highlands Voice* (April 1971). Secretary of State John D. Rockefeller IV saw momentum building behind the prohibition bill and decided to support it in his run for governor.

15 'West Virginia Legislature Halts Move to Abolish Surface Mining', *Coal Age* (April 1971); 'West Virginia Senate Votes Ban on Strip Mining in 36 Counties', *New York Times* (7 March

***

Figure 3.

The French countryside turned to wasteland during the First World War. The sign reads, 'This Was Forges', referring to Forges-sur-Meuse, site of the final Allied offensive. Photo by Edward Steichen (1918), public domain from Library of Congress, Prints & Photographs Division.

Another term describes the strange sense of displacement caused by strip mining. *No-man's land* first appeared in the English Domesday book of 1086 for a location beyond the walls of London reserved for executions. The Western Front of the First World War introduced a new kind of no-man's land, a zone of obliteration. In the five years between 1914 and 1919, nearly eighteen million soldiers and civilians died. The killing extended to the rural fields that served as fields of battle. Trees stripped to snags, the ground gullied and poisoned. 'Over the edge of the trench … every wire entanglement an antinomy,

1971). See the testimony of James Branscome in US Congress, Senate 1971: 224–25. Montrie 2003: 122–28, 142. For coal prices, see the US Energy Information Administration, https://www.eia.gov/coal/. The representative who introduced the ban in Congress was Ken Hechler (WV 4th District, 1959–1977). US Congress, Senate1971: 168, 224–25.

every barb a definition, every explosion a thesis', wrote the philosopher Walter Benjamin. 'Deeply imbued with its own depravity, technology gave shape to the apocalyptic face of nature and reduced nature to silence."[16]

Today, an estimated one million people in Appalachia live under drift clouds in 'blast communities', where they drink arsenic and breathe particulate matter. They suffer from cardiovascular disease, kidney failure, chronic lung disease, cancers, congenital disabilities and low birth weight, adding up to 1,200 early deaths every year in the four most affected states (West Virginia, eastern Kentucky, eastern Tennessee and southwestern Virginia), even after controlling for poverty, obesity, smoking and inadequate health insurance.[17]

A team of researchers measured environmental decline in the same regions. In one example, almost all the streams from underneath valleys filled with overburden reveal selenium concentrations high enough to cause deformities in larval fish and reproductive failure in birds. Algae along the streambeds contained 2,000 times the selenium found in the streams. Strip mining has caused this suffering by devastating an area the size of Vermont and New Hampshire, including 500 mountains blasted and 2,000 miles of river and stream buried, for the unimpressive achievement of generating three per cent of the electricity in the United States.[18]

West Virginia is already a no-man's land in a different sense: between 1950 and 2000, West Virginia lost 10.5 per cent of its population. But there is another way to comprehend this decline. Adding up births, deaths, and migration in and out, by 2000 several counties had lost the equivalent of sixty or seventy per cent of the people they counted in 1950. McDowell County lost 103 per cent, meaning the number of residents who died and left during that half-century was greater than the total in 1950.[19]

Coal companies reject the idea that strip mining creates wastelands or no-

16 Davidson 1955: 20–23; Stilgoe 1982: 220–21; Leshem and Pinkerton 2016: 50; Benjamin 1979: 163. Elsewhere, Benjamin (1968) wrote, 'A generation that had gone to school on a horse-drawn streetcar now stood under the open sky in a countryside in which nothing remained unchanged but the clouds, and beneath these clouds, in a field of force of destructive torrents and explosions, was the tiny, fragile human body'. The 460 square miles of Zone Rouge, including the battlefields of the Somme and Verdun, where the bones of 100,000 soldiers are still unburied, remain so contaminated by unexploded shells and toxins that at the present rate of restoration it will be uninhabitable for another 300 years.

17 Tony 2021.

18 The number of streams found with selenium was 73 out of 78 tested. The study is a digest of peer-reviewed studies. VF stands for valley fill. Palmer et al. 2010.

19 West Virginia Department of Health n.d.

man's lands. Every regulatory law enshrines restoration, as though capital and nature can be reconciled by scattering grass seed. The federal government's early rules and recommendations reveal the absurdity of this policy. A manual from 1968 makes a few suggestions: 'AIR QUALITY. – Help prevent offensive noises and air contamination by controlling use of explosives, fire, and motorised equipment … NATURAL BEAUTY. – Plan operations so they have a minimum impact on the landscape.' The conceit of the laws is their argument that things can be put back to how they had been before.[20]

But putting things back isn't everyone's goal. Certain residents don't see highwalls as ruins but as a kind of topographical improvement. In this view, draglines create blessed flatland, reconfiguring the zigzag of hollows into little simulations of Ohio and Indiana. In 1972, a writer for *Coal Age* bragged about the shopping centres, car dealerships, drive-in theatres and airports that could only have been built on land rendered 'far more valuable than it ever was in its undisturbed condition'. As the sociologist Rebecca R. Scott explains, housing developments built on formally stripped land have the look and feel of suburbs in other parts of the country. They appeal to a managerial class looking for an escape from some of the stigma of Appalachia, 'a way to become more modern, more homogeneously American'.[21]

***

In 2013, members of the Jarrell family visited a cemetery in Boone County where their relatives are buried. They needed permission from Alpha Natural Resources, the owner of the Twilight Mine that circumscribes the site. Alpha insisted on a specific date and a flurry of rules: hours of safety training, steel-toed boots and hard hats. After taking intrusive personal information, including social security numbers, company representatives brought the family across a gouged-out canyon to the top of a lone carved-away pillar with a tuft of trees, seemingly suspended in a nowhere that was once the mountain landscape. When they arrived, they found broken headstones.[22]

The cemetery at the top of the ridge or the bottom of the hollow appears repeatedly in the struggle over strip mining because it represents a violated

20 US Department of Agriculture 1968.

21 Scott 2010: 173–79. Richard Kelly, editor of *West Virginia Illustrated*, quoted in 'The Greening of West Virginia', *Coal Age* 77 (Feb. 1972): 8–88. But this secondary use is often overstated by the industry. Only about 1% of formally stripped land can be used for anything.

22 Asbury 2013.

moral boundary. But it also represents the lack of control residents experience over where they live. When land became a commodity and financial asset, it could be detached from communities. Most Americans embrace private property but often without confronting the contradiction that tormented the people of Raleigh County. They saw that the same freedom to buy and sell a house for all-purpose money allowed distant corporations to gain hold of the landscape and wreck it.

It's all the worse that, by 1970, geologists and chemists had known for decades that burning fossil fuels releases carbon dioxide that causes the atmosphere to heat. Yet the United States did not act – not then, and not until the passage of the Inflation Reduction Act of 2022. Most states have stopped using coal to generate electricity, but fifteen still produce most of their power that way. By this measure, West Virginia reigns supreme. Ninety per cent of its electricity comes from coal. The people there must know that the day will come when no one any longer will mine or burn it. An infrastructure of the future has to include more than infrastructure, but the ideas that invigorate democracy and environments together. When that happens, the mountains will be quiet again, Clear Creek will run clear again, and the dragline excavators will finally come to a stop, their gargantuan wheels and buckets rusted, stuck, and gaping.

***

Ellis Bailey died in 1990 at the age of 86. He is buried in the town of Clear Creek.

References

Asbury, Kayla. 2013. 'Family Says Mountaintop Removal Mine Damaging Cemetery'. *West Virginia Record*, 4 October.

Atwood, Genevieve. 1975. 'The Strip-Mining of Western Coal'. *Scientific American* **233** (6): 23–29.

BBC. 1974. *American Coal Mining*. Video.

Benjamin, Walter. 1968. 'The Storyteller: Reflections on the Works of Nikolai Leskov'. In Hannah Arendt (ed.) *Illuminations: Essays and Reflections*. New York: Shocken Books.

Benjamin, Walter. 1979. 'Theories of German Fascism: On the Collection of Essays War and Warrior, edited by Ernst Jünger'. *New German Critique* **17** (Spring): 120–28.

Burns, Shirley Stewart. 2007. *Bringing Down the Mountains: The Impact of Mountaintop Removal on Southern West Virginia Communities*. Morgantown: West Virginia University Press.

Campbell, Jean. 1970. 'Strip Mining Begins Anew in Clear Fork District'. *Beckley Post-Herald/ Raleigh Register* (14 and 21 June 14).

Cash, Frank E. 1929. *Methods, Costs, and Safety in Stripping and Mining Coal, Copper Ore, Iron Ore, Bauxite, and Pebble Phosphate*. Washington, DC: US Department of Commerce, Bureau of Mines.

Caudill, Harry M. 1972. *Statement of Harry M. Caudill. Regulation of Strip Mining: Hearings Before the Subcommittee on Interior and Insular Affairs*, US House of Representatives, Ninety-Second Congress, First Session. Washington, DC: US Government Printing Office.

Caudill, Harry M. 1971. *My Land Is Dying*. New York: E. P. Dutton.

Charleston Gazette, Charleston, WV.

Coal Age. 1960s and 1970s. New York: McGraw-Hill Publishing.

Davidson, T.D. 1955. 'The Untilled Field'. *Agricultural History Review* 3: 20–25.

Fox, Julia. 1999. 'Mountaintop Removal in West Virginia: An Environmental Sacrifice Zone'. *Organization & Environment* 12: 163–83.

Grim, Elmore C. and Ronald D. Hill. 1972. *Surface Mining Methods and Techniques*. Washington, DC: Environmental Protection Agency.

Hendryx, Michael. 2017. 'The Shocking Danger of Mountaintop Removal—and Why It Must End'. *TEDMED*. November. https://www.ted.com

Henn, John J. 1975. *Updated Cost Evaluation of Metal and Mineral Recovery Process for Treating Municipal Incinerator Residues*. Publication 8691. Washington, DC: US Department of the Interior, Bureau of Mines.

Highlands Voice. N.d. Charleston, WV. West Virginia Highlands Conservancy.

Hornborg, Alf. 2023. *The Magic of Technology: The Machine as a Transformation of Slavery*. New York: Routledge.

Leshem, Noam and Alasdair Pinkerton. 2016. 'Re-Inhabiting No-Man's Land: Genealogies, Political Life and Critical Agendas'. *Transactions of the Institute of British Geographers* **41** (1): 41–53.

Liboiron, Max and Josh Lepawsky. 2022. *Discard Studies: Wasting, Systems, and Power.* Cambridge: MIT Press.

Lucht, William H. 1971. 'To Strip or Not to Strip: The Pros and Cons'. *Register and Post-Herald* (16 January).

Maples, James N. and Elizabeth A. East. 2013. 'Destroying Cemeteries: Historic Mountain Cemeteries in the Coalfields of Boone, Kanawha, and Raleigh Counties, West Virginia'. *Journal of Appalachian Studies* **19** (Spring/Fall): 7–26.

McPhee, John. 1992. 'Assembling California—I: The Geology of the Golden State'. *The New Yorker*. 30 August.

Montrie, Chad. 2003. *To Save the Land and People: A History of Opposition to Surface Coal Mining in Appalachia*. Berkeley and Los Ageles: University of California Press.

National Research Council. 1974. *Rehabilitation Potential of Western Coal Lands: A Report to the Energy Policy Project of the Ford Foundation*. Cambridge, MA: Ballinger Publishing Company.

New York Times.

Palmer, M.A., E.S. Bernhardt, W.H. Schlesinger, K.N. Eshleman, E. Foufoula-Georgiou, M.S. Hendryx, A.D. Lemly et al. 2010. 'Mountaintop Mining Consequences'. *Science* 327 (5962) (8 January): 148–49.

*Reader's Diges*t. 1938. (July).

Schmidt, Richard A. and W.C. Stoneman. 1972. *A Study of Surface Coal Mining in West Virginia; Final Report*. Menlo Park, California: Stanford Research Institute.

Scott, Rebecca R. 2010. *Removing Mountains: Extracting Nature and Identity in the Appalachian Coalfields*. Minneapolis: University of Minnesota Press.

Sharpe, Robert K. 1971. 'Filming "Before the Mountain Was Moved"'. *Filmmakers Newsletter* 5.1: 24–28.

Sharpe, Robert K. (dir.) 1970. *Before the Mountain Was Moved*. Robert K. Sharpe Productions for the Office of Economic Opportunity. http://archive.org/details/gov.archives.arc.53856

Stilgoe, John R. 1982. *Common Landscapes of America: A Visual Guide to the American Landscape*. New Haven: Yale University Press.

Tony, Mike. 2021. 'Raleigh County Community Says Coal Dust from Nearby Mine Is Taking Its Breath Away'. *Charleston Gazette-Mail* (5 June).

US Department of Agriculture. 1968. *Restoring Surface-Mined Land*. Miscellaneous Publication No. 1082. April.

US Bureau of Mines. 1946. *Inspection Standards for Strip Mines (Coal and Lignite)*. Washington, DC: US Department of the Interior, Bureau of Mines.

US Congress. House Committee on Public Works. 1974. *Hearings Before the Subcommittee on Public Buildings and Grounds of the Committee on Public Works*. Washington, DC: US Government Printing Office.

US Congress. House of Representatives Subcommittee on Interior and Insular Affairs. 1971. *Regulation of Strip Mining*. Ninety-Second Congress. First Session. Washington, DC: Government Printing Office.

US Congress. House of Representatives. 1964. *Hearings Before the House Subcommittee on Public Buildings and Grounds of the Committee on Public Works*. Eighty-Eighth Congress. Second Session. Washington, DC: Government Printing Office.

US Congress. Senate Committee on Interior and Insular Affairs. 1973. *Regulation of Surface Mining Operations*. Ninety-Third Congress, First Session. Washington, DC. US Government Printing Office.

US Congress. Senate. 1971. *Surface Mining: Hearings Before the Subcommittee on Minerals, Materials, and Fuels*. Ninety-Second Congress, First Session. Washington, DC: US Government Printing Office.

US Department of Agriculture. 1968. *Restoring Surface-Mined Land*. Publication 1082. Washington, DC. US Government Printing Office.

US Soil Conservation Service. 1977. *The Status of Land Disturbed by Surface Mining in the United States: Basic Statistics by State and County as of July 1, 1977*. Washington, DC: US Soil Conservation Service.

Walters, Patrick. 2013. 'Inside the Battle Over a Strip-Mine Cemetery'. *National Geographic* (7 September).

West Virginia Department of Health and Human Resources. Health Statistics Center. N.d. *A Look at West Virginia's Population by Decade*. Brief No. 8. https://www.wvdhhr.org/bph/hsc/pubs/briefs/008/default.htm

West Virginia Legislature, Regular Session. 1967. Senate Bill 61(9 March).

West Virginia University Library. 2022. *The Buffalo Creek Disaster*. https://arcg.is/010OOq

Ndungu, Tanzania:

Knowing Soil as a Living Thing, Treating it as a Non-Living Body: Contradictory Forms of Care

Lulu Tessua

Ndungu is a village in the Kilimanjaro region under the foothills of the Pare mountains of North-Eastern Tanzania. The village is located in South Pare along the Mkomazi river basin. When a traveller passes by the main road, Ndungu gives the impression of a semi-arid place. There are scattered thorny bushes and a dry, stony and dusty appearance with a few green trees. But Ndungu is blessed with the flow of the Yongoma river, which turns one side of the village into an oasis with endless possibilities of agricultural development. The promising flow of the Yongoma gave way to a period of agricultural modernity when the Japan International Cooperation Agency (JICA) funded a rice farming project in 1988.

Japanese aid projects first emerged in the Kilimanjaro region in the late 1980s in the waning days of *Ujamaa*. *Ujamaa* was President Nyerere's policy of African socialism; a framework for development that, among other things, focused on rural, agricultural projects often undertaken with foreign aid partners.[1] In the second five-year plan (1969–1974), the government of Tanzania introduced and implemented a decentralisation policy.[2] Each region was urged to plan for its own development while the central government remained a general overseer.[3] Japan was asked to assist in Kilimanjaro.

The first project in Lower Moshi, the northern part of the Kilimanjaro region, was handed over to the government in 1987.[4] This essay, however, is about the second project that was built in Ndungu. It was coined as a 'pilot

1 Coulson 1977, 2013: 365–67; JICA 1987. The basic plan report given by the Japan International Cooperation Agency (JICA) shows the historical flow of events that led to changes in policies during Nyerere's leadership to justify their coming to Kilimanjaro.

2 Maro 1990. Decentralisation aimed to minimise bureaucracy in development

3 Coulson 1977, JICA 1987, Maro 1990.

4 JICA 1995, Beez 2003. Northern Kilimanjaro was famously known for coffee growing; the coming of the Japanese introduced rice which shifted the focus of most farmers.

DOI: 10.63308/63897247289532.ess06

project' to help farmers in the Mkomazi valley basin learn modern ways of rice farming from the Japanese.[5] The project was named the Ndungu Agricultural Development Project (NADP). One of the Japanese experts interviewed for the study considered the two projects in Kilimanjaro 'special projects among many others in Africa' as they were intended to replicate Japanese standard irrigation schemes in terms of infrastructure, technology and farming methods.

The project led local farmers to relate to their land and ecology in new ways. Alongside the introduction of a rice monoculture and a new rice variety, IR54, the project also emphasised the use of agrochemicals. Fertilisers and pesticides would supposedly pave the path to financial prosperity for the villagers and the nation.[6] Farmers were introduced to new ways of caring for land which would sustain the new hybrid rice. The old ways of knowing and relating to land through spirits, rituals and the use of animal manure were dismissed by the locals as backward in the modern world of agricultural production.[7]

The people of Pare historically had different ways of caring for their land. There were technological skills to ensure the land was not eroded by intensive cultivation in the nineteenth century. Due to the growth of the Caravan trade, crops were also cultivated for paying tribute to the chiefs for rainmaking, and the region's economic value chain was expanded with new trade goods and food stuffs.[8] Farmers used terraces, irrigation canals and manure to avoid erosion and maintain land fertility.[9]

But caring for land in Pare was more complex than these manual interventions in the soil. It also required communal rituals to mediate between people, spirits and the environment.[10] With the arrival of Japanese aid and experts, the

5 Yamada 1999, JICA report 1987. To respond to the 1969–74 development plans, Kilimanjaro set the Kilimanjaro Development Integrated Plan which aimed to disperse development projects to different areas in the region rather than letting all the projects concentrate in one area. The government of Tanzania therefore requested JICA to move to the Mkomazi valley, Southern Kilimanjaro, where Ndungu would introduce rice farming like they had already done in Lower Moshi. While Lower Moshi was a full project, Ndungu was a pilot project for other farmers in Mkomazi valley to learn from.

6 Yamada 1999.

7 Kimambo 1969, 1996; Hakansson 1998, 2008; Sheridan 2001, 2002.

8 Kimambo 1996, Beez 2003, Hakansson 1998, Hakansson 2008.

9 Lebulu 1979.

10 Lebulu 1979. Hakansson 1998. This was often referred to as 'cooling' the land and it included the amalgamation of other rituals like rainmaking and *mahande*, which I will discuss shortly. The rituals had a purpose of protecting the land and the people dwelling in it from all misfortunes or restoring relationships and order among people or in the environment

village turned to new ways of farming that fractured the relationship between farmers and their land.

Increased use of pesticides for rice replaced the adherence to rituals and intimate relationships between farmers and their environment, which in turn caused detrimental effects for soil fertility.[11] Normalising the use of agrochemicals as a different form of care within the project slowly erased the farmers' memories of soil as a source of life.[12] Today, the younger generation of farmers have not grown up with a set of practices that connects them to the soil and crops as gifts from nature.[13] Instead, they see soil as a place to make bets, hoping to win enough capital to foster other livelihoods, such as selling clothes or leaving Ndungu for a life in the city.

On my second visit to Ndungu, it was time to transplant rice in the 680ha NADP. It was May, supposedly the rainy season, but the seasons were changing and becoming unpredictable. The little rice seedlings were striving under a scorching sun, growing with the little irrigation water available for the rice scheme. The land in most of the farms was breaking into small fissures that signified drought. The viability of the project was now threatened by the hardened land that had been produced by the very circumstances of prolonged rice monocropping. Now, recurring drought dashed the hopes for the better future promised to farmers.

During this time of uncertainty, I met Ally, who was eking out his living through pesticide spraying. He was hired by different farmers who could not spray their own farms, an activity which required expertise, and energy. The older interlocutors in my research mentioned their inability to carry the knapsack on their backs, and to handle the health side effects of pesticides. They chose to pay younger people like Ally, who was in his forties, experienced, and ready to take the risk imposed by pesticides.

Ally referred to himself as a rice intellectual with his primary formal education and a long experience of 'taking care' of rice, and the land underneath it. In that season when I arrived, rice yellow mottle virus disease (RYMV) was the major concern among farmers. RYMV turns rice leaves a yellow colour and it spreads quickly, extinguishing the hope of good harvests. The need for more attentiveness to the farms is often expressed by farmers, '*inabidi kutunza shamba*'

11 Opande and Onyango-Ouma 2024 showed the Luo of Kano, who still perform the ritual of digging hailstones to protect their rice, refused to shift to modern rice farming and methods including the use of agrochemicals; they instead keep their rituals to protect the rice from the possible supernatural dangers.

12 Nixon 2011, Shiva 2013.

13 Suding and Leger 2012, Alleway et al. 2023.

meaning there is a need to care for the farm by applying more agrochemicals to salvage what remains after the rice diseases have attacked.

Ally gained more customers who enquired about ways to take care of their land and deal with RYMV. The concoctions of pesticides were made, fertiliser had to be moderate according to Ally, but his customers had already applied more than they should have. Explanations followed explanations as to why the disease persisted. Ally shared his expertise, but this time there was more to it; 'scientific' ways of caring for rice and land have failed. Some farmers chose to turn to *'mahande'*, a forgotten ritual that farmers believed, if carried out alongside other efforts, might be the missing ingredient for better harvests. At this point, care for land to make it more productive meant adding the ritual back in.

Mahande is a ritual which was originally performed under the agreement of the whole community to cool the land. The anthropologist Michael Sheridan, who did research in North Pare starting in the 1990s, shows that his interlocutors referred to the loss of 'cool' land as a result of using the land without adhering to culturally-defined ways of relating to it.[14] It is a terminology that extends land infertility beyond the natural processes and into politics, interpersonal relations and human-land relations. *Mahande* was the ritual that mediated these relationships to help restore the coolness of the land. The last communal *mahande* in Ndungu was done in 2001. I was informed by my interlocutors that further attempts to do it communally failed in 2018 due to the interference of religion and an over-reliance on modern rice farming techniques.

The purpose of *mahande* to unify, mediate and restore relationships with the soil's ecology now sat amongst land use and agricultural practices that had become more individualistic and profit- based. The ritual therefore is now performed by individuals rather than the community. The changes in rituals have thus created tensions among farmers, as some see it as witchcraft.[15] Such tensions reflect the uncertainty of modern farming in a modern landscape when modern solutions fail.[16]

14 Sheridan 2001 wrote his thesis in Usangi, North Pare; he used the term cooling the land which is also used in South Pare, Ndungu to define the function of *mahande.*

15 Smith 2008. In his work on witchcraft in Africa, Smith points out that the accusations of witchcraft reflect the the social class or a way of living of those who are accused. The individual performing *mahande* that I followed in my fieldwork is a relatively rich farmer who used more pesticides than others because he could afford them. His father accumulated his wealth from the unfair distribution of land when the project started. The tensions pointed out about rituals and witchcraft therefore have their basis in social inequality and class, where poorer farmers view the success of the richer farmer as exploitative of their land, due to extra use of pesticides, and evil, due to the position of his family in the village and the project

16 Comaroff and Comaroff 1993, Smith 2019.

The efficacy of pesticides for farmers and experts like Ally was not merely the chemicals alone, but the cocktail of chemicals coming together to create something new. A number of pesticides are often combined and then farmers mix in an additional liquid 'booster' fertiliser as well as (for some farmers) a bit of an intervention from the spirits through *mahande*. This is the recipe that will ensure the efficiency of pesticides and fertilisers for those who believe. The ritual was the last resort; the last ingredient that would bind together the scattered efforts to heal the land.

The demands of rice on the soil and the labour of farmers in recent years extend the temporality of agricultural intensification in Ndungu, but with new characters at play. Instead of the chiefs, who received tributes in form of food, there are taxes burdening the farmers.[17] The caravan trade was replaced by the world market system of pesticides and seeds which is oppressive to the farmer, with more dependency on agrochemicals and their inability to be reused.[18] The economic value chain in Kilimanjaro, which involved the exchange of products, is now a country-wide market system that the farmer has little control over[19].

These new characteristics of agricultural intensification in Ndungu arose when the project first began in the 1980s. Experts arrived and taught farmers how to spray pesticides and apply fertilisers. Synthetic fertilisers became a beacon of hope while manuring, and traditional human-land relations, were considered backward, slow and ineffective for the quick results that 'development' demanded.[20] Some farmers also recalled that these experts instructed them to use compost and manure after every few seasons to minimise the impact of agrochemicals. However, this was not written down in the manuals, downplaying the importance of manure as a necessary form of soil care. Delaying manuring overlooked the living element of the soil – the part that can die. These misconceptions dictated the misuse of land and forms of care which feed rice with agrochemicals, while tiring the soil's capacity to sustainably give life and health to people and plants.[21]

The irony is that farmers knew that cow dung manure helps revive the dying soil. However, they wanted quick results for several reasons. Often, farmers leased land on seasonal contracts while also taking loans offered to them on a

17 Hakansson 1998. Food was given to the chiefs as a form of tribute, forcing farmers to grow more that they need which resulted in the intensification of agriculture in Pare since the eighteenth century.

18 Kloppenburg 2004, Mizuno 2020.

19 Hakansson 2008.

20 Cullather 2013.

21 Tironi et al. 2020.

seasonal basis. Ally told me that for the cow dung manure to effectively work took more than a season; repairing the soil takes time and it is a process that requires patience.[22]

Farmers did not have the sense of ownership, the resources or the motives to wait for the soil to recover naturally. They only wanted their rice to be fed for a season before they had to return the farm to the owner and repay their loans. Farmers were borrowing the nutrients from the soil just as much as they borrowed the money to work on the same. These extractive relationships revolving around loans have thus led to the depletion of both labour and the soil.[23]

Care in the project landscape became synonymous with more use of agrochemicals. Those who could afford to apply more were applauded as the most committed farmers, while those who failed to afford the risks or rewards of pesticides were shamed as poor and a liability for the health of other farmers' rice, since the failure to spray pesticides could create a hiding place for pests and rice diseases. The soil became compacted and its microbiomes succumbed to the chemicals applied.[24] The dying soil in Ndungu is a call to slow down the pace of production and to consider soil regeneration as the only capital for a healthy life of humans, soil and the universe.[25]

Social inequality has been the major setback to effective soil preservation and care in Ndungu. According to the original design of the project, the dry season was supposed to be the season for maize and beans, while the rainy season was for rice. But, under the pressures of commercial production, conflict grew between those who had the financial capacity to expand rice farming and others who failed to find the necessary capital to manage the high costs of rice farming in both seasons. Mismanagement of the rice scheme in Ndungu has thus furthered social tensions, inequality and oppression of both human labour and soil microorganisms.

Class divisions and resentment started to emerge among farmers as their fortunes diverged. Poor farmers often lost not only their land and money, but their voice in decision-making. Those who struggled with their farms started renting them out or selling them to richer farmers, a move which reproduced more problems related to land use and declining land quality. The reflection of Marx's concerns about how nature is entangled in social relations manifest in the dynamics of power relations that are still unfolding in NADP.[26]

22 Meulemans 2020.

23 Nyerere 1987, Roberts 2020.

24 Wei et al. 2022.

25 Shiva 2013.

26 Roberts 2020.

As we can see, farming in NADP separates plants from the soils that carry the life of those plants. It reduced the soil to a passive substrate that can be bent and abused for monetary profits while expecting it to survive and live in harmony with humans after such an abusive relationship. Ironically, the failure to embrace the art of valuing other non-human species has led to the decline of commercial benefits of rice farming in Ndungu.[27]

The most recurring statement among farmers is: 'the land is dying'. The manner in which it is dying is explained through the decreasing yields every year. There are more rice diseases, the land is hardened and the water is not as 'nutritious to the plants as it used to be'. All these crises are related to the continuous cultivation of rice over the past thirty years. Agricultural development was what the Japanese had in mind, but it is the soil that has to carry that vision and the weight of such a burden is beyond its carrying capacity.

Soil is turned into land through our daily lives, labour and the processes of utilising it. Soil can also be slowly turned into a commercial, non-living object that is tinkered with abusively to force it to comply with the speed of the market. In such goings-on, the soil is forgotten as a source of life; the vitality that vibrates in us but also outside of us. How humans relate to soil should therefore be reformed, first by decentring humans and, secondly, by acknowledging that the forms of care we bring to the soil depend on knowing that it is a living thing. Caring for soil is therefore knowing that it is as vulnerable and fragile as all other forms of life.

References

Alleway, H.K. et al. 2023. 'The Shifting Baseline Syndrome as a Connective Concept for More Informed and Just Responses to Global Environmental Change'. *People and Nature* **5** (3): 885–96. https://doi.org/10.1002/pan3.10473

Beez, J. 2003. 'The Appropriation of Rice at Mt. Kilimanjaro: A Japanese Development Project and its Consequences'. In Peter Probst and Gerd Spittler (eds). *Between Resistance and Expansion: Dimensions of Local Vitality in Africa*. Münster: Lit Verl. pp. 193–209.

Comaroff, J. and J.L. Comaroff. 1993. 'Introduction'. In *Modernity and its Malcontents: Ritual and Power in Postcolonial Africa*. Chicago and London: University of Chicago Press.

Coulson, A. 1977. 'Agriculture Policies in Mainland Tanzania'. *Review of African Political Economy* 10: 74–100.

Coulson, A. 2013. *Tanzania: A Political Economy*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199679966.001.0001

Cullather, N. 2013. *The Hungry World: America's Cold War Battle Against Poverty in Asia*. Cambridge, MA: Harvard University Press.

27 Meulemans 2020.

Hakansson, T. 1998. 'Rulers and Rainmakers in Precolonial South Pare, Tanzania: Exchange and Ritual Experts in Political Centralization'. *Ethnology* **37** (3): 263. https://doi.org/10.2307/3774016

Hakansson, T. 2008. 'Regional Political Ecology and Intensive Cultivation in Pre-Colonial and Colonial South Pare, Tanzania'. *Boston University of African Studies Centre* **41** (3): 433–59.

JICA. 1987. *Basic Design Study Report on Ndungu Agricultural Development Project in the United Republic of Tanzania*. Basic Design Study Report 87–54. United Republic of Tanzania.

JICA. 1995. *Kilimanjaro Region Intergrated Development Plan Follow Up Report 1995*. AFR TZA/S 102/77. United Republic of Tanzania.

Kimambo, I. 1969. *A Political History of the Pare of Tanzania c1500–1900*. Nairobi, Kenya: East African Publishing House.

Kimambo, I. 1996. 'Environmental Control and Hunger in the Mountains and Plains of Nineteenth-Century Northeastern Tanzania'. In *Custodians of the Land; Ecology and Culture in the History of Tanzania*. London: Villiers Publications.

Kloppenburg, J.R. 2004. *First the Seed: The Political Economy of Plant Biotechnology, 1492–2000*. 2nd ed. Madison, WI: University of Wisconsin Press (Science and technology in society).

Lebulu, J. 1979. 'Religion as the Dominant Element of the Superstructure among the Pare of Tanzania'. *Social Compass* 26: 417–59.

Maro, P. 1990. 'The Impact of Decentralization on Spatial Equity and Rural Development in Tanzania'. *World Development* **18** (5): 673–93.

Meulemans, G. 2020. 'Wormy Collaborations in Practices of Soil Construction'. *Theory, Culture & Society* **37** (1): 93–112. https://doi.org/10.1177/0263276419851857

Mizuno, H. 2020. 'Mutant Rice and Agricultural Modernization in Asia'. *History and Technology* **36** (3–4): 360–81. https://doi.org/10.1080/07341512.2020.1862991

Nyerere, J.K. 1987. 'Ujamaa: The Basis of African Socialism'. *The Journal of Pan African Studies* **1** (1): 4–11.

Roberts, M. 2020. 'Marx on the Environment: A Review of "Karl Marx's Ecosocialism: Capital, Nature, and the Unfinished Critique of Political Economy"'. *Review of Agrarian Studies* **10** (2): 99–109.

Sheridan, M.J. 2001. Cooling the Land: The Political Ecology of the North Pare Mountains, Tanzania. Ph.D. Thesis. Boston University, Graduate School of Arts and Sciences.

Sheridan, M.J. 2002. 'An Irrigation Intake Is like a Uterus: Culture and Agriculture in Precolonial North Pare, Tanzania'. *American Anthropologist* **104** (1): 79–92. https://doi.org/10.1525/aa.2002.104.1.79

Shiva, V. 2013. 'Caring for What We Care About'. In Jack Appleton (ed.) *Values in Sustainable Development*. New York: Routledge.

Smith, J. 2019. 'Witchcraft in Africa'. In S.C. Lubkemann, C.B. Steiner and R.R. Grinker (eds). *A Companion to the Anthropology of Africa*. Hoboken, NJ: Wiley-Blackwell.

Suding, K. and E. Leger. 2012. 'Shifting Baselines: Dynamics of Evolution and Community Change in a Changing World'. In Jelte van Andel and James Aronson (eds). *Restoration Ecology: The New Frontier*. Hoboken, NJ: Wiley-Blackwell.

Yamada, R. 1999. 'The Development of Irrigated Rice Farming in Tanzania and Associated Socio-economic Considerations'. *Journal of Rural Planning Association* **18** (2): 126–37.

Lusatia, Germany

Punkt Null (Point Zero): An Ecological Substrate Begins Anew

Cynthia Browne

As we drive across sweeping green fields towards the Chicken Creek (*Hühnerwasser*) artificial catchment from the German city of Cottbus in September 2021, Professor R. tells me that the substrate sustaining this vegetation lies only a few metres deep. The rest of its depths remain the backfill of a former opencast mining pit named Welzow-Süd, one of last remaining lignite mines still open in Lusatia, a region that once belonged to East Germany. The legislative decision of the current federal government in 2020 to close all coal-powered plants by 2038 heralds the end of its operations, while numerous protests by environmental groups call for its closure by 2030. Yet if 2038 marks an end point in chronological time for the operations of Welzöw-Sud, the anthrotechnogenic landscape of its recultivated substrate offers multiple timelines of entry.

Delving into these multiple timelines asks us to consider how to think about the temporalities of soil from the materiality of the substrate itself. In this regard, I draw upon others who theorise through close engagements with the material constraints and elements of environmental surroundings to reconfigure genres of writing, modes of temporal experience and the social relations of ecology.[1] Attending to the materiality of soil and the geological layers of substrate that lie beneath it offers a complementary but distinct contribution to the theory-machine of elements, such as seawater and sand, that move across categories.[2] Between land and sea, between earth and air, between nature and culture, between above- and below-ground, sand, seawater and soil trouble binaries and invite us, as readers of landscapes and texts, to narrate anew.

Today's soil is the weathered rock of yesteryear, interwoven with plants, fungi and decaying matter in a robust aggregate that recursively reconstitutes itself through metabolic interaction. As the final home of most residues, it carries Earth's material memory and the plants that grew within it, aided and abetted

1 Agard-Jones 2012, Zee 2022, De Silvey 2017.

2 Helmreich 2011, Zee 2022.

DOI: 10.63308/63897247289532.ess07

by various microorganisms, fungi and abiotic conditions. As a residue, though, its imperceptibility stems not only from symbolic structures of recognition and value,[3] but also from physical structures. As ground, it lies beneath our feet, hidden below the vegetation, concrete, asphalt, brick and other combinations of substances that cover it, rendering it part of an infrastructural background,[4] unless and until it becomes the matter of our activity, as it does in composting, gardening or planting. On a larger scale, the organic matter of soil, and the geological substrates supporting it, become a focus of attention[5] when they become disrupted widely and irrevocably, as occurs with surface mining, which dominates the world production of minerals. Currently, nearly 95 per cent of non-metallic minerals, most metallic minerals (ninety per cent), and the majority of coal are mined by surface methods.[6] Such surface mining practices produce patches in the earthly layer that sustains life. In this essay, I tell a story of one such patch of substrate and how observations of its ecological temporalities call into question the frameworks of responsibility and knowledge that, in Germany, make the ruination of the substrate legally palatable. My story hews close to how the mining of this substrate produces residues of rubble often not seen because they are recycled and buried again to refill the underground that was excavated; what remains visible is the (vegetative) growth and soil communities that grow after this event of excavation and reburial. It is a story told largely through the observations of others, those of scientists whose observations of this aftermath offer alternative narratives to those of the corporation responsible for the restoration of the site.

In what follows, I situate my gaze and my ears on the landscape unit of the Chicken Creek, which scientists responsible for observing and monitoring the site refer to as 'Point Zero' (*Punkt Null*). These observations provide a perspective into the geophysical and ecological temporalities percolating up and traversing across the substrate both under and up to the surface. These temporalities complicate the projections of the corporation responsible for restoration and the predictions traced out on paper by engineers, undercutting the future timeline anticipated for Punkt Null. Like the term 'ground zero', point zero refers to a place reset to a new beginning by destruction, its previous state destroyed by an event of violence; for Chicken Creek, the vast anthropogenic disturbances to the biotic and abiotic dimensions of a landscape caused by open-cast lignite mining made this reset possible. In this respect,

3 Gordillo 2014.

4 Puig de la Bellacasa 2014.

5 Star and Bowker 2007.

6 Ramani 2012.

Chicken Creek is both specific and general; the parameters for its restoration are shaped by its previous existence as the source for a creek, yet its process of ruination corresponds to geological conditions and histories of the fossil fuel industries that generate many such patches.

I borrow the term 'patch' from ecology, where it is used to demarcate units of heterogeneity within a landscape unit and to offer greater attention to discontinuity across temporal and spatial scales.[7] Attention to patch dynamics stands as a corrective to approaches to ecosystems that privilege homeostasis and stable state equilibrium.[8] Yet even when ecologists acknowledge that patches can arise from human-induced disturbances, Tsing, Mathews and Bubandt extend the concept to give more attention to how histories of industrial capitalism shape the land and produce heterogenous patch dynamics that can be known through the arts of noticing.[9] These arts encourage observers to notice specific patterns of life, such as vegetation or the presence of pests, as signs in the landscape that might be read to divulge multiple histories and futures.[10] The patch of Punkt Null is both a heterogenous unit within the larger patch of Germany's brown coal landscape and a place comprising different, smaller patches that have arisen temporally out of geomorphological processes, stochastic events, weathering, substrate structure and composition, and legal prerogatives that mandate the (impossibility of) restoration. In what follows, I turn to look first at the temporal and spatial scales of industrial scale lignite mining that historically produced the larger area in which Welzow-Süd operates, as well as the geological timeline such mining technologies disrupt, before turning to the ecological temporalities of restoration that began to emerge out of Punkt Null's new beginning.

Fuelling the Future ca. 1900–1990

Lignite, or brown coal, powered the GDR. Considered the geologically younger and lower quality cousin of bituminous coal, brown coal mining became profitable through technological changes that enabled the transformation of brown coal into briquettes alongside the mechanisation of the extraction around the turn of the twentieth century. Describing these changes in a 1921 article in *Scientific American*, Robert Skerrett describes brown coal as 'bituminous coal

7 Tsing, Mathews and Bubandt 2019.

8 Wu and Loucks 1995.

9 Tsing, Mathews and Bubandt 2019.

10 See also Mathews 2018.

in the making – vegetable matter which has not been subjected to the compression and the high temperatures that brought about the formation of the well-known combustible'.[11] While the two species of coal bear similarities in their geological origins as emergent out of 'slowly sinking swamps at a time of crustal instability',[12] their differences in geological age span millions of years; while bituminous coal originated in the Carboniferous, the crumbling lignite of the Lausitz comes from Tertiary rock layers.[13] The friable and highly combustible material properties of lignite initially posed difficulties for the use of this substratum until Germans learned how to transform it into briquettes.

The skilful alchemy behind 'How Teuton Chemists Have Converted the Lovely Swamp Muck into an Industrial Cinderella' is the laudatory subject of Skerrett's article, for, through the briquetting process, a friable, unstable commodity becomes a 'product that would stand rough handling and endure exposure to the weather for months without disintegrating'.[14] Skerrett describes the various processes necessary to convert crumbling brown coal out of the ground into hard, cubic briquettes; this chain involves mechanically sieving out the lignite from the woody parts and hard clumps of earth in which it was buried, drying the duly crushed, fine, moist lignite through the use of cylinders to reduce its moisture content from sixty to fifteen per cent, after which pulverisers reduce the dried material to a uniform size that then passes through presses of an 'open-mold plunger type' to form briquettes. As such, the process itself involves an estimated 3¼ tons of brown coal as fuel to produce one ton of briquettes.

The geographical affordances of brown coal in Germany – its abundance, its relatively thick seams close to the surface and the 'unresistant nature both of the coal and of the overburden of sands, gravels, and clays'[15] – coupled with mechanical methods of extraction, rendered this substrate a profitable endeavour beginning in the twentieth century. As such, the amount of brown coal excavated

11 Skerrett 1921: 304.

12 Ibid.

13 This dating corresponds with contemporary geological dating of the Lausitz coal region, and I retain the use of the term 'Tertiary', since it continues as an actor's category and retains broad use in contemporary scientific literature despite the decision of the International Union of Geological Sciences to ratify the Neogene and Paleogene as two periods/systems of the Cenozoic Era based on Globally Boundary Stratotype Section and Points (GSSP). These two periods roughly correspond to the same geological time span referenced by the term Tertiary, both of which designate the interval of geological time between the Cretaceous and Quaternary (Head, Gibbard and Salvador 2008).

14 Skerrett 1921.

15 Elkins 1953a: 20.

began to exceed that of more (fuel) efficient hard coal reserves, which are largely concentrated in the Ruhr Valley of Germany. As Elkin notes, the brown coal industry in its 'modern form', by which he means the use of large excavating machines that scoop up unconsolidated overburden by means of chains of buckets along a single long face, contributed to a shift in coal extraction. Between 1880 and 1943, the proportion of deep-mine coal decreased from eighty per cent to five percent,[16] while brown coal increased from an annual extraction of 12,146 metric tons to 253,499 metric tons.[17] And whereas hard coal mining requires vertical depths of 500 to 1,000 metres to be driven into the earth, the expansion of surface mining requires the equivalent in horizontal dimensions.

The geopolitics of divided Germany following the Second World War contributed to a much greater expanse of horizontal surface excavations in the GDR, encouraging a politics of resource autonomy built upon its most abundant natural resource – lignite. For, following the division, the East German economy lost access to the coal industry of the Ruhr and Saarland. As a result, between 1950 and 1960, the number of kilowatt hours per year provided by brown-coal power plants doubled to forty million kilowatt hours, an increase that required around 225 million tons of raw lignite coal and made the GDR the global leader in lignite extraction.[18] This exponential increase in the use of brown coal as a fuel to power homes and industries, as well as a material substrate in the industrial catalysis of other industrial products (i.e. tar, oil, coke and chemicals, especially for the GDR) meant that wide swathes of the organic soil substrate supporting life above the surface were dug up and redeposited. The patch of Welzow-Süd, whose mine began operations in 1959, is part and parcel of this history of industrial ruination that leaves in its wake residue and rubble.

To dig up buried lignite on an industrial scale is to exchange one biogeochemical residue, i.e. lignite, for another kind of residue: disturbed and mixed geological layers visible as sandy piles, heaps of stone and leftover rubble that then get used to fill the negative hole left behind. Lignite is literally decayed and anaerobically compressed organic matter from plants that grew in and adjacent to swamps. Partly decomposed and remaining wet from surrounding humid conditions, this matter became converted into peat through the activity of microorganisms within an atmosphere absent of oxygen, which allowed its carbon content to increase. Lignite, the first phase of coalification, scarcely differs from the peat from which it is derived; it often still contains plant remains

16 Ibid.

17 Mitchell 1975: 362–66.

18 Möller 2022.

Figure 1.

One of the four remaining active lignite mines in Lusatia; and the view from there (a), viewing point of Tagebau Nochten (b), 19 September 2021. Photos by the author, with thanks to Christian and Edith Penk for sharing their knowledge and experience of the area.

Figure 2.

Colour photo by the author of a black and white photograph reproduced on an informational tablet for visitors at the Tagebau Nochten viewing point. It documents the accumulation of rubble, i.e. large boulders, as part of the excavation of lignite at the former Greifenhain open-cast mine. The original black and white photograph was taken in 1973 by W. Nowel.

recognisable to the forensic eye. These layers also contain residues of former human habitation, and the groundwater depletion as a necessary precursor to the excavation of these layers often affords archaeological teams an opportunity to first undertake their own excavation to remove artefacts of interest for scientific knowledge and preservation.[19] In this way, looking closely at lignite as both a residue formed at the nexus of organic and inorganic processes and a container of residual objects of forensic interest[20] indicates its potential for narrating both geological and human histories. The observations of the substrate's materiality that provide the ground for such narratives often become visible as part of a process that extinguishes lignite to produce energy,[21] leaving behind a large pit in the earth's substrate that then must be filled. One way to fix this negative space leftover by open cast mining, is to re-fill it with the same geological layers previously dug up but now devoid of lignite, a kind of residue called backfill.[22]

This process of backfilling produces a complementary but distinct constellation of rubble from those occupied by other storytellers of ruination, for what is unearthed is again quickly buried. These burial grounds, however, provide the basis for a substrate that introduces new temporalities within its aftermath. These temporalities, and the multiple futures unfolded within them, appear – not unlike wind-sand in China – at the nexus of engineering techniques, ecological interventions and corporatist hopes,[23] a nexus mandated by laws that govern and regulate restoration as an anticipatory, speculative thing.[24]

19 Archaeological research teams from the federal state office often receive permission to first undertake their own excavations to document and remove artefacts of interest after a new area has been approved for open-cast mining. I visited one such site open to the public on a Sunday with Edith Penk. See also Tagebau Nochten, Objektansicht, https://www.kuladig.de/Objektansicht/BKM-31100014 (Accessed 4 Feb. 2025).

20 See Puig de la Bellacasa 2014 for further discussion of how STS approaches to the social work of classification help foreground the relation between the situatedness of knowledge-making and the shifting categorisations of soil and substrates. For some, the substrate remains in the background as a residual category, while for others, it becomes a matter of concern, housing relevant data for analysis.

21 Such a process is part of how lignite becomes rendered into a resource materiality (Richardson and Weszkalnys 2014).

22 Another common way of dealing with these large pits in the Lusatia (and former East Germany more generally) is to turn them into lakes by flooding them with redirected water. For an account of the elements of surprise and non-knowledge accompanying the social epistemologies involved in transforming these open-cast mining pits into lakes, see Gross 2010.

23 Zee 2022: 118.

24 Adams, Murphy and Clarke 2009.

Restoring a New Beginning: The Aftermath of Lignite Mining

German mining law in its current and previous forms provides regulations for the levelling and restoration of land disturbed by mining. Writing in 1953 on his observations of the brown coal fields in the Rhineland, James Elkins notes that, while the law stipulates the aims and methods of restoration, factors such as substrate composition and other irregularities hamper it in practice. Such an account could be read as the recalcitrance of nature to man's will and efforts at control. Yet, rather than casting the power of nature as an agonist thwarting the instrumental machinations of human volition, I instead consider how the residual substrates of these disturbed landscapes shape the contour of their own temporality, by attending to observations of the ecologically unexpected. In doing so, I focus attention on the doubled nature of this substate as an aftermath.[25] This substrate, by coming 'after', marks an historical event. At the same time, what came after was the construction of a substrate with the temporal aim of supporting abiotic and biotic components to well up and multiply again, thereby entailing a biogeochemical component as well.

Such a frame invites thinking through the timelines of the substrate beyond those derived from the historical disruptions propagated by industrial surface mining, as well as from the anticipatory ones outlined by environmental engineers; it also involves attending to the perspectives of scientists observing the patterns of an emergent creek bed, whose arts of noticing speak to other affects and timelines that stem from the ecological peculiarities of the soil. Because, as scientists began to adopt methods from the soil and ecological sciences to understand the chemical, biological and physical parameters of restored landscape, what they experienced was surprise and humility at how these findings complicated engineering predictions and corporatist anticipation. Measuring and watching ecological parameters over the years made sensible to them the impossibility of restoration, at least restoration informed by scientific prediction based on modelling or a return to a previous 'reference state'.[26] Instead, the post-mining landscape performed itself as an experimental world, complex arrangements of matter and language where knowledge emerges through practices that participate in the reconfiguring of that landscape.[27]

25 Landecker 2024.

26 Wiegleb et al. 2013.

27 Zee 2022: 39.

The Experimental World of Chicken Creek

One such experimental world appeared on a patch of land created to restore the source of a creek that formerly ran across Welzow-Süd. The very condition of possibility for the site stemmed from the federal laws that regulate mining operations. When Vattenfall, a Swedish energy company, expanded their open-cast lignite mine and destroyed the creek, they inherited a legal responsibility to restore it following the end of mining operations. To do so, they contracted consultants, who developed a plan to establish an artificial catchment area in which the watershed could be fed solely through precipitation. The recharge through precipitation, rather than through surrounding groundwater inflows, was due to the lowering of the overall groundwater table as part of mining activities in Lusatia.

In 2004, Vattenfall outsourced the construction of the catchment to Beak Consultants GmbH, which oversaw the laying down of three substrate layers: 1) a base spoil layer; 2) a clay layer that functionally served as an aquiclude to block the passage of water; and 3) a sand layer functioning as an aquifer. Using large mining machinery, such as conveyor belt systems involving bucket wheel excavators and coupled stackers, the company divided the circa six-hectare site into four different strips progressively built up. The clay material for the aquiclude came from Tertiary geological layers excavated as a by-product of mining. Known as '*Flaschenton*', its clay content varies between 24 and 93 per cent and, following swelling, presents an extremely low permeability, a concept defined by scientists through measures of a substrate's water saturation.

Once this clay layer[28] was levelled and shaped at a particular incline to induce the underground flow of water, i.e. to act as a groundwater discharge unit, the company then dumped 117,500 cubic metres of 'sandy substrate material' sourced from 'a variety of Pleistocene sediments from the forefield of Welzow-Süd, where they had been deposited during the Salle-glacial period, a part of its terminal moraine and lodgement till layers'.[29] This construction period of the aquifer comprised three temporal phases with the outer edges being dumped first, followed by the central area left open for a period of seven months before being filled by bulldozers in May 2024. The final steps of the overall catchment construction processes culminated in a final flattening and homogenising of the entire surface of the site using rails pulled by tractors. The

28 In addition to clay being used to craft the initial morphology of the site, sandy dams were also constructed around the groundwater outlet unit to redirect surface water away from the area in order to restrict erosion and sedimentation processes. See Gerwin et al. 2010: 20.

29 Ibid.:19.

purpose of this flattening was to remove surface structures generated by the anthrotechnogenic nature of the construction, as well as emerging features of an 'already forming ecosystem', such as erosion gullies, soil crusts and vegetation to ensure 'uniform initial surface conditions'.[30] With the complete fencing of the area in September 2005 to prevent unauthorised visitors, both human and more-than-human, the site began a new existence marked by 'point zero'; this point marks the start of a new ecosystem, a laboratory for observations within a patch of landscape.

Its birth as an artificial catchment area, according to Professor R., failed, even as life as aftermath began to take root. It is the surprises and accidental events that are the most interesting, he tells me. The engineer from the mining company, for instance, had estimated that it would take five to six years to get the site running, by which he meant that the water discharged from the site would feed the creek bed and begin to resurrect this destroyed surface water pathway. However, water has ceased to discharge since 2016. The bed has been more or less dry for a year and a half.

The surprise of this turn of affairs was also a surprise to me, countering and correcting my initial interpretations of the site. For when I had first entered the area of *Punkt Null* through the gate, I had seen the small pond before my eyes. I had read its glimmering surface as a sign that the sculpted geomorphology of the substrate had succeeded in orchestrating the underground flows of water towards that convex centre crafted to become the pond's base. What I discovered from Professor R., however, is that the filling of the pond stemmed from the surprise effects of an aberrant winter. As a result, what hydrologists had predicted would take several years took only several weeks following a winter with atypical amounts of snow. When spring brought warmer temperatures, the snow melted and ran down the still frozen slope of the surface, filling the pond. Since then, evaporation and the lack of groundwater flow within the constructed substrate has led to a steady decrease in the pond's volume, complicating the mining companies' planning predictions.

Professor R. suspects that the impossibility of erasing the site's anthrotechnogenic origins by trying to mutate it into a homogenously constructed substrate may have contributed to the failure, one that holds a cautionary tale. Although the use of conveyor belts and tractor pulls had aimed to generate homogenous conditions, Professor R. remarked that it resulted in cone shapes in which the sandy substrate was more compacted in the centre and softer at the edges. These traces of the site's technogenic origin likely complicated the flow of water.

30 Ibid.: 20.

Though the engineers had crafted the substrate at a slope to harness the force of gravity to direct the water towards the future pond, these differentiations in compactedness likely blocked certain flows. Professor R. recounted to me how two weekends of strong rains in the initial years further contributed to differentiation within the surface and structure of the site, producing erosion and deep gullies. The environmental engineers had not expected such severity, which altered the initial morphology and groundwater discharge flows. As a consequence, two streams appeared that diverted the direction of the water into the drainage trench. This combination of chance with the impossibility of erasing the anthrotechnogenic origins of the site seems to suggest a moral parable within its very failure. For, as my fieldnotes detail, if it were so easy to remake a destroyed catchment area with the right kind of scientific knowledge, then it would seem to give mining companies full licence to do anything they want, because, then, anything in the end could be restored.

Like the sand-swept, mobile dunes Jerry Zee describes in his ethnography of the Chinese continent in dust,[31] environmental engineers contracted by the mining companies in Lusatia attempt to mould sandy substrates into the linear teleologies of human aspiration; in doing so, they create conditions for other temporal patterns and shapes to emerge. Yet, unlike Zee's account, here the scientists are less aligned with state bureaucrats and engineers. If the latter indeed attempt, through the design of the substrate, to exercise control over the future of its material development, the scientists I met embrace the geophysical and ecological temporalities actively shaping the emerging signs of life and flows of water on the site. Professor R. and his team refuse to intentionally intervene in the ecological dynamics of the site. Instead, the always precarious agreement of their cooperation with the mining company, which must be continually renewed, is one where they set up monitoring stations to observe these errant ecological temporalities. With two weather stations, as well as a series of monitoring stations positioned in a grid-like fashion one metre apart, the scientists observing the site welcome its unpredictable temporalities, which reveal themselves through patches: patterns of black locust (*Robinia pseudoacacia)* that colonise one patch, able to fixate nitrogen from the atmosphere because there is none in the soil,, whose leaves nonetheless litter the ground, an observation leading scientists to conclude that the soil lacks certain decomposers to break down this organic material; the patches of *Sanddorn* (*Hippophae rhamnoides)* on sandy stretches where acidity is high, leading to the conjecture that pyrite (Tertiary) layers have been mixed into the initial Quaternary soils.

31 Zee 2022.

Figure 3.

Monitoring stations set up by scientists at Punkt Null (Point Zero), 23 September 2021. Photo by the author.

Ecological particularity and difference offer moments for these scientists to theorise from the substrate about the presence or absence of living organisms, about its chemical composition, about its origin, while absolving them of the responsibility to intervene or try to control the direction. Furthermore, the unpredictable aftermaths that crop up in the site call into question the very condition of possibility for taking on such responsibility to control the future temporalities of a substrate's ecology, by underscoring how such processes are subject to not only human, but also geophysical and biochemical, temporalities.

In other words, the very elements of surprise and the temporalities unfolding from unexpected occurrences which punctuate Chicken Creek's biogeochemical life after 'point zero', provide evidence that responsibility for ecological restoration that hinges on such anthropocentric control is misplaced.[32] In this way, the science of the substrate in deeply disturbed landscapes brings attention to its own limitations and, by extension, to legal regulations that rely on such control in delegating responsibility for restoring ecosystems and destroyed riverbeds as a condition for providing mining concessions. More broadly, it invites attention to how excavating material histories of our soil substrates can reveal unexpected insights into the ways in which histories of industrialisation, capitalism and technology alter the metabolic matter of soil substrates, shaping the ecological futures that grow out of it.

The green grassy fields on the surface may, after all, be but a few metres deep.

References

Agard-Jones, Vanessa. 2012. 'What the Sands Remember'. *GLQ: A Journal of Lesbian and Gay Studies* **18** (2–3): 325–46. https://doi.org/10.1215/10642684-1472917

Elkins, T.H. 1953a. 'The Brown Coal Industry of Germany'. *Geography* **38** (1): 18–29.

Elkins, T.H. 1953b. 'The Cologne Brown-Coal Field: A Study of the Law and the Landscape'. *Transactions and Papers (Institute of British Geographers)* **19** (131). https://doi.org/10.2307/621233

32 As Matthias Gross (2010) has carefully analysed, surprise and ignorance are abiding characteristics of knowledge-making and its applications within the practice and design of ecological restoration. The uncertainties within knowledge practices of ecological restoration have also, in recent decades, contributed to a wider debate about responsibility within environmental regulatory law and policy, and crystallised in a growing literature about the so-called precautionary principle. For an overview and discussion of the relation between scientific uncertainty, responsibility and the precautionary principle, see Pellizzoni and Ylönen 2008.

DeSilvey, Caitlin. 2017. *Curated Decay: Heritage beyond Saving*. Minneapolis; London: University of Minnesota Press

Gerwin, Werner, Wolfgang Schaaf, Detlef Biemelt, Michael Elmer, Thomas Maurer and Anna Schneider. 2010. 'The Artificial Catchment "Hühnerwasser" (Chicken Creek): Construction and Initial Properties'. https://opus4.kobv.de/opus4-btu/frontdoor/index/index/docId/2008.

Gordillo, Gastón. 2014. *Rubble: The Afterlife of Destruction*. Durham, NC: Duke University Press.

Gross, Matthias. 2010. *Ignorance and Surprise: Science, Society, and Ecological Design*. Cambridge, MA: The MIT Press.
https://doi.org/10.7551/mitpress/9780262013482.001.0001.

Head, Martin J., Philip Gibbard and Amos Salvador. 2008. 'The Tertiary; a Proposal for Its Formal Definition'. *Episodes* **31** (2): 248–50.
https://doi.org/10.18814/epiiugs/2008/v31i2/012

Helmreich, Stefan. 2011. 'Nature/Culture/Seawater'. *American Anthropologist* **113** (1):

132–44.

Landecker, Hannah. 2024. 'Life as Aftermath: Social Theory for an Age of Anthropogenic Biology'. *Science, Technology, & Human Values* 01622439241233946 (March).
https://doi.org/10.1177/01622439241233946

Mathews, Andrew S. 2018. 'Landscapes and Throughscapes in Italian Forest Worlds: Thinking Dramatically about the Anthropocene'. *Cultural Anthropology* **33** (3): 386–414.
https://doi.org/10.14506/ca33.3.05

Mitchell, B.R. 1975. *European Historical Statistics 1750–1970*. London: Palgrave Macmillan UK.
https://doi.org/10.1007/978-1-349-01088-2

Möller, Christian. 2022. 'Braunkohle und Umweltschutz in der DDR: Ressourcenabhängigkeit, ökologische Folgen und umweltpolitische Lösungsversuche in der Diktatur'. In Helmuth Albrecht, Michael Farrenkopf, Helmut Maier, and Torsten Meyer(eds). *Bergbau und Umwelt in DDR und BRD: Praktiken der Umweltpolitik und Rekultivierung*, pp. 43–70. Oldenbourg: De Gruyter.
https://doi.org/10.1515

Pellizzoni, Luigi and Marja Ylönen. 2008. 'Responsibility in Uncertain Times: An Institutional Perspective on Precaution'. *Global Environmental Politics* **8** (3): 51–73.

Puig de la Bellacasa, María. 'Encountering Bioinfrastructure: Ecological Struggles and the Sciences of Soil'. *Social Epistemology* **28** (1) (2014): 26–40.
https://doi.org/10.1080/02691728.2013.862879

Ramani, Raja V. 2012. 'Surface Mining Technology: Progress and Prospects', SYMPHOS 2011 – 1st International Symposium on Innovation and Technology in the Phosphate Industry, *Procedia Engineering* 46 (January): 9–21.
https://doi.org/10.1016/j.proeng.2012.09.440

Richardson, Tanya and Gisa Weszkalnys. 2014. 'Introduction: Resource Materialities'. *Anthropological Quarterly* **87** (1): 5–30.
https://doi.org/10.1353/anq.2014.0007

Skerrett, Robert G. 1921. 'Germany's Brown Coal'. *Scientific American* **124** (16): 304.
https://doi.org/10.1038/scientificamerican04161921-304

Star, Susan Leigh and Geoffrey C. Bowker. 2007. 'Enacting Silence: Residual Categories as a Challenge for Ethics, Information Systems, and Communication'. *Ethics and Information*

Technology **9** (4): 273–80.
https://doi.org/10.1007/s10676-007-9141-7.

Tsing, Anna Lowenhaupt, Andrew S. Mathews and Nils Bubandt. 2019. 'Patchy Anthropocene: Landscape Structure, Multispecies History, and the Retooling of Anthropology: An Introduction to Supplement 20'. *Current Anthropology* **60** (S20): 186–97.
https://doi.org/10.1086/703391

Wiegleb, Gerhard, Udo Bröring, Gyewoon Choi, Hans-Uwe Dahms, Kamalaporn Kanongdate, Chan-Woo Byeon and Lian Guey Ler. 2013. 'Ecological Restoration as Precaution and Not as Restitutional Compensation'. *Biodiversity and Conservation* **22** (9): 1931–48.
https://doi.org/10.1007/s10531-013-0518-0

Wu, Jianguo and Orie L. Loucks. 1995. 'From Balance of Nature to Hierarchical Patch Dynamics: A Paradigm Shift in Ecology'. *The Quarterly Review of Biology* **70** (4): 439–66.

Zee, Jerry C. 2022. *Continent in Dust: Experiments in a Chinese Weather System*. Berkeley: University of California Press.
https://doi.org/10.1525/9780520384101

SUBSTRATES AND BELONGING

Berlin, the Cosmos:

Blood over Soil. Albert Speer's Heavy Load-Bearing Cylinder, Glacial Till, and Racial Terra-Forming

Paul Kurek

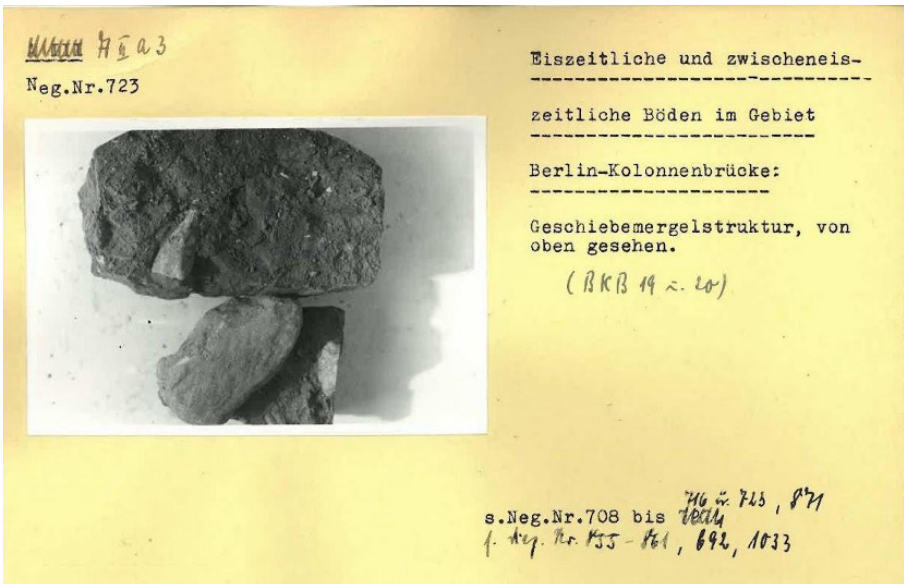


Figure 1.

Glacial and interglacial soils in the area Berlin-Kolonnenbrücke: structure of glacial till, seen from the side, 1941.

Source: TU Berlin, FG Grundbau and Bodenmechanik via Karteiarchiv Degebo, no. AIIa3., Neg. Nr. 716.

Geology

The above file card from the archives of the *Deutsche Gesellschaft für Bodenmechanik* (German Society for Soil Mechanics), short *Degebo*, depicts a piece of German soil (Figure 1). Or does it? Well, this piece of earth was, without a doubt, withdrawn within the aggressively expanding borders of the *Großdeutsches*

DOI: 10.63308/63897247289532.ess08

Reich (Great German Empire) in 1941 by boring through a layer of sand into a depth of about eighteen metres (sixty feet).[1] But, has it always been in that location or could you even argue it firmly 'belongs' there?

Not quite, as the card details, it is a piece of *Geschiebemergel* (glacial till) and, as the prefix *Geschiebe-* ('that which pushes or is being pushed') suggests, it arrived at this location in Berlin's glacial valley through the act of a glacier pushing it across Europe; or, better, it was forged by the friction between the glacier's mass and the landscapes it was pushing through until it came to a halt at the end of the last ice age about 11,700 years ago. As a result, glacial till typically contains all grain sizes from fine sands to giant boulders.[2] On 10 February 1940, Degebo member Heinz Muhs described the 'violent' creation of the traveling glacial soils as 'mechanical disintegration through crevasse frost and reciprocal abrasion during the transport in the meltwater'.[3] So, where does this little piece of land, forged by movement and friction, belong then?

Obviously, soil as a material predates the category of *Germanness* into which it was later embedded in the context of fascist blood and soil ideology that drew a parallel between the purity of race and cultivation of soil. In *Das Bauen im neuen Reich* (Building in the new Empire) from 1938, Gerdy Troost, wife of fascist architect Paul Ludwig Troost, wrote: 'People of German blood have transformed steppe and primeval forest into fertile fields and have always and everywhere in the world shaped the primeval landscape according to their

1 Unlike geology or soil science, fields interested in age or fertility, soil mechanics is strictly purpose-oriented and mainly concerned with one question: how to deal with soil as a purely mechanical element in the construction world. In the late 19th/early 20th-century countless construction accidents occurred due to the rapid urbanisation and dramatic expansion of the road, railway and shipping networks that struggled with critical structural damage caused by soil movement including landslides, which sometimes continued over decades and mobilised massive amounts of soil (Muhs 1969: 1–2). The discipline of soil mechanics emerged with the publication of the book *Earth Construction Mechanics on the Basis of Soil Physics* by Austrian engineer Karl Terzaghi in 1925. In the introduction, Terzaghi described his contribution as the first attempt to establish the much needed 'link between geology and technical practice' that was without any predecessor (1–2). Terzaghi, the 'father of soil mechanics', was the first to ask the question: 'What was the weight limit for construction before the soils collapse?' (Kerisel 1987: 61). The book was a first-class synthesis and centennial achievement within civil engineering (Kurrer 2016: 347). Only three years later, in 1928, the Degebo was founded in Berlin and embedded into TU Berlin (Kirsch 2016: 12). Needless to say, to this day, soil mechanics is literally foundational for any kind of construction.

2 Litt et al. 2007: 45–47.

3 Muhs 1940. All translations from German into English are mine, if not stated otherwise.

inner predisposition … and are firmly rooted in the soil'.[4] When looking at space, time and identity through the narrow lens of a human life span, soil can become a spatio-temporal-identitarian marker, as we all know.

Sarah Ahmed described how the imaginary of a stable nation can trigger collective feelings against 'the other' as a threat to the 'groundedness' of the nation as an object of love that requires a passionate defence against any contaminants that might disrupt its purity.[5] Instability, hybridity, transformativity, ephemerality, etc., posed the greatest threats to the fascist narrative of supposed 'eternity'. Roger Griffin proposed *palingenesis*, rebirth, '[t]he psychological profound longing for cleansing, for renewal through "creative destruction" … expressed in the regenerative myths … of a totally new society and the creation of a "new man"' as lowest common denominator of all varieties of fascism.[6]

In this spirit of firmly grounding an overarching 'racial renewal' that promised an eternal sense of belonging, the reason soil was being examined here was because geotechnical engineers – in anticipation of their prominent client Albert Speer's monumental building plans that featured history's heaviest buildings as the 'appropriate' architectural backdrop for the 'reborn' static racial core of Germanness – wanted to test how much weight this particular geological layer could take without crumbling. I conceptualise this attempted narrative domination of the force of static blood over mobile soils as racial terra-forming.[7]

Concretely, the location where the piece of glacial till was withdrawn was chosen as the site of history's largest Triumphal Arch, conceptualised as an 'eternal erection' that was to mark the triumph of 'eternal' German blood over the plasticity and plurality of spaces, times and identities – racially-based terra-forming. By carving an idealised – and static – concept of Germanness in stone

4 Troost 1938: 5. While Gerdy Troost's name was printed on the book, the actual writer was the rather unknown geographer Karl Trampler: 'his treatise captures the design thinking of the day in relation to Nazi political ideology like none other in this period' (Haney 2022: 21–22).

5 Ahmed 2004: 26.

6 Griffin 2018: 41.

7 Ironically, the conceptual pair of *blood and soil* was equally semantically unstable within the fascist realm of ideas. The idea that the German blood was shaped by the soil its 'carriers' were thrown upon competed with the contradictory idea that the German blood – due to its unique potency – was able to shape, and fertilise, even the most hostile soils (Haney 2022: 32). These two competing meanings, first – soil shapes race; second – race shapes soil, were somewhat symptomatic for the social Darwinist power structures of the fascist regime and, indeed, in the long run, the latter understanding, which was closer to what Hitler believed, became more important; which is why the formula *blood over soil*, racial terra-forming, as I present it here, makes sense overall, I believe.

these monuments were to signal the arrival of its purest and final form (see Figure 3). Todd Presner described German fascism as an 'immobilization' of Germaness, as it conceptualised the latter as a static, timeless and pure entity.[8] The semantically multi-layered Berlin was being transformed to the monolithic world capital known as the Germania project, as Julia Hell put it:

> What Hitler, Speer, and the entire army of National Socialist architects built was a weighty imperial structure with fortresses along its borders, and a heavy solid core in its metropolitan center … [that] promised unlimited expansion, but within a framework of extraordinary stability—a country made of stone.[9]

While these imperial fantasies of absolute stability never materialised, what remains of such megalomaniac plans to this day is the so-called *Schwerbelastungskörper*, the heavy load-bearing cylinder that simulated the 1:1 weight of the Triumphal Arch and still weighs heavily upon the layer of glacial till – and the city's collective memory, as I emphasised on a recent episode of the popular Architecture and Design podcast *99% Invisible* (see Figure 2).[10] The cylinder is forty feet high, has a diameter of eighty feet, and goes sixty feet underground. Its 12,650 tons of ferroconcrete, more than the Statue of Liberty in New York City, the Eiffel Tower in Paris and the Christ the Redeemer Statue in Rio de Janeiro combined, are pressing down onto the earth.[11] In terms of soil pressure, it even exceeds history's probably heaviest construction, the Cheops pyramid.[12]

8 Presner 2007: 29.

9 Hell 2019: 374.

10 Kurek 2025. While the secret project was referred to mostly as *Großbelastungskörper* (great load-bearing cylinder) or *Betonpilz* (concrete mushroom) by the experts, the name *Schwerbelastungskörper* (heavy load-bearing cylinder) has established itself in the public imaginary. It was coined by Michael Richter, a practising architect and member of the community organisation Berliner Unterwelten e.V., with the publication of his brochure *Der Schwerbelastungskörper: Mysteriöses Erbe Der Reichshauptstadt* (with Felix Escher) in 2005.

11 Tomerius 2013: 156–157.

12 As geotechnical engineer Jean Kerisel laid out, the Cheops pyramid distinguished itself among other existing constructions through a 'great load concentration within a relatively narrow perimeter: a pyramid like that of Cheops weighs 5 000 000 tons and presses down on the soil within a square measuring 231 m [ca. 760 feet] along each side; in other words it weighs 6 500 tons per square meter [ca. 650 tons per foot] of this perimeter, far more than the heaviest structures of modern civilization—300 to 900 tons/meter [ca. 30 to 90 tons/square feet] for a nuclear power station, 400-500 tons/meter [ca. 40-50 tons/square feet] for a building of 50 storeys; … illustrating the fact that present day engineers are not nearly as bold as Imhotep and his successors were' (Kerisel 1987: 17). The cylinder's overall weight is 'only' 12,650 tons, which, of course, is far less than the approximately five million tons of the Cheops pyramid. Nevertheless, the weight of the cylinder is distributed on a surface of only 100 square metres (ca. 1,000 square feet), whereas the weight of the Cheops pyramid

Given its multifaçeted history, as I laid it out, the particular piece of ground underneath the cylinder is part of a 'cultural geology' breaking down into a *Ge-schiebe* ('that which is pushing or being pushed') and a *Ge-schichte* ('that which is layering or being layered'), but, most of all, part of a *Ge-wichte* ('that which is weighing or being weighed upon'). This word play centred around the German concept *Ge-schichte* – consisting of the prefix *Ge-* and the noun *Schicht* (layer), simultaneously meaning *history* and *story*, thus carrying both factual and fictional semantic potential – underlines the fact that any historical narrative is fictional and helps me uncover the complexity of the intertwined material and conceptual history of a charged piece of glacial till.[13]

In this essay that departs from a piece of soil I want to – literally and figuratively – *think through soil* and string together a few meditations about how its structural and conceptual mobility undermines the fantasies of eternity it was designated to carry out during German fascism. As I will argue, the soils, due to their mobile, complex and ever-shifting nature, are naturally unfit to carry 'such' an endeavour, meaning carrying a static, eternal or pure identity construct as desired in the fascist imaginary, both physically and metaphysically speaking (which are two sides of the same coin) – in particular glacial till due to its highly heterogeneous and diverse composition forged by its formation through movement. To make this point, we will fluctuate between the minuscule grains of soil and the vastness of the universe, while also being conscious of the infinite limitation of our human perspective in all of this. At the core stands the basic fact that *matter* can be transformed into *energy*, and vice versa, probably the most basic insight of Einstein's theory of relativity that points to the overarching 'cosmic flux' (as the ancient Greek philosopher Heraclitus viewed it), from which I deducted the 'natural' fluidity of spaces, times and identities in contrast to the 'artificial' fascist 'immobilisation' efforts.[14] To illustrate my

presses on 53,361 square metres (231x231) (ca. 500,000 square feet). Thus, Speer's cylinder accumulates to 126.5 tons/square metre (ca. 12.65 tons/square foot), and thus 'outweighs' the 'only' around 93.7 tons/square metre (ca. 9.37 tons/square foot) of the Cheops Pyramid in terms of soil pressure.

13 For more about this tripartite mode of writing, see my recent think piece 'Towards a Cultural Geology: Merging Material and Conceptual History' in the *Journal of the History of Ideas Blog*: 'Building upon Koselleck's conceptualization of history as (metaphorical) layers that I bring together with current (neo-)materialist and geological readings of history, I argue that we, collectively, are part of geology and, thus, belong to a complex space-time-identity-continuum…' (Kurek 2025). I will unpack this in more detail in my upcoming chapter 'A Cultural Geology of *Be*(long)*ing*: *Ge-schiebe*, *Ge-schichte*, and *Ge-wichte*'; and my book *Heavy Load-Bearing Modernity: A Cultural Geology of Albert Speer's Berlin Germania*.

14 Porter 2024: 62.

Figure 2.

Heavy Load-Bearing Cylinder, 1941.

Source: TU Berlin, FG Grundbau G and Bodenmechanik via Diaarchiv Degebo.

thoughts, I draw upon largely unpublished materials (photos, graphs, maps, correspondence, etc.) from the currently publicly inaccessible archives of the German Society of Soil Mechanics (nowadays Institute for Soil Mechanics and Foundation Engineering at the Technical University of Berlin) that are presented here for the first time on a larger stage.[15]

The history of the Degebo, as an institution that flourished under fascist megalomania, reminds us of the Benjaminian dialectic of technological progress and societal regression, but also the dialectic of rigidity and fluidity that underlies all of creation/destruction, especially buildings that need to stand on

15 One of my efforts in the coming years will be to continue digitising the materials and make them publicly accessible.

Figure 3.

Great Arch, 24 February 1941, Büro Speer.

Source: Bayerisches Hauptstaatsarchiv München, Büro Speer Pläne, 2898.

the ground, ideally for a long time, to fulfill their purpose. Accordingly, my piece is structured in three separate sections that – albeit deeply interconnected and constantly flowing into each other – shift gears in terms of scale and perspective. I started the chapter with an analysis of a piece soil (*Geology*), then zoom out into the larger cosmological perspective (*Cosmology*), and finally root my analysis back into the limits of my own human perspective and the struggle to fit into the latter two ways of seeing the world (geology/cosmology), asking the ancient question: 'where do I belong in all of this?', dealing with the inborn desire to ground myself as an individual being-thrown-into-the-cosmos on a vertical, horizontal and existential scale (*Be(long)ing*).

From an architectural standpoint, Speer's Triumphal Arch, allegedly based on a 1920s sketch by Hitler, was almost fully developed in 1939, at least on paper. Following the intuitive idea 'the bigger the better', the architect revealed

in his memoirs that the edifice was planned at over 500 feet width, about 400 feet depth and almost 400 feet height – the biggest arch ever built, and thus an appropriate monument to the 'new German ego' (see Figure 3).[16] Building history's largest arch in Berlin, the designated capital of the new German empire, was, of course, a strategic placement of Germanness above other architectural histories, or at the peak of architectural history in general, with highly symbolic significance. It is a common practice among modern empires to integrate ancient Rome, as the paradigm of the 'eternal city' that embodied 'permanence, order, authority', into the narrative of the (re-)birth of their empires in times of uproar to signal stability.[17] We see similar tendencies under the current American government: promoting 'beautiful civil federal architecture' to stimulate a return to the classical heritage of Western civilisation by erecting a triumphal fortress against (post-)modernist aesthetic confusion, including plans for a massive Triumphal Arch, most recently.

In his memoirs, Speer described how he was intoxicated by the idea of '[having] "beaten" historically outstanding buildings at least on the scale ... [with the] idea of his own greatness projected into eternity'.[18] In another book, he claimed that 'a monument's value resides in its size is a belief basic to mankind'.[19] Like massive egos, the supersized scale of his monuments made them structurally extremely fragile, given the immense pressure they would pose on the ground that led to all kinds of complications in the planning process facilitated by the powerful office of the *Generalbauinspektor* (General Building Inspector, *GBI* for short), spearheaded by Speer. To create the 'signature' monumentalised neoclassical aesthetic of fascist state architecture necessitated maintaining a delicate balance between the ferroconcrete skeleton and the granite façades that were to be attached to it. Given that these two components, due to their different weights, sink into the soil at a different pace, the danger was that damaging tensions between the stone and the concrete would develop. What made this even more complicated were the very strict requirements of the GBI: 'The suggestion to apply the cut stone facing only after the construction of the buildings, so after the actual loading on the building ground and thus also after the occurrence of the main settlements, was denied, as well as the suggestion to apply settling joints in the walls'.[20]

16 Speer 2005: 149–150.

17 Edwards 1999: 2–3.

18 Speer 2005: 83.

19 Speer 1985: 213.

20 Muhs 1948: 5.

On top of that, the GBI did not allow a sinkage of more than five centimetres (about two inches). Speer must have been quite concerned that more soil movement would lead to cracks in the sublime façade of his prosthetic ego projected in his monuments. Therefore, the supporting layer that was to carry the buildings needed to be quite firm, 'the harder the better'. As a consequence, the GBI considered placing the foundations of the arch on top of the harder layer of glacial till, rather than the softer layer of sand above it (even if the geotechnical experts advised against it). Glacial till was fairly unexplored, but promising, as building ground. In the archival manuscript to the research report, Muhs revealed: 'This thought was, on the one hand, based upon the intuitive idea: the deeper, the better; on the other hand probably the seemingly so firm nature of glacial till, which has to be loosened up with a pickaxe, unlike the seemingly so loose nature of sand, was the motivation for this'.[21] Speer's monumental 'world wonders' were supposed to embody the racial superiority of the Aryans by creating the illusion of absolute monumentality, eternity and purity. Accordingly, the ground, naturally a highly heterogeneous construct, had to be properly prepared to be able to carry these 'eternal erections' as metonyms of the to-be-purified-body of the nation.

Echoing the friend/enemy distinction of Carl Schmitt's political theology, these fantasies of purity were built upon the concept of 'the other' whose role in the fascist world design was to 'embody the danger of impurity, or the mixing or taking of blood. They threaten to violate the pure bodies'. Thus, 'mixed-race couplings and immigration become legible as forms of rape or molestation: an invasion of the body of the nation'.[22] But, when we, just like geotechnical engineers, penetrate the body of the earth and measure out her layered but disrupted properties, we must recognise that the lack of a clear order makes it almost impossible to determine a finite spatio-temporal, stratigraphical or chronological order of the soil. Echoing this, classifying soil is equally difficult, as different soil types constantly invade and flow into each other.

The internal and external irregularity of glacial till became most evident in the accounts of the geologists working on the project. When facing the multilayered properties of Berlin's soil in 1938 while preparing the construction of Hitler's monumental North-South Axis – the planned parade street designated as the supersized German version of the Champs Élysées featuring said arch but also history's greatest congregation hall (see Figure 4) – Degebo geologist

21 Projektarchiv Degebo, 3352-1c Probebelastung Bauwerk T, n.a., Veranlassung zu den nachstehenden Probebelastungen: 7.

22 Ahmed 2004: 26.

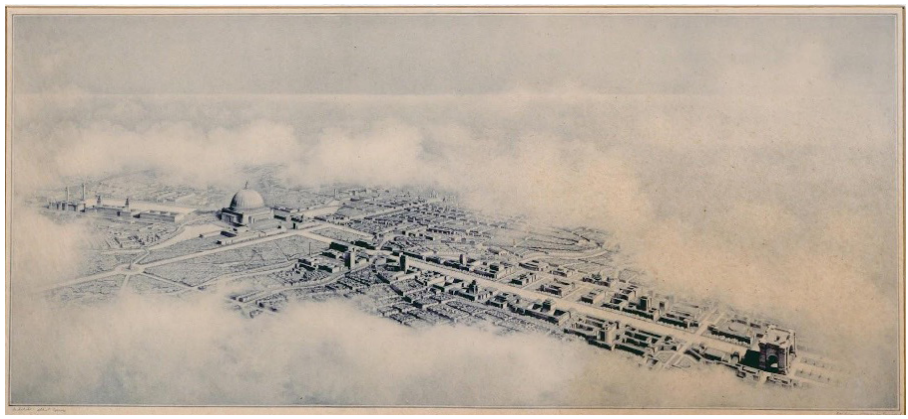


Figure 4.

Drawing of Albert Speer's North–South Axis (Alexander Friedrich 1939, based on a concept by Generalbauinspektor Albert Speer).
Source: Landesarchiv Berlin, LAB, F. Rep. 270, A8750. This image is expressly excluded from the CC BY 4.0 licence governing the book.

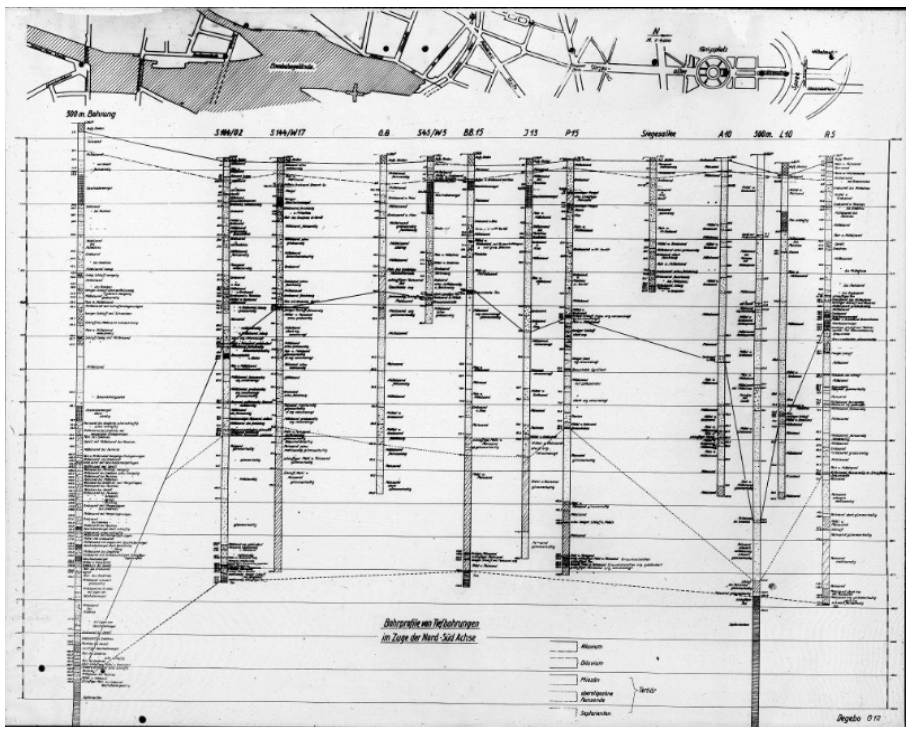


Figure 5.

Drilling Profiles of Deep Drillings in the Context of the North–South Axis, 1938.
Source: TU Berlin, FG Grundbau and Bodenmechanik via Diaarchiv Degebo.

Josef Mauz analysed the results of a 1,600 feet deep drilling conducted at the Kolonnenbrücke, very close to the site designated for the Triumphal Arch. This was part of an effort to measure out Berlin's entire soil profile, a project called *Baugrundkarte* (building ground map) (see Figure 5). In an initial distant reading, Mauz breaks down the drilling profile by unpacking the larger spatio-temporal frame it is structured by, the geological soil layers (alluvium, diluvium, tertiary and oligocene) that reach millions and millions of years deep. From there, he breaks down each of these four larger frames in closer readings. I want to pick out his reading of the diluvium, an archaic word for ice age, as it was the layer relevant for the construction of the cylinder (and for constructions in Berlin in general). I quote a passage, which I find quite insightful, almost poetic, in the way it unpacks the dynamic structure of soil.[23]

> What is apparent on the profiles is that the layer composition and thickness of the diluvial sediments fluctuate heavily. Till, slip rock horizons, gravel, sand, silt, and clay alternate in colourful diversity or intermesh, and even for the geologist it is hard to figure out the chronological order. The drilling profile demonstrates, in the most impressive way, the extreme fluctuation of the border between the diluvium and the tertiary. Often one must oppose the layman's belief that the border proceeds vertical and is 'planar', which one could hope for in a 'certain' depth … How uncertain the course of the border ... yet is, becomes clear only through the few profiles presented here, and this fact can be borne out with many more examples.[24]

What is immediately apparent in the narrative that the geologist provides about the structure of soil is the limitation of his knowledge. His analytical gaze is confronted with the lack of a clear internal and external structural order. Internally, each soil layer fluctuates in terms of material composition, as it consists of various types of soil, making each layer a highly heterogeneous construct. Externally, the vertical and horizontal expansion of each soil layer varies as well, while the different layers also mix with each other. Altogether, the lack of a clear order makes it almost impossible to determine a spatio-temporal, stratigraphical or chronological order of the soil, as the layers are constantly being condensed, move around and contaminate each other; or, as literary scholar Mark McGurl puts it, 'what we call the "ground" is no ground at all but the result of a process whose own ground is another, antecedent process extending backward in time' – turtles all the way down.[25] It appears that soil, in the way it is programmed, transcends categorical thinking in terms of rigid soil identities (or spatial and temporal borders), towards an inherent conceptual

23 BArch R4606 639: 12–13.

24 BArch R4606 639: 12–13.

25 McGurl 2011: 384.

fluidity, providing a counter-narrative to what Speer's monuments – driven by the desire to feel big to overcompensate the fear of being small – wanted to tell us. While geological rock formations often, not always, provide us with the illusion of a clean-cut stratigraphy, glacial till, the soil Speer intended to build upon, following his intuition to erect his monuments of a German super-identity, undermines the message it was chosen to carry.

Cosmology

If we decide to peel away the layer of nationhood and dig even deeper into the space-time-identity continuum, we shall see: about fourteen billion years ago the piece of soil we are examining here was contained within a tiny pinhead with the rest of all matter that now exists in the universe, assuming we follow the most common cosmological theory of the Big Bang, the cosmic inflation. In this contracted state, known as singularity, our universe was absolutely inclusive: it literally contained all possible times, spaces and beings. An 'extension' to this is the theory, the cosmological model of the Big Bounce, which proclaims that once our universe has reached its state of maximum expansion, it will contract

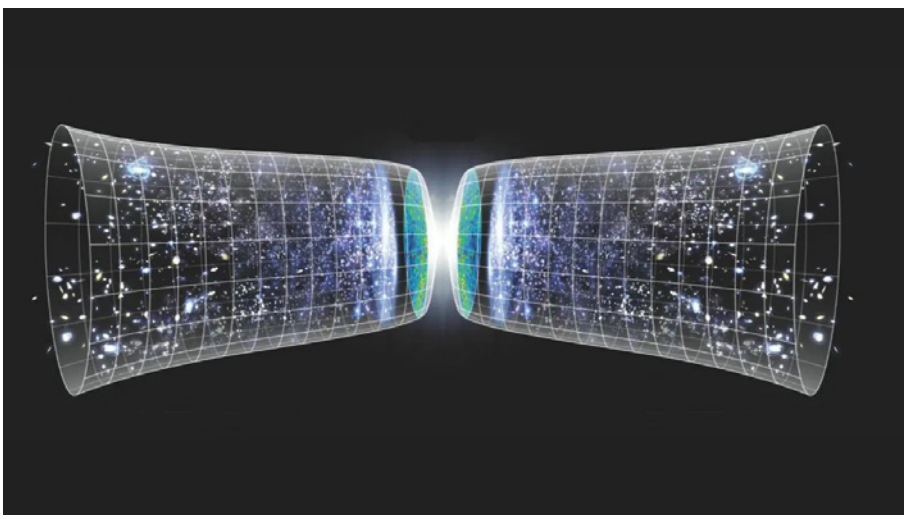


Figure 6.

NASA, Model of the Big Bounce Theory. Image by NASA/WMAP Science Team [modified].

again, from where it will expand again, forming an 'eternal pulse' (see Figure 6).[26] This distant reading of mine demonstrates how related geology and cosmology, so are going down and going up, to the bottom and to the top, despite their inverted constellations: the inward journey is always interstellar. When we look at the world and the little piece of soil like this, standpoint epistemology loses all of its meaning: there is no truth to pinpoint and nothing to stand upon, neither physically nor metaphysically – a very Nietzschean perspective.

As physicist Martin Bojowald, a 'proponent' of the speculative Big Bounce Theory, emphasised, none of it is set in stone and thoughts about the origin of everything lead to more questions than answers, questions that hitherto have to leave the realm of physics and enter the 'borderlands to philosophy'.[27] What is exciting about this, I believe, at least on a meta-metaphorical level, is how it suggests that everything is in transition, matter and energy are in a constant state of flow and transformed into each other, nothing ever stands still – except mathematical patterns?[28] This echoes Heraclitus' ancient description of the dispersion of 'biomass' in the overarching 'cosmic flux', even if '[m]odern scholars of Heraclitus (with the exception of … Nietzsche) are not fond of unstable models of complexity. They prefer concepts like regularity, consistency, and structured coherence. "Regularity" is not the most relevant description of nature's processes. Complexity is.'[29]

26 Big Bounce is a speculative, but common cosmological model (among others), represented, e.g. by 2020 Nobel laureate (physics) Roger Penrose, but also by Martin Bojowald, a German professor of physics at Penn State, whose work I reference here. The hypothesis states that, before our universe expanded, it was actually contracting, but before it could collapse into an infinitely single point, called singularity (which is mathematically impossible to deduce so far), it started expanding again (Bojowald 2009: 127). Nevertheless, with the discovery of dark energy, it is the inflation theory that is most supported by the available data. A good take on this is Brian Greene's (professor for mathematics and physics at Columbia) 2020 book *Until the End of Time: Mind, Matter, and Our Search for Meaning in an Evolving Universe*, written for a broader audience.

27 Bojowald 2009: 127.

28 This essay is written with an emphasis on the 'eternal flow' obviously. One could, of course, argue, that this flow is guided by 'eternal principles' – capturing the neverending metaphysical battle between rigidity and fluidity. Michael Levin, working on the intersection of developmental biology, computer, science and cognitive science, is currently undertaking spectacular research that analyses how cells seem to intuitively grasp the shape of the organism they are part of, which is relevant, e.g., for regrowing limbs (regenerative medicine) – as if they were a aware of a Platonic realm of ideas.

29 Porter 2024: 85. '[A]ll physical states of the cosmos exist along a continuum that stretches across the whole of nature. Because the cosmic stuffs are without exception mutually interconvertible (each can be transformed into the others), and because the transitions from one

Inspired by Nietzsche's critique of the Enlightenment's constructions of scientific and religious truths in the essay fragment 'On Truth and Lies in an Extramoral Sense' (1872–1873), I want to briefly enter the said 'borderlands to philosophy' and contrast the figure of the architect, mostly concerned with maintaining the verticality of his building, with the geotechnical engineer, who, due to his geological awareness, deals with the forces that pull buildings back into horizontality, becoming aware of the fundamental tension of every construction between 'artificial' man-made rigidity and 'natural' fluidity. Both the architect and the soil engineer work on the problem of the structural stability of a building, just with different awareness and priority. While the architect cares mostly about greatness and legacy, the geotechnical engineer, who knows about the mobility of the building ground and the resulting temporality of constructions, wants to find a solution that works for the moment, in order to manage 'to erect an infinitely complicated dome of concepts on mobile foundations and so to speak on flowing water'.[30] Whereas the philosopher acknowledges the human achievement of erecting grand constructions (of truth) under these difficult circumstances, this achievement is based upon the inherent structural fragility of any foundation we can possibly build upon; and, given the scale of the cosmos, it remains minuscule in size within the big picture of things, unlike Speer's fantasies of gigantic 'eternal erections' that promised people could hold onto them for eternity.[31] Facing this vastness of time and space through the limited lens of our humanness, we may feel tempted to withdraw ourselves and hide in our bubble. It is our human nature.

Nietzsche drew a parallel between the human self-perception of 'smallness' in the face of the vast universe with the infinite limitation of the cognitive

state to the next are anything but clean (stuffs bleed into one another along this continuum, producing further intermediate states, such as air, which represents the evaporation of water ascending to fire), hard and fast distinctions ('borderlines') are distortions of nature's reality, as are the way the stuffs come to be named.' (Porter 2024: 78).

30 Nietzsche 1954: 314–15.

31 Klaus Theweleit offered an insightful analysis of the fascist soldier's 'hyper-masculine' desire to 'stay up' and 'stay hard'. He argued that 'the soldierly man freezes in front of erotic femininity, becomes an icicle' and thus keeps himself 'together as a whole, as a body with rigid borders, as which he would cease to exist with the touch of an erotic woman. … He defends himself with a type of permanent erection of the whole body, entire cities, whole troop units …. If it is the man himself, a city, a rock, a border: critical for the defense against the flood is the towering' (Theweleit 1977: 308–09). Interesting enough, contemporary psychiatrist Wilhelm Reich 'reports from clinical practice that soldiers indeed frequently suffered from permanent erections' (Theweleit 1977: 311).

apparatus in trying to penetrate the essence of reality.[32] 'Consequently, the recognition of instability, flux, becoming, and so on in fact also insinuates a false sense of stability.'[33] Instead of succumbing to the 'eternal flow', we may also proceed to try to take control over its properties, encouraged by our Faustian desire to understand the mechanics of the earth, 'So that I may understand / what holds the world together in its deepest ends'.[34] By now, we do understand quite a bit, and our history of understanding certainly grew exponentially since the age of Goethe, as the world population and the resulting weight we pose on the planet did. But the more we know, the less we seem to know about where we belong, as belonging seems to be built upon a moment of 'eternal ephemerality'. But are we really just stardust? Can't we find solace in believing in a sacred principle that secretly governs the universe beyond all this creation and destruction? The oceanic feeling that Freud was so afraid of? Isn't our passion to travel through the space-time-identity continuum proof enough of an intelligent design? Aren't we the strongest when we are spiritually connected?

In his book *After Finitude* (2005), speculative philosopher Quentin Meillessaux summed up the major insights of our age and provided us with a clearly measurable geological timeline (that predates human consciousness) into which we are embedded and with which we have to grapple:

– the date of the origin of the universe (13.5 billion years ago)
– the date of the accretion of the earth (4.56 billion years ago)
– the date of origin of life on earth (3.5 billion years ago)
– the date of the origin of humankind (*Homo habilis*, 2 million years ago)[35]

I believe there remains to be added to this list:
– the death of the sun/earth (in 5 billion years from now)

Meillasseaux goes on to ask, 'what is it exactly that astrophysicists, geologists, or paleontologists are talking about when they discuss the age of the universe, the date of the accretion of the earth, the date of the appearance of pre-human species, or the date of the emergence of humanity itself?'[36] In order to think through that, he defines as *ancestral* any type of reality that predates humanity

32 Landgraf 2023: 42.
33 Ibid. 43–44.
34 Goethe 1808: 34.
35 Meillassoux 2005: 9.
36 Ibid.

and as *arche-fossil* any materials that prove the existence of an ancestral reality, such as stellar emissions or a meteorite that lands on earth and informs us about the age of the universe.[37] Just a few days ago, CNN (and many other news outlets) posted a story about the likelihood of two per cent of an asteroid named 2024 YR4 hitting the earth in 2032, which reminds us how incredibly short the lifespan of the human species is in the grand scheme of things and that eventually we will collide with a piece of ancestral matter that we were once united with.[38] It seems we've now got lost in the vastness of the cosmos, and it is time to return to the little piece of soil we started our journey with in order to ground ourselves, even if just for a split-second of feeling some type of belonging to something at least or at last.

Be(long)*ing*

While researching the cylinder, my journey led me from the various archives in Berlin to a private archive close to Munich, where I was able to locate the building's construction plans that had been deemed lost since the war, so, ironically, my search sent me back home, almost full circle. Despite the dispersion of 'biomass' in the overarching 'cosmic flux' of all things, I can't deny that I was born on German soil. My parents were not. My lineage nearly came to a halt when my grandfather, who was an officer in the Slovak army and later joined the resistance, the *partyzáni*, came into German fascist captivity while hiding in the mountains with the other partisans. He survived because he knew a little bit of German and thus gained the mercy of a German doctor who saved his life, so he came back from the *Lazarett* like *Lazarus* – after bleeding out of all cavities and nearly perishing from the cold and hunger. This is one of the many pieces of history I heard falling from my mother's tongue again and again (see Figure 7). His death would have inevitably ended my genealogy by preventing my coming-into-being. Am I still clinging on to the German language as a means of survival?

The 'glacier'– when metaphorically read as a massive historical force – that pushed my parents across the Iron Curtain was the spectre of communism; currently haunting and rearranging the guts of Europe again. My parents found shelter in the West. A typical migration history.

I can surely relate to what Röttger-Rössler wrote about 'multiple belongings' when she states that: 'Generally, individuals only become aware of their

37 Ibid: 10.

38 Strickland 2025.

Figure 7.

Pavol Kurek, 'Mother and Son', undated. Private source.

fundamental bodily placing, their deep sensory anchoring in specific environments, after a change of place.'[39] She makes the distinction between *being* and *belonging*, stating that *being* describes the state-of-mind when we unconsciously understand the norms, rituals, and patterns of behaviour of the particular environment we are thrown into; whereas *belonging* describes the state-of-mind after

39 Röttger-Rössler 2018: 253.

we leave our home, therefore become conscious of our roots and, as a result, feel alienated by our displacement – in this case '*Being* becomes *belonging*'.[40] In my case this is true, as the longer I am away from the place where I was born and grew up, the Bavarian countryside, the more I understand how it has shaped who I am and what I believe in and a certain nostalgic *longing* for a return to this place becomes stronger and stronger.

Things that I formerly perceived as a prison of body and mind – the ringing of the church bell, the cock-crow, the cows mooing, the smell of meadows and forests, the folk singing and traditional garments, the sound-, smell- and landscapes of my childhood – now appear as a place in my memory where the world was still *in Ordnung* (in order). I know that this romantic longing's object of desire may just be an illusion, possibly a way to escape back into childhood carelessness in the midst of a world that appears more and more complex and chaotic every day. But, it appears as if this is an illusion that I need to cling tightly to in order to feel connected to *something* at least, like a timber on the open ocean after a shipwreck. It may be an illusion, but a necessary illusion that I need to maintain a sense of purpose in my life, something I can hold onto in order not to drown in the streams of endlessness, which is an inevitable consequence when we recognise that every sheltering truth is just a fragile construction built on flowing water, as Nietzsche described it.

This little paper hardly gives me enough space to get to the bottom of my fascination with this particular subject, *be*long*ing*, which was triggered by a piece of soil. In a few pages I will not be able 'to reach the substructure of [my] thought, the underground, the nutrient solution of systematic crystallizations' and show 'with which "courage" the mind is ahead of itself in its images and with how its history is shaped by its courage to guess', as Hans Blumenberg would say.[41] This question will remain central to my development of cultural geology – an exploration of the complexity and scale of existence. But the more I think about it, the less I feel my migration background is of interest to me, I merely think that it sensitised me more towards reflecting about what it means to be thrown into this world out of my human mother's womb. At most, it explains why I have a heightened need for soul searching and digging 'deeper' – in comparison to those who 'feel' more rooted in one place. Given the tension between East/West in my genealogy, I could have looked at how the German scientific community felt the threat of being '[i]nfiltrated by Russian language', even if the global exchange in the soil mechanical community

40 Röttger-Rössler 2018: 244.

41 Blumenberg 1960: 11.

somewhat prevailed throughout the war.[42] In a previous version of this chapter I thought way more about my childhood, liminality, hybridity, the Eastern European accent of my parents and my obsession with high German, etc. – but it all just seemed like a superficial distraction once I revisited it. When I peel away the layer of my Eastern European ethnicity and my Western nationality and go deeper, humanness itself, the belief in human exceptionalism that is almost impossible to let go, and the weight we apply as a highly 'invasive species' to the planet as a whole (some call our age the Anthropocene), seems to be at the core of the problem, which I will need to think more about when further developing my idea of *heavy load-bearing modernity*.

When the geotechnical engineers from the Degebo subtracted the piece of 'German' glacial till that triggered my flow of thoughts from underneath the cylinder, they were very well informed about the complex and mobile composition of the ground(s), as they were in the process of meticulously measuring everything to be able to precisely determine its load-bearing capacity. For that reason, three measurement chambers were placed beneath the massive upper cylinder to enable the Degebo to register the precise vertical, horizontal and axial movements of the cylinder with a system of gauges alongside other measuring instruments (for temperature etc.).[43] The day the workers started pouring the hot concrete into the cold steel encasing, which marks the beginning of the initial measuring, was 28 August 1941, resulting in a sinkage of about eight inches by 1945, overshooting the two-inch maximum demanded by Speer.[44] Did the erection of a monolithic and eternal Germanness on top of these 'resistant' grounds seem like a contradiction to the geotechnical engineers, given they certainly knew about the local soil mechanics as well as the larger geological/cosmological timescale? Most likely not.

Even if the leading architect's guiding intuitions, 'the bigger, the better', 'the deeper, the better' and 'the harder, the better' did not necessarily turn out to be true for determining the soil's load-bearing capacity, the overall question was never *whether* the earth could take it, only *how* to ensure its load-bearing capacity would hold up; if not naturally, soil-condensation methods and other 'terra-forming' techniques for an appropriate foundation design were already at hand. Concretely, it would have been necessary to build deep foundations and densify the sand artificially to significant depths. These methods were already available through the companies Franki, via 'earth post method', and Keller,

42 Arend 2017: 683.

43 Muhs 1948: 101–06.

44 Dywidag. 'Zeitlicher Verlauf der Baugrundbelastung'. 27 Nov. 1941. ALLVIA Ingenieurgesellschaft mbH, 4112-03.

via 'vibration pressure method' – techniques that had been tested out at the Nuremberg Party Rally Grounds, for example.[45]

National Socialism was never about discovering truth, it was about creating and violently imposing truth and moulding reality after it: *blood over soil* – racial terra-forming. While the Triumphal Arch – as a supersized monument to the 'rebirth' of the German master race – never materialised, the data collection at the cylinder continued into the 1980s and, along the way, informed still intact building norms (incl. DIN 1054) and countless heavy building projects. During the regime, several bridges, power plants, hangars, machine halls and steel plants in several German cities were built with the data collected by the Degebo.[46] As Muhs wrote in the Degebo chronicles, after the war, the data came in very handy as well, especially for the rebuilding Berlin[47] – but also representative buildings such as the Kongresshalle, Deutsche Oper and Philharmonie, a lot of infrastructure (bridges, streets, harbours, factories, subway, ringroad, etc.), governmental and industrial buildings.[48] Wherever in Germany you are, you are probably walking on grounds that have been measured out by the Degebo in some way.[49]

While the 'palingenetic' racial terra-forming of German fascism came to an abrupt halt, humanity's terra-forming capacities (for which fascism served as a catalyst) grew in an accelerated manner and testify to the aggressive hunger for growth driving the human population. The Degebo's large-scale, top-down and in-depth *Vermessung der Welt* (measuring of the world) was to be followed up by a *Vermassung der Welt* (massification of the world), in this case massive monuments – embodying superiority – that the ground was designated to carry. While the NS-empire broke down in 1945, humanity itself scaled up. Therefore, when on site nowadays – everyone can tour the cylinder during

45 Muhs 1948: 101–11.

46 Projektarchiv Degebo, Tätigkeit des Arbeitsausschusses der Degebo im 12. Geschäftsjahr (1 April 1939 bis 31. März 1940): 5–6.

47 Muhs 2004 1969: 21.

48 Ibid.: 18.

49 The cylinder was the Degebo's main research site up to the 1980s. In conversation, some experts even claim 70–80% of knowledge we have about soil mechanics today come from this one site. Using the cylinder as deadweight, the researchers were able to simulate almost infinite pressures on a variety of materials and soils. In 1979, Prof. Dr. Dr.-Ing. E.H. Meyerhof from the Technical University of Halifax, Canada, sent a letter to the Degebo, highlighting the international reputation of the German research institute by stating that, with their 'cutting-edge research, especially their … large scaled test-loads … the Degebo has acquired an international reputation'. He acknowledged them as 'one of the oldest research institutes in the world within their field' (Projektarchiv Degebo, Heft 33 einschl. Schriftwechsel).

opening hours (usually from 1–6 pm from October to April) – I still sense that unbound human hunger for scaling up, building higher, reaching for the skies, purification, putting oneself on a pedestal far above others, that drove German fascism and is still driving human exceptionalism.[50] And, given the population explosion from 1 billion in the year 1800 to over 8 billion today, we are already far beyond '*earth's limited carrying capacity*' as the MIT scientists that formed the Club of Rome have argued since the regularly updated publication of *Limits to Growth* in 1971: the load-bearing capacity of glacial till is connected to the earth's overall load-bearing capacity.[51] I myself, as someone who is enthusiastic about technology, science and architecture, and can certainly relate to the intoxicating 'drive to height' of 'Generation Ikarus', despite flashes of potential collapse, am part of the problem. We want to believe we can go higher and fix 'it'.[52]

The imprint of the cylinder, as the heaviest memorial in so many ways, embodies this trait of the 'supersizing' Anthropocene. And while we are passionately distracting ourselves with deciding about so-called progressive, conservative, identity, etc., politics, this imprint is getting deeper and deeper; the beast within us grows and grows under the mask of many different colours.

Thinking through soil, starting at the granular level of glacial till as part of a *Ge-schiebe* that transcends German national borders and nationalistic symbolic orders, (up-)rooting it back to its origin in the overarching 'cosmic flux', then grounding myself back in the fond memories of the land I was born in – whilst undermining fascist fantasies of stability/purity on the way and also trying to understand the human need for a firm grounding within this overwhelming fluidity of things, somewhat coming full circle – allowed me to look at soil as a material, a metaphor, a place of romantic longing, and at many other layers of its meaningfulness.

This summer, which I spent in an apartment close to the cylinder while finishing this chapter, allowed me to circle around the structure and get lost in my reflections on a daily basis. Sometimes, I think, thinking in vast cosmological scales is just my way to evade real-world problems; sometimes, I think, being absorbed by the real-world is evading how things really are on the grand scale. There is truth in both, and by thinking through soil like a cultural geologist, we

50 More info on www.schwerbelastungskoerper.de

51 Meadows et al. 2004: 137.

52 As if there was a justifying voice whispering in our ears: 'A fascination for hugeness is expressed in the Tower of Babel, the Egyptian pyramids, the buildings of Olympia, the temples of Selinunt, the Colosseum in Rome, whether they represent the power of a state, individual will, a symbol of faith, or a demonstration of technical skill.' (Speer 1985: 213)

can learn to appreciate all the smallest and the largest pieces across all scales but also locate painful pressure points and imprints of 'creative destruction' and 'destructive creation' that continue to haunt us – like the noise of trains passing by the cylinder that makes the earth shatter reverberating throughout all shifting layers of history: *Ge-schiebe*, *Ge-schichte* and *Ge-wichte*…

Acknowledgements

Personal:

Emily Brownell, University of Edinburgh: for her patience with my manuscript, excellent feedback and encouraging words. Dana Cuff, UCLA Urban Humanities Initiative: for encouraging me to explore architecture and urban spaces. Marco Kano: for lending me his civil engineering eye to check upon my calculations. David Kim, UCLA: for consistently brilliant and detailed feedback, reading recommendations, and career-building advice. René Krüger, Berliner Unterwelten e.V.: for introducing me to everything, his resourcefulness, and kind spirit. Julia Hell, University of Michigan: for her mentorship, encouraging words, and pushing me to publish faster. Marcel Ney, TU Berlin: for allowing me to dig through the archives since 2018 and making my project possible. Todd Presner, UCLA Urban Humanities: for encouraging me to discover my own path and years of mentorship. Michael Richter, Berliner Unterwelten e.V.: for providing me with a plethora of resources, connecting me with the right people, and making my project possible. Maite Zubiaurre, UCLA Urban Humanities Initiative: for encouraging me to liberate my poetic voice.

Institutional:

The White Horse Press; Michigan Society of Fellows; Department of Germanic Languages and Literatures, University of Michigan (UM); Fachgebiert Grundbau und Bodenmechanik, Technische Universität Berlin; UM Weiser Center for Europe and Eurasia; Berlin Program for Advanced German and European Studies, Freie Universität Berlin; Ernst Adolf Marum Fellowship, UCLA Center for European and Russian Studies; UCLA Department of European Languages and Transcultural Studies; UCLA Division of Humanities; UCLA Alan D. Leve Center for Jewish Studies; UCLA Department of Germanic Languages and Literatures; UCLA International Institute.

References

Ahmed, Sarah. 2004. 'Collective Feelings. Or, The Impressions Left by Others'. *Theory, Culture & Society* **21** (3): 25–42.

Arend, Jan. 2017. 'Russian Science in Translation: How Pochvovedenie Was Brought to the West, c. 1875–1945'. *Kritika: Explorations in Russian and Eurasian History* **18** (4): 683–708.

Blumenberg, Hans. 1960. 'Paradigmen zu einer Metaphorologie'. *Archiv für Begriffsgeschichte* **6**: 7–142.

Bojowald, Martin. 2009. *Zurück vor den Urknall. Die ganze Geschichte des Universums*. Frankfurt am Main: S. Fischer.

Edwards, Catherine (ed.) 1999. *Roman Presences: Receptions of Rome in European Culture, 1789–1945*. Cambridge: Cambridge University Press.

Goethe, Johann Wolfgang von. 1808. *Faust: Der Tragödie erster Teil*. Tübingen: Cotta.

Greene, Brian. 2020. *Until the End of Time: Mind, Matter, and Our Search for Meaning in an Evolving Universe*. New York: Vintage.

Griffin, Roger. 2018. *Fascism: An Introduction to Comparative Fascist Studies*. Cambridge: Polity.

Haney, David. 2022. *Architecture and the Nazi Cultural Landscape: Blood, Soil, Building*. London: Routledge.

Hell, Julia. 2019. *The Conquest of Ruins: The Third Reich and the Fall of Rome*. Chicago: University of Chicago Press.

Kerisel, Jean. 1987. *Down to Earth: Foundations Past and Present: The Invisible Art of the Builder*. Rotterdam/Bosten: Balkema.

Kirsch, Klaus and Fabian Kirsch. 2016. *Ground Improvement by Deep Vibratory Methods*. 2nd. ed. Boca Raton: CRC Press.

Kurek, Paul (contributor). 'The Nazi Block'. Episode 616, 99% Invisible: 99percentinvisible.org/episode/616-the-nazi-block/transcript/ (Accessed 13 June 2025).

Kurek, Paul. 2025. 'Towards a Cultural Geology: Merging Material and Conceptual History'. *The Journal of the History of Ideas Blog*, ed. by Jonathon Catlin, 15 Jan.: jhiblog.org/2025/01/15/towards-a-cultural-geology-merging-material-and-conceptual-history (Accessed 15 Jan. 2025).

Kurrer, Karl-Eugen. 2016. *Geschichte der Baustatik: Auf der Suche nach dem Gleichgewicht*. 2nd ed. Berlin: Ernst & Sohn.

Landgraf, Edgar. 2023. *Nietzsche's Posthumanism*. Minneapolis: University of Minnesota Press.

Litt, Thomas, et al. 2007. 'Stratigraphische Begriffe für das Quartär des Norddeutschen Vereisungsgebietes'. *E&G Quaternary Science Journal* **56** (1/2): 7–65.

McGurl, Mark. 2011. 'The New Cultural Geology'. *Twentieth Century Literature* **57** (3/4): 380–90.

Meadows, Donella, Dennis Meadows and Jorgen Randers. 2004. *Limits to Growth: The 30-Year Update.* London: Chelsea Green.

Meillassoux, Quentin. 2008. *After Finitude*. London/New York City: Continuum.

Meyerhof, George Geoffrey. 1979. Letter to the Degebo. Projektarchiv Degebo, Heft 33 einschl. Schriftwechsel.

Muhs, Heinz. 1969. *1928–1968: 40 Jahre Degebo*. Berlin: Deutsche Forschungsgesellschaft für

Bodenmechanik an der Technischen Universität Berlin.

Nietzsche, Friedrich. 1954. 'Über Lüge und Wahrheit im aussermoralischen Sinn'. *Friedrich Nietzsche. Werke in drei Bänden*, vol. 3, ed. by Karl Schlechta. Munich: Hanser. pp. 308–22.

Porter, James. 2024. 'Life Cycles beyond the Human: Biomass and Biorhythms in Heraclitus'. *Classical Antiquity* **43** (1): 50–96.

Presner, Todd. 2007. *Mobile Modernity: Germans, Jews, Trains*. New York City: Columbia University Press.

Röttger-Rössler, Birgitt. 2018. 'Multiple Belongings. On the Affective Dimension of Migration'. *Zeitschrift für Ethnologie* **143** (2): 237–62.

Speer, Albert. 2005 [1969]. *Erinnerungen*. Berlin: Ullstein.

Speer, Albert. 1985. 'Foreword'. *Albert Speer: Architecture 1932-1942*, ed. by Leon Krier, Brussels: AAM. pp. 213–216.

Strickland, Ashely. 2025. 'Asteroid 2024 YR4 Could Hit Earth in 7 Years. Here's What Could Happen — and What's Being Done About It'. *CNN*, 16 Feb.: https://edition.cnn.com/2025/02/15/science/asteroid-2024-yr4-earth-tracking/index.html (Accessed 16 Feb. 2025).

Theleweit, Klaus. 1977. *Männerphantasien: Frauen, Fluten, Körper, Geschichte*, vol. 1. Frankfurt am Main: Roter Stern.

Tomerius, Cornelia. 2013. *Ach du dickes B: Eine Berliner Pleitengeschichte*. Berlin: Berlin Verlag.

Troost, Gerdy. 1938. *Das Bauen im neuen Reich*. Bayreuth: Gauverlag Bayerische Ostmark.

Weber, Renée (ed.) 1986. *Dialogues with Scientists and Sages: The Search for Unity*. London/New York City: Routledge & Kegan Paul.

Archival Sources

Degebo. 'Tätigkeit des Arbeitsausschusses der Degebo im 12. Geschäftsjahr (1 April 1939 bis 31 März 1940)'. 1940. TU Berlin, FG Grundbau und Bodenmechanik, Projektarchiv Degebo, 3112-3117 Geschäftsführung bis 1945, 3112 Tätigkeitsberichte.

Dywidag. 'Zeitlicher Verlauf der Baugrundbelastung'. 27 Nov. 1941. ALLVIA Ingenieurgesellschaft mbH, 4112-03.

Mauz, Josef, Tiefbohrungen als wichtige Hilfsmittel bei der Neugestaltung Berlins. 1939. BArch, R 4606/639, Bl. 10-11.

Muhs, Heinz. 'Durchführung und Ergebnis einer großen Probebelastung'. Manuscript. 1948. TU Berlin, FG Grundbau und Bodenmechanik, Projektarchiv Degebo, 3352-1/1c Probebelastung Bauwerk T.

Muhs, Heinz. 'Durchführung und Ergebnis einer großen Probebelastung'. Manuscript. 1948. Projektarchiv Degebo, 3352-1/1c Probebelastung Bauwerk T.

Muhs, Heinz. 'Struktur der eiszeitlichen Böden'. 10 Feb. 1940. TU Berlin, FG Grundbau und Bodenmechanik, Projektarchiv Degebo, 361 BKB O Große Halle, Poststadion, Stromrüttelverfahren.

The Gaza Strip, Palestine:

Cultivating an Ancient Soil: Sub-dune Histories and Ecologies

Dotan Halevy

Sand is a material defined by size. It can consist of any inert substance as long as its particles range from 250 micrometres to 2 millimetres in diameter. Under what conditions can this material attribute become a life-supporting environment? In other words, what is required for sand to transform into soil, and what criteria measure this transition? The capacity to retain water molecules? The development of humus, organic nutrients, between sand grains? Their arrangement, mobility or immobility? Soil chemists, pedologists and geographers would provide ample and diverse answers. This chapter, however, suggests that converting sand to soil (and back) is also, and sometimes primarily, a political process. This is because, once sand is classified as 'soil', it also acquires the properties of 'land', complete with the baggage of belonging, ownership, profit, possession and dispossession that often comes with it. History writing has often been soil-biased in choosing areas of interest, focusing on characteristic terrains of agricultural production as the primary sites where history is arguably the most condensed and eventful. Sand might exemplify a terrain frequently seen as limitless, innate, unmappable, uncultivable, having no owners and, thus, no history. Yet, colonial contexts reveal that these assumptions are in and of themselves historic. Distinguishing between productive and unproductive lands, wastelands and arable lands, sand and soil, was not a scientific question but rather a political one, driven by goals of colonial management and expansion. Colonial thought constructed uncultivable lands as no lands at all, and made their inhabitants correspondingly landless throughout history, thus subject to removal, stripping of sovereignty and rights or political subjugation.

But what alternative histories can environmental historians narrate about sand as soil or as land? How can we historicise or politicise sand? This chapter attempts to do that by exploring a specific case in the Gaza Strip during the 1970s, shortly after its occupation by Israel in 1967. Here, the efforts of colonial expansion and scientific research, combined with the practices of Palestinian economic survival under occupation, reveal how unexpectedly political sand's history, cultivability, and ownership rights can be. What follows is an excavation

DOI: 10.63308/63897247289532.ess09

into a sand dune in the outskirts of Deir al-Balah in the central Gaza Strip. The chapter's five sections reveal five layers of meaning, removed one after the other to explore a micro-story of colonial irony: how colonial usurpation, bulldozing and looting of one Palestinian plot of duneland granted its owner rights of cultivation amidst a wave of dispossession. The first layer of the chapter sets the stage by recounting the story of an Israeli archaeological excavation beneath the Deir al-Balah dunes between 1972 and 1982. As the chapter unfolds, each section peels another layer off this story, demonstrating how it is through the supposedly unfertile and negligent environment of sand that the transformation of the Palestinian coastal landscape under Israeli colonisation is best exposed, complete with its reliance on the imperial and colonial perception of dunes dating back to the nineteenth century.

I

In 1968, some unusual archaeological artefacts began appearing in antiquities shops in the old city of Jerusalem. Over the past few months, the illicit digging and antiquities trafficking industry had grown significantly due to the Israeli occupation of the West Bank and the influx of Israeli buyers and enthusiasts into the antiquities markets. Yet, the objects here discussed were different. They included bronze, faience, alabaster vessels, figurines, scarabs, gold jewellery and semi-precious stones from the Late Bronze Age. The artefacts' origin appeared Egyptian and featured remnants of yellow marine sand. Israeli archaeologists suspected that they did not originate from the West Bank but rather from another occupied territory now under Israel's control, the Gaza Strip. Unlike the West Bank, Gaza was not a hotspot for archaeological research or antiquarianism. Part of ancient Philistia in Western historical tradition, it did not hold the same Judeo-Christian allure as the biblical sites of the Palestinian highlands centred in Jerusalem. How, then, did these artefacts surface in Jerusalem's markets?

At least one high-ranking Israeli official knew the answer. Shortly after the 1967 war, Israel's Minister of Defence, Moshe Dayan, received information from an associate in the village of Deir al-Balah in the central Gaza Strip about a trove buried in the dunes. Hammad Abu Shams was a Bedouin man, most probably from a 1948 refugee family who resided in the Deir al-Balah refugee camp. According to Dayan's memoirs, Hammad 'excelled' in discovering antiquities and unearthing them delicately. His greatest-ever discovery was in the land of Shaikh Abu Majid, of the Abu Mu'liq clan of the Tarabin tribe. The Sheikh removed a layer of sand with excavators to plant a citrus orchard. But when his workers started digging to plant the seedlings, they hit stiff objects

buried in the soil lying underneath the sand.[1] Digging into this layer, Hammad, maybe one of the workers, discovered a group of anthropoid sarcophagi. He secretly informed Dayan of the finding. Dayan, by yet-unexposed means, encouraged illicit digging by buying the recovered relics from the landowner, with Hammad gaining as a middleman.[2]

After gathering a significant treasure of artefacts, Dayan seems to have informed Trude Dothan, a Hebrew University professor specialising in Philistine archaeology, about the precious anthropoids. Dothan already knew of the findings that had reached the antiquities markets in Jerusalem. It is unclear, however, whether she knew already that Dayan was actively involved in their excavation. Anyhow, she suspected that the origin of the objects in Jerusalem was somewhere in the coastal plain. Together with rumours in the army that some illicit digging had been spotted in Deir al-Balah, the circle was closed.[3] Dothan and her husband, Moshe, visited the site for the first time for a brief survey in 1968 and then again in 1970.[4] In a report published later, she confirmed that this was indeed where the Jerusalemite findings came from. Large amounts of sand, removed by an excavator, created a small hill, and a newly planted orchard was visible. In one place, she could spot the holes from which the anthropoids were exhumed.[5]

Following this first survey, Dothan requested to run an official excavation of the site but this was denied by the military authorities. Since the occupation of the Gaza Strip in 1967, Palestinian militia groups associated with the PLO sustained a guerrilla warfare against the Israeli army, and the presence of Israeli civilians in the Gaza Strip was limited. In July 1971, following the murder of an Israeli family driving their car through the Strip, Israel launched a brutal counter-insurgency offensive in al-Shati, Jabalia and Khan Yunis

1 Dayan 1976: 407.

2 On Dayan's lifelong involvement in antiquities theft and illegal excavations, see Patrick Cockburn, 'The Pictures That Prove the Guilt of Moshe Dayan: Hero and Thief', *Independent,* 14 Feb. 1997. https://www.independent.co.uk/news/world/the-pictures-that-prove-the-guilt-of-moshe-dayan-hero-and-thief-1278480.html; Kletter 2003; Kletter 2006: 150–64; Thomas Friedman, 'Dayan Legacy Prompts Dispute on Antiquities', *New York Times*, 14 May 1986.

3 Trude Dothan's later version in *People of the Sea* (1992) is different. There, she argues that she informed Dayan of the illicit digging in Deir al-Balah and that he never knew about it. Archival documents from the Department of Antiquities testify that Dayan's involvement was already known in the military.

4 'Mizkar-Aronot Antropoyidim – Dayan', 11 Feb. 1977, Deir al-Balah, The Israel Antiquities Authority Archives.

5 Dothan 1978: 2–3.

refugee camps. Led by General Ariel Sharon, the Israeli troops bulldozed large parts of these camps with military excavators, forcibly removing some 40,000 residents, killing hundreds of armed and unarmed men and imposing extended curfews, arrests and exiles. In January 1972, Dayan cut short the operation for being over-aggressive. In parallel, he launched an open-door policy to enable residents of the Gaza Strip to travel freely into Israel and the West Bank to seek employment in low-skilled occupations.[6]

As relative stability ensued, Dothan's request for a formal excavation was approved in February 1972. The expedition was defined as a 'Salvage Excavation' since it was known that illicit digging had gone on since 1968, and many more coffins had been removed from the site. Israeli soldiers deployed in Deir al-Balah testified in 1970 that excavations on a large scale were running at the site 'by authority', without interruption, and that the findings were delivered 'to someone'.[7] In 1971, it was exposed that Dayan himself transferred the fragments of some thirteen Sarcophagi to the lab of the Israel Museum in Jerusalem to restore them into complete objects.[8]

It is no wonder, then, that by the time Dothan's formal excavation started in March 1972 (first season) and June 1972 (second season), not much was left on the site. Amidst the remains of 'amateur excavations', Dothan could only trace one plundered and empty coffin *in situ*, and another three complete coffins (Tomb 114), buried some eight metres under the sand within natural red soil (*ḥamra*) or *kurkar* sandstone.[9] Announcing these first findings, Dothan already knew of 45 other coffins that Dayan had previously found and held. In her first publication on the 1972 excavation, Dothan used pictures of Dayan's coffins to make a typology of the findings.[10] They were found to be very rare Egyptian anthropoid sarcophagi in which ruling-class Egyptians in Canaan were buried in the thirteenth century BC. The minister's illegal antiquities trafficking both supplied the scientific foundation of the excavation and the

6 Filiu 2014: 125–45; Weizman 2017: 67–68.

7 Avraham Biran, Head of Antiquities Department of the Ministry of Education to Avner Goren, Archaeology Officer of The Israeli Defence Forces, 16 Sept. 1970, שר-1555/1, Israel State Archive.

8 'Takhshitim Kortzim BeDeir al-Balah', *Ha'olam Haze,* 16 Feb. 1977, 32. It had taken the museum 5 years to amend them. Upon completion, nine coffins were bought from Dayan for 5,000 pounds each; two were given as gifts, and another two remained amended in his possession. 'Pras Lashoded', *Ha'olam Haze,* 26 Jan. 1977, 34.

9 Dothan and Bet-Arieh 1972; Anon. 1972.

10 Ibid; Dothan 1992: 205. Tzvi Ilan, 'Nehqarim Shloshim Antropoidim Mi-Deir al-Balah Hametsuyim Be'osef Moshe Dayan', *Davar*, 17 Feb. 1972, 4.

necessity to undertake it as a form of 'salvage' operation. Archaeologists such as Dothan needed Dayan on their side since, as Minister of Defence, he was also the person to authorise excavating in the occupied territories. Thus, despite his illegal acts, he appears in Dothan's publication not as the plunderer of the site but as the excavations' facilitator.

The excavation of what came to be defined as 'The Deir al-Balah Cemetery' in 1972 led Dothan to conclude that there must also be a town, an Egyptian outpost, of the same period somewhere around too.[11] And indeed, in a survey conducted about 200 metres west of the cemetery, the expedition found a site of potential habitation. Thus, a new archaeological project emerged in search of the historic society to which the cemetery belonged.[12] The eruption of the 1973 Israeli-Arab war halted these ambitious plans, but the search for the settlement did start in 1976, in the place where the surveyors traced pottery relics that seemed promising.[13]

Unlike the cemetery, in the new site, the expedition had to start digging from the contemporary sand surface, a formidable task. 'Our problem was that it is impossible to excavate any further in the dunes', Dothan wrote. How would they remove thirteen metres of sand, hundreds of tons, and who would pay for it? In a region under military occupation, the army, with its heavy machinery, was the solution to all these questions. 'With the help of the IDF', Dothan writes, 'it was decided to quarry and sell the sand to local construction companies in order to offset the costs.'[14] Israeli sand mining in the coastal enclave was not new, and evidence shows that even dredging on the coastline, a practice that was outlawed in Israel proper by then, was sanctioned in the occupied Strip.[15]

Equally important, however, was to reach an agreement with individual Palestinian landholders upon whose land the massive operation was planned. 'Our initial efforts at clearing the area had already caused some disturbances', Dothan explained, but did not provide details.[16] To avoid such delays, then, 'the landowner became a partner in the enterprise on the condition that the

11 Dothan 1972: 21–25.

12 Dothan 1978: 4.

13 Israeli archaeology and war have a long history of entanglements. Territorial expansion enabled Israeli archaeological surveys and digging in the Golan Hights, the West Bank and Sinai, while the discovery of ancient Jewish sites or artefacts often justifies military control and oppression. See Kletter 2006a: 1–8; Greenberg and Keinan 2007; Abed Rabo 2024.

14 Dothan 1978: 4.

15 *Din Veheshbon Shnat Hamimshal Hatshi'it 1975–1976* (IDF: Mifkedet Ezor Retsu'at 'Aza, 1976) [Report of the IDF Military Administration in the Gaza Strip, 1976], 87.

16 Dothan 2010: XXVIII.

Figures 1 and 2.

The advancement of the sand removal and site excavation. The red arrow marks the site of the future plantation. Photos from *Qedem* 49, XXXIII – Figure 1: 'Photo 4. The site of Deir el-Balah in August 1977'; Figure 2: 'Photo 6. The site of Deir el-Balah in April 1979'.

Figures 3 and 4.

The advancement of the local plantation in 1981 is marked by a red arrow. Photos from *Qedem* 49, VIII, XXXV – Figure 3: 'Color plate 2B. The site of Deir el-Balah in 1981'; Figure 4: 'Photo 10. The site of Deir el-Balah in 1982'.

excavated areas would be filled in, covered with arable soil, and returned to him'. In other words, the expedition applied the method by which the cemetery was initially discovered only the other way around; instead of an agrarian improvement leading to an excavation, it would be an excavation leading to an agrarian improvement.

Indeed, several months after the beginning of the excavation in 1977, '175,000 metric tons of sand were removed by the [military] bulldozers, clearing an area of 2000 square metres down to the occupation level'. Figures 1 and 2 show the advancement of the excavation by 1979, and figures 3 and 4 show that the landowner did not wait for the site to be entirely abandoned by the archaeologists to start cultivation in the excavated area.[17] During the last season

17 All pictures in this chapter were taken from Dothan and Barandl 2010 (*Qedem* 49) and are reproduced with the permission of the Institute of Archaeology, The Hebrew University of Jerusalem.

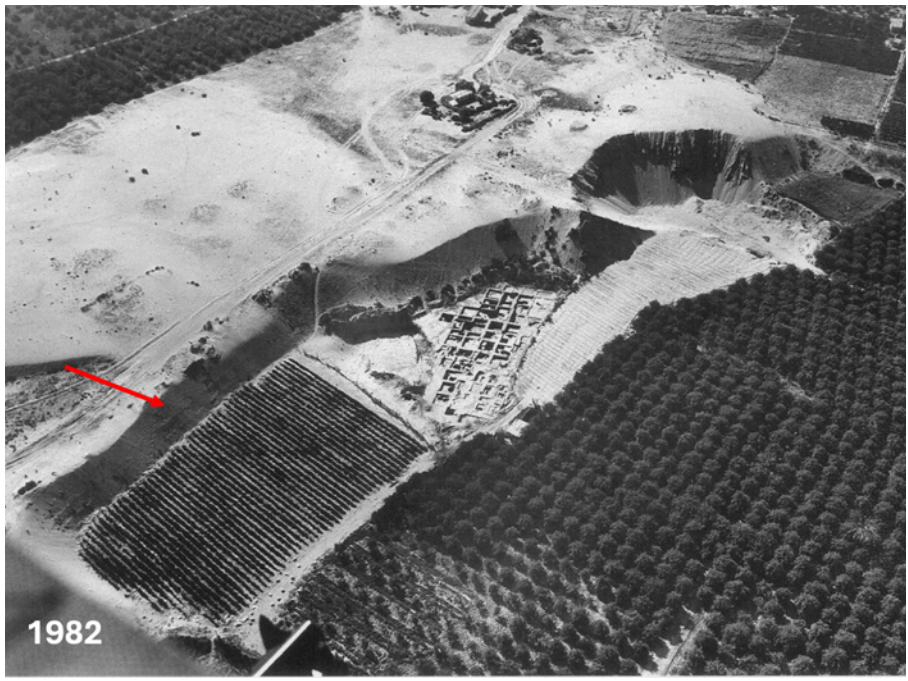


Figure 5.

The crater created by the excavation and the plantation already in place upon the conclusion of the dig in 1982. Photo from *Qedem* 49, XXX: 'Photo 1. The site of Deir el-Balah in 1982, general view'.

of 1982, a large part of the area dug by the bulldozers was already planted with trees by the Palestinian landowner. 'Our last season ended abruptly in 1982', Dothan wrote, 'when the landowner preemptively re-interred the excavated area and denied us further access.'[18]

II

The Israeli accounts narrating the exposure of the ancient cemetery of Deir al-Balah all start from the Palestinian effort at 'land reclamation', the process of removing a layer of sand before starting agricultural production.[19] Indeed,

18 Dothan 2010: XXXIV.

19 Dothan 1978; Lipton 2010: 3.

this agrarian practice was common along the Palestinian coastal plain and is known locally as *mawasi*, which literally means 'suction'. Dating back to the early Islamic period, cultivators performing *mawasi* would dig the upper sandy surface along the coast to create long sunken ponds where vegetables could grow, relying on the high water table of the coastal aquifer. *Mawasi* agriculture typically occurred very close to the seashore, evident clearly in historical maps of the Palestinian coastline.[20] However, the expansion of this practice farther west from the beach, to the site where the archeological cemetery was discovered, was unique and resulted from the unusual colonial circumstances of the Gaza Strip at the time. So did the 'solution' found for expanding the excavation by granting the Palestinians of Deir al-Balah the land exposed underneath the dunes. Let us examine, then, how the post-1967 military occupation that facilitated the plunder and excavation of the Deir al-Balah archeological treasures was simultaneously tied to the village's agricultural transition.

The Gaza Strip was enclosed as a political enclave in February 1949 due to the demarcation of the Egyptian-Israeli armistice agreement. The territory was the last remaining holding of the vast area the Egyptian army occupied in Palestine during the 1948 war. Held by a friendly army, what became known as the Gaza Strip absorbed some 200,000 Palestinian refugees who fled the battle areas north and east or were forcefully displaced by Jewish-turned-Israeli troops. Under Egyptian military rule from 1949 to 1967, citriculture came to dominate the Gaza Strip's agrarian landscape. For an enclave with no other sources of income, citrus was a profitable export commodity of high production per *dunam* (1/4 acre). The plantations served as the primary investment for remittances sent by Palestinian migrants abroad and for tradesmen benefiting from Egypt's classification of the Strip as a tax-free zone.[21] Labour and water-intensive, Gazan citriculture relied on the combination of readily available well-water from the local coastal aquifer and readily available refugee labour, a workforce almost three times the size of Gaza's native population. Thus, about 6,000 dunams of citrus by the end of the mandate period increased to 92,618 dunams on the eve of the Israeli occupation in 1967, constituting 35 per cent of all cultivated area and 23.5 per cent of the total area of the Gaza Strip.[22]

Once Israel occupied the Strip, this economic dynamic changed. The military

20 Tsoar and Zohar 1985; Roskin and Taxel 2021; Ben-Bassat and Buessow 2024: 98–99.

21 Abu al-Niml 1979: 251–62; Cossali and Robson 1986: 19.

22 Roy 1995: 86–87; The Gaza Strip: Survey of Cultivated Lands, רפ-1613/18, ISA; Israel celebrated its agricultural guidance per the myths of enlightened occupation in media, in films such as: 'Citrus Fruits from the Gaza Strip is Shipped to Greece', 1967, Israel Film Archive, https://jfc.org.il/en/news_journal/60481-2/102166-2/

authorities identified Gaza's citrus industry as too reliant on the free-flowing water from private wells. They calculated that, if the same growth of the citrus industry endured unchecked, it would salinise the local aquifer. In the coastal margin, fresh groundwater from rain on the continent meets a column of saline seawater underground. Therefore, pumping must remain balanced with the natural replenishing of the aquifer by precipitation. Overpumping could lead to seawater intrusion into the aquifer and salinisation of the wells. Therefore, alongside introducing water pipes and irrigation technologies, and regulating existing wells, Israel imposed severe restrictions on water usage and limited the planting of new orchards after 1972.[23] The result was an expansion of *mawasi* vegetable plots that required no external irrigation. Israeli Arabist Gideon Wingert, who reported on Israel's agricultural regulations and guidance in the Strip, noted in a 1977 article that 'following the 1967 occupation of the Gaza Strip, *mawasi* cultivation was given an enormous push, [due to] the need to conserve underground water as much as possible'. In Khan Yunis, for instance, 'cultivators uprooted some 750 acres of palms along the coastline and used heavy bulldozers to push huge quantities of sand in the direction of the sea shore, thus forming ponds of ½ acre each [for vegetables]'. Under Israeli instruction, the Gazans are 'conquering the dunes', Wingert wrote.[24] Political economist Sara Roy illustrates too how, over time, citrus crops lost their prominence to vegetables that were more efficient in water consumption and ultimately more profitable for growers under Israeli restrictions. By the late 1980s, the share of citrus in the local economy had declined, while the area devoted to vegetables had increased by forty per cent and produce output rose by 120 per cent. The agricultural landscape of the Strip gradually transformed into one of hothouses and plastic-covered fields, while the open orchard area shrank. Water management regulations, combined with the continued isolation of the Strip economically, enabled the Israeli authorities to remove Palestinian competitors against Israeli citrus growers. At the same time, vegetable and strawberry growing, as well as their export abroad or to the Israeli market by Israeli firms, were encouraged. Hardly a 'rational choice' made by landowners, this process was controlled by the Israeli authorities by law. As Roy explains, 'reclamation of land', which involved 'bulldozing a piece of land … to make it cultivable', or planting new trees, were forbidden without obtaining permission from the

23 Development of Agriculture in the Gaza Strip, Ministry of Agriculture, 4 Aug. 1972, לג-62960/9, ISA; 'Mesheq Hamyim Beretzua't 'Aza - Tzav Hamayim' *Yedi'on 'Aza* 48 (1977): 1-2 [The Water Ordinance]; Roy 1995: 162–64.

24 Weigert 1977.

military authorities.[25] To connect the dots, water and land use restrictions led to a gradual agricultural transition from citrus orchards to vegetable growing and from the agricultural lands to the dunes. This economy was less competitive with Israeli growers, enabled self-sufficiency of water resources, and relieved Israel from the need to supply the Strip with external water resources for agriculture.

In 1977, while writing his memoir, Dayan recalled that the anthropoids of Deir al-Balah were discovered on Sheikh Abu Majid's land as he dug the sand to cultivate *mawasi* agriculture.[26] Although Abu Majid seems to have been preparing the ground for a citrus orchard, not vegetables, it appears that, at this stage, the practice of extracting sand had penetrated the plantation industry due to the expansion of *mawasi* plots. It is reasonable to assert that this situation was not an isolated incident; since 1973, the Israeli military authorities designated Deir al-Balah as the centre for vegetable cultivation and marketing both within and beyond the Strip. The town's new role as the vegetable capital of the Gaza Strip was frequently highlighted in the Arabic language propaganda magazines circulated by the Israeli military government and is particularly apparent in the most popular publication, *al-Zira'a wa'l-Rakha* (Agriculture and Prosperity).[27] In other words, Israeli restrictions-driven expansion of Palestinian agriculture towards the dunes was common around Deir al-Balah, making the discovery of the cemetery intertwined with the practices of the occupation authorities.

Israeli guidance and support for the Palestinian farming sector in the Gaza Strip were integral to maintaining a prolonged military occupation under the pretence of economic improvement and pacification. Israel's economic regulation of the Gaza Strip's agricultural and industrial production led the enclave into a state of economic 'de-development' and total subjugation to Israeli economic preferences by the mid-1980s.[28] Economic improvement was never meant to deliver economic sovereignty or self-sufficiency but rather to make the Strip economically and infrastructurally dependent on Israel while remaining legally and politically subjected to military control. The expansion of agriculture onto the dunes of Deir al-Balah was a product of this policy.

However, this policy did not stop with economic restructuring; it also included ambitious plans for refugee resettlement inside the Strip to defuse the

25 Roy 1995: 230–31.

26 Dayan 1976: 407.

27 'Nadwa li-Muzara'i Hudar al-Tasdir', *al-Zira'a wa al-Rakha'* 9 (1973): 1; 'Tartibat Jadida li-Hudar al-Tasdir', *al-Zira'a wa al-Rakha'* 20 (1974): 1; 'Ahamiyyat Tasdir al-Hudar', *al-Zira'a wa al-Rakha'* 27 (1975): 1; 'Jawa'iz Tashji' li'l-Muzari'in', *al-Zira'a wa al-Rakha'* 54 (1977): 1.

28 Roy 1995.

Palestinian nuclei of resistance. The same purpose also guided the establishment of Israeli military-agricultural outposts that were meant to disrupt the Palestinian demographic continuum between cities and towns. In Israeli land categorisation, sand dunes were considered the most suitable terrain for these planning and building initiatives, as they were ostensibly devoid of ownership. That understanding of the dunes relied, in turn, on deeply-rooted colonial forms of understanding the eastern Mediterranean landscape, and decades of prior dispossession of sand-dwelling societies. This historical layer will be discussed next.

III

Israeli rule in the Occupied Territories since 1967 has followed the legal practices established during the British mandate (1920–1948), which set a very low threshold for expropriating 'abandoned' or 'uncultivated' lands from local inhabitants and cultivators, thus making them state property. Continuous cultivation in sandy areas was more difficult to achieve and demonstrate than in other types of land, making such expropriation common both under British rule in Palestine and later under Israel.

During the British mandate period, Zionist immigration, land purchasing and settlement, along with Palestinian population growth, created a crisis of land shortage and landlessness that intensified the political tension between Jews and Arabs. To utilise as much land as possible for cultivation, the British mandate government worked to prevent sand drift from the coast to the northwest, which encroached upon arable lands, reducing their cultivability. To address this problem, they issued a series of ordinances that eliminated the legal possibility to claim ownership and usufruct rights over sands, converting much of these areas into closed forests and state domains cultivated only by state guidance.[29] These regulations abruptly changed longstanding norms practised legally under the former Ottoman rule, by which cultivators could claim possession over abandoned lands as a means of agricultural 'revival', in Arabic *ihya.* Under the new mandatory rules, Arab occupation of sand areas designated as abandoned, dead or enclosed for afforestation now became classified as squatting and was outlawed.[30]

29 'Analysis of Ownership and Occupation of the Coastal Sands Dunes Extended from Jaffa to Rafah', 1945, 1945, מ-22/2, ISA [129].

30 Bunton 2007: 36–37, 43–44; On the concept of Mawat, see also in *Grasping Soil,* 'Unit 4: Soil as Belonging', Soil as Property and Properties of Soil.

Supporting these efforts was an elaborate ecological perception of sands and their inhabitants as avatars of environmental ruin. British forestry and land officers took the dunes as an uncultivable wasteland because of their arid and shifty nature. Dunes, in British perception, were not only waste in and of themselves but were also *laying waste* fertile lands in their vicinity by drifting and covering them. Arab cultivation of sands, which commonly included *bustans* of vines, sycamore and mulberry, and patches sown with lupine or watermelons, let alone grazing upon the sand, were taken not as a valid economic use but, on the contrary, as the cause for sand drift in the first place. As sand drifted, in other words, it was as if it covered the preexisting land rights together with the soil, making growing spaces 'abandoned' and supposedly ownerless.

Relying on accounts of a glorious past lost to a degrading environment, the British understood the holy land's landscape in a declensionist manner.[31] The British Soil Conservation Board in Palestine explained in its second bulletin, published in 1946 and titled *The Destruction of Soil in Palestine*, that the contemporary scarcity of arable soil in the country resulted from centuries of Muslim neglect. The Muslim conquests of the seventh century arguably brought with them 'the great increase of the goat, the Bedouin invasion, and the Muslim civil war'. These destroyed the cultivable lands after eons of 'well-balanced soil conditions and good agricultural practices from very early times, continuing on through Roman and Byzantine times up to the Muslim conquest, and perhaps somewhat later'.[32] While the land saw oscillating periods of recovery and destruction under Muslim rule, 'near the end of the Turkish regime … increased grazing by animals caused a rapid destruction of [soil] cover, particularly on the hills and sand dunes'. The final blow came with the destruction of fruit trees during the First World War when 'encroachment of sand dunes followed at once'.[33]

To stop sand drift and prevent the Arab agricultural practices that supposedly caused it, the British administration in Palestine launched a campaign to plant trees and grass known for their soil-holding capacity along the coastal plain. Such initiatives were already in progress in French-controlled North Africa, under Italian rule in Libya, Australia, South Africa and other regions

31 Halevy 2023: 537–64.

32 Taylor 1946: 10; On British understanding of Palestine as land of plenty ravaged by the Bedouin and the goats, see Novick 2023: 47–58.

33 Taylor 1946: 12.

from which the species for sand planting were sourced.[34] Like in these colonial territories, dune-afforestation work in Palestine depended on the very people whose land was enclosed, first by coercion and later as a form of government employment. With its exceptionally vast stretch of dunes, the Gaza region became a mandatory test case for sand afforestation in the 1920s. Three extensive forests were planted on the sands around Gaza, the village of Jabaliya and Khan Yunis.[35]

However, scaling up the experiment to encompass the entire coastal plain of the country was far beyond British resources and capabilities in Palestine.[36] To face this problem, the British outsourced afforestation works to Zionist companies that sought to lease state property from the government. Throughout the 1920s and 1930s, sandy areas from Acre in the north down to the sands of Jaffa were made available to Zionist development companies, which the British regarded as both financially capable and ideologically committed to greening the land and preventing sand drift. By the late 1930s, some of these companies proposed that they could develop the sands for industry and urbanisation instead of afforestation, a goal the British government could hardly resist. This way, large areas of the coastal plain were transferred through long-term leases into Zionist real estate.[37]

34 On the long history of state struggle against sand drift by afforestation, see De Freitas 2025: 29–89; Bennett 2011: 125–45.

35 El-Eini 2006: 189–240; Tear 1925; Tear 1927.

36 By 1945, the sand dunes area in Palestine from Jaffa to Rafah (the southern border of Palestine) amounted to 312,000 dunams. Out of this area, 197,448 dunams (63%) were successfully registered as State Domain by the 'Land Settlement' process in the 1930s. 44,142 dunams (22%) of the total State Domain in the sands from Jaffa to Rafah were marked as a forest reserve, but only 6,991 (16%) dunams were successfully planted. See 'Analysis of Ownership and Occupation of the Coastal Sands Dunes Extended from Jaffa to Rafah', 1945, 1945, מ-22/2, ISA [129].

37 The Palestinian share of lands leased from the British government in traditionally cultivable soils was significantly bigger than the Zionist one. However, in the coastal plain the case was exactly the opposite. In the Haifa subdistrict, Jewish companies were granted by the government 37,100 dunams, while Arab leaseholds amounted to 1,117 dunams. 29,000 dunams of this Jewish land were a concession for the Palestine Jewish Colonization Association in the Caesarea dunes and 'Atlit marshes, and some 10,000 dunams were the sands of the Haifa-Acre Bay leased to the Gav Yam Co. In the subdistrict of Tul Karem, where the Jewish city of Netanya was established, 6,554 dunams were leased to Jews and only 432 to Arabs. 5,000 dunams of those lands were the dunes of Ghabat Kfar Sur, allocated for the Zionist *Hanote'a* company to develop the city of Netanya. In the Jaffa subdistrict, 7,700 dunams became Jewish compared to a single Arab dunam, based on lands allocated to Tel Aviv north of the wadi 'Uja (Today: Hayarkon) from the village of Shaikh Mu'anis and

By the time of the 1948 war, then, the dispossession of Palestinians in the coastal plain was already well underway. The alienation of Palestinian land rights in the dunes was so common that in a 1945 application to the British Colonial Development Fund for a 'Fixation of Sand Dunes' scheme, the Government of Palestine could argue that afforestation of the sands was a 'necessity of action [that is] is obvious and accepted by all', that such 'conservation operations *would not seriously affect local life and customs*' and that 'there would be comparatively little opposition to an afforestation scheme, while land problems of ownership and status would be far fewer and easier of solution than in other parts of the country'.[38] That was true only since much of the coastal sands were becoming state domain, designated for Zionist development.

The Gaza region, however, remained almost unaffected by this dynamic. For the better part of the mandate period, Zionist expansion hardly touched the southern coastal plain due to the difficulty in purchasing lands from local Palestinian landholders, Gaza's destruction in the First World War and the relative remoteness of the region from the main Zionist centres elsewhere.[39] As a result, the Gaza dunes were one of the only areas where Jews were not involved in coastal development. The lack of a significant Zionist presence determined the fate of Gaza in later decades. As mentioned, during the 1948 war, approximately 200,000 Palestinian refugees, many from the coastal plain stretching from Jaffa southwards, were displaced and found refuge in the newly established enclave of the Gaza Strip, which soon became the densest concentration of refugees in the entire Palestinian diaspora.[40] The Egyptian military administration, which governed the Strip until 1967, settled some of the refugees in the same forest reserves that the British had designated and planted to prevent sand drift. The starving and destitute refugees depleted the trees for cooking and makeshift shelters.[41] These areas would become the al-Shati, Jabaliya and Khan Yunis refugee camps under Egyptian rule between 1948 and 1967. This is how we return to the sands of Deir al-Balah of the 1970s, a

land in dunes south of Jaffa leased to the Jewish National Fund (JNF), *Shikun* Co., and the Palestine Land Development Company. Further south, 8,475 dunams of sand were given to the Rishon Le'tzion colony. The only coastal subdistrict where this relationship was the opposite was Gaza, in which Jewish presence was scarce. See Tyler 2001: 33–36; מ-300/7, ISA [p.143]; Summary of the State Owned lands, 1 May 1949, לג-19704/4, ISA.

38 Application for Grant from Colonial Development Fund, 1945, מ-22/2, ISA; Wicker 1958, 170–92.

39 Halevy 2021: 293–303, 328–31, 374–85.

40 Filiu 2014: 57–72.

41 Gallagher 2007: 64, 68, 73; Halevy 2024: 43–44.

village hosting a small refugee camp to its west, and to the first encounters of Jewish Israeli settlers with the dune landscape of the Gaza Strip.

IV

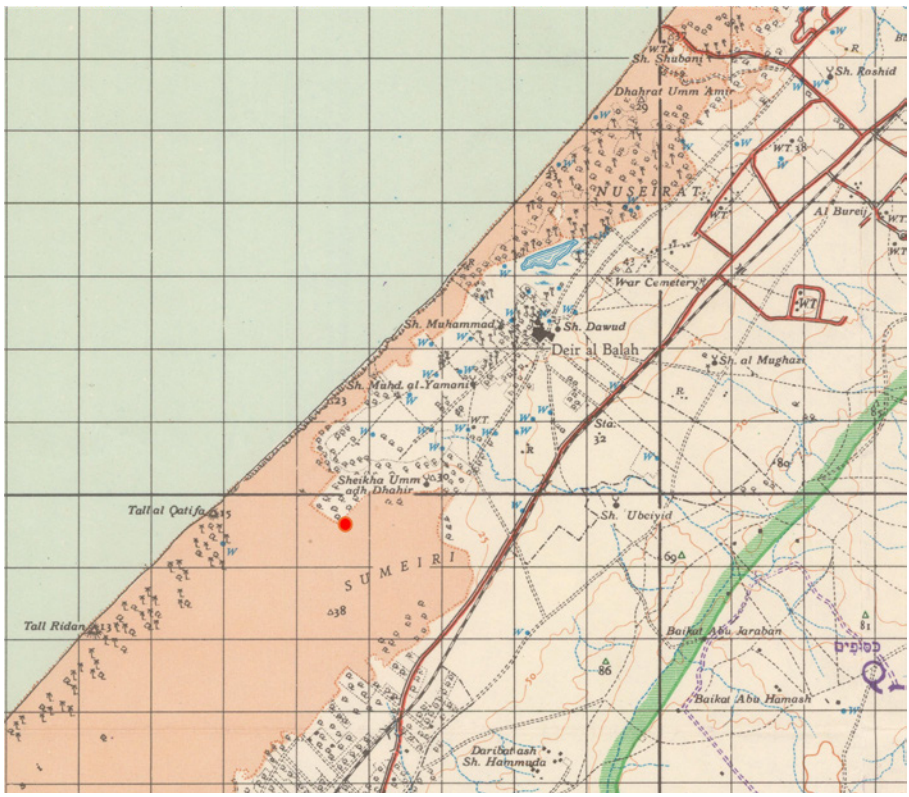
After Israel occupied the Gaza Strip in 1967, the dunes frontier reopened for state appropriation. During the 1970s, the Israeli military administration gradually enclosed thousands of dunams of dune areas for settlement and public purposes; some of these lands had already been categorised as state domains since the mandatory period, while others were newly appropriated.[42] One dune area, known locally as *al-Sumayri,* was situated between the agricultural outskirts of Deir al-Balah in the north and those of Khan Yunis to the south (Map 1). It was initially earmarked in Israeli plans for a refugee resettlement neighborhood for the Deir al-Balah refugee camp.[43] Yet, as the 'capture' of this dune area expanded, decision-makers in Israel shifted to a plan that envisioned three Jewish settlements on the dunes instead.[44] Unlike the first Israeli settlements in the West Bank, which primarily aimed to capture strategic locations at the barren hilltops or sites of religious significance, those in the Gaza Strip were planned from the outset as agricultural ventures. This meant that land expenses were crucial. Like the British before them, it was now the Israeli settlers' turn to assert that the dunes were empty and uncultivable for the local Arabs and thus needed to be appropriated by the technologically advanced Jews.

As mentioned, this vision of the dunes was not foreign to Zionist-turned-Israeli understanding of the coastal landscape. Its key representative in the Israeli case is probably Adolf Reifenberg, a German-Jewish soil chemist and one of the founders of agricultural studies at the Hebrew University in Jerusalem. Reifenberg served in the British government's Department of Agriculture and was part of the above-mentioned 'Soil Conservation Board'. He was also an

42 *Din Veheshbon Shnat Hamimshal Ha-14: 1979–1980* (IDF: Mifkedet Ezor Retsu'at 'Aza, 1980) [Report of the IDF Military Administration in the Gaza Strip, 1980], 5–75.

43 'Retzu'at 'Aza Utzfon Sinai', 1970, ISA, א-7311/6 [The Gaza Strip and Northern Sinai Settlement]; *Din Veheshbon Shnat Hamimshal Ha-14*, 5–75.

44 'Gush Qatif: Programa Litihnun Hayishuvim', 1975, לג-43387/2, ISA [A Program for Settlement Planning of Gush Qatif]; *Din Veheshbon Shnat Hamimshal Hatshi'it 1975–1976* (IDF: Mifkedet Ezor Retsu'at 'Aza, 1976) [Report of the IDF Military Administration in the Gaza Strip, 1976], 86; 'Amir Shapira, 'Ta'am Halehima 'al Sumayri', *'Al Hamishmar,* 8 Nov. 1976, 4 [The Reason for the Struggle Over Sumayri]; Ibid, 'Qatif Tmurat Hapitha', *'Al Hamishmar*, 11 Nov. 1976, 4; On the conflating schemes between refugee resettlement and Jewish settlement in the Gaza Strip, see Abreek-Zubiedat 2025: 68–94.



Map 1.

The Sumayri dune, and the excavation site marked by a red dot.

Gaza 1:100,000, Map created by UK Government (1934; revised 1943,1955; printed 1959), Crown copyright expired.

avid Zionist, amateur historian and archaeologist. Following a lifelong career in academic publications, he published in 1950 his classic account combining history, geography and more than a speck of ideology, *The Struggle between the Desert and the Sown: Rise and Fall of Agriculture in the Levant*. Among other processes of soil depletion, he dedicated much attention in this book to the historical formation of Palestine's coastal dunes. 'When not held by vegetation', he explained, 'the sand thrown on the beach [by the wind and sea waves] inevitably moves inland, covering everything on its way'. His observations of the depth and reach of the dunes on the coastal plain of Palestine from Cae-

sarea in the north to Gaza in the south led him to conclude that 'this condition dates from the Arab invasion'.[45] Later in the book, he ties the dots together:[46]

> When the Arabs conquered the countries of the Fertile Crescent, they found a smoothly working Byzantine administration … It was not religious fanaticism only but economic necessity which drove the Bedouin hordes. These Arabs had no agricultural tradition … [They] knew only about the rising of stock. It was after the Arab conquest that the type of agriculture began to change fundamentally. The overgrazing of goats and camels had an especially devastating effect on the natural vegetation.

Reifenberg, in his time, was not driven by colonial aspirations in Gaza. However, two decades following, the spirit of his ideas had nevertheless taken root. 'The Strip is very densely populated, yet along the beach from north to south, there are vast dunes that, due to the character of the terrain, were not settled', explained Yehiel Admoni, head of the Jewish Agency's Settlement Division, in a governmental meeting in 1975:[47]

> Most of it is uncultivated and unoccupied. These dunes had never been settled or cultivated and remained under state possession throughout all periods. During the mandate, some of it was afforested, and so did the Egyptians, and so we continue to do, to prevent the sand from drifting.

These 'empty' dunes represented an opportunity for Admoni and others regarding Jewish settlements. 'Establishing settlements in a place so densely populated by Arabs [the Strip] is a waste', Admoni reasoned, however, the 10,000 dunams of dunes of *al-Sumayri*, located between Khan Yunis and Deir al-Balah, were, for him, 'a space where we would not have to deal with the issues of land, water, and property rights'. The only challenge was the current reality where, in recent years,

> the Arabs have been encroaching; they enter and cultivate plots, especially on the outskirts of Deir al-Balah. They plant both trees and vegetables. Closer to the beach, they lower the ground surface beneath the water table to create small vegetable gardens using this fresh water.[48]

Indeed, Admoni's description of the growing cultivation in the dunes materialised simultaneously with the gradual enclosure of the *al-Sumayri* dunes, establishing the settlements to be known later as the Qatif Block (Hebrew: Gush Qatif). The excavation site of Deir al-Balah, established several months

45 Reifenberg 1955: 47–48.

46 Ibid, 98.

47 Governmental Settlement Commission Meeting Protocol, 4 Feb. 1975, ג-13092/10, ISA. [41]

48 Ibid.

after, was located on the northern edge of this dune, at the border of the Deir al-Balah farmland (see Map 1). The agreement between the archaeological delegation and the Palestinian landowner to expand his cultivation by removing the dune, along with the broader changes in Palestinian agricultural practices since 1967, was precisely what Admoni viewed as a threat of Palestinian encroachment on the sands.

Oddly enough, while the Israeli settlement effort marked the dunes, following the British, as a terrain of easy and ecologically justified dispossession, the Israeli archaeological deal with the landowner substantiated the Palestinian right to this dune land. While the basic understanding since the mandate saw sand drift as covering both the soil and its embedded history of land ownership, the archaeological delegation had very literally removed the supposedly uncultivable layer of sand, the Israeli-coveted object of dispossession, promising the soil discovered beneath it to the landowner, approving his precarious ownership. Under a constant threat of dispossession, it is easier to understand why the excavation ended abruptly in 1982, as the landowner demanded to cut the deal short and to settle for what he had gained thus far. That year, Israel completed its withdrawal from the Sinai Peninsula following the Israeli-Egyptian 1979 Peace Agreement. As a result, Jewish settlement in the Gaza Strip rapidly accelerated.[49] It is reasonable to assume that the landowner believed he needed to establish tangible possession; otherwise, dispossession would soon encroach upon his territory too. A request filed by the military administration's 'Archaeology Staff Officer' in 1983 supports this understanding. He asked the regional command for approval to remove the dune further and expand the excavation site by declaring it a sand quarry. He noted that, thus far, the site had been returned to the owner according to the preexisting agreement, yet from this point forward, the digging would occur 'within a sand-covered area which is a state domain for all intents and purposes'.[50] That means that the military authorities, too, thought of the site as the southernmost point of private Palestinian land. In Map 2, the land expropriated for the settlements upon the *al-Sumayri* dune is marked by a white background, while the Palestinian territory is marked with orange. The site of the excavation is precisely at the boundary between the two. Approval for expanding the site, though, was never given. The summer of 1982 was the last season of the Deir al-Balah excavation, after which the site was

49 Abreek-Zubeidat 2025: 145–47.

50 Dov Meron, Archaeological Officer of the Military Administration to the Gaza Military Administration Assets Division, 20 Oct. 1983, Deir al-Balah, Israel Antiquities Authority Archives.

Map 2.

The Israeli Settlements upon the Sumayri dune and the Deir al-Balah farmland. The excavation site is marked by a red dot. Gaza 1:50:000. Map by Survey of Israel 2006; Accessible via amudanan.co.il. Courtesy of the Survey of Israel (MAPI). All rights reserved to the Survey of Israel. English captions and other marks are by the author and do not appear on the original map.

left for agricultural cultivation. A coordinate registry of the location remained only in the archaeological reports. No signs remained in the place itself or on the maps. Neither the Deir al-Balah people nor the students who took part in the dig could tell later where it was.

V

The final layer of colonial dialectics in this case was revealed in the years following, when the findings of Deir al-Balah were gradually published. Aside from the archaeological significance, which is none of our concern here, the Deir al-Balah excavation supposedly provided corroboration for the long-held belief that dunes began encroaching upon the land during the Muslim conquest and persisted throughout Islamic rule, leaving the coastal plain desolate and

uncultivable. This is because the most recent artefacts uncovered at the Deir al-Balah excavation were dated to the Byzantine period in the sixth century.[51] For Dothan, this fact illustrated that the dunes played a role in the decline of a civilisation that had thrived in the eastern Mediterranean since biblical times and into the Judeo-Christian era. In Dothan's own picturesque description: 'High ridges of rolling sand dunes marked an oncoming wave of desolation advancing from the sea, a testament to the environmental catastrophe that had been plaguing the area since the Middle Ages, gradually blanketing thousands of acres of rich farmland.'[52] Citing the famous Deir al-Balah findings, from the 1980s, geomorphologists and historians defined the sands of the southeastern Mediterranean as 'post-Byzantine', supposedly a phenomenon characterising an Arab landscape of abandoned, sand-covered, ancient cities and deserted agricultural land wasted by the overgrazing of camels and goats.[53]

Trading excavation for cultivation with the Deir al-Balah landowner was a form of time travel, then. The archaeologists gained a glimpse into an ancient world 'before the coming of the dunes', as Dothan put it, while the landowner acquired cultivable land that dated back 1,300 years – a soil last inhabited during the Byzantine period.[54] Within the dynamic of colonial settlement in Gaza since the 1970s, this 'trade' emerged as both symbolic and very practical in cementing the Palestinian landowner's rights to the land, which might otherwise have been appropriated for being a dune. However, this rarely acknowledged right by an Israeli authority was, even if unknowingly, tied to reinforcing the old colonial legislation that viewed the dunes as a landscape of desolation brought to the region by Arab invaders and as terrain on which they could not claim possession.

Not coincidentally, then, the Deir al-Balah findings featured also in later narratives calling for the continued dispossession of Palestinians for the advancement of Jewish settlements in the Strip. Chronicling the evolution of the Gaza Strip Jewish settlements in *al-Sumayri*, religious-Zionist journalist Hagai Huberman, explained that 'in archeological surveys it became clear that there were no signs of cultivation or occupation of any kind':[55]

51 Lipton 2010: 3; Brandl 2010: 144.

52 Dothan 1992: 129.

53 Tsoar 1990: 51–60; Bakler 2010: 287.

54 Dothan 1992: 121; About the composition of the soil in the Gaza Strip underneath the dunes, see Al-Mubayyid 1987 28–33.

55 Huberman 2005: 61.

> Never could any human being revive these dunes. Hard soil was discovered only underneath the dunes, upon which campsites from the Israelite period were found. These findings proved that there was never a permanent settlement there, and these lands were, at best, used as camping grounds for wandering tribes.

This portrayal justified the seizure of the dunes while simultaneously making a case for the Jewish ingenuity that managed to turn them into agricultural farms during the 1980s and 1990s. That account disregarded, of course, the Palestinian cultivation on the dunes that had long been there, the Palestinian workforce upon which the settlements relied and the sheer inequality of resources that enabled the bare survival of the settlements. By the middle of the 1980s, while some 2,200 Jewish Israelis inhabited the Gaza Strip settlements, their agricultural areas and military buffers protecting them occupied a third of the Strip's territory. Israeli water consumption per capita in the Strip stood at 2,326 cubic metres per annum compared to only 123 cubic metres for Palestinians.[56]

Famously, the Gaza Strip Jewish settlements specialised in producing pest-free lettuce and greens aimed at Jewish Orthodox consumers, who are incredibly anxious about mistakenly eating insects because they are not Kosher. This endeavour was initially developed due to the isolated and regulated conditions required for growing vegetables within hothouses in the arid and sunny Gaza Strip dunes.[57] The 2005 Israeli 'Disengagement' from the Gaza Strip relocated this agricultural industry into Israel proper. Yet, under more conventional agricultural and climatic conditions, achieving the same insect-free produce commercialised as 'Gush Qatif' greens required heavy applications of pesticides. Several years later, the levels of poisonous substances in these vegetables became so high that Israel's Chief Rabbi had to publish a legal opinion calling upon consumers to prioritise regular produce, which may contain insects, over the 'Gush Qatif' brand that was simply harmful.[58] From the perspective of the time when this chapter is being written, the poisonous greens of the Qatif Block can be taken as a symbol for the toxic memory in Israel of the Gaza Strip Jewish settlements, which Israel's right-wing leadership has outspokenly positioned as a reason for prolonging the destruction and ethnic cleansing in Gaza following the 7 October massacre. It is a cruel flip of history, that at the same time, the very sites to which such ultranationalist visions dream of returning, the dunes known as *mawasi,* have become one of the last remaining spots for displaced

56 Roy 1987: 69, 81.

57 Nir Hasson, 'Hozrim Lehasa 'im Tola'im', *Haaretz,* 2 Feb. 2005 [Back to Lettuce with Insects]; Yehoshua Simon, 'Hasa Vehalila', *Globes,* 19 July 2005 [God Forbid].

58 Kobi Nahshoni, 'Harav 'Amar: Yerakot Alim Lelo Tola'im Mesukanim', *Ynet,* 1 Nov. 2012.

Palestinians to escape Israel's bombardments, which have laid the rest of the Gaza Strip to waste.

References

Newspapers and Magazines

Al-Zira'a wa al-Rakha (Arabic)

Yedi'on 'Aza (Hebrew)

Ha'olam Haze (Hebrew)

Haaretz (Hebrew)

'Al Hamishmar (Hebrew)

Ynet (Hebrew)

Davar (Hebrew)

Independent

New York Times

Archives

Israel State Archive

IDF Archive

Israel Antiquities Authority Archive

Books and Articles

Abed Rabo, O. 2024. 'Archaeology and the Cultural and Natural Heritage: A Tool to Grab Land for Colonization and Expropriation on the West Bank'. *Policy Papers of the Institute for Palestine Studies.* https://www.palestine-studies.org/en/node/1655941

Abreek-Zubiedat, F. 2025. *A Territory in Conflict: Eras of Development and Urban Architecture in Gaza.* Pittsburg: Pittsburg University Press.

Abu al-Niml, Hussein. 1979. *Qita' Ghazza 1948–1967*. Bayrut: Markaz al-Abhath fi Munazamat al-Tahrir al-Filastiniyya.

Anon. 1972. 'Deir el-Balah'. *Hadashot Arkheologiyot* 43: 22–23.

Bakler, N. 2010. 'The Geological Background of the Deir al-Balah Site'. *Qedem* 49: 287–88.

Ben-Bassat, Y. and J. Buessow. 2024. *Late Ottoman Gaza: An Eastern Mediterranean Hub in Transformation*. Cambridge: Cambridge University Press.

Brandl, B. 2010. 'The Stratigraphy of the Settlement'. *Qedem* 49: 62–114.

Brett, M.B. 2011. 'A Global History of Australian Trees'. *Journal of the History of Biology* **44** (1): 125–45.

Bunton, M.P. 2007. *Colonial Land Policies in Palestine, 1917–1936*. New York: Oxford University Press.

Cossali, P. and C. Robson. *Stateless in Gaza.* London: Zed Books.

Dayan, M. 1976. *Moshe Dayan: Story of My Life*. New York: Morrow.

Dothan, T. 1972. 'The Cemetery near Deir el-Balah and Burial in Anthropoid Sarcophagi in Eretz-Israel'. *Qadmoniot* **1** (17): 21–25.

Dothan, T. 1978. *Excavations at the Cemetery of Deir al-Balah.* Jerusalem: Qedem (no.10).

Dothan, T. 1992. *People of the Sea: The Search for the Philistines*. New York: Macmillan.

Dothan, T. 2010. 'Introduction'. *Qedem* 49: XXVII–XXXVI.

Dothan, T. and Y. Bet-Arieh. 1972. 'Rescue Excavations at Deir el-Balah'. *Qadmoniyot* **1** (17): 26.

Dothan, T. and B. Brandl. 2010. *Qedem 49: Deir al-Balah: Excavations in 1977–1982 in the Cemetery and Settlement*. Jerusalem: Institute of Archaeology, Hebrew University.

El-Eini, R. 2006. *Mandated Landscape: British Imperial Rule in Palestine, 1929–1948*. New York: Routledge.

Filiu, J.P. 2014. *Gaza: A History*. New York: Oxford University Press.

Gallagher, N. 2007. *Quakers in the Israeli–Palestinian Conflict: The Dilemmas of NGO Humanitarian Activism*. Cairo: American University in Cairo.

Gaspar De Freitas, J. 2025. *A Global Environmental History of Coastal Dunes*. Oxford: Taylor & Francis.

Greenberg, R. and A. Keinan. 2007. 'The Present Past of the Israeli-Palestinian Conflict: Israeli Archaeology in the West Bank and East Jerusalem Since 1967'. *The S. Daniel Abraham Center for International and Regional Studies*, Research Paper No. 1, pp. 5–57.

Halevy, D. 2021. *Stripped: Ruination, Liminality and Making of the Gaza Strip.* Ph.D. Diss., Columbia University.

Halevy, D. 2023. 'Sand and the City: On Colonial Development and Its Evasive Enemies in Twentieth-Century Palestine'. *Environment and History* **29** (4): 537–64.

Halevy, D. 2024. '*Sawafi al-Raml*: Sandiness and the Palestinian Refugee'. *Syrian Studies Association Bulletin* **28** (1): 43–44.

Huberman, H. 2005. *Shorashim Baholot: Sipur Hahityashvut Hayehudit Behevel 'Aza.* Netzarim: Midreshet Netzarim.

Kletter, R. 2003. 'A Very General Archaeologist—Moshe Dayan and Israeli Archaeology'. *The Journal of Hebrew Scriptures* 4. https://jhsonline.org/index.php/jhs/article/view/5856/4909.

Kletter, R. 2006. *Just Past? The Making of Israeli Archeology*. New York: Routledge.

Lipton, G. 2010. 'The Excavation of the Cemetery'. *Qedem* 49: 3–46.

Al-Mubayyid, S.A. 1987. *Ghazza Waqita'iha*. Cairo: Al-Hay'a al-Masriyya al-'Ama Li'l Kitab.

Novick, T. 2023. *Milk and Honey: Technologies of Plenty in the Making of a Holy Land.* Cambridge: The MIT Press.

Reifenberg, Adolf. 1955. *The Struggle between the Desert and the Sown: Rise and Fall of Agriculture in the Levant*. Jerusalem: Publishing Department of the Jewish Agency.

Roskin, J. and I. Taxel. 2021. '"He Who Revives Dead Land": Groundwater Harvesting Agroecosystems in Sand along the Southeastern Mediterranean Coast since Early Medieval Times'. *Mediterranean Geoscience Reviews* 3: 293–318.

Roy, S. 1987. 'The Gaza Strip: A Case of Economic De-Development'. *Journal of Palestine Studies* **17** (1).

Roy, S. 1995. *The Gaza Strip: The Political Economy of De-Development*. Washington, DC: The Institute For Palestine Studies.

Taylor, H. 1946. *Soil Conservation Board Bulletin No. 2: The Destruction of Soil in Palestine.* Jerusalem: Government of Palestine.

Tear, F.J. 1925. 'Sand Dune Reclamation in Palestine'. *Empire Forestry Journal* **4** (1): 24–38.

Tear, F.J. 1927. 'Sand Dune Reclamation in Palestine'. *Empire Forestry Journal* **6** (1): 85–93.

Tsoar, H. 1990. 'Trends in the Development of Sand Dunes Along the Southeastern Mediterranean Coast'. *Catena Supplement* 18: 51–60

Tsoar, H. and Y. Zohar. 1985. 'Desert Dune Sand and Its Potential for Modern Agricultural Development'. In Y. Gradus (ed.) *Desert Development* 4. Dordrecht: Springer Netherlands. pp.184–200.

Warwick, P.N.T. 2001. *State Lands and Rural Development in Mandatory Palestine, 1920–1948*. Brighton: Sussex Academic Press.

Weigert, G. 1977. *Flourishing Deserts: The 'Green Revolution' in the Gaza Strip.* Jerusalem.

Weizman, E. 2017. *Hollow Land: Israel's Architecture of Occupation*. New York: Verso.

Wicker, E.R. 1958. 'Colonial Development and Welfare, 1929–1957: The Evolution of a Policy'. *Social and Economic Studies* **7** (4): 170–92.

CONTRIBUTOR BIOGRAPHIES

Cynthia Browne is a Research Scholar at the Max Planck Institute for History of Science, where she currently leads the working group 'Troubling Exposure'. The group, as well as Browne's research, examines exposure as a documentary practice that has been foundational to certain forms of environmental knowledge, as well as integral to counter-documentary practices that work to disclose how trajectories of environmental exposure intersect with legacies and infrastructures of colonialism and racial privilege.

Emily Brownell is a Senior Lecturer in Environmental History at the University of Edinburgh. Her current project, *Stories from the Substrate*, considers twentieth century East African history through a variety of interventions with, and extractions from, the soil.

Amiel Bize is an Assistant Professor of Anthropology at Cornell University whose research focuses on social and economic transformations at capitalist margins. Her current book project, *The Post-Agrarian Question*, considers how people make value, in material and meaningful ways, in rural East Africa. She has also published on practices of 'gleaning' (claiming the right to leftovers) and is beginning new research on green finance.

Seth Denizen is a researcher and design practitioner trained in landscape architecture, evolutionary biology, and human geography. His published work is multidisciplinary, addressing art and design, soil science, urban geography and agriculture. He is currently an Assistant Professor at the Sam Fox School of Design and Visual Arts and his book with Montserrat Bonvehi-Rosich, *Thinking through Soil: Wastewater Agriculture in the Mezquital Valley* came out with Harvard Design Press in the spring of 2025.

Dotan Halevy is an environmental historian of the modern Middle East and a senior lecturer at the department of Middle Eastern and African history at Tel Aviv University. His current research project, Settling Sands: Commodification, Displacement, and the Modern Coastline 1900–1970, explores how the Eastern Mediterranean coastal plain, sparsely populated for centuries, emerged in the modern period as an aggressive frontier of economic and political expansion.

Basil Ibrahim is an independent researcher and writer based in Ithaca, New York. His research explores the political life of voluntary associations, in particular the mobilisation and sustenance of collectives as a mechanism for social and economic insurance. He works historically and ethnographically and has collaborated with Amiel Bize on several projects on urban and rural life in East Africa.

Brian Jones is a historian and web developer who has worked on a broad array of digital projects including The Public Domain Review, The Appendix, and history of local music in Austin, Texas. You can find out more about his work at https://brianjon.es/.

Paul Kurek is a Postdoc in the Society of Fellows and an Assistant Professor of German at the University of Michigan. His current book project, *Heavy Load-Bearing Modernity: A Cultural Geology of Albert Speer's Berlin/Germania*, unpacks the intellectual and material history of the so-called heavy load-bearing cylinder, arguably history's heaviest memorial.

Johannes Lehmann is the Liberty Hyde Bailey Professor of Soil Biogeochemistry at Cornell University. His research focuses on nano-scale investigations of soil organic matter, the biogeochemistry of pyrogenic carbon, sustainable soil management, climate change, biochar systems and the circular economy. He is a member of the US National Academy of Sciences and the German National Academy of Sciences (Leopoldina), and serves as Associate Editor for the Proceedings of the National Academy of Sciences.

Tamar Novick is Assistant Professor of the History of Technology at the Technical University of Munich. Her research lies at the intersection of the history of technology, environmental history and Middle East studies. She is the author of *Milk and Honey: Technologies of Plenty in the Making of a Holy Land* (MIT Press, 2023), and her current research focuses on meanings and uses of bodily waste.

Jayson Maurice Porter is an assistant professor of history at the University of Maryland, College Park where he teaches environmental histories of Mexico, the African Diaspora, oilseed crops, and agrochemicals. He serves as a Black and Indigenous Climate Faculty Fellow at UMD's Indigenous Futures Lab, a board member of Rutgers University's Black Ecologies Lab, and a co-designer of the Chicago Teachers Union's Environmental Justice Freedom School.

Steven Stoll is Professor of History at Fordham University. He is the author of *Ramp Hollow: The Ordeal of Appalachia* (2017). He is writing *A Word For Land: How We Relate in the Spaces We Create*, to be published by Yale University Press.

Lulu Tessua is a Ph.D. student in Anthropology at the University of Nairobi. Her current research is on the afterlives of Ndungu Agricultural Project in Kilimanjaro, Tanzania, with a major focus on pesticide use and its effects on health and environment.

Natasha Russell is an artist and illustrator based in Edinburgh, Scotland. Her work is usually developed in collaboration with communities, researchers or organisations in order to visualise their ideas and to explore connections between people and their surrounding environments. Often, these projects are developed in response to a particular location or environment and take the form of murals, ink drawings and linocuts. You can see her work at https://www.natasharussell.com/

Soil has a nearly ubiquitous presence in our lives, regardless of whether we spend much time noticing it. Soil holds worlds within itself and also builds other worlds; it devours and remakes things; it sustains life and gives cover to the dead. Grasping Soil is a collectively-authored syllabus and series of essays, all examining, with different inflections, the fundamental question: what comes into view when we 'grasp' soil as a vessel of human history and point of view for inquiry?

Part I is an interdisciplinary syllabus that traces the contours of a growing body of work in the humanities that uses soil as a bridge between human and more-than-human histories. The syllabus offers a template of readings, discussion questions and assignments with an accompanying website for easy access to the supporting materials. The essays that follow in Part 2 explore particular moments and locations in which communities have modified, depleted or remade soil to suit a particular need. In examining these engagements with soil, each essay provides a particular view on the social, political or economic conditions that they reflect and create. The essays range from mountain top mining in Appalachia to the construction of a load-bearing monolith in Nazi-era Berlin, and the layered, residual histories of agricultural projects in Tanzania. As these essays make clear, soil is a lively presence not an inert recipient of human desires and actions. It is a living and not always governable community with ever-changing stories to tell.

Emily Brownell is a Senior Lecturer in Environmental History at the University of Edinburgh. Her current project, Stories from the Substrate, considers twentieth-century East African history through a variety of interventions with, and extractions from, the soil.

The White Horse Press

www.whpress.co.uk

ISBN 0000000000000