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Toxic Entanglements and PFAS Practices
On Care and Pollution in a Southeast Dutch Allotment Garden

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Pipi Paloeka De Koning BSc

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Univ.-Prof. Dr. Ulrike Felt

Table of Contents

<i>Acknowledgements</i>	3
<i>Abstract in English</i>	5
<i>Abstrakt auf Deutsch</i>	6
<i>Abstract in het Nederlands</i>	7
Introduction	8
<i>Outline & Research Questions</i>	10
Chapter 1: The PFAS-Exposed Garden	14
<i>1.0 Vignette</i>	14
<i>1.1 Methodology</i>	15
1.1.1 Situating the Spatiality of <i>Volkstuin Hobuis</i>	16
1.1.2 Fieldwork and Data Gathering	20
1.1.3 Ethics and Consent	23
1.1.4 Transcription, Coding, and Analysis	24
<i>1.2 Defining Toxicity & Pollution</i>	25
<i>1.3 Community Narratives</i>	29
1.3.1 Entangled Toxicity	35
1.3.2 Uncertainty in PFAS	37
<i>1.4 Concluding Observations</i>	42
Chapter 2: The Body in the Garden	44
<i>2.0 Vignette</i>	44
<i>2.1 Introduction</i>	46
<i>2.2 PFAS Norms and Technical Thresholds</i>	47
<i>2.3 Defining Environment</i>	50
<i>2.4 Gardening Practices</i>	51
<i>2.5 The Art of Noticing the Body</i>	53

2.5.1 Potential Unhealthy Bodies	55
2.5.2 Healthy Gardening Bodies	60
2.5.3 Embodied PFAS Ecologies	61
2.6 Concluding Observations	65
Chapter 3: Care for & in the garden	67
3.0 <i>Vignette</i>	67
3.1 <i>Introduction</i>	68
3.2 <i>Matters of Care & Asymmetries of Politics of Care</i>	69
3.3 <i>Dark Side of Care</i>	71
3.3.1 The Aesthetics of Care	72
3.3.2 Selective Institutional Care	74
3.4 <i>Soil Caring in Contamination</i>	75
3.5 <i>Temporalities of Care</i>	80
3.6 <i>Making Kin in PFAS's Chemosociality</i>	85
3.7 <i>Concluding Observations</i>	87
Conclusion	89
<i>Vignette</i>	89
Bibliography	95

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Abstract in English

This MA thesis in Science and Technology Studies (STS) explores how to live and take care in chemically polluted landscapes. Per- and polyfluoroalkyl substances (PFAS), also known as "forever chemicals," are a class of human-made chemicals embedded in all living ecosystems that have been linked to adverse health effects. Consequently, safety thresholds and government investigations have been established to its mitigate harm. Inspired by multispecies approaches, I have conducted a two-month chemo-ethnography in a PFAS-exposed allotment garden complex in Helmond, the Netherlands. My analysis centers on the gardeners' embodied experiences, as well as their practices and perceptions of toxicity. In this regard, I focus on the materialities of care that toxic events bring about. I address how these materialities emerge in attunement to living in the Chemical Anthropocene, particularly in the alterlives of PFAS. Overall, in the thesis, I explore the dynamics of care, community, and the body through a continued notion of uncertainty in troubled ecologies.

Abstrakt auf Deutsch

In dieser Masterarbeit im Fachbereich Science and Technology Studies (STS) wird untersucht, wie man in chemisch belasteten Landschaften leben und für sie Sorge tragen kann. Per- und polyfluorierte Alkylsubstanzen (PFAS), auch als „Ewigkeitschemikalien“ bekannt, sind eine Klasse von vom Menschen hergestellten Stoffen, die in allen Ökosystemen vorkommen und mit gesundheitsschädlichen Auswirkungen in Verbindung gebracht werden. Infolgedessen wurden Sicherheitsgrenzwerte eingeführt und staatliche Untersuchungen durchgeführt, um Schäden zu mindern. Inspiriert von Multispezies-Konzepten habe ich eine zweimonatige Chemo-Ethnografie in einem mit PFAS belasteten Volksgarten in Helmond in den Niederlanden durchgeführt. Dabei konzentriert sich meine Analyse auf die Erfahrungen der Gärtner*innen sowie ihre Praktiken und Perzeptionen von Toxizität.

In diesem Zusammenhang untersuche ich mich auf die Materialitäten der Pflege, die toxische Ereignisse mit sich bringen. Konkret befasse ich mich damit, wie diese Materialitäten im Einklang mit dem Leben im chemischen Anthropozän, insbesondere im Alterleben von PFAS, entstehen. Damit analysiere ich in dieser Arbeit die Dynamiken von Care-Arbeit, Gemeinschaft und Körper anhand des Konzepts der konstanten Ungewissheit in den „troubled ecologies“ (Ü. *Unruhigen Ökologien*).

Abstract in het Nederlands

Deze masterscriptie in Science and Technology Studies (STS) onderzoekt hoe men leeft en zorgt in chemisch vervuilde landschappen. Per- en polyfluoralkylstoffen (PFAS), ook wel bekend als de “forever chemicals”, vormen een klasse van kunstmatige chemische stoffen die inmiddels in alle ecosystemen aanwezig zijn en in verband worden gebracht met schadelijke gezondheidseffecten. Daarom zijn er veiligheidsnormen vastgesteld en wordt er onderzoek gedaan om de mogelijk schadelijke risico’s zo goed als het kan te kunnen te beperken.

Geïnspireerd door multispecies-benaderingen, heb ik een twee-maanden-durende chemo-etnografie uitgevoerd in een met PFAS vervuilde volkstuin in Helmond, Nederland. Mijn analyse richt zich op de “embodied experiences” (belichaamde ervaringen) van de tuinierders, kijkend naar hun praktijken en percepties ten opzichte tot toxiciteit. Binnen dit kader onderzoek ik hoe materialiteiten van zorg door toxische gebeurtenissen tot stand komen. Concreet kijk ik naar hoe deze materiële verstrengelingen ontstaan in afstemming met leven in het chemische Antropoceen, en in het bijzonder binnen het concept van de “Alterlives” (alterleven) van PFAS. Zodoende analyseer ik in deze scriptie hoe onzekerheid in “troubled ecologies” (vert. *ecologieën ten onruste*) vorm krijgt binnen dynamieken van zorg, gemeenschap en het lichaam.

Introduction

In June 2021, gardeners at the *Volkstuin Hobuis*, an allotment gardening complex in Helmond, the Netherlands, were informed that their garden might have elevated levels of PFAS (per- and polyfluoroalkyl substances). PFAS are also referred to as the “forever chemicals,” and are a class of numerous human-made chemicals that have been developed and used since the mid-20th century for their water- and oil-resistant properties. Their strong carbon-fluorine bonds make them highly persistent, meaning they do not readily degrade or transform in the environment. As a result, rather than breaking down or assimilating, PFAS persist and bioaccumulate across ecosystems, becoming part of every living organism (Bond, 2022). Additionally, PFAS have been linked to various adverse health effects even in low-level exposure, influencing immune systems, increasing certain forms of cancer (i.e., testicular and kidney cancer), and more (C8 Science Panel).

Earlier, in the first half of 2021, the Dutch government tightened the safety thresholds for PFAS to 4.4 ng/kg, aligning with EU-set safety threshold standards. As the allotment garden had been located 1100 meters downwind from Custom Powders. And Custom Powders was involved in PFAS processing from 1996 to 2018. The allotment garden, *Volkstuin Hobuis*, became a suspect of surpassing this safety threshold in June 2021. As such, this suspicion of elevated PFAS levels led the garden to become the subject of toxic pollution investigation.

The investigation lasted a year. By mid-2022, the Dutch *National Institute for Public Health and the Environment* (RIVM) concluded that there were indeed excessive levels of PFAS found in the soil, water, and crops of the allotment garden. Nevertheless, the municipality argued that gardeners could continue to consume their crops safely, reasoning that everyone in the Netherlands already surpasses the PFAS safety threshold intake and that the consumption of allotment gardens would only slightly increase this toxic intake. The municipality also asserted that garden-grown crops contained only slightly more PFAS than store-bought produce alternatives. As a result, it has been recommended that gardeners refrain from eating from their gardens daily, thereby negating the need for further soil remediation. For the described timeline of key PFAS-related events for the garden, see *Figure 1*.

Another nearby allotment garden, *Volkstuin Walveld*, was also part of the same investigation. Located at a closer 450 meters downwind from Custom Powders and positioned between Custom Powders and *Volkstuin Hobuis*, this allotment garden also exceeded safety threshold levels of PFAS. Their PFAS levels, however, resulted in the decision to remediate the soil. Their soil remediation was completed in late 2023.

Reading on PFAS cases in local media, combined with this notion of the “forever chemical”, made me wonder, what does it mean to live knowingly in a world polluted by PFAS? If low levels of PFAS exposure are already considered toxic, how do these categories make sense in places where safety thresholds

have already been exceeded? I further started to muse on how caring works, between plants, as nonhuman entities, that humans consume, embedded in PFAS that transfers both into these more-than-human relationships. Building on this, what does PFAS pollution then mean for how health, care, and the body are constructed when the very standards meant to regulate exposure are themselves surpassed?

As Liboiron (2021b) argues, pollution is a situated phenomenon that is deeply connected to political systems, ethics, and technologies. PFAS has been created through certain technologies, and its pollution in the environment is analyzed by using specific technologies as well. Firstly, even as there is no place on this planet untouched by PFAS particles, PFAS pollution is not distributed equally.¹ PFAS are carried downwind and downstream from polluting sources. The pollution is highest around facilities that process PFAS chemically, in areas with extensive use of firefighting foam, such as airports, and landfills (Dasu et al., 2022). Specifically in the case of this thesis, Custom Powders was located 1100 meters upwind and upstream from *Volkstuin Hobuis*, see *Figure 2*.² Secondly, prevention and even restitution for decontamination are envisioned by further utilizing specialized technologies. Navigating post-pollution and the political actions connected to localized PFAS contamination exemplifies the complexities of toxic pollution that extend beyond technical solutions.

The PFAS investigation in the Helmond allotment gardens revealed that gardeners had indeed been exposed to higher levels of PFAS. The gardeners were made aware of that possibility through the investigation itself. And if they wished to continue gardening, they needed to find ways to navigate care for the garden in a toxic, polluted space. This care included tending to the plants and garden, themselves, their families, and the community of allotment gardeners. As such, the awareness of having been exposed to PFAS transformed the garden into a place of toxic geography of polluted landscapes (Davies, 2022).

Specifically, in this thesis, I examine gardening in PFAS-polluted spaces through the notion of “troubled ecologies”. The concept of troubled ecologies introduced by Besky & Blancette (2019) highlights how pollution and toxicity are coproduced by bodies and environments, connecting local practices to global political systems (Fisher et al., 2021). At *Volkstuin Hobuis*, practices for navigating PFAS pollution are shaped, among others, by discourses of safety threshold standards. Furthermore, the concept of troubled ecologies highlights how materialities are co-constituted. It means that PFAS exists simultaneously as a chemical in the environment, a substance in the body, and as an element tied through social relations within

¹ The ubiquity for PFAS has been problematized as, while PFAS is present over Earth’s top layer, there are still deep earth geological layers that don’t contain PFAS (yet) (Tokranov et al. 2025).

² Custom Powders was located southwest from *Volkstuin Hobuis*. The southwestern wind is the most common wind direction in the Netherlands, accounting for more than half of the winds that come from this direction.

the gardens. These materialities are especially shaped by, and shape, human and nonhuman interactions, including those with soil and plants entangled with PFAS.

Moreover, to consider troubled ecologies in the late industrial spatiality of the Netherlands, I was initially inspired by Donna Haraway's influential work, *Staying with the Trouble* (2016). In this book, Haraway opts for alternative ways of examining and living within ecological devastation. As PFAS is such an ecologically devastating *trouble*, I continued to ask what it means to stay with PFAS? By continuing to garden in known PFAS-polluted gardens, gardeners are *staying with* PFAS; the gardeners have become aware that they cannot escape living in a world entangled with PFAS. In continuing to garden, they themselves cultivate lives embedded with PFAS. Within an allotment complex, gardeners have cultivated multispecies landscapes, discovering unexpected companions and entangled relationships through their everyday interactions in the garden. It is what Haraway calls to make *Oddkin* (2016), to recognize these unexpected more-than-human relations, that offers ways to understand care in a polluted landscape.

Care is an embodied material act that results from attention. It emerges in time through noticing and handling within relationality and attunement. Consequently, caring is a way to sustain relationships in which more-than-selves can sustain and even flourish, despite precarious or damaged situations. It is further asymmetrical and a form of governance. Hence, *staying with* means caring for both the materialities and the relationships that compose these entangled worlds. Through this care unfolds across multiple embodied relational practices.

Another initial inspiration has been Anna Tsing's *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (2015). In this book, she explores the troubles in late-industrial landscapes. In her concept of "arts of noticing," she emphasizes attentiveness to the situatedness of multispecies and more-than-human relations. It sparked my own attentiveness to enter the allotment garden complex not as a just human-cultivated space, but as a space that has been co-created through the more-than-human relationships between the gardeners and their plants and by nonhuman entities, such as PFAS. It is through this lens of attentiveness to PFAS that I continue to approach *Volkstuin Hobuis* as a space created through more-than-human relations.

Outline & Research Questions

This is a master's thesis in the field of Science and Technology Studies (STS) that has been inspired by the Anthropology of Toxicity, New Feminist Materialism, and Environmental Humanities.³ The

³ Citation is a situated and political practice and referencing deeply influences the ontological and epistemic framework I have used in writing this thesis. Therefore, for transparency, all authors' gender and race were assessed when I finalized the bibliography using the Gender Balance Assessment Tool

ethnographic fieldwork at the allotment garden forms the foundation of this thesis. In my ethnography, I examined the presence of PFAS chemicals in a garden's multispecies environment. In this regard, I conducted a two-month chemo-ethnography inspired by multispecies theory in February and March 2025 at *Volkstuin Hobuis* in Helmond (Kirksey et al., 2014; Shapiro & Kirksey, 2017).

Throughout the process, from conceptualization to fieldwork and writing, the main research question guiding this thesis emerged:

How is care negotiated in an allotment garden contaminated by PFAS?

The question explores how practices of care exist at *Volkstuin Hobuis*: care for the garden, for the community of gardeners, for friends and family beyond the garden, and for the surrounding environment. The people, community, institutions, environment, and other bodies mentioned refer to those associated with the geographical location of the allotment garden and must be understood in their situated context. As noted, the allotment garden is a site of environmental contamination and social interaction. The main question provides a lens to understand how people enact care in a toxically polluted setting. To answer my main question, this thesis is organized around three sub-research questions. These chapters build on one another while also interweaving and cross-referencing each other throughout the thesis, each addressing a question in a separate chapter and building upon the preceding analysis.

In Chapter One, *"The PFAS-Exposed Garden,"* I present a detailed account of my methodology and further introduce the allotment garden where the PFAS investigation took place. Additionally, I will go into my first sub-research question:

1) *What role do community narratives on the municipality's PFAS investigation play in building an understanding of the garden as a site impacted by pollution?*

This first sub-question explores the garden as a site of toxicity. I examine narratives about PFAS in the garden and how the gardeners have navigated gardening in a toxic space. PFAS has not been the first polluting or toxic event they have faced individually and collectively, yet direct exposure places them within the specific realities of PFAS contamination. Consequently, this direct exposure is intertwined with the broader patterns of pollution, and I will delve into the uncertainties associated with living in a contaminated landscape.

In the second chapter, *The Body in the Garden*, I will address the question:

2) *How do the environment and the body co-emerge in PFAS-contaminated spaces?*

(<https://jlsumner.shinyapps.io/syllabustool/>). I used this tool to take part in a wider academic debate on critically analyzing and denaturalizing to the authors and people we quote. The GBAT-tool predicts gender based on given names, in binary terms, which may not reflect authors' self-identifications, and further categorizes race in limited. Though a lot of critique still can go into this categorization of diversity. Nevertheless, the results indicate 62.5% women, 37.5% men, of which whom 85.53% were white authors. My bibliography represents and reflects the broader patterns of epistemic selectivity and bias.

This consecutive sub-question will address the body in sites of toxicity and explore the entanglements of pollution. In particular, it will highlight how the body has materialized in multiple ways in relation to PFAS and gardening. The government advises gardeners to eat vegetables from the supermarket to dilute their toxic PFAS intake. In contrast, the gardeners perceive their produce as organic and healthier than the alternative of supermarket produce, regardless of their PFAS content levels. Moreover, they also see the act of gardening as a healthy practice. Through embodied arts of noticing and unnoticing, gardeners attune to PFAS beyond technoscientific measurements.

In the third chapter, *Care for & in the Garden*, the last sub-research question is covered:

3) *How are temporalities of care negotiated in an allotment garden contaminated by PFAS?*

This question relates, in particular, to the after-effects of toxic events experienced by the gardeners. The gardeners have been gardening, unknowingly in a polluted space for decades, and they have been feeding themselves and others with the crops they produce. They care for the garden as a multispecies space full of plants, animals, including insects, microbes, and humans. And in their caring activities, they derive pleasure from it. In this final chapter, I explain the role of PFAS pollution and toxicity in these navigations in matters of practice.

In the conclusion, I will then connect the main question to the three sub-research questions. Here, I will discuss the negotiations of care regarding PFAS. The tracing of the entanglement of material, temporal, and affective dimensions. Throughout, particular attention will be given to how uncertainty, temporality, and emotional engagement shape ongoing care practices, multispecies relationships, and community life. Furthermore, this chapter will address how care can be understood within troubled ecologies of polluted spaces.

Each part of the thesis will highlight connections between care, the body, community, and the environment, where the uncertainties of toxicity come into play. Ultimately, this thesis shows how living with contamination is negotiated through everyday practices, revealing how care, emotional engagement, and relationality are continuously shaped and reshaped in troubled ecologies. It demonstrates that care is not only a disruption to harm but an ongoing practice through which humans, nonhumans, and communities sustain life together in toxic landscapes. Overall, throughout *Toxic Entanglements & PFAS Practices: On Care and Pollution in a Southeast Dutch Allotment Garden*, I address how PFAS entanglements are perceived through collective lived experiences and in relation to their troubled environment.

Timeline of Key Events

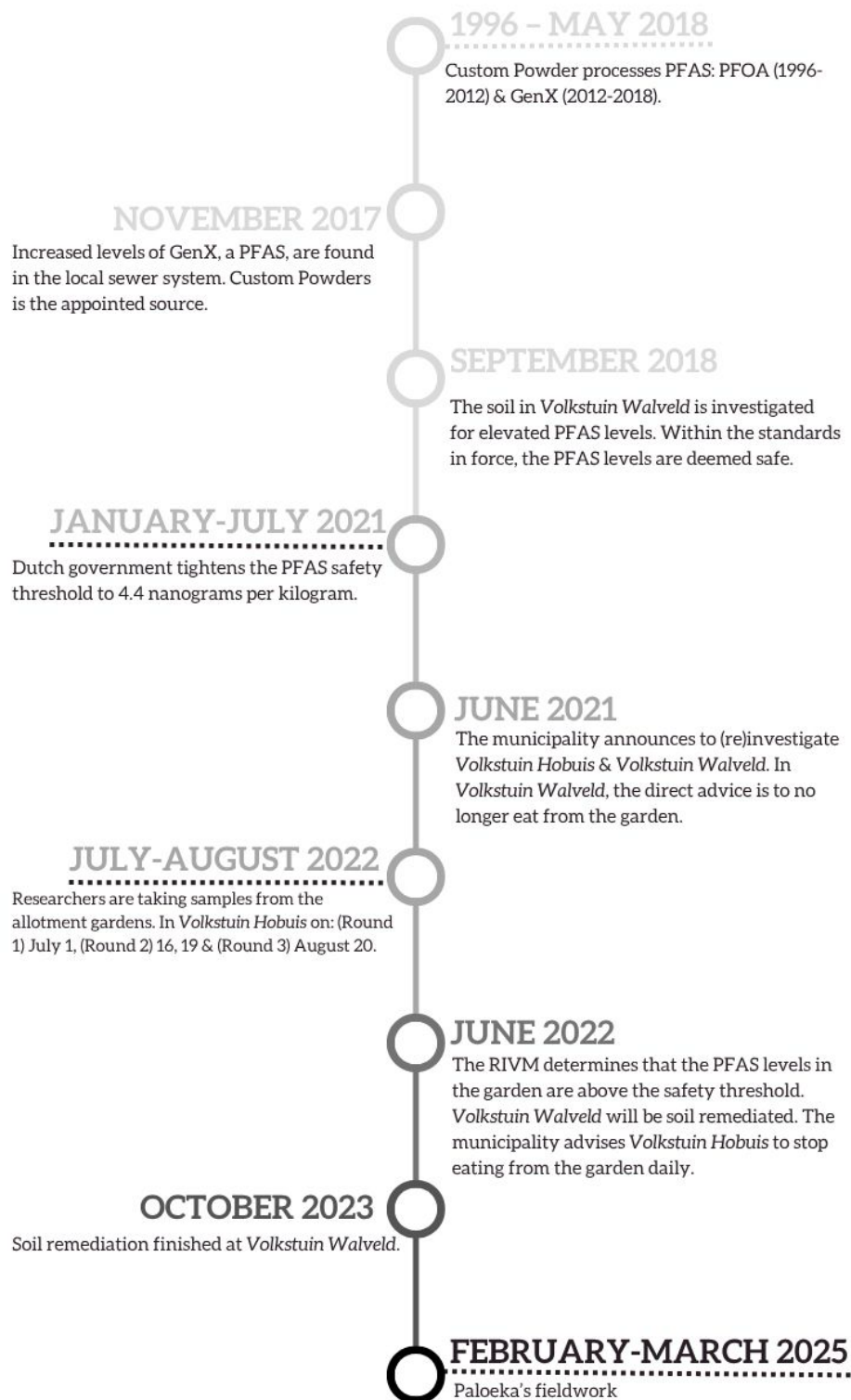


Figure 1: Timeline of Key Events

Chapter 1: The PFAS-Exposed Garden

1.0 Vignette

Esther came to Volkstuin Hobuis in 2023, after the PFAS investigation in the allotment garden. She lives a few kilometers away from the garden. When she came to Volkstuin Hobuis, she read up on the situation regarding PFAS and talked with other gardeners about it. The people in the Canteen said that while there is PFAS here in the soil, it is still within the acceptable norms. Esther recounted during our interview:

“That guy from Wageningen University said, ‘I would just grow and eat out of this [garden]’” (Interview with Esther, translated from Dutch).

Importantly, Esther never met “that guy”, but Toon had. When the researcher visited the allotment complex in 2021, Toon had spoken extensively with him. “That guy,” a researcher involved in vegetable sample collection for the PFAS investigation, had been asked by Toon whether he would eat the crops if he were in their situation. According to Esther, the researcher answered, “Yes.” Since the researcher wasn’t worried, Toon wasn’t worried either, and consequently, Esther wasn’t worried as well.

Toon had also told me about this encounter with the researcher from Wageningen multiple times during my fieldwork at the coffee mornings in the Canteen. Here at Volkstuin Hobuis, it seemed okay, gardeners told me repeatedly. For Toon, this reassurance from the researcher mattered. Even when the municipality sent a letter later in June 2022 stating that the garden’s PFAS levels exceeded safety thresholds, the Wageningen University researcher’s earlier statement still held weight for Toon, Esther, and others who maintained the garden.

In this first chapter, I will explain my methodology and describe the place where I conducted my fieldwork for this master’s thesis. Moreover, I will provide the definition and framework of pollution and toxicity that I will use throughout this thesis. Finally, this will set the stage for addressing the first sub-research question: *What role do community narratives on the PFAS investigation play in building an understanding of the garden as a site impacted by pollution?* These community narratives, ranging from voiced concerns to silences and hesitations, will reveal how chemical contamination is experienced through the lens of lived experiences. Concluding that the allotment garden, in this sense, is not simply a physical space, but a socio-material world where the notion of pollution is negotiated, felt, and, at times, resisted.

1.1 Methodology

In February and March 2025, I conducted ethnographic fieldwork at the allotment garden, *Volkstuin Hobuis*, in the Netherlands. There are many different forms of ethnography, as ethnography itself is a broad methodology originating from the qualitative social sciences, particularly cultural and social anthropology. It is centered on conducting in-depth research, and ethnography can be described as both a practice as well as an inscription (Harrison, 2020). Besides, ethnography exists within a space of material, human, and more-than-human reconfigurations. According to Löw (2008), space is always a set of pluralities where there are possibilities of overlapping and reciprocal relations with open endings. This means that the allotment's space belongs to the garden and is not predetermined by its materiality but rather formed by the social structures. Davies (2022) further argues that spaces exposed to toxicity have the potential to bear witness to the shifting temporalities of the environment. As a result, spatiality influences the perception of places and the way bodies interact with them in everyday practices.

Furthermore, building on Tsing's *Mushroom at the End of the World* (2015) concept of "world-in-the-making," gardens are such situated spaces where world-making unfolds. World-in-the-making refers to the dynamic practices through which gardeners, plants, soil organisms, and PFAS co-constitute their environment. Through acts of care, cultivation, sharing, and managing contamination, the gardeners participate in shaping the garden as a relational, living space. These spaces are not pre-given or fixed; they emerge from ongoing interactions with life and toxicity, which are intertwined and continually reformed. Thus, the garden itself becomes a space-in-the-making, constituting the environment and continuously being shaped through its multispecies interactions and entanglements with PFAS.

Through a chemo-ethnography and a multispecies ethnography framework, I attended *Volkstuin Hobuis* and beyond to see how PFAS emerged here. Specifically, I examined this attunement to relationships between humans and nonhumans, as well as to relationships between humans and more-than-human entities. Here: humans refer to the gardeners themselves; nonhumans include plants, soil organisms, and other living species in the allotment garden; more-than-human entities extend to chemicals like PFAS that affect, circulate through, and shape these relationships. I focused on how these relationships unfolded around PFAS, tracing stories of imagination, speculation, neglect, and care among gardeners and the chemical. Moreover, I considered the "chemosociality" of the allotment garden, which emerged from the known exposure to PFAS as a communal topic of concern (Shapiro & Kirksey, 2017).

I was inspired to conduct a chemo-ethnography as it considers the chemical relations in the more-than-human realms (ibid, , p. 482). In particular, chemo-ethnography asks how these molecular frictions between forms of non-life reconfigure our knowing and being (ibid). First, in my case, the chemo-ethnography has centered around the chemical relation to PFAS. Second, the more-than-human realm

encompasses the interactions among gardeners, their allotment, the garden itself, and consumption from the garden, in which PFAS permeates. Accordingly, this methodology is further as a toxic methodology that encourages thinking about bodies, care, and affect, as well as the relationality between them (Chen, 2011).

In addition, a multispecies ethnography examines the interactions between species and how humans have been shaped through these encounters (Kirksey et al., 2014). The allotment garden is not just a multispecies space in itself. The interactions among plants, soil organisms, and gardeners illustrate how humans and more-than-human species are entangled, co-constituting each other and the conditions for life. Or, as Tsing (2012) remarks, humans are embedded in interspecies relations that are essential to sustaining life on Earth. Likewise, Besky and Blanchette (2019) argue that we live within entanglements of humans and nonhumans. This entanglement for a multispecies lens offers pathways of learning, unlearning, and negotiating pollution within interspecies temporalities (Tam, 2023), where different paces and rhythms of living and nonliving beings interweave.

Moreover, the multispecies relationships in the allotment garden are characterized by multispecies alignments and asymmetrical power relationships (Tam, 2023). Multispecies attunements happen when plants grow, but gardeners decide where which plants are allowed to grow; the gardeners might invite insects with their planted flowers but cannot determine if they will come, or if the plant will grow flowers; gardeners might appreciate the birds singing but build structures against them eating and picking from crops and berries; to name a few of these relationships briefly. Notably, multispecies attunement focuses on, appreciates, and attends to these relations. There are various multispecies relationships among humans, more-than-humans, and nonhumans occurring in the garden. Consider the microbial soil, plant-debris compost, vegetable planting, and weeding. By highlighting these interactions, this framework of multispeciesness helps to understand how care unfolds within the allotment garden.

In the end, both chemo-ethnography and multispecies ethnography are methods for situated contexts of description and inscription in joining the speculations in participant observation of ‘what life *might* or *could* be like’ (italics in original, Ingold, 2013, p. 4). This process has allowed me to explore the relationships between humans, nonhumans, and more-than-human entities, as well as the relational spaces from the latter, particularly when PFAS becomes part of us.

1.1.1 Situating the Spatiality of *Volkstuin Hobuis*

On my bike route to *Volkstuin Hobuis* during my fieldwork, I rode alongside farms and canals built to connect industrial sites for transportation. As such, Helmond is located within an agricultural industrial region. Moreover, the city of Helmond itself has five major industrial parks, and has been steered toward specialized industries through deliberate political strategies (Bronneberg et al., 2023), of which Custom

Powders served as an example as well of these efforts.⁴ It notes on a landscape where the environment is deeply entangled with wider regional industrial settings.

To further describe the spatiality of *Volkstuin Hobuis*, the allotment complex is located on a historic pasture that is rented from the municipality by its garden association. Within the complex, there is a one-meter height difference due to leftover sand used to build the bordering neighborhood in the 1980s. In this higher part of the complex, the soil is drier and sandier. Therefore, the soil also drains quickly here. The lower part of the garden, on the other hand, is directly located on the old pasture soil and is accordingly moister. Additionally, through the years, the old pasture's gullies have been filled by soil to create additional

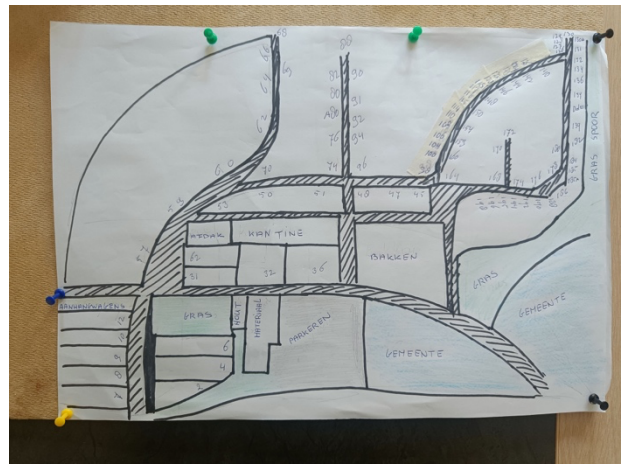


Photo 1: The Canteen from the outside, allotment gardens in front, and raised garden tubs on the side.
Photo 2: The inside of the Canteen. Photo 3: Map of Volkstuin Hobuis edited for anonymization done by Anna Fink.

⁴ The small company's visitors' office was located on the front side of the building, across the lawn. Behind the visitor's office, the factory was housed. Custom Powders is located on the industrial side, no different than the other buildings in the area. Only, the green in front of their building seemed more aesthetically pleasing than the boxes of factories the others are faced with at a street view, and therefore slightly out of the ordinary.

cultivation areas. However, due to the excess rain last year, the water streams still flow along their original trajectories, etched by the land's memory, prompting them to flood. This winter, the rain was not as heavy, and the groundwater level dropped again. The groundwater receded, and the soil remained moist, letting worms and moles thrive. As a result, the garden's lawns broke open in early 2025, filled with molehills.

On the complex's higher part is the Canteen, located next to the raised garden beds. The twenty-two raised beds measure 1.20m by 10m; they are designed to facilitate gardening for individuals with physical disabilities. They are elevated to hip height and spaced to allow scooter and wheelchair mobility around them. Furthermore, arranged in a semicircle, the Canteen and raised garden beds are surrounded by approximately 115 allotment gardens (91–420 m²), accessible via grassed paths. To see a schematic map of the garden, see *Photo 4*.

The Canteen is described as a modern brick building that is wheelchair accessible. In Winter, the Canteen is heated by a wood-burning stove located in the middle of the room. It could raise the space's temperature by 10 degrees above the outside temperature. The Canteen is run by volunteers from Monday to Saturday between 9 am and 12 pm, who often still attend on their day off. Gardeners gathered there to drink coffee together. As it was the last winter months, attending the coffee mornings was a reliable way to meet people. Therefore, during the two months that I conducted my fieldwork at *Volkstuin Hobuis*, I spent the 28 days mainly in the garden in the mornings, drinking coffee with the gardeners.

Entering the building, you find yourself in a small hallway with a wheelchair-accessible toilet on your right side and another door in front of you. When you open the front door, there is a billiards table in the middle of the first half of the room, followed by two light oak woodgrain dining tables pushed together and one smaller table on the far-left side in the back. Around the big table, eight chairs are placed, and only on the busiest mornings in February and March do extra chairs from the back table need to be added. But for most mornings, these eight chairs suffice.

Behind the smaller table in the back is a cabinet with locally sourced non-organic eggs, where gardeners and others interested could buy eggs for €2,50 a carton. In the morning, attendees and others would occasionally come in to buy a carton. At the left end of the room, there are the leading stairs to the attic, which is used for storage. Behind the entrance, on the other side of the cabinet and stairs, is a small office where Maria and the other board members conduct the association's organizational work. Moreover, next to the office and on the left side of the billiard table is a kitchen countertop, with a sink and a filter coffee machine.

In the morning, at the large table next to the woodstove, the large thermos was filled with hot filter coffee, a small aluminum bowl containing sugar cubes, and a plastic pot of coffee milk powder, arranged on a plastic tray with white coffee cups, and a weekly pile of advertising leaflets from local stores. Otto is the only one with his favorite, slightly smaller, white coffee cup. Most people pour themselves a cup of coffee

when they enter the room and take a seat at the table. However, sometimes, the volunteer of that day will do it for you. Especially, Niko is generous in pouring coffee for others, or at least for me. But when this happened, Otto would joke that he only did it specifically for me because I am a young lady. He was then jokingly offended because he did not do it for him, as he is an old man. These teasing banters set the mood for the rest of the morning.

In the late winter of 2025, the garden was quiet. The outside is cold, and the sky is white. The weather hovered around the freezing point, and a wetness would creep into my body. Still, a fluctuating group of people, mostly retirees, come to the garden multiple times a week to drink coffee together. They talk about supermarket discounts listed in the leaflets on the table, their past and upcoming dinners shaped by those discounted offers, the news, and recent happenings.

Every gardener follows their own rhythms and routines. Outside, Hendrik and Anton might do maintenance and repair work and come in for a quick cup of coffee to heat

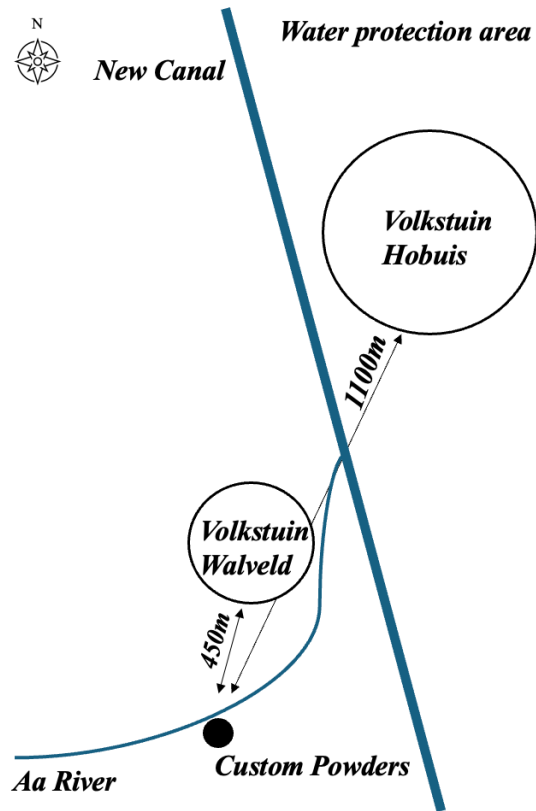


Figure 2: Schematic drawing of the allotment gardens to the PFAS plant and local waterways.
 Photo 4: A traffic sign indicating the end of the groundwater protection area, approximately at the waterway intersection of Figure 2.

Photo 5: The New Canal, on the left side, is Volkstuin Hobuis.

up again approximately every hour. Marie spends most of her mornings outside as she is able to work in the greenhouse and therefore is not as affected by the cold wind. But when the cold hits her, she comes in for a hot coffee as well. Theo likes to work early in the morning and then comes in for a cup of coffee for the rest of the morning. Rudi will check on his plot before or after entering the Canteen to drink lukewarm magnesium water. And when the weather allows it, Nellie and Toon go to their raised garden bed at the end of the morning, when the coffee morning is almost over. But when it is too cold, and the soils are still frozen, the place to be is inside. Here, people gather, converse, and heat up. However, from March onwards, when temperatures rise above 10 degrees Celsius, gardeners spend more time outside, and the allotment garden complex generally becomes more active as the gardens reach these comfortable temperatures.

1.1.2 Fieldwork and Data Gathering

In those last two Winter months in early 2025, I suspected that I had met approximately a third of Hobuis' gardeners. I went to the garden for 28 days, excluding the preliminary visit on December 20th, 2024. After my field visits to the garden, I took down my field notes in the afternoons, evenings, and/or on subsequent days. It accumulated into a 99-page fieldnote research diary, from December 18th to March 25th, 2025, in which I focused on including affective reflections. Moreover, I collected approximately 400 photos, 10 videos, several sound recordings as soundscapes, news articles, in-garden newsletters,⁵ governmental presentation slides and letters, a jam jar made from berries from the garden, and I copied a garden journal from 2020 to 2025.

Additionally, I conducted a total of 17 interviews: 14 interviews with gardeners one-on-one,⁶ one group interview with eleven people who joined the morning coffee sessions,⁷ and two additional interviews: 1 interview with an ex-employee of Custom Powders and turned anti-PFAS activist, and 1 interview with a journalist who wrote about the allotment gardens in the main local newspaper. The interviews lasted on average over an hour (precisely 1 hour and 5 minutes). Notably, the municipality's PFAS officer declined the offer to be interviewed, citing time as the reason; however, they provided me with additional reports and presentation slides used in council meetings.

In addition to the interviews and field days at *Volkstuin Hobuis*, I also visited the site where Custom Powders was located, see *Photo 7*. Although the company is now bankrupt, the remnants of the closed firm

⁵ *I want to note that in the newsletter edition of Spring 2025, published during my research period, I wrote a contribution as well, explaining my research. It inspired the editor to make the whole newsletter have a thematic focus on pollution.*

⁶ *The interview with Theo was conducted in two separate sessions.*

⁷ *The eight of whom I did not conduct an interview with individually, steered the conversation.*

persist: the name sign, the office building, and the windowless, box-like industrial building behind it. Furthermore, I made observation visits to the borders of the water protection area and familiarized myself with the waterways, the canal, the River Aa, and the gullies around the garden (see *Photos 5 and 6*).⁸

One month into my fieldwork, I also visited *Volkstuin Walveld*. This allotment garden complex is located 450 meters from Custom Powders, and as mentioned in the introduction, *Volkstuin Walveld* was part of the same investigation project as *Volkstuin Hobuis*. This other allotment garden was remediated in 2022 after PFAS concentrations exceeded safety thresholds. Instead of removing soil layers, the municipality added a new topsoil layer where the crops primarily rooted, to limit PFAS uptake of those plants.

To go back to the fieldwork at *Volkstuin Hobuis*, the gardeners at *Volkstuin Hobuis* held an allotment plot as a leisure activity. It was a hobby not intended to help them economically; in fact, for most, it required spending money rather than saving or generating it. Additionally, there is flexibility at *Volkstuin Hobuis* to move between a raised garden bed and an allotment plot. Of the 22 gardeners who participated in a recorded interview, 7 were currently gardening in one of the raised garden beds. While initially built for disability accessibility, raised garden beds also require less time to maintain; some gardeners start with a raised bed to see if they enjoy leisure gardening before moving to an allotment plot. Nevertheless, gardeners can transition from an allotment plot to a raised garden bed when mobility issues arise or when spare time



Photo 6: Bankrupt Custom Powder visitor's center and granule factory, February 2025.

⁸ Custom Powders is located next to the Aa River. *Volkstuin Hobuis* is located on top of the water protection area where groundwater is collected for local consumption.

becomes less available in the foreseeable future. This flexibility enables a diverse group of gardeners to participate in gardening practices.

The diversity of gardeners and the variety of gardening practices were often mentioned. Even though formal demographics are not tracked, Maria, the chair of the garden association, as well as others, further told me that approximately half of the gardeners are first-generation migrants. These groups tend to somewhat mirror broader migration patterns in the Netherlands. There are older Moroccan men, a group of elderly Turkish women, and middle-aged Polish families, Maria told me. The older generation in the garden, who drink coffee every morning, is White Dutch. The different groups formed communities among themselves within the allotment garden complex. While older White Dutch people drink coffee together, most first-generation migrant groups tend not to attend these Canteen coffee mornings; they come only for practical matters. Moreover, overall fluency in Dutch was lower among first-generation migrants than among those born and raised in the Netherlands. Of course, there were continuous exceptions as well.

Nevertheless, this directly impacted my data collection. My language proficiency allowed me to conduct interviews in Dutch, English, or German, but not in Turkish, Moroccan Arabic, or Polish. Consequently, all 17 interviews were conducted in Dutch. The interviewees included at least one participant from each decade of age, ranging from 20 to 80 years old. This sample roughly reflected the broader age diversity of the gardeners. Of the 14 individual garden interviews I conducted, five were with older white Dutch men, and four were with middle-aged white women. I also interviewed an older Turkish man, a middle-aged Polish woman, a middle-aged Surinamese man, and a younger Syrian man. Not speaking the same language fluently as nearly half of the gardeners made it more difficult to communicate, build trust, spend time together, and conduct interviews within this short period. Therefore, the two-month fieldwork period was too short to move beyond the core group of volunteers who were active in the garden community and regularly attended the coffee mornings in Winter.

Moreover, outside the recorded semi-structured interviews, I noticed that the terms “PFAS” and “pollution” (Dutch: *vervuiling*) often seemed unfamiliar to non-Dutch gardeners.⁹ And while these gardeners might be unfamiliar with these terms, they remembered and were aware that the municipality had conducted some form of research in the garden. Notably, Dutch gardeners who were new to *Volkstuin Hobuis* appeared

⁹ *In some instances, the interviewee and I used translation apps to translate the word "pollution" (Dutch: "vervuiling") into their native language. While this made it easier for them to understand me, it did not spark further conversations about the concept itself. However, it did lead me to talk more about practical examples of pollution and ways of dealing with it, both in interviews and in casual conversations. These conversations were about household waste recycling and plastics. While microplastics were not a topic of concern during the interviews, the interviewees emphasized their practices in waste recycling to me. The these gardeners disclosed the waste categories they recycled and their practices for doing so, including taking waste from the garden with them.*

to be aware of PFAS and the prior associated toxic investigation into the garden. This did not seem to apply to non-Dutch gardeners who obtained their plot post-investigation; they appeared to be incognizant of the potential PFAS-pollutedness of the garden. And indubitably, the (in)cognizantization of PFAS influenced the depth and relatedness of the thematic interview I conducted with them.

1.1.3 Ethics and Consent

Given these dynamics, it is important to recognize that ethnography is a method of intimacy and vulnerability (Funk & Thajib, 2019). Attention to consent is crucial for establishing and maintaining the ethical conduct of research. Therefore, consent and ethical considerations have been a central focus throughout the research process. In ethical research, the guiding principle has always been to do no harm. This has meant being open with all those involved in my research about my intentions and maintaining an ongoing dialogue with my supervisor, Ulrike Felt, and peers about the ethical decisions I have made throughout the research process.

Consent was obtained during ethnographic fieldwork upon every introduction, where I would introduce myself and the research I was conducting in the garden, and (in)explicit verbal consent was given. Moreover, consent for the audio-recorded interviews was obtained using a consent form provided in Dutch, the language of the interview. Before each interview, I reviewed the consent form and explained the purpose of my research and the interview. I emphasized that they could withdraw from the interview at any moment. According to the consent agreement, the post-interview participation could be withdrawn until April 1, 2025,¹⁰ and all audio recordings would be deleted by April 1, 2026.

Additionally, all personal names and the names of the allotment garden associations within the thesis are pseudonymized to ensure certain levels of anonymity. Pseudonymization is a standard practice within ethnography, as well as a contested tool for its efficacy (Vorhölter, 2021). The gardeners have been given names only to improve readability, personalize them, and remind you that they are human beings. Although not all participants opted to have their names pseudonymized in the consent form, in consideration of my supervisor's guidance, we decided to provide all participants with a pseudonymized name as part of standard practices. Moreover, other personalized characteristics from the gardeners have been limited and only revealed for relevance to the storytelling or arguments I make in this thesis. As such, throughout the thesis, you will find over a dozen pseudonymized names of gardeners.¹¹ I discourage attempts to match names

¹⁰ This date was set for practical reasons related to the analysis and writing process. Gladly, no withdrawal requests have been made since.

¹¹ Over the course of writing this thesis I've listed 40 different pseudonymized names of the people I've met and who have moved in and out of writing this thesis.

to specific individuals continuously, as doing so would require unnecessary effort and would move attention away from the narratives themselves.

The names of the allotment garden complexes in Helmond have also been pseudonymized to ensure an additional layer of anonymity. For my argument, the location of the garden is more important than its public name.¹² This decision also prompted the question of how much locational detail to include. Throughout the conceptualization of my research, I wrestled with the decision of whether to use a pseudonym for the city where the garden is located and the name of the PFAS manufacturer. Ultimately, I have decided against this consideration to raise awareness of the fieldwork's local context, to help readers connect it to wider PFAS issues, and to make it known to those familiar with the region.

I also want to acknowledge my connection to the region as well as my own positionality as a White autistic woman in her twenties.¹³ Firstly, my neurodivergence shaped my attunement to sensory and social experiences and relationships, as well as my reflexive engagement with the field. Likewise, my gender, age, race/ethnicity, and background influenced both how I behaved within the garden and how others perceived me. Secondly, my mother's side of the family has lived in nearby villages for generations; however, nobody in *Volkstuin Hobuis* knew my family directly. Also, I lived in the area from the age of five to twelve and went to primary school in Helmond, among others. It shaped my engagement with the field, for example, by allowing me to understand dialect fairly well, even though I do not speak it, and by being informed by my family about regional PFAS media items after I went back to Austria.

1.1.4 Transcription, Coding, and Analysis

After I returned from the Netherlands, I finalized my fieldnotes in English and transcribed my interviews in Dutch. To transcribe the interviews, I used aTrain. aTrain is a transcription tool for qualitative research developed by researchers from the University of Graz, Austria. The reason I used aTrain is that it is free, allows for transcription in Dutch, and, most importantly, only runs locally. I therefore felt I could better secure my data. I explicitly avoided using cloud-based AI model transcription and analysis software to ensure that my sensitive research material remained private and secure.¹⁴

¹² Regardless, the name of the allotment garden can still be deduced by consulting the bibliography in depth, being familiar with the region, or conducting an in-depth internet search. I urge you not to do so.

¹³ During my fieldwork, I heard gardeners refer to me in ways beyond my name: 'researcher,' 'student,' or 'young lady' (of which especially the elderly men referred to me); or at one point 'part of the furniture' (which was a huge compliment to me as an ethnographer).

¹⁴ I have utilized AI to assist me in writing regarding, translating, finding synonyms and linking words, order of sentences, limiting spelling and grammar mistakes. For this, I used a combination of Grammarly, DeepL and ChatGPT.

Nevertheless, there was a cloud copy of the pictures and videos I took, the interviews I conducted, and the consent forms in my private Google Drive while I was in the field. Simultaneously, the data existed over periods on my phone, my laptop, and a backup disk. Moreover, a digital copy of my raw data is stored on a password-protected USB stick in a safe at my brother's place in the Netherlands. The interviews have been recorded using my phone's recording app, as well as an occasional backup recording with my iPad using GoodNotes.

Subsequently, I manually coded my fieldnotes and interviews to guide my analysis in ATLAS.ti.¹⁵ Coding for me has been a way to organize the data and guide me through the process of writing the thesis. Firstly, I did initial open qualitative coding during the transcription phase. Open or initial coding has its origins in grounded theory (Saldaña, 2021). It is a methodological, systemic approach to analyzing data, informed by the raw data. Secondly, I have been inspired by thematic coding and critical coding. Thematic coding is based on repetition, similarities, and differences within the data, as well as the explicit or latent meanings, and how people make sense of concepts. For this, Braun & Clarke (2006) provided clear steps on how to analyze data through six distinct phases: 1) Familiarizing yourself with your data, 2) Generating initial codes, 3) Searching for themes, 4) Reviewing themes, 5) Defining and naming themes, 6) Writing the thesis (producing the report). I took these steps as a reference and moved more fluidly between them in practice. For example, during the transcription phase, I already started coding the first few interviews. After completing the initial phase, I grouped my codes by theme, concept, and sub-research question. Throughout the remaining process, I continued adding new codes and occasionally revising existing transcripts and codes, totaling 90 codes.

Additionally, throughout the coding process, I have been informed by critical coding. Critical coding has helped me to further examine the construction of systems of meaning from my empirical materials (Byrne, 2022). This meant, first, that I focused critically on power relations, systems, and structures in my data. Second, being aware of power relations within the garden has enabled a closer examination of the affective and embodied dimensions of PFAS in the garden. Therefore, incorporating a critical coding approach has helped me identify the discourses and absences at play in *Volkstuin Hobuis*.

1.2 Defining Toxicity & Pollution

Before I go into answering the first sub-research question, I will first describe how toxicity and pollution have been defined, in the following second section. Briefly, toxicity and pollution are always locally situated, both in their materiality and sociocultural relations. This means that toxicity and pollution are

¹⁵ I did not use the AI-assisted features in ATLAS.ti and relied solely on manual coding to ensure full control over interpretation and data handling.

material and sociopolitical entities that are multiple (Fisher et al., 2021). This socio-materiality is then further coproduced through encounters in human-environment relations. Drawing on STS, feminist science studies, and the environmental humanities, I will explain below how I will engage with these terms further throughout the thesis.

Firstly, to understand pollution, I draw on Douglas's classic formulation of "dirt" as "matter out of place" from *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (Douglas, 1966). Douglas' notion reminds us that "dirt" is never just about material substances but also about cultural order and disorder. "Dirt" signals a breach of boundaries: what is acceptable in one context becomes pollution in another. Widely adopted within critical waste studies, it suggests that "dirt" as pollution refers to substances that disrupt established categories or systems of control (Douglas, 1966; Liboiron, 2021a). By mobilizing Douglas' notion, I will show how toxicants in everyday environments are not only environmental hazards but also symbolic intrusions as they unsettle sociocultural categories.

Not only does PFAS fit this definition as a substance beyond containment, but its pervasive presence in the garden also disrupts both ecological and social orders. Ecologically, PFAS infiltrates soil, water, and plants, altering life and shaping what species can thrive. Socially, it introduces uncertainty into everyday gardening practices, able to influence decisions about planting, consumption, and care, while also reshaping community interactions and collective negotiations around exposure and precaution.

Moreover, PFAS, as a substance beyond containment, further contributes to challenging the 20th-century understanding of pollution and toxicology, which previously assumed that polluting chemicals could be separated from the wider environment (Fisher et al., 2021; Langston, 2010). PFAS is not only a pollutant but also a toxicant (Liboiron et al., 2018), a persistent substance that cannot easily be removed from the environment and has, in effect, become part of our bodies. As PFAS has entered the environment, it has become inseparable from it. Its persistence reshapes how humans, plants, and soils are entangled, highlighting how chemical industrial pollutants have shaped our environments into a permanently polluted world (Casper, 2003; Liboiron et al., 2018).

While toxicants actually often remain below thresholds, they can still exert cumulative harm through what Perczel (2024) terms "toxic layering," where multiple low-level exposures accumulate and interact across time and space. Toxic layering entangles pollution. This layering not only affects individual bodies but also reshapes ecological processes and social practices, making the effects of contamination unevenly distributed. Consequently, PFAS has become part of us, and there is no escaping from it. As Perczel (2024) has shown, and as I witnessed in the garden, living in toxic environments can become normalized. Perczel (2024) expanded on Murphy's (2017) concept of the "alterlives," which have formed from living in chemical worlds. In the context of "alterlives," toxic exposure refers to a life that acknowledges ongoing exposure to chemicals (Murphy, 2017). Moreover, this concept underscores how chemical exposures have

entangled responsibilities that extend beyond the boundaries of the individual body. It is therefore not about preventing PFAS exposure individually, which a gardener can do themselves, but about chemical exposures becoming entangled within the broader structures that led to the garden's exposure.

Additionally, exploring alterlives in polluted environments further has reminded me of Tsing's (2015) notion of where she discusses "third nature."¹⁶ Third nature refers to landscapes profoundly altered or ruined by late capitalism, where ecological destruction and human intervention have transformed land into precarious, damaged spaces. Yet, Tsing emphasizes that even within these devastated landscapes, life persists, and unexpected forms of hope and resilience can emerge. She illustrates this through the example of matsutake mushrooms, which thrive in disturbed forests, showing how organisms adapt and generate value in environments humans have disrupted. In this sense, the third nature highlights the possibilities of relational engagement and attentiveness to multispecies life even in industrially damaged, altered worlds. Building on Tsing's work, Ureta (2021) has discussed the "blasted landscapes" of toxic entanglements, which are characterized by complex relationships and interactions between humans and nonhumans. Toxic pollution has become ubiquitous. Within that, again, Ureta (2021) argues that toxicity cannot be disentangled from the environment.

Moreover, an environment embedded with PFAS has made it into a spatiality of toxicological concern (Evich et al., 2022; Renfrew & Pearson, 2021). Toxicity is then often defined through safety thresholds rooted in science and regulation (Liboiron et al., 2018). Threshold limits assume bodies and ecosystems can assimilate the toxicant before harm occurs. It becomes 'a way to describe a disruption of particular existing orders, collectives, materials and relations' (ibid). Surpassing safety threshold levels makes PFAS an unsettling notion of pollution.

Therefore, I have chosen to use the term "polluted landscape," introduced by Wiebe (2016, p. 59) and Davies (2022). Polluted landscapes draw attention to how toxic (low-)level exposure becomes geographically tangible. Moreover, polluted landscapes acknowledge how pollution has become embedded in everyday spaces. In particular, the notion of polluted landscapes emphasizes that they are not only materially contaminated but also socially and culturally inhabited spaces, where the presence of toxicants shapes everyday practices, perceptions, and relationalities. This concept follows Liboiron et al.'s (2018, p. 334) toxic politics, which conceptualize toxicants as industrially produced substances whose widespread presence in bodies and environments is bound up with systems of capitalism and industrialization. These landscapes make visible how human and nonhuman life are entangled with chemical exposure, thereby highlighting that pollution is a condition that is simultaneously environmental, social, and ethical.

¹⁶ *First nature refers to the changing ecological relations including humans. Second nature refers to the capitalistic transformation of the environment.*

Consequently, polluted landscapes provide a framework for analyzing how contamination is lived, experienced, and negotiated in specific sites, such as allotment gardens.

To understand this, I draw on Nading's (2020) article *Living in a Toxic World*, in which he argues that life in a toxic world must be examined through the encounters between matter and the systems it circulates within. Toxicity, Nading explains, 'emerges in the situated biologies and ecologies of particular bodies and places, but the particulars add up to a global pattern of harm' (2020, p. 210). In this sense, the lived reality of toxicity is frequently treated as the "shadow side" of modern progress (Casper, 2003). Locally, industrial handling of PFAS by companies such as Custom Powders has increased pollution, yet the effects of chemical biotoxicity are unevenly distributed (Hendlin, 2021). Many gardeners, for example, were unaware that they had become entangled in this contamination, illustrating how toxicity operates both invisibly and socially, influencing bodies and communities in unexpected ways.

Considering toxicity and pollution, ecofeminist scholar Di Chiro (2010) argues that polluted politics should include acknowledging diversity and justice to counter dominant anti-toxic discourse that naturalizes the multiple injustices. Even as PFAS is able to become normalized, it should not become normalized for anti-toxic discourses. In this case, PFAS, toxic politics focuses on agencies and relations of power, as well as the imagination of the materiality of the chemical in its interactions within human-environment relations (Hendlin, 2021; Liboiron et al., 2018). PFAS has become a substance that is impossible to fully escape: toxicity is ubiquitous, shaping both local environments and global systems. Therefore, accounting for polluted politics means moving away from imagining a PFAS-free world, which is impossible, to understanding the impacts PFAS have and where they occur.

Notably, uneven exposure to toxicants exemplifies the biopolitical life in the (late-)industrial worlds of the Anthropocene, where toxic exposure remains spatially and socially uneven, reinforcing patterns of vulnerability and care. In particular, Hendlin (2021) examines this as the Chemical Anthropocene. In the Chemical Anthropocene, PFAS has entered as a toxic chemical that has left scars on our ecological and bodily records. The Chemical Anthropocene highlights the impacts of how PFAS has become a matter of unavoidance (Hendlin, 2021).

For me, perceiving the Chemical Anthropocene meant, as an ethnographer, focusing on the narratives or stories of toxicity in polluted landscapes, which highlighted underlying epistemological issues. These stories are experienced through the body and material processes (Perczel, 2024), and can be perceived through witnessing (Davies, 2022). It is to what Tsing also called the "arts of noticing" (Tsing, 2015), to stay attentive in the alternation of multispecies interactions. To move forward, I will explore how community narratives have collectively shaped within *Volkstuin Hobuis*, while also contrasting individual gardeners.

1.3 Community Narratives

“PFAS is everywhere, and this bit doesn’t do much” (Interview with Edward, translated from Dutch).

Previously, I have described the spatiality of the garden, the methodology employed in my research, and how pollution and toxicity have been conceptualized within STS. In this third section of the first chapter, I will explain the role community narratives play in understanding the garden as a site impacted by pollution. Emerging from this will be an overview of the construction and negotiation of PFAS in *Volkstuin Hobuis*. As mentioned previously, the community narratives around PFAS, which I observed and will describe, have mostly been set by (middle-) aging Dutch gardeners. Not only were they mainly present within the association, volunteering in the garden, and at the coffee mornings, but communication from the government and the garden association board was predominantly in Dutch. The municipality sent letters to the gardeners informing them about the upcoming research. Meanwhile, the garden association board sent emails and created flyers at the entrance sign to further inform the gardeners about the investigation. Additionally, information about PFAS in the allotment gardens came from articles in the local newspaper that were written on the pending situation of the research investigation.

Alie, the previous board chair who still handles PFAS-related topics surrounding *Volkstuin Hobuis*, recognized that some gardeners might not have received the information regarding PFAS and the investigation due to language barriers. Therefore, to address this, she had asked gardeners who spoke Dutch and the key first-generation migrant languages, such as Turkish, Moroccan, and Polish, to share information about the PFAS investigation with those who were less proficient in Dutch in 2021-2022. She said, during our interview, when I asked her if they thought about offering information regarding the PFAS investigation other than Dutch:

“We have so many different languages, and then you would hang the entrance sign full of them [information flyers]. Yes, we thought sometimes: “What are the most common ones: Polish, Moroccan, and Turkish? And if we take those three, then you cover it, but then you also discriminate against the other members, because they are not Polish, or Turkish, or Moroccan. So, you either do it for everybody, or you don’t.” (Interview with Alie, translated from Dutch).

Nevertheless, the Dutch-proficient gardeners were able to access information about the investigation and became aware of the potentially toxic garden. Dutch gardeners were directly favored, as they had access to information provision. As already mentioned, this was further evident when I brought PFAS up to Turkish, Moroccan, and Polish gardeners during my fieldwork. Within these first-generation

migrant groups, there did not seem to be a difference between them for PFAS awareness.¹⁷ Now, one and a half years after the investigation had been concluded, none of them seemed to be aware of the municipality's toxicological investigation.¹⁸ They were aware of a general research investigation conducted by the municipality, but they did not relate it to PFAS or toxic pollution.

Even though some first-generation migrant gardeners like Tarik were connected to other Turkish gardeners and spoke Dutch fluently, PFAS was still largely a non-topic for them. Tarik has had a plot next to the Canteen for over ten years and regularly comes into the Canteen, joining the coffee mornings. He is one of the few first-generation migrants who does so. He listens more than he speaks, and occasionally makes physical jokes. Yet, neither when I first met him nor in later interviews did he show any awareness of PFAS.

Further, when I asked Ahmed directly during our interview if he had heard about PFAS or could tell me something about PFAS, he said he had never heard about it. However, Ahmed was one of the first-generation migrants who was aware that the municipal research investigation had something to do with pollution. When I asked him about the municipality, the garden, and research, he said,

"I had heard something like that. They measured something in the soil. Because they say that the soil is no longer suitable for plants. If you planted anything, you weren't allowed to eat it, or something like that. But what was going on, exactly, I don't dare say." (Interview with Ahmed, translated from Dutch).

I tried to probe further to see what he knew about it. When I asked him if he ever noticed something about the soil, or what his opinion was about the soil, he said,

"I think it's normal [...] I think it is good soil" (Interview with Ahmed, translated from Dutch).

He notices it in how his crops grow and continues to cultivate them in his raised garden bed.

Therefore, during my conversations and interviews with first-generation migrants, I decided that, when the term PFAS was unknown, we could discuss broader topics such as pollution, recycling, and soil quality. In this regard, their responses were similar to those of Dutch gardeners and were generally indistinguishable. Both saw waste management, particularly recycling, as important and a normalized practice, and they did not link it further to soil quality or PFAS contamination. I will talk about the soil quality more in Chapter 3.4, *Soil Caring in Contamination*.

In every introduction to a gardener, I explained that my research focused on pollution, and specifically PFAS. This was part of adhering to principles of doing ethical ethnography. However, in doing

¹⁷ There was an exception with new gardener from Lithuania, who I met briefly when he just got his garden this year. He had heard about PFAS. However, it seemed that he was unaware of the research investigation of PFAS in the garden years earlier. Also, Jerry, who moved from Suriname as a child, was aware of PFAS.

¹⁸ I speak in general about first-generation migrants who moved to the Netherlands as an adult.

so, I became a living reminder of the previous PFAS investigation, as well as of the ongoing presence of PFAS in the garden and beyond. As I will soon discuss, typical responses to PFAS and how it emerged as a matter of concern, it is important to note that on most mornings, PFAS would not be a topic of conversation unless something brought it back into focus. The issue had largely faded into the background in early 2025. Only when, in late February, the news broke that the municipality had received 8.7 million euros from the Dutch government for PFAS-contaminated soil remediation, did PFAS again briefly resurface as a topic of concern, and the gardeners immediately wondered again whether the garden would be included in the soil remediation efforts.

While PFAS may not be a primary concern for gardeners in early 2025, it became one from the moment the government announced its investigation into the allotment garden for potential PFAS contamination in June 2021. The gardeners recounted that it was the topic of the day for over a year, as almost everyone was worried about what the investigation's results would be and, as importantly, what the subsequent measurements would be. The degrees of concern, however, differed between the gardeners, as their concern about PFAS as toxicant pollution was different.

Interestingly, the conversations in their responses to PFAS were retrospective, reenacted multiple times when I introduced myself or asked something about PFAS and the garden. These reenactments often split the gardeners into two groups. One group would express concern, reflecting on the potential risks and how they had affected their gardening practices. However, this group was more often imagined by the other group. The other group described themselves as “down to earth” and not particularly worried, framing PFAS as something distant or abstract that did not require immediate attention. This “down-to-earth” stance was more dominant with the gardeners I spoke to. Then, near the end of the reenactment between the two groups, a gardener would turn to me and say, *“Now you can see how it was.”* These reenactments revealed the gardeners’ direct opinions on PFAS and their position as subjects of toxic investigations. The dynamics conveyed knowledge, speculation, and lived experience from when PFAS and the investigation were discussed at length together in 2021-2022.

Since these conversations were retrospective, reading Ellie’s journal was extremely helpful in providing a sense of time and place. Ellie has kept a gardening journal since she and her husband took on a gardening plot in 2020. Every couple of days, she writes, draws, and collages in the journal. As such, the journal has become a rich collection of harvest records, activity logs, recipe inspirations, garden-related proverbs, magazine cutouts with gardening tips, and more. Although I was told many times that PFAS was a major topic back when the investigation was conducted, it was only mentioned once in the entire journal, on Tuesday, June 22, 2021. The entry is of a similar size to the other entries. The day of entry is:

“There have been a couple days of heavy rains. Really good for the garden. Previously raked loose. Many questions from people about PFAS-poison. But in the newspaper, it stated that you can just

eat it. Monique (opposite neighbor/widower) hesitated. People have already been eaten for years from the garden but notice nothing” (translated from Dutch).

Further, that week, on Friday, June 25th, 2021, she writes that the RIVM and the municipality visited the garden regarding the research. After this, neither PFAS, the investigation, nor the results are ever mentioned again.

Earlier, on June 4, 2021, the municipality announced that elevated PFAS contamination might be present and that a toxicological investigation was underway. As much remained uncertain for the gardeners, PFAS quickly became a topic of collective concern, circulating through conversations and speculation, as reflected in the journal.

Despite this moment of attention and concern in her journal, later in the year, Ellie returned to recording her harvests and the everyday pleasures of gardening and community life. Most gardeners continued their routines, plowing, planting, and harvesting as in previous years. It seemed that when PFAS was no longer actively discussed among the gardeners, it became, for Ellie, not something worth noting down. Even after they obtained official clearance for non-soil remediation, and the gardeners could continue with caution, it was not mentioned in the journal.

For gardeners, having a plot is a significant part of their lives. Reactions to the investigation ranged from concerns about negotiating with everyday gardening practices to concerns about the investigation itself. Rather than ignoring speculation, it was a matter of situating it within a broader context. The investigation prompted reflection and speculation on the potentially polluted spatiality of the garden, yet daily practices persisted largely unchanged.

In addition, as read in Ellie’s journal, as well as many other retrospective conversations of gardeners who are not too concerned with the PFAS pollution in the garden, many gardeners argued:

“No, no, there are plenty of people who are concerned with that. Me, no. I’m not particularly interested in it myself.” (Interview with Sanne, translated from Dutch).

And,

“I thought then, well, I’ve been here for so long, here in the allotment garden, I’ve survived all this time, it will probably be fine for me” (Interview with Rudi, translated from Dutch).

The reaction of Sanne, Willem, and Rudi was part of a much more common response. Unconcernedness was self-proclaimed to be “down to earth.” Being down to earth meant that gardeners were less likely to worry about risk, uncertainty, and potential adverse health effects. It meant being practical and adapting to the situation. As long as there was no governmental or institutional interference, the problem was not severe enough to warrant continued concern.

The ubiquity of low PFAS exposure in general determined the main sentiment of the gardeners who continued to stay and garden on their plots. As seen in the opening vignette, even new gardeners like

Esther take part in the collective reflection on what it means to live with low-exposure toxicants. Edward's above statement at *1.3 Community Narratives* was taken as a collective stance on how to negotiate gardening in a troubled ecology. In general, gardeners were critical of soil remediation as a means to restore the troubled ecology of the allotment garden. They argued that PFAS could only be diluted with soil that had lower levels of PFAS because no soil is PFAS-free. Rudi extended this critique by suggesting that remediation does not eliminate contamination but rather redistributes it, displacing PFAS from one place to another.

"At most, you can dilute it [PFAS] with clean soil. Yes, but then there will be even more of it, you will just be spread around." (Interview with Rudi, translated from Dutch).

They knew PFAS was present in their garden, on the pans, and on their clothing (as mentioned explicitly by Loes, Edward, Anna, Rudi, Edward, Heiko, Jerry, Maria, and Theo).

"Because we already knew, of course, that it is used in pans, [...] It's a chemical compound, which is very difficult to break down. But I didn't know that it was already so widespread, that it had been used for so long, and that it's in the water and so on [...] PFAS is still in the soil, you can't do anything with that." (Interview with Rudi, translated from Dutch).

In addition, some compared or equated it to plastic (mentioned by Sanne, Johan):

"I always thought it was plastic. I knew that. But that it was that bad. I didn't know that." (Interview with Johan, translated from Dutch).

The people at *Volkstuin Hobuis* came to realize that PFAS, in its substance, it is a persistent or "forever" chemical. As explained by Alie, what PFAS is:

"To put it simply, it stays in there and never comes out again." (Interview with Alie, translated from Dutch).

There is the body as well as the environment. As such, it was linked to speculating on what the effects of it would be,

"Yes, I just hope it doesn't make me sick in the end. But I don't think... I think that's wishful thinking. I think it will always have consequences somewhere." (Interview with Loes, translated from Dutch).

Additionally, the gardeners were aware that alternative produce also contained PFAS. They speculated on whether the difference in PFAS levels between store-bought produce and their own harvest would even be significant. Moreover, store-bought vegetables, after all, would contain other agrochemicals, as earlier mentioned by Paul. Most gardeners purchased additional non-organic produce from supermarkets or local stores. They emphasized that they did not use additional biocides in their gardens, even making their vegetables potentially healthier and less toxic despite the potential for increased PFAS levels.

However, discussing PFAS with Theo, he mentioned that PFAS is always on the back of his mind. When he recalled the moment, he realized that the municipality wanted to investigate the garden. He reacted outrageously:

“Horrible! It would be the worst thing you could hear as an organic gardener [...] But there is nothing to do.” (Interview with Theo, translated from Dutch).

On the contrary, Edward was one of the few gardeners who completely stopped eating from his garden in 2021. I was put into contact with Edward through Rudi, who thought he would be valuable for my research as one of the few gardeners Rudi knew to be deeply concerned with PFAS pollution. In my interview with Edward, recollecting the announcement for the PFAS investigation in 2021, he recounted:

“You hope for the best. But the more you hear over time, and also about the other allotment garden complex [Volkstuin Walveld], since it was very heavily contaminated. The stories and gossip start to circulate, saying, ‘Yes, it needs to be cleaned up.’ Then the municipality eventually gets involved and comes here, and you think, ‘Wow, this is really serious.’” (Interview with Edward, translated from Dutch).

It was a big shock for Edward, and the mere fact that the municipality wanted to investigate the garden meant that it was a serious event. The gossiping did not only account for people speculating about the possible presence of PFAS in the soil, vegetables, and themselves, but also about what such contamination might mean for municipal intervention and the future of the community garden itself.

Similarly, when Loes recalled the announcement of the toxic pollution investigation, she panicked, cried, and became extremely worried about potentially losing her garden. Having heard about PFAS before, she was deeply upset about all the PFAS she had unknowingly ingested. Although the news greatly impacted Loes, Theo, and Edward, they decided to continue gardening at *Volkstuin Hobuis* because not maintaining a garden was also not a satisfying option.

They decided to continue. Meanwhile, Alie mentioned that during the investigation period, approximately 20 gardeners stopped, regardless of whether they were first-generation migrants. There could be numerous reasons why someone might choose to have a garden plot, most notably the investigation that happened in the middle of the COVID-19 pandemic. Some of the gardeners who gave up their plots in the allotment garden complex mentioned potential PFAS pollution as a reason for their decision. However, it remained unclear to me how much PFAS exposure contributed to the individuals who gave up their plots, as I did not speak directly to any ex-gardener from the *Volkstuin Hobuis*.

1.3.1 Entangled Toxicity

Chemical ethnography is able to situate a specific pollutant within a broader context by attending to its wider entanglements. In the renowned PFAS ethnography of the United States, Renfrew and Pearson (2021) explore how multiple toxic events led to an understanding of PFAS exposure. In their multisided ethnography of the Upper Great Lakes and Mid-Ohio Valley, U.S., Renfrew and Pearson have examined the communal response to PFAS exposure. They demonstrate how toxic events transform chemical exposure into a collective understanding. Firstly, they showcase how these events exist as symbolic-material assemblages that are mobilized in contested science, media, and public discourse. Secondly, as events, they become visible and are socially and institutionally acknowledged. Toxic events are thus the contexts and conditions in which invisible pollution becomes public episodes of interruption. Here, I want to expand the scope of toxic events beyond PFAS exposure to include other previous toxic events as well.

For the gardeners at *Volkstuin Hobuis*, toxic events unfolded through a mix of local, regional, and national moments that shaped their awareness of PFAS. The municipality's announcement of the investigation was experienced directly in the garden, but this was complemented by local media coverage, national reporting, and international attention in print and film. At the same time, PFAS circulated in consumer products marketed as PFAS-free, which reminded gardeners of the chemical's presence when similar products were not marketed as such. Or on public health boards at the local swimming lake that warns of elevated PFAS contamination. These events collectively produced awareness of PFAS, linking official investigation, media narratives, and daily practices in the garden and beyond.

Therefore, building on Renfrew and Pearson's insights, my ethnography at *Volkstuin Hobuis* reveals that the understanding of PFAS is shaped not only by the increasing visualization of pollution and toxicity, but also by memories of earlier polluted events. These previous encounters with contamination are embodied in the everyday experiences of gardeners and form part of the "chemical sublime" (Shapiro, 2015), which shapes how this new toxic event is understood. The "chemical sublime" refers to an affective process of low-level exposure in the material ecologies of living in polluted landscapes (ibid). In Chapter 2, I will further expand on this concept and discuss how the body and environment interact in PFAS-contaminated spaces. Ultimately, the chemical sublime contributes to the experience of toxic layering, in which gardeners navigate living within a toxic continuum (Goldstein & Hall, 2015; Renfrew & Pearson, 2021).

Importantly, PFAS has not been the first polluted event to occur in the gardeners' lives, nor in the wider region of the Netherlands. This toxic continuum is not just with PFAS, but also with wider toxic legacies of living in a late-industrial landscape. During my ethnographic fieldwork, examples of other toxic events were (continuously) brought up.

Specifically, Edward connected the PFAS investigation to other industrial-related toxic events, such as scandals involving mining and the military's use of Chromium VI paint. Other gardeners drew comparisons between current pollution and past disasters. Jerry and Johan said that PFAS contamination could be as catastrophic as the 1986 Chernobyl nuclear disaster. The effects of Chernobyl were recalled through the memory of cheap, unsafe spinach and lettuce. The gardeners remembered to avoid eating those vegetables. This toxic event exemplified how toxic legacies linger and continue to inform new toxic events, where the results remain uncertain.

Other gardeners also mentioned environmental degradation caused by industrial agricultural practices. For instance, Heiko speculated that the soil in the tomato greenhouses seven kilometers away might contain even higher levels of PFAS than the garden soil. At the same time, the gardeners I spoke with believed that the garden could be kept weed-free through manual weeding alone; for large-scale commercial agriculture, however, this was complicated. The gardeners acknowledged that those plots were much larger, making manual weeding too time-consuming and thus reliant on chemical spraying. Likewise, Paul often mentioned the commercial use of biochemicals in agriculture and the numerous pig farms in the region known to contribute to pollution. Once, during a canteen coffee morning, he asked me if I knew how often leek gets sprayed with biocides. "Sixteen times," he said, "and that can't be good." (Fieldnotes, 12.03.2025; 21.03.2025).

Moreover, many older citizens of Helmond, particularly men, have worked in local textile dyeing companies. Johan explained that while textile dyeing is highly damaging to the environment, he had only recently become aware of its full extent. According to him, the industry released harmful chemicals that may still be impacting the area today, although much of the long-term damage remains unknown. The textile dyeing industry was not the only example brought up by Johan for a retrospective realization of a toxic event; he also mentioned asbestos. The cancer of his brother-in-law was linked to his asbestos exposure as a construction worker. Here, too, the full extent of asbestos toxicity was not realized until later, when his brother-in-law was no longer working in construction. In a similar way, Johan anticipated that the toxic effects of PFAS would likely be recognized in the future, through retrospective realizations of toxic events.

Additionally, microplastics were a continuing source of pollution that gardeners also needed to address. After my first two weeks in the garden, Rudi pointed out the rooting canvas that people use and the microplastics that end up in the soil through the canvas's contact with the sun's radiation. Although he is generally against its use, he recognizes the necessity of using it in small amounts; for instance, he uses rooting canvas to protect the pile of manure from the rain. Moreover, Johan, Theo, and others connected microplastics to PFAS as the realization of pollution unfolded. Microplastics were seen as unavoidable, much like PFAS. What is more, microplastics were featured in the news. Therefore, microplastics as pollution became a topic of discussion during coffee mornings. The Nature article on microplastics present in the brain was

published across multiple public lay media outlets.¹⁹ The fact that there was a tangible amount of accumulated microplastics in one's brain was repeatedly referenced among gardeners in the following months, and referenced as a salient toxic pollution event.

These toxic events exemplified how ruinous legacies continued to be tangibly remembered. Nevertheless, most gardeners continued cultivating their plots. They reasoned that, since nothing was certain, it might not turn out badly, much like other toxic events that had later proven less catastrophic than first feared. These latent non-toxic events were also mentioned. For example, during the semi-structured group interview, Evi brought up the 2017 fipronil scandal in eggs. The government advised people to stop eating eggs or reduce their consumption due to insecticide contamination. Despite the sales ban, Evi could still buy Dutch eggs without any problems during her holiday in Switzerland. After consulting her daughter, who worked for the Dutch government, Evi decided that eating the eggs would not be harmful. This toxic event was trivialized into a non-toxic event for her.

PFAS was often viewed as just another toxic event that had befallen them. Historical, retrospective, and emerging toxic events and non-events influenced the negotiations and decisions gardeners made regarding PFAS pollution. PFAS was often viewed as yet another toxic event that affected them. These events shaped how gardeners negotiated and navigated PFAS pollution. The scale of other toxic events that emerged and took precedence in their lives influenced how they negotiated toxicity when subsequent events occurred. Thus, prior toxic events and accumulated chemical exposure informed the gardeners' ongoing negotiations with past, present, and anticipated toxic events.

1.3.2 Uncertainty in PFAS

Importantly, uncertainty surrounds toxicity and vice versa (Nading, 2020). It is therefore that modes of uncertainty shape PFAS's knowledge production and regulatory management practices (Buttle et al., 2023; Cordner et al., 2019; Ohayon et al., 2023; Renfrew & Pearson, 2021; Richter et al., 2018). A common argument made about PFAS knowledge production is that a lot remains uncertain (Richter et al., 2021). A state of toxicity uncertainty is not necessarily negative. Nevertheless, the uncertainty surrounding PFAS toxicity is leveraged by industry actors to obscure evidence or delay accountability (Boudia & Jas, 2022; Onencan et al., 2024; Richter et al., 2021). As such, uncertainty is not only a state of toxicity but also a mechanism for producing ignorance. The strategic use of uncertainty reflects both the affective and cognitive

¹⁹ The original nature publication: Nihart, A.J., Garcia, M.A., El Hayek, E. et al. Bioaccumulation of microplastics in decedent human brains. *Nat Med* 31, 1114–1119 (2025). <https://doi.org/10.1038/s41591-024-03453-1>, as referenced in <https://nos.nl/artikel/2554472-microplastics-in-hersenen-mensen-aangetroffen> (last accessed 13.06.2025).

dimensions of the public's understanding of PFAS (Boudia et al., 2021, p. 82). This public understanding of uncertainty surrounding PFAS has been pronounced in studies documenting the experiences of affected communities, where concerns about potential health effects dominate local responses, i.e., Australia (Banwell et al., 2021), Italy (Menegatto et al., 2022), and the United States (Wickham & Shriver, 2021). In Chapter 2, I will expand on the perspectives and practices regarding uncertain adverse health outcomes from gardening at *Volkstuin Hobuis*.

Furthermore, rather than being confined to public perception, the notion of uncertainty also extends to the negotiation of toxic events and the broader navigation of troubled ecologies (Besky & Blanchette, 2019). Especially, dealing with uncertainty is a key aspect of socio-ecological research (Biggs et al., 2021), and methods of STS, such as chemo-ethnography, are particularly well-equipped to navigate the uncertainty of engaging with toxic and polluted landscapes. Even though uncertainty within STS has often been linked to risks and the governance of technoscientific modernity (Samimian-Darash & Rabinow, 2015), uncertainty is an integral part of an embodied troubled ecology and informs regimes of living in unsettled situations (Little, 2012; Puig de la Bellacasa, 2017, p. 138).

In this sense, uncertainty is a part of a biosociality that informs chemosociality; or in other words, this means that living in an PFAS's embodied troubled ecology relations emerge (Bradley, 2021; Shapiro & Kirksey, 2017). Firstly, the uncertainty surrounding toxicity is further derived from the complex phenomenon of exposure, which obscures the boundaries between “natural” and “synthetic” (Langston, 2010; Murphy, 2006). In this context, the boundary between the supposedly natural, such as bodies or plants, and the synthetic, like PFAS, becomes unstable and blurs, reflecting how chemical exposures entangle with biological and ecological processes. This explains how toxicants alter biological life (Nading, 2020, p. 210). Secondly, chemosociality acknowledges the multispecies dependency on and effect of synthetic chemicals (Kirksey, 2020). Chemosociality builds around communities that experience similar chemical exposures; more on chemosociality is discussed in *Chapter 3.6*.

In my fieldwork, this uncertainty manifested in four interconnected ways: 1) limited and unsettled knowledge about contamination levels, 2) the prospect of governmental intervention in their gardens, 3) bodily health and potential alterations, and 4) the temporal dynamics of PFAS. The last two modes of uncertainty will be extensively described in further separate sections. In *Chapter 2*, I delve deeper into mode 3 on how uncertainty is linked to the body and into adverse health effects that have not been directly observed but remain a future possibility. Additionally, in *3.5 Temporalities of Care*, I will delve further into mode 4 on how uncertainty is connected to PFAS temporality in soil. The gardeners did not deny that PFAS was non-degradable, but they recognized it was mobile and not fixed in place. As the PFAS levels in the soil at *Volkstuin Walveld* in 2018 were higher than in 2022, gardeners speculated that PFAS was migrating downward. It let them wonder if, maybe, if they waited for a couple of years, PFAS would also move down

in *Volkstuin Hobuis*. The higher PFAS concentrations would decrease in the topsoil layer, where plants are rooted, thereby reducing their future potential exposure.

To continue, the first mode of uncertainty regarding PFAS in *Volkstuin Hobuis* concerned the exact levels of PFAS in the garden and in the crops. Although an official report of the investigation existed, most gardeners had not received it in a form that was accessible or meaningful to them. The report has been available on the municipality's website, among other PFAS-related documents; however, it required both effort and specialized knowledge to read and interpret it. As such, it was not accessible to the gardeners. Therefore, in conjunction with the investigation report, the municipality organized information sessions where gardeners could ask questions about the research at *Volkstuin Hobuis* both during and after the investigation. However, the answers the attendees received were often still unsettling in terms of tangible actions, where the municipality could not deliver unambiguous answers. The gardeners were well aware of the advice not to eat out of the garden daily, but they were uncertain about the exact PFAS levels in the crops, which were then linked to their exposure risk.

One concrete way in which PFAS enters the body's ecosystem is through food consumption. Therefore, the municipality advised gardeners not to eat from the garden every day. This advice was well known; in our first conversations, many gardeners immediately mentioned that the municipality had informed them not to eat from their plots daily. Yet when asked more concretely about their adherence to this advice and how often they ate from the garden, gardeners quickly complicated this advice.

Firstly, the garden plots are too small to cultivate year-round crops. Secondly, gardening remained a leisure activity, where self-cultivation and store-bought produce came together in their meals. Thirdly, the crops planted shifted slightly each year, guided by the gardeners' tastes and habits. Some crops flourished one season and failed the next, with outcomes attributed to weather, luck, or the subtle skill of their green thumb. These seasonal fluctuations and personal choices shaped both what was harvested and how food from the garden entered their diets. Fourthly, during summer, gardeners and their families often ate from the garden several times a week, particularly vegetables harvested the same day. Surplus harvests were either shared with friends, family, colleagues, and neighbors or preserved for later use, mainly as ready-made freezer meals. In the winter, garden produce was consumed less frequently due to the lack of fresh harvests. Hence, frozen meals and other stored produce reappeared in meals, but it was noted that most produce came from supermarkets, inspired by the weekly discount leaflets lying on the Canteen table.

As a result, the municipality's guideline was not so much a restriction requiring behavioral adjustment, but advice that aligned with what was already in practice. Whilst gardeners lacked precise information about which vegetables contained more PFAS or whether repeated consumption had cumulative effects. This uncertainty left room for speculation, but it did not result in major changes to daily routines.

Thus, in practice, they automatically complied with the recommendation not to rely on garden produce every day.

Despite not intending to quiz the gardeners on the research results, the topic of which crops would have more or less PFAS came up in various interviews. It turned out that the gardeners I spoke to did not have a collective understanding about which crops would contain more or less PFAS. And the answers between gardeners varied or even contradicted each other. This was, for example, the case with PFAS levels in potatoes, which are comparable to those in other vegetables.²⁰ In our interview, Heiko argued that potatoes were relatively PFAS-free, while Edward saw them as crops that would have higher levels of PFAS in them:

“Because I think that in potatoes, there were hardly any in it [PFAS]. And there were other plants which absorbed more.” (Interview with Heiko, translated from Dutch)

“With potatoes, there was also something said about, hey, you have to be careful there [because of the elevated PFAS levels].” (Interview with Edward, translated from Dutch).

It resembled their existing dietary practices, with Heiko eating potatoes more regularly than Edward, as the uncertain answers led them to maintain their usual habits. Yet, most of the uncertainty for the gardeners was actually not about the exact levels of PFAS within the crops or the bodily effects.

Therefore, the second mode of uncertainty for gardeners is that elevated PFAS levels could lead to additional government regulations, potentially requiring soil remediation. Soil remediation would mean a temporary closure of the garden, and potentially the inability to restore the garden to its current state or a workable condition. It was the prospect that their gardening activities could be halted entirely. This happened in *Volkstuin Walveld*, a few hundred meters away.

In the wake of the soil remediation suspicions at *Volkstuin Walveld*, Heiko decided to relocate to *Volkstuin Hobuis* during the PFAS investigation. He believed it would be safer there, with less risk of remediation disrupting his gardening. For Heiko, the uncertainty was not so much about the levels of PFAS in the soil or crops. The municipality advised those at the *Volkstuin Walveld* garden to stop eating food from their gardens altogether. Rather, the uncertainty was about whether the municipality would decide to remediate the soil. As he explained:

“No, for me it wasn't uncertainty. The only uncertainty was, are they going to remediate the soil or not [...] I wanted to continue gardening. It always went well, the soil was good, I could grow my plants there, I enjoyed myself there.” (Interview with Heiko, translated from Dutch).

²⁰ According to the final report of Boon et al. (2022), the sum concentration of PFAS was between 28 (low) and 37 (high) nanograms of PFOA equivalent per kilogram of potato. This concentration was relatively average compared to other crops measured in the garden, comparable to tomatoes and plums, but much higher than the reference location.

Most were not too worried that *Volkstuin Hobuis* would be closed. While soil remediation halted gardening activities at *Volkstuin Walveld* for two years, gardeners were eventually able to return and continue their practices on the new topsoil. Early on after reopening, there were problems with greenhouses and garden sheds that were not properly supported due to a lack of foundations. During a common storm of bad weather, many were damaged. In addition, there were water drainage problems that led to flooding, as the soil had been too compressed, and no underground streams had yet been edged into the land.

Volkstuin Walveld served as a harbinger of what might happen to *Volkstuin Hobuis*. In our very first encounter, Anna immediately remarked to me that if the soil were remediated, she would no longer have the physical capacity to restore her garden. She had laid down all the tiles herself in her plot and had carefully shaped the garden into a place where she could go to de-stress. For her, soil remediation would have meant the end of having an allotment garden plot, and she suspected that many of the older gardeners would also stop.

So, when, in late February 2025, the news broke that the municipality had received almost nine million euros from the Dutch government for soil remediation, some of the concerns about soil remediation resurfaced. The availability of funds, as well as the government's changing safety threshold levels, was not viewed as ensuring more safety with renewed insights but rather as contributing to uncertainty and speculation. According to the gardeners, the government or municipality could relatively easily change regulations and measurements. As they were “just above the safety threshold levels,” it could therefore easily be that *Volkstuin Hobuis* would be “safe” again if the threshold levels were changed, as well as needing to undergo soil remediation after all.

Thus, a temporary interruption could also have permanent effects. It would be a personal loss for current gardeners like Anna, who would have stopped, as well as for future gardeners, because much of the tacit gardening knowledge held by the present community would be lost. The absence of the older gardeners would also mean the loss of knowledge about the association, the soil, and gardening practices, which were transferred from the older gardeners to newcomers at coffee mornings.

Speculation was also unintentionally promoted by media reports about the garden. In the Canteen, there was a big blue folder filled with local PFAS-related news collected during the investigation. The articles, stored in plastic sleeves, were dated and annotated with their sources when the cut-outs themselves did not include them. Together, they formed a patchwork of updates that gardeners had received directly from the municipality, as well as newspaper coverage about *Volkstuin Hobuis*, *Volkstuin Walveld*, and local PFAS developments. In this blue folder were also articles of *Volkstuin Hobuis*, as they had become a media topic itself. On the one hand, the local newspapers wanted to inform the broader public about toxic events in the region. The media reports were a way for gardeners and others to stay informed about the situation themselves as well. Some new gardeners were aware of the previous PFAS investigation as residents of the

municipality or the neighboring neighborhood, and were informed by local media reports. They mentioned that they read articles about the investigation and elevated levels of PFAS. For them, the media reports were a reliable and trustworthy source of information about the PFAS situation and its potential effects on their prospective gardening.

On the other hand, the media coverage of the garden became contested in the garden itself. The board of the association did not wish to contribute to further speculation about the investigation. Alie, as the head of the board, was aiming to maintain quiet and stability in *Volkstuin Hobuis*. Additionally, not all gardeners identified with the media reports made about them. For example, Nellie said it was “very much exaggerated.” Moreover, Heiko argued that the intense media attention about *Volkstuin Walveld* was a reason the municipality decided to remediate the soil there. In this way, the gardeners’ practices and perceptions were negotiated not only through the investigation itself but also through the mediatized environment surrounding it.

1.4 Concluding Observations

During the coffee mornings, the gardeners discussed topics on their minds. These conversations centered on their garden practices, as well as news, personal troubles, and other small talk. After I introduced myself to every new person I met, and by doing so, I reminded them of their PFAS-exposed location, I sat with them, listened to their conversations, and on a few occasions helped them with their daily practices. Moreover, I walked through the gardens and spoke to people harvesting their winter crops and preparing their gardens for the upcoming season.

PFAS in the *Volkstuin Hobuis* gardens have been extensively discussed among gardeners over the last four years, as well as with their extended network. Community negotiations on what PFAS are and how to continue in PFAS-polluted landscapes have been informed by scientific knowledge in the media, as well as by their own embodied experiences of gardening at *Volkstuin Hobuis*. In doing so, the persistence of PFAS proved to be complicated in practice. It is easy to focus on those gardeners who expressed concern about PFAS. Their stories offered deep insights into the situation: their entanglements with chemical exposure, multispecies lives, and the nonhuman elements of PFAS in the allotment garden. And I have let their voices speak directly in my writing. But just as importantly, I aimed to attend to the non-stories of PFAS in my thesis: the silences, the gaps in concern, the uneven awareness.

Helmond is a historical industrial city of metal and textiles located in an industrial-agricultural region. The case of PFAS in the allotment garden exemplified yet another toxic event in which unseen environmental hazards had come to light. The different toxic events the gardeners have experienced were

locally situated and previously encountered, forming a framework that shapes gardeners' ongoing negotiations with toxicant exposures, past, present, and anticipated.

Therefore, what continued to loom larger than the presence of PFAS itself was the threat of further governmental intervention. Submitting their garden plots to testing was, on the one hand, a method to determine if they were at risk and to what extent. It was concealed with a more profound concern about what could be set in motion after its detection; if PFAS pollution levels surpassed safety thresholds, soil remediation or even garden closure was possible. That possibility, more than the chemical, became the speculated reality. For many, the allotment garden remained an emotional, social, and material commitment. Hence, losing their allotment would mean a rupture in the gardener's everyday lives and routines.

When I asked gardeners to explain PFAS, their responses revealed multiplicities of affective responses to uncertainties. And while uncertainty is a defining feature of life in troubled ecologies (Besky & Blanchette, 2019), it does not make it easier for those living with it. The gardeners came to realize that PFAS is widespread, even unescapable. PFAS transformed the garden into sites where the "invisible forever chemical" has become reality in various matters, manners, and entanglements. Living in a toxic world and polluted landscapes means encountering the entanglement of contamination that has become embedded in our everyday lives. Practice and perception diverge for the PFAS compounds that fall within collective sociotechnical imaginaries. Therefore, PFAS has unsettled them in a sociocultural imagination of pervasive ubiquity. Everyday exposure might become normalized, resulting in a necessary cost of modernization rather than a correctable design flaw (Hendlin, 2021, p. 186). The bioaccumulation of these "forever chemicals" has caused our environments and bodies to be deeply and persistently contaminated by PFAS pollution.

In this first chapter, I have focused on the community narratives of PFAS. PFAS turned *Volkstuin Hobuis* into a known site of a polluted landscape. The investigation itself marked PFAS as a toxic event (Renfrew & Pearson, 2021), prompting gardeners to relate it not only to their garden plot spaces but to other toxic events in their lives as well. As such, beyond PFAS, other polluting events further contributed to how gardeners made sense of and navigated life amid toxic entanglements of uncertainty.

The gardeners were already unable to eat solely on their own plots throughout the year; thus, the municipality's advice not to eat daily from the garden aligned with their existing practices and did not prompt mandatory changes in dietary routines. Together, the gardeners' at *Volkstuin Hobuis* negotiations of PFAS persistence and their everyday practices illustrate how knowledge about PFAS contamination has been continuously shaped through lived experience since the announcement of the toxicological investigation in 2021.

Chapter 2: The Body in the Garden

2.0 Vignette



Photo 7: Esther's garden plot in March 25, 2025

It's early March, and the sun finally starts to break through after months of white clouds slowly. Esther is working with her 16-year-old son, Sem, in her garden. They sit squatted down, digging through the earth, and removing weeds, preparing the garden for the upcoming seasons. In the background, birds are singing and their music is playing from a small portable speaker, accompanying their chatting. Today, Sem is off from school, and he helps his mother out. Even though he is not particularly interested in working in the garden, as Esther remarked earlier, it is a time for them to bond together.

When Esther was young, she was not too interested in vegetable gardening either. She thought it was boring and stupid, as Esther remarked during our interview. However, a couple of years ago, her opinion shifted. With a few tubs in her backyard, she soon became in awe of the phenomenon of putting something so small, as a seed, in the ground and caring for it, and then, after a while, seeing it growing and being able to eat it.

In her work at the nursery, she sees this same sense of marveling for plant life growth mirrored in the children's eyes. This new fascination made her want to join an allotment garden association, and after a few months of gardening in a raised tub at Volkstuin Hobuis, her current plot became available. She started by taking it step by step, slowly realizing how much time maintaining the garden takes. She designs the garden according to her planned availability. That is why, currently, she is leaving one side as a grassy lawn.

In general, Esther tries to practice semi-permaculture gardening. This means that she does not turn over the soil to foster soil life. Moreover, she pays close attention to which plants go well together, which plants hinder each other's growth, and where to place them. She also practices crop rotation and composting, where she covers most of the soil with straw. Whilst she avoids biocides to maintain organic care in her garden, she also remains unconcerned about PFAS in the soil, considering the levels negligible.

Esther had only had her garden for less than a year when she fell severely ill after routine surgery last year, which made it difficult for her to take care of the garden plot. Volunteers, as Rudi and others who come together in the Canteen mornings, helped her a great deal by watering her plants and maintaining her plot. The community aspect of the allotment became even more important to her as a result. Now, she tries to attend coffee mornings twice a week.

Plus, after having been repeatedly hospitalized, fresh food became even more valuable to her. Her garden provides her with fresh, unsprayed produce that she considers healthier than store-bought food. Describing her garden plot, Esther said in our interview:

"The garden really is my happy place, a place to unwind, to... yeah, just enjoying the birds' singing. The allotment really helped me through my illness. Even when I couldn't do anything at first, I'd still go to my garden, just sit there for a while. Maybe put in only three little plants. I live with the seasons, and you kind of go back to basics, really. And what's truly important? That's simply food, and sweet people around you."^{21, 22}

²¹ Based on fieldnotes and our interview.

²² The vignette could be placed for the next chapter on care as well, as you can see the multiple ways of caring already appear through parental and communal care, multispecies care, governmental care, etc. However, it is set prologuing to this chapter, as it describes how the environment, the body, pollution, community, and health and illness come into play at Volkstuin Hobuis. The vignette describes the gardening practices within the more-than-sensorial at attunements to being in the allotment.

2.1 Introduction

PFAS has become part of our environment and is currently present in all forms of life (Bond, 2022). Exposure to PFAS has been linked with adverse health outcomes (Menegatto et al., 2022). Overview studies have shown that even ‘extremely low levels of PFAS are associated with a wide range of health problems’ (Renfrew & Pearson, 2021). Specifically, PFOA exposure, one of the PFAS most present in *Volkstuin Hobuis*, has been linked to asthma, decreased fertility, hypercholesterolemia, increased cholesterol levels, kidney cancer, liver damage, pregnancy-induced hypertension, reduced antibody response to vaccines, testicular cancer, thyroid disease, and ulcerative colitis (ATSDR, 2025; Renfrew & Pearson, 2021). However, linking specific PFAS compounds to illnesses, as well as individual bodily effects, remains challenging, if not impossible (Richter et al., 2018, 2021).²³

PFAS exposure is thus closely associated with a range of adverse health effects and has become a central reference point for policy making. In this context, focusing on illnesses and syndromes is one way to witness how PFAS materially constructs the body. The awareness of PFAS contamination has the potential to shape how gardeners relate to their bodies and their practices beyond illness diagnoses. Additionally, pathologizing bodies and places merely exposed to the altered terrains of polluted landscapes have been critiqued for unnecessarily or unintentionally amplifying chemical violence (Mandler et al., 2025; Murphy, 2017). Where illness represents a major alteration from an expected state of normalcy, this very notion of “normalcy” has been further critiqued in critical studies on toxicity (Chen, 2011; Di Chiro, 2010). Therefore, in this chapter, I examine how gardeners themselves relate to PFAS, as their practices and understandings are shaped by framings of elevated exposure.

Previously, in Chapter 1, I discussed the uncertainty surrounding PFAS and how it is entangled with speculation. There, I already briefly mentioned Shapiro’s (2015) concept of the “chemical sublime.” Toxicity is set in an ecology of environment and situated within the body. The “chemical sublime” entails the experience and practice that focuses on the process of an embodied understanding of ‘human vulnerability to and entanglements with ordinary toxicity’ (Shapiro, 2015, p. 369). Namely, in the chemical sublime, there is a focus on material ecologies of toxicity. Living in the chemical sublime is not just a singular moment of shock, but rather an ongoing condition in which toxicity becomes palpable in everyday life, both as a bodily

²³ *The C8 Health Project's large-scale epidemiological study in Ohio and West Virginia in the mid-2000s was essential for identifying potential links between PFOA exposure and negative health outcomes. It was the largest epidemiological study on toxic chemicals at the time, yet the framework remains that not much is known. Lauren Richter, Alissa Cordner, and Phil Brown have written about the ongoing framework of the unknowns. Moreover, in section 1.3.2 I discuss how the framework of not-knowing relates to negotiating uncertainty in Volkstuin Hobuis.*

awareness and as a social discourse. PFAS exemplifies this condition of the chemical sublime, as its persistence renders toxicity a continuous presence in both bodies and environments.

In this second chapter, I expand on the concept of uncertainty in polluted landscapes and its contribution to the construction of the body, the third mode of 1.3.2. Specifically, I will focus on my second sub-research question: *How do the environment and the body emerge in effect in PFAS-contaminated spaces?* I will explain the various types of bodies that have been present and constructed in the garden, ranging from a gardening body involved in plowing, planting, and plucking, to a body that may have been affected by toxic exposure through adverse health effects. However, first, I will give a technical note on how the current PFAS norms and safety thresholds emerged, to which the ecologies became toxically exposed.

2.2 PFAS Norms and Technical Thresholds

Safety thresholds for guide policy. They are based on the assumption that scientific knowledge is the most authoritative source, through which scientists and policymakers seek to obtain the best data possible (Boudia & Jas, 2022; Casper, 2003). Accordingly, the Helmond municipality commissioned public-private scientific institutions to measure PFAS levels at the allotment gardens that are presumed to have exceeded PFAS levels. Their results would then inform the municipality's policy decisions. In turn, the public research institution of RIVM was tasked with analyzing and interpreting the data and providing policy guidance. Whereas the municipality's reliance on RIVM positions science as the key authority in rendering PFAS legible to policymakers, STS scholars remind us that such processes do more than only deliver data on a toxicant (Boudia & Jas, 2022). They, research institutions, actively construct PFAS as a public issue. By identifying and characterizing toxicants, these chemicals make the toxic world visible and into public issues (Renfrew & Pearson, 2021). From this perspective of STS, social scientists examine the grounds upon which data for science and policy are collected (Casper, 2003). It is a critical engagement to contextualize these very facts on which the troubled ecology is constructed (Mandler et al., 2025). Ergo, underlying these policy processes are specific scientific assumptions about how toxicity is understood and governed.

Central to these assumptions for governing is the concept of a "safety threshold," which posits that ecosystems can assimilate toxicants such as PFAS if exposure levels remain below a certain limit (Liboiron et al., 2018). Sampling organizes the environment into measurable units that can be statistically generalized to the whole. To conduct the analysis, samples were collected at the allotment garden complex. Sampling is considered a normative practice because it not only measures reality but also helps constitute it. In other words, by sampling soil, water, and crops, researchers aim to determine whether there is a risk of harm to humans or the environment.

In 2021, the Dutch government tightened the PFAS safety threshold to align with the guidelines of the European Food Safety Authority (EFSA), described in the introduction and see *Figure 1*. The EFSA norm meant that a cumulative sum had been established for four different PFAS: PFOA, PFOS, PFNA, and PFHxS,²⁴ out of the thousands of PFAS, that would indicate a health safety threshold. These PFAS were used as they are among the relatively better-studied PFAS, and they are the four PFAS most prevalent in human blood (Van Der Aa et al., 2021). Therefore, focusing on these four PFAS meant for policy, public health, and toxicological assessments to limit the uncertainty associated with PFAS as much as possible.

In the revised PFAS safety threshold standards, a cumulative sum was established at an accumulation of PFAS of 4.4 nanograms per kilogram body weight per tolerable weekly intake, abbreviated to 4.4 ng/kg bw/TWI. For PFOA, also the PFAS associated with Custom Powder's pollution in the allotment gardens, meant that the safety threshold was tightened to an almost 20-fold (from 12.5 ng/kg bw/TWI to 0.63 ng/kg bw/TWI). Wherefore, when *Volkstuin Walveld* was previously investigated in 2018, their PFAS levels were below the old safety threshold. However, with the new safety threshold levels, they were far exceeding these limits (Gebbink & van Leeuwen, 2020).²⁵

Consequently, in 2021, the municipality of Helmond decided to conduct a PFAS investigation at *Volkstuin Walveld* again and to include the additional site of *Volkstuin Hobuis*, located 650 meters away from *Volkstuin Walveld* and 1100 meters from Custom Powders. For this investigation, a collection of external actors was mobilized. *Tritium Advies*, a private consultation agency, was contracted by the municipality to research the soil and water. *Tritium Advies* then hired *Agrolab* to conduct their laboratory work. The crops were collected and analyzed by researchers from the *Food Safety Laboratory of Wageningen University*. Finally, the RIVM was tasked with examining the results and determining the safety threshold. Together, they analyzed over 30 different PFAS compounds that could be present at *Volkstuin Hobuis* and be detected with their technological equipment.

The board of *Volkstuin Hobuis* welcomed the municipality and researchers to collect samples of fruits and vegetables in three rounds over the summer of 2021: July 1st, 16th, and 19th (Round 2), and August 20th. Additionally, on August 5th of the same year, soil and water samples were collected. By June 2022, a year later, the municipality announced that the soil, water, and crops in the *Volkstuin Hobuis* had indeed higher concentrations of PFAS than suspected crops from a store.

²⁴ PFOA: Perfluorooctanoic Acid, also referred to as C8

PFOS: Perfluorooctanesulfonic Acid, key component of Scotchgard

PFNA: Perfluorononanoic Acid

PFHxS: Perfluorohexanesulfonic Acid

²⁵ The PFAS exposure estimates indicated that, under the worst-case conditions, gardeners could consume 4.3–12 ng/kg bw/day of PFOA, from their produce alone. This corresponds to surpassing of 7–19 times PFAS levels from fruits and vegetables alone within the new safety threshold.

Yet, to assess gardeners' exposure, the RIVM constructed an imagined body representing a person consuming the average Dutch diet. This was informed by another study conducted by the RIVM to determine general exposure to PFAS in the Netherlands, using data gathered from 4,313 anonymous Dutch participants aged 1 to 79 between 2012 and 2016 (Van Der Aa et al., 2021). Notably, the participants were not pregnant or breastfeeding, and they recorded only two days of their food consumption. Additional factors influencing diet, such as seasonality and origin of produce (store-bought or self-cultivated) were not taken into account. Continuously, exposure estimates were guided by the same assessment variables.

The average Dutch diet not only shapes its participants' bodies, but Van der Aa et al. (2021) also used a 70-kg standard Dutch body to model the toxicant exposure for the gardeners. Models were corrected with an additional 20% factor.²⁶ As the 70 kg body has been made into a standard body that has been deemed a representative alternative for gardeners, assuming those who follow the same average diet. It held the assumption as well that seasonal variation would not affect the long-term PFAS exposure, since PFAS is considered toxic mainly through cumulative, long-term exposure.²⁷ Then the imagined body of the people consuming from *Volkstuin Hobuis* was treated as representative of the gardeners' bodies, assuming they followed the same average diet. Therefore, the municipality only advised alternating store-bought fruits and vegetables with garden-grown produce to reduce PFAS exposure.

Before I move on, I want to briefly note that the oldest gardener at *Volkstuin Hobuis* turned 90 years old on the day I left, and I did not report whether people who had stopped consuming from the garden, if or when they were pregnant or breastfeeding. Crucially, this not only points to how actual bodies are not only more complex than the imagined in the standardized body, but also to the more multiplicity of the bodies envisioned in the investigation itself.

Revisiting the RIVM report on the PFAS investigation, it did not have current PFAS levels in store-bought vegetables. The levels of PFAS in store-bought vegetables were based on a 2009 study, which was derived from a Standard Dutch Diet survey conducted in the late 1990s (Van Der Aa et al., 2021). Therefore, their report speculated that levels in store-bought crops would be lower than in garden-grown crops. The RIVM explicitly mentioned this as a limitation of the study (Van Der Aa et al., 2021). According to RIVM's study, fruits and vegetables alone account for 10-39% of total weekly PFAS intake from food and water (Schepens et al., 2023; Van Der Aa et al., 2021). The original 2009 study, which aimed to evaluate Dutch PFAS consumption, revealed that PFOS and PFOA were the primary sources of PFAS intake. This intake

²⁶ The 70 kg body used in Van Der Aa et al. (2021) is approximately 14.3% heavier than the WHO standard body, which serves as a generalized model of the adult human. To account for this difference, models were adjusted with an additional 20% factor when estimating PFAS exposure.

²⁷ It was interesting to read in Gebbink et al. (2020) as well that they assumed allotment gardeners in *Volkstuin Walveld*, with smaller plots than *Volkstuin Walveld*, where it was mentioned that they would eat out of the garden year round.

was calculated to be 3.5-4.55 ng/kg bw/week of PFAS from fruits and vegetables for the average Dutch person (Noorlander et al., 2011, p. 7501). RIVM then relied on these measurements and calculations from Noorlander et al. (2011), treating them as representative of the average Dutch fruit and vegetable PFAS intake. This broad dietary average extended directly to the very different, much smaller subgroup of *Volkstuin Hobuis*' gardeners when issuing its advisory (RIVM in, Heuvel & Ruiter, 2022).

Furthermore, in the RIVM report, the crops analyzed were not cooked or prepared in any way; they were instead washed and raw. The results were that for their suspected intake, the allotment garden crops would accumulate to a median of 0.55 ng/kg bw/week of PFAS if the gardeners would eat out of the garden every day, and a suspected factor 1.5-fold lower when gardeners would eat only a quarter of their potatoes and half of their fruits and vegetables from the garden (RIVM in, Heuvel & Ruiter, 2022).

As no current data existed on PFAS levels in store-bought crops, RIVM used another allotment garden complex in the Netherlands as a reference point, and comparative model. This garden was located 80 km from Helmond and 15 km from another well-known PFAS plant. Later studies proved that the referenced allotment garden and store-bought vegetables were indeed comparable. Fruits and vegetables accounted for 0.39-3.2 ng/kg bw/week of PFAS, accounting for 6.5%-12.3% of weekly PFAS intake. (Schepens et al., 2023). Thus, the conclusion has been that store-bought vegetables would contribute to a slightly lower PFAS intake.

Collectively, through other sources, such as water, air, and consumer products, gardeners at *Volkstuin Hobuis* would likely surpass the PFAS safety threshold. However, as noted in the RIVM report and reiterated in the municipality's letter, everyone in the Netherlands already has a daily intake of PFAS that is too high. Only the combined accumulation from other sources resulted in the PFAS contribution from garden crops appearing slightly lower than previously assumed in relation to the safety threshold. Hence, illustrating how technoscientific practices are politically critical in identifying environmental toxicants and their health effects (Boudia & Jas, 2022).

2.3 Defining Environment

The RIVM safeguards both public health and the environment, linking science to policy and practice (RIVM, 2025). In their work, the environment primarily serves as a site for measurement, threshold setting, and regulation. Accordingly, they approached the allotment garden complex to determine its environmental exposure to PFAS. My approach diverges from this policy-technoscientific framing. In Chapter 1, I already described the space of the allotment garden complex and how it exists as a polluted landscape within troubled ecologies. For this Chapter's research question, however, I will look at how this

space of the environment emerges together with the body. Accordingly, I approach the environment through the rationality of its materiality.

Specifically, in this notion, I align with to the argument that allotment gardens are ‘spaces for the enactment of human-nature relations at an everyday level’ through eco-leisure activities (Jensen & Sørensen, 2020, p. 324). Having an allotment garden means engaging with embodied practices of material-nature interactions. Here, materials are encountering nature through the embodied acts of cultivating the spatiality of an allotment garden. Moreover, in the social sciences of chemicals, the established perspective has been that the current environment is shaped by human impact. Not only is a vegetable garden cultivated by humans. But as said, we are living in the Chemical Anthropocene due to widespread toxic pollution (Hendlin, 2021). The (synthetic) chemical saturation of the environment alters interactions between humans and nonhumans, giving rise to new nonbiological and interspecies living structures (Nading, 2020; Shapiro & Kirksey, 2017). This means that the environment is part of a toxic worlding, where the overlapping of polluted and toxic landscapes is assembled (Davies, 2022; Nading, 2020). Together, these environments are materially and chemically entangled spaces that co-emerge with human and non-human bodies. They are shaped by and shape everyday practices, toxic exposures, and challenges to the boundaries between them.

Extending, PFAS is present not only in this garden but also everywhere in our environment. PFAS are chemically stable and resistant to natural decomposition in the environment and therefore the contamination poses a significant challenge to scientific, technological, health, social, and political issues (Boudia & Jas, 2022; Buttle et al., 2023). The chemicals refer to a class of thousands of synthetic, bioaccumulating molecules, the exact number of which remains unknown. As a result, PFAS has become embedded in soils, waters, and bodies worldwide (Evich et al., 2022). While there exist geological layers on this earth where PFAS is not (yet) present (Tokranov et al., 2025), it is ubiquitously present in all cellular life (Bond, 2022; Buttle et al., 2023).

2.4 Gardening Practices

Dong and Yang (2023) demonstrated that, in hypothetical scenarios, people express a clear intention to adopt practices that reduce toxic exposure. In practice, this stated intention is far more nuanced. These health communication studies tend to focus on intention and individual decision-making, whereas the gardeners’ practices continue to reveal a more situated and ambivalent relation to toxicity.

As I spent two winter months in the allotment garden, it was challenging to document how PFAS impacted their entire gardening practices throughout the seasons. Moreover, I was not at *Volkstuin Hobuis* before the broad awareness of PFAS’s presence caused by the municipal PFAS investigation. It was often

emphasized to me how the gardening practices differed among the gardeners themselves. In general, generational differences as well as national background differences were often listed as influencing factors for particular gardening practices. For example, the Dutch gardens often had (six-)sectioned plots for crop rotation. This was done to prevent soil exhaustion. Polish gardeners, on the other hand, planted one row at a time and waited a couple of weeks to space out the harvest over the summer. And both gardening groups planted carrots and onions side by side to ward off each other's fly infestations.

Additionally, most of the older Dutch gardeners cleared the soil in the winter to maintain an aesthetically organized appearance. Others, however, let the soil rest and let it be covered in the fallen leaves. Alongside this, biodynamic gardening practices and newer techniques, such as permaculture practices, were also explored, adopted, and later sometimes rejected.

When I walked over the garden in the morning, I could spot people working in their gardens, primarily individually tending their plots. They were standing and slightly bent over to move rakes and pushing down with rooting forks to loosen and aerate the soil before planting began for the new season. Or they squatted down to remove individual weeds and to plant seeds. The work was done through physical manual labor, since the plots were small. And electricity was scarce, with grid power available only in the Canteen. It seemed like typical early-season gardening behavior.

Furthermore, when I inquired about their gardening practices, most gardeners emphasized that their gardening practices remained unchanged. Planting flowers could have replaced vegetable gardening as a way to continue leisure gardening practices and limit PFAS exposure through consumption.²⁸ Willem noted that he might have planted more flowers since 2021, but added that he has not changed his practices because of PFAS; instead, he was inspired by English gardens. Marie has always predominantly had a flower garden anyway. Klaas explained that, with his mixture of vegetables and flowers, PFAS does not affect him much. Loes and Edward said they had temporarily stopped eating food from the garden, Edward had only planted more non-edible perennials in 2021. The day after our interview, Edward drove to the other side of the country to buy uncommon specialty fruit and vegetable seeds for this gardening year.

Nevertheless, on my last day at *Volkstuin Hobuis*, Jerry pointed out in our interview that Hendrik now has a grass field and has stopped vegetable gardening since the investigation. He also mentioned that Hao, his neighbor, has been buying new soil every year since the investigation. Loes also bought new soil to slowly self-soil-remediate her garden, but this was a long-lasting, one-time effort for her. Whilst Hao and Hendrik were aware of my research and spoke to me informally, they did not mention their adjusted practices to me, nor were they generally interested in being interviewed.

²⁸ *It is standard practice, as required by the Volkstuin Hobuis association, to maintain a belt of flowers along the front side of each garden plot.*

2.5 The Art of Noticing the Body

'Produced by assemblages that are anchored in material culture, regimes of perceptibility establish what phenomena become perceptible, and thus what phenomena come into being for us, giving objects boundaries and imbuing them with qualities' - (Murphy, 2006, p. 24).

The gardeners are, as Grandia (2021) argued, canaries in the coal mine, able to sensitize the perspectives on what it means to live within toxicity. In the precarity of chemical landscapes, people, as canaries, are living in the frontiers of pollutant exposure. As discussed in Chapter 1, gardeners embody this entanglement of toxic exposure and everyday practice. In this sense, gardeners as canaries make visible the otherwise hidden effects of PFAS. It is in parallel, to what Anna Tsing (2015) famously called for, an arts of noticing; to witness the troubled ecologies in which we live in. Therefore, attuning to PFAS through the arts of noticing is to witness how toxicity shapes both the environment and the body. It involves is about the selectiveness of witnessing something and becoming attentive in more-than-human spaces that highlight the situatedness of a place (Skinner, 2024).

The question, however, becomes how to witness or notice something that is invisible to the human senses. Or to notice something that has become normalized. Through ethnographic attunement, I tried to notice PFAS in *Volkstuin Hobuis*. The gardeners I spoke with knew that PFAS was present in the garden. However, I often served as a reminder to them and instigated their awareness of it again. Anthropologist Loretta Lou (2022) asked a similar question in her ethnography on petrochemicals in China. She observed that people were largely unencumbered by the toxic chemical pollution emanating from petrochemical industries (Lou, 2022). Building on Tsing's (2015) work, she reconceptualized the "arts of noticing" to the "art of unnoticing" for her case. In the art of unnoticing, it is a matter of restraint in actions. Especially when uncertainty becomes present, unnoticing has become a way to justify continuing to live in certain precarious environments. In the next part, I turn to how bodies themselves can become sites of knowledge about toxicity, while also attending to how gardeners were. Building on Lou's (2022) art of unnoticing and Mandler et al. (2025)'s embodied ecology, further discussed in 2.5.3, I began to notice how in the garden, in many ways, became an embodied unnoticing of PFAS.

Previously, STS scholar Nancy Langston (2010) has shown how interactions between natural and synthetic chemicals destabilize the very categories that are meant to distinguish them. Rather than bounded entities, bodies emerge within these blurred lines. In her book, *Toxic Bodies*, she described toxic chemicals as having 'the potential to cross the boundaries between species and generations, altering the systems that shape our internal ecosystems of health, as well as our relationships with the broader ecosystems around us'

(Langston, 2010, p. 2).²⁹ PFAS is such a chemical: it not only circulates across human and nonhuman bodies, but becomes constitutive of them, embedding itself in the very ecologies through which life is sustained.

Within chemical-body interactions at *Volkstuin Hobuis*, the perceptibility of chemical effects on the body is shaped by how PFAS circulates through practices and the attentiveness of the gardeners. Also, STS scholar Michelle Murphy has extensively written on the interactions between technoscience, environmental justice, and chemical exposures. Their concept of "regimes of perceptibility" is helpful in understanding chemical exposure and the body (Murphy, 2006). Regimes of perceptibility describe how some phenomena are rendered visible while others remain hidden within sociomaterial infrastructures. Imperceptibility, in this framework, refers to what is ignored or rendered invisible by these regimes. Murphy (2006, 2017) argues that the infrastructures of chemical relations produce large realms of imperceptibility, shaping what bodies notice or fail to notice. PFAS, for example, can persist in gardens and bodies without being detected. Therefore, PFAS becomes perceptible only when the body is actively exposed to it, highlighting the entanglement of chemical exposure and everyday life.

Similar to Murphy's regimes of perceptibility, multiplicity demonstrates how bodies, as material entities, can exist as multiple things at once (Murphy, 2006, p. 10). These regimes of perceptibility resonate with Annemarie Mol's notion of multiplicity (2002). Her well-known insight that "the body is multiple" comes from her in-hospital ethnography, where a patient with a medical condition becomes many bodies simultaneously. Multiplicity emerges through sociomaterial interactions, emphasizing the doing or enactment of bodies. Through these enactments, bodies become more than one.

In the context of the PFAS investigation at *Volkstuin Hobuis*, a standardized model of the body was initially produced to measure PFAS exposure rates. This model described in 2.2 assumes a singular, uniform body. Yet, through everyday practices and perceptions, the body becomes multiple. In the garden, it is at once a gardener tending soil, a neighbor sharing harvests, a participant in conversations at the coffee table, a body entangled with PFAS both influenced by it and made to measure it, and more. PFAS circulate through and with these practices, shaping the body as a relational and multiple entity. As Mol emphasizes, reality is multiple, and no object or body exists as singular within a multiplicity of enacted realities (2002, p. 6).

This interplay between multiplicity, perceptibility, and unnoticing sets the stage for understanding PFAS not only as an external pollutant but as something that shapes bodies from within. Therefore, on the one hand, bodies emerge as sites of embodied knowledge. On the other hand, toxic substances can become normalized or ignored within everyday practices. Not because they are absent but because sociomaterial

²⁹ The extended title of *Toxic Bodies is Hormone Disruptors and the legacy of DES*. Langston (2010) specifically talks about the first synthetically marked estrogen and the legacies of diethylstilbestrol. However, the general claims she marks in the book and are quoted in this thesis hold true for other (toxic) synthetic chemicals as well.

infrastructures and routines shape attention away from them. In *Volkstuin Hobuis*, gardeners often continued their practices without being constantly aware of PFAS in their bodies or environment, demonstrating how imperceptibility and attentiveness coexist within chemical-body interactions.

2.5.1 Potential Unhealthy Bodies

As technoscientific research tends to seek the presence of synthetic chemicals, such as PFAS, by detecting and measuring them in bodies, ethnographic research, on the other hand, seeks to witness how evidence of damage is lived and recognized (Murphy, 2017). So, what is this damage? Or how is this damage witnessed? While PFAS activists might link their adverse health outcomes to PFAS exposure, this was not necessarily the case for the gardeners.³⁰ PFAS is not only linked to public health discourses (Banwell et al., 2021), but gardeners themselves have also mentioned possible connections between illness and PFAS. A connection to cancer, for instance, was raised by six of the fourteen gardeners I interviewed. Yet none of them identified their own bodily alterations as related to PFAS. Even when they acknowledged that PFAS could contribute to adverse health effects in general, they placed it outside of this by connecting it to aging or their own experiences of illness.

From the beginning, I had been interested in how PFAS became noticeable, and especially concerning the body. I thought that “the body” itself as a concept might have been too abstract, and I had hoped that the body could emerge when we discussed health. Therefore, one of my prepared questions for the interviews continuously had been: *Are you worried about your health concerning PFAS?*³¹ The responses illustrated a broader pattern among gardeners who did not associate long-term PFAS exposure with noticeable health changes or bodily effects. As such, it continued to be a form of embodied unnoticing of PFAS where noticeable bodily alterations or adverse health were not currently associated with long-term PFAS exposure.

³⁰ During my fieldwork I also interviewed a prominent Helmond PFAS activist and who used to work at Custom Powders. He links his illnesses to his high exposure to PFAS as the process operator. Other accounts of people who actively do link their illness to PFAS can be found for example, in Ohayon et al. (2023) and in the documentary *The Toxic Legacy of 3M's 'Forever Chemicals'* (2022).

³¹ Importantly, no one in the garden mentioned that a personal physician had linked their illnesses to their exposure to PFAS. Potentially doctors as authorities of medical diagnosis played an important role for them not linking their body alterations with PFAS on an individual basis.

Already in my first interview, when I asked this question, Rudi responded:

“No, no, no, no, no. Look, I’m getting older, everything is starting to creak and squeak a bit, that’s more now. But I attribute that to aging rather than what I’ve ingested through what I eat and drink and so on. So, no.” (Interview with Rudi, translated from Dutch).

Already in his answer, you see how the body emerges in his discussion of health concerns. He talks about his body as creaking and squeaking. Rudi his body alteration was linked to aging. Rudi is 75 years old and has been gardening at *Volkstuin Hobuis* for over 35 years, making him one of the longest-standing gardeners at the allotment garden. He gardens biodynamically, out of care for the earth. He leaves the soil intact, protecting the multispecies life that inhabits it. Throughout my fieldwork, he was critical of herbicides, such as glyphosate, and plastic use, including landscape fabric, as mentioned in Chapter 1. Bodily witnessing through alteration did not come from decade-long exposure to PFAS as the body was also not perceived to exist in a static state.

In a similar vein as Rudi, Nina and Johan remarked:

“We’re fine with it [PFAS]. There’s ‘t Streeckhuys [a supermarket literally meaning “regional home”] here too. Everything they sell is from around here, so you don’t have to worry about getting sick.” (Nina in the group interview, translated from Dutch).

For Nina, the fact that produce from ‘t Streeckhuys was grown locally and sold in stores signaled its safety; if such food could be sold under government regulations, then locally grown produce more generally must also be safe. Or an excerpt from my fieldnotes diary from the first day I met Johan, when he showed me his two raised garden beds:

“I asked Johan about PFAS as well. He said they (referring to the municipality of Helmond) checked it, and everything is okay. He doesn’t worry about it. At least his vegetables are not sprayed, which makes them more health, according to Johan” (Fieldnotes Wednesday 05.02.2025).

These gardeners did not worry, as the municipality had assured them, they could continue to garden and eat from their plots. This sense of reassurance contributed to the embodied unnoticing of PFAS, where the absence of perceived bodily or health alterations in connection to PFAS was reinforced. Moreover, the investigation of the garden itself was understood as part of these governmental food safety checks, much like the regulation would be too, for other locally grown produce sold in stores. Together, these practices reflected a broader trust in institutional oversight of food safety.

When I asked Jerry about PFAS and when he had first heard about it. He connected that to when the municipality announced the PFAS investigation. Jerry said:

“But yes. PFAS. When they said... That’s that non-stick coating. Anti-stick coating. Then I already knew it. That’s that toxic stuff. Carcinogenic stuff. [...] But, if you start developing a phobia for

those kinds of things... Yes. You have to adjust. Well. But for me... Well...” (Interview with Jerry, translated from Dutch).

The answer might have been a bit disjointed, but I interpreted the “Well...” as him accepting he needs to live with PFAS. Jerry knows that PFAS is toxic and could affect the body, but worrying about that could only lead to fear. In the silence that followed, I did not ask if he was afraid of getting cancer or what his fears would entail explicitly.³² Throughout the interview, he made it clear that he chose to focus on the joy of leisure gardening rather than worry about it too much. PFAS could such be bodily noticed through fear and phobia, but it was not noticed through chemical-body alterations.

One of the other gardeners who brought up cancer as well I asked about PFAS’s health effects was Theo. His mother was diagnosed with cancer last year. She also used to be a gardener and volunteer at *Volkstuin Hobuis*. However, these were seen as unrelated events, and I only bring them in to provide context for the interview. And while Theo worried about PFAS pollution, he did not link it directly to adverse health effects. An excerpt from our interview:

Paloeka: Do you worry about your own health? And to what extent is that connected with PFAS?

Theo: Also, especially the things I can’t control. For years, that company knowingly sprayed poison, releasing them into the canal and the air. I don’t know what else has happened that we’re unaware of, but I think there’s more. We’re seeing more strange illnesses in recent generations, ADHD and other conditions that perhaps existed before but are now more common. Almost one in two people now develops cancer. And where do you think all that comes from? That happens when you buy a lot of that processed food from the supermarket. When you read the label, you don’t even know what the words mean. Together, these things damage us; we make ourselves sick.

Paloeka: And do you worry about yourself that you might get sick as well?

Theo: There is no animal or plant where cancer would occur with a one in two chance of cancer. Then there is something seriously wrong with such a species, that life form. We, humans, are very sick at the moment. And we’re taking the rest of the world with us. So, yes. It’s terrible. (Interview with Theo, translated from Dutch).

³² *These kinds of follow-up questions arose after the interview. Oftentimes, I felt that I could have elaborated on a particular idea that was mentioned after the interview, especially during transcribing and analyzing the interviews. This excerpt was at the end of Jerry’s interview. My prepared questions were finished at this point, the conversation was dying down, and I had the feeling he had said everything he wanted to say about his PFAS experiences to me. Additionally, the interview ran to the agreed-upon hour. While I could argue that I wanted to wrap things up, I could simultaneously argue that I overlooked to follow up, which I only later wished I had done.*

Theo quickly moved on from PFAS being the only toxicant that influences our health in his answer and connected it to wider chemical exposure that influences bodily conditions. It connects to what I described in *1.3.1 Entangled Toxicity*, where the various toxic events influenced polluted perceptions from living in a late-industrial chemical world. As his voice grew louder and more frustrated as he spoke about living in a toxic, polluted space, I tried to steer the conversation back to PFAS and his health concerns. In response to his last statement about the terrible occurrence of cancer and to bring the conversation back, I asked:

Paloeka: *Are you afraid of developing cancer?*

Theo: *No, not really. It doesn't matter.* (Interview with Theo, translated from Dutch).

When I asked him this question, his tone immediately calmed or softened down. I was surprised by his clear-minded answer, as he had been so vocal about the state of the world and its connection to adverse health effects in general. The conversation did not go back to living in a chemical sublime or to PFAS. The conversation turned toward a sense of acceptance, perhaps resignation, or deliberate detachment, since he could not influence whether he would develop cancer.

Additionally, Edward recounted his negotiations to stop eating from the allotment plot in 2021. When the PFAS investigation was announced, he became concerned not only about his own health due to potential PFAS exposure, but also about that of his children. If he had agency over the situation, he felt responsible for protecting his children against potential chemical exposures. He recalled his concerns:

“What are we doing to our children? Then later, we'll hear a story from them: ‘Daddy, Mommy, you made us eat vegetables. But there was poison in them, and you were aware of that.’ Because, yes, you hear enough stories like that in the Netherlands. In other areas too, where people have been exposed. And later it turns out that, yes, it makes them ill. Or even causes birth defects in children. Like in Belgium and such.” (Interview with Edward, translated from Dutch).

Edward has heard about other places where children have been born with congenital disabilities, and that people have gotten sick because of PFAS. It is not that his children were ill, or that he mentioned that his children had been born with congenital disabilities. Nevertheless, he wanted to avoid future blame from his children for exposing them to PFAS through the garden crops.³³ Concerns about adverse health effects in response to PFAS have been raised not only regarding intergenerational biological impacts but also in intergenerational forms of parental care.

³³ However, when Edward learned that PFAS is everywhere and that everyone in the Netherlands has exceeded PFAS safety limits, together with the results of the municipal investigation that PFAS levels had just exceeded safety thresholds. He felt that exposure to PFAS had become unavoidable and that he could continue to garden.

I also discussed with Loes PFAS and its health effects. When I asked her to recount the investigation in 2021, she brought her health concerns up herself. During our interview, she mentioned how the older generation in the garden already suffers from the adverse health effects. She related their bodily health states to PFAS. Loes mentioned that they all have the same early onset symptoms. She mentioned throughout the interview: stomach and intestinal cancer, Parkinson's, Alzheimer's, joint and bone ailments.

"And so, if you look at the older people in the garden, and that generation that ate a lot of it, they almost all have the same symptoms. Stomach and intestines, real soon, at a young age. Stomach and intestinal cancer." (Interview with Loes, translated from Dutch).

Moreover, in addition, she said,

"Well, PFAS attaches to everything. So, if you look, where can it stick the most, surely it is in your brain and in your bones. So yeah, that's pretty scary" (Interview with Loes, translated from Dutch).

In Loes' understanding of PFAS, she places it in the body, where it "attaches to everything." Loes feels she is witnessing the adverse health effects already in the older generation in the garden. They share similar symptoms and diagnoses. However, in all my interactions with the older generation in the garden, while they might experience these adverse health effects, they do not link them to PFAS in the garden.

Additionally, Loes described the panic she felt and her worry about potentially losing the garden due to toxic exposure. She cried a lot when the municipality announced the toxicological investigation. This fear was similar to the anxiety Anna expressed, see section 1.3.2 *Uncertainty in PFAS*. The investigation caused stress not only about possibly losing the garden but also about the uncertainty of the future. For Loes, the stress of the investigation and the awareness it brought of environmental pollution continues to linger. As with Theo, it remains something that is always at the back of her mind.

Nevertheless, Loes remains worried that she might experience adverse health effects as well,

"I just hope it doesn't make me sick in the end. But I don't think... I think that's just wishful thinking. I think it will always have consequences somewhere." (Interview with Loes, translated from Dutch).

Currently, Loes (58) herself has been chronically ill since she was 24 years old. And she has had her allotment for seven years. Therefore, she does not attribute her illnesses to the garden either. Loes actually argued, like many others from *Volkstuin Hobuis*, that eating from the garden is healthier compared to vegetables from the store. First, she asserts that these have been cared for with love and attention. Second, she emphasizes that her crops do not contain herbicides like those found in supermarket produce.³⁴ It is within these negotiations over health values that gardeners position their practices.

³⁴ *It is forbidden to use biocides in Volkstuin Hobuis, by their own rules. However, there are instances and suspicions of gardeners using herbicides and pesticides.*

Thus, this is not to say that gardeners were unaware of PFAS's potential health effects or did not have embodied experience surrounding PFAS; instead, they located their body alterations to illness, aging, and within a broader landscape of environmental toxicity. Like Rudi, Theo situated his body in relation to a generalized condition of living in a polluted world, rather than to specific, traceable PFAS exposures. Loes observes the adverse health effects already in others, but not yet in herself. This focus corresponded with Loes' and Theo's reflections, who acknowledged PFAS as part of a wider chemical presence that shapes everyday life. Similarly, Edward's concerns centered not on his own body but on intergenerational responsibility, seeking to protect his children from possible harm and from future blame from them. Together, gardeners' engagements with PFAS have not been characterized by denial, but by a situatedness in an environment where toxicity is both pervasive and ordinary.

2.5.2 Healthy Gardening Bodies

As Loes has noted above, the practice of gardening was seen as healthy. Gardening was considered a healthy activity due to the absence of agrochemicals and the physical movement involved. This movement was considered mentally and physically healthy. Gardening enables gardeners to work at their own pace, adjusting the intensity and type of activity according to their physical capabilities. The older gardeners, who were still active and able to turn over entire gardening beds every year, were seen as health-inspiring by other gardeners who were decades younger than them. They hoped their future selves would also be able to do that.

Gardening entails a range of movements that require the body to interact with the garden, including bending, digging, standing, lifting, walking, rooting, squatting, and leaning, among others. The bodily practices of movement in gardening, which involve hard and tiring labor, have been a way for gardeners to stay active in their everyday lives at every age. At the same time, having an allotment as a leisure activity also means that these practices allow gardeners to work at their own pace and take scheduled rest breaks if needed. For example, Milena's work as a care worker has strained her body. Therefore, she works with 5 to 10-minute increments with seated breaks, trying not to overwork her body. And Otto, whom I often spotted leaning on his rake with a cigarette in his mouth, while he raked his plot, as he is not as fast anymore as he used to be.³⁵ Whether they are digging, lifting, or taking brief seated breaks, gardeners actively negotiate their bodily limits while engaging in their labor practices. This allows them to enact agency through the rhythms of their own plots.

³⁵ Milena is 39 years old and tired her body as a care worker. I did not note Hans' age down, but he was part of the older generation. I assumed he was in his mid-70s to mid-80s.

Willem has a whole gardening plot, the case for most gardeners. The first time I met Willem in late March, almost at the end of my fieldwork, he talked passionately about the joy of having an allotment plot. I struck up a conversation with him while he was unloading a trailer of tiles together with his sister-in-law. I specifically documented in my field notes how he discussed the pleasure he derived from digging in the ground and touching the soil as well. He told me that he does not particularly like to go to the gym, but gardening involves moving the whole body. He mentioned how this moving of the body was considered healthy. And when tired, one can easily take a small break. In our conversation, Willem also referred to another gardener, who was in his 80s, whom he knew from another allotment garden complex. That gardener still turned over the whole 500m² garden by himself, and Willem hoped that he would also be as vital at that age.

Moreover, Maria was one of the gardeners who also explicitly mentioned this mental relief during our interview,

“When I put my hands in the soil, I can let go of everything. Then I’m in my own world for a while. And I think you’ve heard a lot of people say that. Then you’re busy with the soil and the vegetables. And you don’t see or hear anything else. And that’s really nice. Then you really don’t have any stress or worries for a while” (Interview with Maria, translated from Dutch).

As soon as her hands dug into the sand and soil, stress was relieved. This stress relief was bodily experienced. We were talking about her raised garden tub. Maria has muscular dystrophy in her hands and feet, and the raised gardening bed allowed her to do vegetable gardening as well. When her body is tired, she can lean on the tub, resting her body and sparing it from further strain.

2.5.3 Embodied PFAS Ecologies

Many gardeners noted that the toxicity of PFAS is not confined to their bodies or reducible to disease. They understood it as already part of their lived environment. As Loes repeatedly said, *“it is part of the system”* (Interview with Loes, translated from Dutch). Within STS, a central engagement with the body and the environment has been the recognition that toxicants (re)make bodies (Fisher et al., 2021). As Murphy (2017) observed, pollution from industrial chemicals has become woven into the very fabric of both the environment and our bodies. This perspective from “troubled ecologies” has also been mobilized as the basis for reparative politics, ones that reject the idea of returning to a state of untouched purity (Fisher et al.,

2021).³⁶ It means that PFAS is not just embedded in bodies or the environment, but also has the possibility to change them.

Another way that queer and environmental humanities scholars have proposed reclaiming toxicity in pollution-altered bodies is through the metaphor of the “body as home.” The metaphor has been introduced by disability and genderqueer author Eli Clare and taken up by Giovanna Di Chiro (2010) in the context of environmental justice and ecofeminist thought. She argued that this metaphor provides a ‘material grounding for constructing an embodied ecological politics that articulates the concepts of diversity, interdependence, social justice, and ecological integrity’ (Di Chiro, 2010, p. 200). From this perspective, the body does not stand apart from the environment; ecological embodiment means that the body is part of the environment. Again, this is also a way in which the body and the environment rematerialize each other in multiplicity. The call for the metaphor of the “body as home” is part of a wider body of scholarly work that challenges dominant anti-toxics discourses in mainstream environmentalism. Rather than a natural state of the body, toxicity reveals how bodies are socially and politically naturalized as sites that are presumed to normalize to pollution (Liboiron, 2021b; Liboiron et al., 2018). As such, PFAS has become part of the body that continues to garden in *Volkstuin Hobuis*. And while, anti-toxic discourses are based on cultural fears of exposure to pollution and the toxicity of troubling and destabilizing naturalizations of (colonial) gendered bodies (Di Chiro, 2010, p. 201), they also continue to exist alongside efforts to reclaim toxicity as part of embodied, lived ecologies, revealing the tension between resistance to contamination and the necessity of living within it.

It further relates to what environmental feminist scholar Stacy Alaimo (2010) refers to as trans-corporeality. Trans-corporeality also focuses on the movement between interactions across bodies and nature. The concept dares to explain the interconnectedness of the more-than-human world in its material exchange. Again, moving away from the body as a mere biological matter, trans-corporeality focuses on the sociocultural material construction of the body and the environment. Resultantly, Alaimo argues that the environment is always located in the substance of ourselves (Alaimo, 2010, p. 4).

Besides, as Perczel (2024) notes, ‘living with toxicity may alter bodies and their ability to sense toxicants to the extent that it becomes necessary to attend to the limits to which outsiders can understand what it means to live in toxic places in the long term’ (p. 75). PFAS altered the body and the environment, inhabiting the organic through the synthetic and moving beyond the boundaries of human imagination.

³⁶ *These modes of engagement stem from decolonial perspectives that reject the idea of returning to a state of untouched purity. I have been inspired by these decolonial ecofeminist scholars, and I have seen notions of their concepts in the gardens. However, I want to make it explicit that the gardeners were not actively engaging with decolonial queer multispecies theory in any way, as I am doing in this thesis. The mode of engagement was where they were aware that PFAS is everywhere, and the impossibility of living PFAS-free was impossible. At the same time, gardeners expressed wishes for technoscientific innovation that would offer solutions, and disability was rather something to be avoided than embraced.*

This all can also be described through “embodied ecologies” (Ford, 2019; Mandler et al., 2025). Embodied ecologies are ‘a conceptual framework for describing a fluidity between bodies and worlds that foregrounds relations instead of bounded entities’ (Ford, 2019). It is to work with the materiality of a broader environmental context where health and well-being are manifested through practices (Ford, 2019; Mandler et al., 2025). It is then within the concept of embodied ecologies that refers to attending to sensorial experiences and embodied knowledge of exposure. It addresses the interaction between humans and the environment through embodied toxicity in polluted landscapes (Mandler et al., 2025). The gardeners at *Volkstuin Hobuis* embodied the notion of PFAS toxicity through their continued interaction with the garden, while remaining bodily unnoticed.

Along these lines, embodied witnessing or noticing PFAS, the chemical regimes of perceptibility described by Murphy (2006) in the book, *Sick Building Syndrome and the Problem of Uncertainty*, illustrate how adverse health experiences can relate to uncertainty. In their case, office workers experienced a wide range of symptoms, yet for the longest time, no chemical cause was found. While the opposite was true in my case, where a known source of potential adverse health effects existed, and people might experience these adverse health effects, they did not link them to their chemical exposure. Neither they, the gardeners, the researchers, nor their personal doctors were able to draw direct links between their consumption from the garden and their own bodies. Adverse health effects existed merely as increased probabilities and likelihoods. Even in cases where there is more evidence of even higher PFAS exposure, health experts have hesitated to make individual causal links. This resulted in a different problem of embodied uncertainty, where the individual body-alteration links to PFAS exposure were not made through the embodied witnessing of the gardeners.³⁷

Instead, at best, knowledge about PFAS contamination has been mediated through speculation based on witnessing adverse health effects in general, as observed in epidemiological studies and media and news reports. This speculation about potential body alterations was most prevalent when gardeners discussed increased health conditions or the consumption of cultivated crops.³⁸ Pollution, and PFAS in particular, is something abstract where most senses of direct noticing are not there. There is no pungent or faint smell, foul or subtle taste, painful or dim sight, or deafening or soft sound with PFAS.

As previously mentioned, this does not mean that bodily reactions were not present in response to PFAS; becoming aware of PFAS created affective responses to the awareness of toxic embodiment. The

³⁷ In my interview with a former Custom Powders employee turned anti-PFAS activist, he described his decades-long struggle to gain recognition for the adverse health effects caused by his high PFAS exposure. He links his body's altered disabled state to his exposure to intense PFAS.

³⁸ At the time of writing this thesis, municipal executives in the local government are advocating for individual blood testing, wishing to enable citizens to technoscientifically measure their PFAS levels.

panic Loes felt when she heard about the potential PFAS pollution was palpable. She cried, and her worry spread throughout her body. As such, Loes' chronic illness worsened due to her worries. Her worry was not just that she was gardening in a polluted space, per se, but also the fear of losing the garden. Loes loves the garden. It is the place where she can spend her days and be close to nature. If PFAS pollution levels were too high, the municipality could decide to close the allotment garden or at least prohibit its use while the soil was being remediated.³⁹

In consideration of the potential closure of the allotment gardens and Heiko's recent retirement and grandparenthood, he was inspired to have an allotment garden. He returned to *Volkstuin Hobuis* from *Volkstuin Walveld* to continue vegetable gardening, which he left in 1994. As a farmer's son, he has had a vegetable garden since 1987. First, he had a plot at *Volkstuin Hobuis* and later at *Volkstuin Walveld*, to move back to *Volkstuin Hobuis* in 2023. Since retiring, Heiko has had plenty of spare time, which he spends in the garden. While Heiko is generally concerned with PFAS, the PFAS investigations and soil remediation were not a reason for him to stop gardening, as gardening remained an opportunity for him to have an everyday activity. He argued, as many long-term *Volkstuin Hobuis* gardeners do, that having been exposed for so many years, in his continuing to consume from the garden is also negligible for his remaining future.

Moreover, the garden is a place where Heiko can spend time with his 1.5-year-old granddaughter. A place he can play with her and teach her about how plants grow. He is aware, like Loes, of the notion that PFAS accumulate and persist in the body. And in children, Heiko argued, it would build up faster in their bodies, because their bodies are smaller. He had been worried for his children, as they had grown up with vegetables from the allotment gardens. Yet, he does not worry about his granddaughter eating a few berries from the garden, as he views her as a blank slate for PFAS pollution.⁴⁰

To continue, Heiko could only speculate how PFAS altered his body. It was marked with this notion of embodied uncertainty regarding the individual health effects of PFAS:

"But yeah. What about your body? Does it even leave your body? They say it doesn't. It stays in your body. I've read that it doesn't leave your body. And it's carcinogenic. Everything is carcinogenic. But, yeah, what does it do?" (Interview with Heiko, translated from Dutch).

Heiko acknowledges that there is embodied uncertainty connected to the broader, intertwined pollution of living in toxically polluted world. In this the fact that PFAS is embedded in the body but does not necessarily cause observable alterations through adverse health effects, such as cancer, is part of what it means to live in the chemical sublime (Shapiro, 2015).

³⁹ In *Volkstuin Walveld*, the soil remediation lasted for over a year, affecting two gardening seasons from June 2021 to October 2022.

⁴⁰ However, PFAS is generationally transferred, prenatally already in utero and through breastfeeding, meaning children are not born free from PFAS exposure.

Furthermore, Heiko, like Edward, had always believed he was providing his children with fresh and healthy vegetables while they were growing up, which, in retrospect, were contaminated with toxicants. Heiko expressed how upsetting it had been that his children were exposed to PFAS through him, and he worried about the potential health effects they might experience. While Heiko has not been particularly concerned about his own health, he speculated about his wife's health, given her weaker immune system. However, again, he noted again that linking any effects to PFAS has been nearly impossible. He said:

“She has her lungs. But, well, it's hard to say whether that [PFAS] is the reason; you don't know.
(Interview with Heiko, translated from Dutch).

Not only, the potential for adverse health effects to be bodily noticeable is entangled with the awareness of inhabiting a toxic world, but also exposure to multiple toxic substances, including PFAS, converges with biological alterations exhibited in the body. The gardeners are well aware that PFAS may cause adverse health effects, however, linking them to specific health issues in their own bodies have been elusive. And even once chemical alterations may would become noticeable through adverse health effects, the links between exposure and health outcomes remain uncertain.

2.6 Concluding Observations

Troubled ecologies frame pollution and toxicity to be coproduced within bodies and environments (Fisher et al., 2021). This framework describes how toxic experiences are embedded within broader socio-environmental contexts. In the case for the gardeners at *Volkstuin Hobuis*, PFAS exposure did not produce immediate adverse health effects, although uncertainty about future risks remained. They lived within embodied troubled ecologies, often unsure how or whether bodily alterations could be directly linked to PFAS. The gardeners, as well as their doctors and researchers to their account, were unable to draw direct links between their consumption from the garden and their own bodies, it only existed in increased chances from exceeding toxic intake. Therefore, as Loes said,

“We all ingested so much bad stuff that we will probably get sick from it” (Interview with Loes, translated from Dutch).

However, the bad stuff is not only PFAS; it contains everything that exists in the chemical sublime from living in polluted landscapes (Davies, 2022; Shapiro, 2015)

Throughout this chapter, I have approached uncertainty of toxic embodiment to highlight how gardeners at *Volkstuin Hobuis* perceived and enacted their bodily existence while navigating a polluted landscape. Bodily awareness of potential health effects is entangled in living in a toxic environment, where exposure to PFAS and other contaminants intersects with speculations of alterations. By acknowledging PFAS alongside broader environmental exposures, gardeners continue to negotiate an entangled experience

of embodied toxicity within what can be described as the chemical sublime of polluted environments (Liboiron et al., 2018; Shapiro, 2015). It has attuned them to notice and unnoticeable PFAS through their daily interactions in the garden.

Specifically, in this second chapter, I have focused on how PFAS shapes health, bodily alterations, and gardening practices. Although the gardeners were aware of PFAS exposure they experienced an embodied unnoticing. This meant that they did not associate directly their adverse health effects with the embodied troubled ecologies of PFAS exposure, but situated potential risks to broader contexts of everyday life and living within toxic geographies.

Uncontradictory, health continued to be an important reason for maintaining an allotment. Firstly, produce from the garden has been considered healthy. Secondly, gardening as a practice provided physical and mental well-being. The garden is a place to stay with the seasons and relieve stress. Moreover, older gardeners, especially, were admired for their ability to remain active through their labor in the garden.

Furthermore, data on PFAS pollution has been centered on the relationship between chemical corporations and regulatory agencies, and for a long time, institutional ignorance has influenced the chemical regulatory pathways (Richter et al., 2021). In the case of *Volkstuin Hobuis*, safety thresholds and proximity to Custom Powders meant that the municipality and RIVM have been central in producing and interpreting the data that shaped the advisory. The municipality's justification for allowing the garden to continue rested mainly on the notion that the general population in the Netherlands already consumes PFAS at levels above the safety threshold (Heuvel & Ruiter, 2022; Van Der Aa et al., 2021). Their assessments have been based on a series of assumptions, both acknowledged and unacknowledged, about bodies and environmental exposures. It demonstrates how regulatory frameworks for PFAS toxicants operate under the assumption of assimilation, even when the PFAS safety threshold is generally exceeded. Rather than the limits to the safety threshold, the framework works to legitimize practices in terms of how much of the safety threshold is exceeded. These institutional framings coexisted with the gardeners' own experiences of uncertainty, leaving them to negotiate these realities through modes of embodied uncertainties.



Photo 8: The Raised Garden Beds at Volkstuin Hobuis.

Chapter 3: Care for & in the garden

3.0 Vignette

From the chimney of that factory that handled PFAS, Custom Powders, PFOA has spread around the area. Most days, the wind blows southwest. It spread through the air when they were drying wet Teflon. The molecular particles traveled down, onto the land, onto the soil, onto the water, into the vegetables, into people's bodies.



Photo 9: Volkstuin Hobuis on a misty winter day in 2025. The tall trees are in the background.

"There you see," Heiko pointed to the rows of tall trees on the Northeast side, "they caught most of the PFAS. That's why this allotment complex is not as affected."

The bare-leaved branches sway in the wind. From the New Canal's side, you can see over four rows of trees, each row a different height, peaking at the allotment's border. In the summer, it's barely possible to spot the garden from the local road, when driving between the allotment complex and the canal.

*The particle, moving through the air,
Swayed by the wind flow.
Drifting, Falling, Catching.
Did the trees protect us? Where did it stop? How did it settle on the branches and leaves?
Seeping through,
Nestling, Sticking.
It becomes part of us; PFAS in our environment, in our body'ies.
No living thing escaped being exposed to it.*

After Heiko pointed out the trees on the southwestern side one day, I often found myself thinking about what that would mean, and I tried to imagine the PFAS particles getting caught in the trees. More than a month after I left my fieldwork, I finally wrote down the poem that had been conceptually stuck in my head. According to the letter from the municipality, PFAS particles had been present in the air since 1998, originating from the Custom Powder factory. And as the levels of PFAS pollution were not as high as initially anticipated, could it be that the trees unintentionally captured PFAS particles, thereby limiting pollution in the allotment? Could the trees have caught these PFAS particles? These trees are commonly planted to capture particulate matter from road traffic and provide generally additional environmental value (Van Iperen et al., 2019). However, when the trees intercepted PFAS flowing through the air, they became an unexpected companion and protector of PFAS. Or as Haraway (2016) would call it in *Staying with the Trouble*, an *oddkin*.

3.1 Introduction

In this chapter, I revisit one of the three modes of *Living in a Toxic* world from Nading (2020), namely care. Care within STS, and beyond, has often been theorized in its invisibilized practice, which defines care to be everything done to maintain, continue, and repair the world we live in (Kenney, 2024). Care in *Volkstuin Hobuis* is organized to care for the garden itself, including the soil, plants, and the community of the garden association. However, care is also present in feeding oneself or others through the crops grown in the garden. In this thesis, and specifically in this chapter, I focus on the aspects of care in living in toxic landscapes. As care interweaves between the fabric of social and biological existence in human and more-than-human relations (Martin et al., 2015), it becomes both material and emotional. Hence, care is apt to be multiple, situated, asymmetrical, and omnipresent, in no consecutive order of importance.

As discussed in Chapter 2 regarding the regimes of (im)perceptibility, care also works in a selective mode of attention; care is finite, as no one can care for all (Martin et al., 2015). Still, there is an omnipresence

of care. In this chapter, I will discuss in which ways care is enacted and materialized in the garden. This includes both maintenance and the absence of maintenance, showing the tensions inherent in the practice of caring. As such, Martin et al. (2015) explore the “dark side” of care, highlighting that even when care is omnipresent, neglect remains visible in areas or relationships where attention is absent. This reveals that care is not innocent: it is entangled with ethical responsibilities, limitations, and sometimes unintended harms.

While care is not a mode of control (Mol et al., 2010), care is a form of governance (Martin et al., 2015). This is exemplified by the case of the municipality caring for gardeners by investigating the garden and advising them on how to limit their consumption from it. The PFAS investigation has been intrusive in the mode of care; it interrupted the expected mode of gardening at *Volkstuin Hobuis*. On the one hand, the investigation served as a means for the municipality to address environmental pollution. On the other hand, the gardeners experienced stress during both the investigation period and the post-investigation period, which continued to be markers by uncertainty for the future. It is in the darker side of care, the lack of innocence, that is so profoundly connected to it (Martin et al., 2015, p. 627).

In this third chapter, I will answer my third sub-research question: *how are temporalities of care negotiated in an allotment garden contaminated by PFAS?* Firstly, I draw on Puig de la Bellacasa’s *Matters of Care* (2017) to frame how care unfolds within multispecies relations in the garden. Secondly, building on Martin et al. (2015), I examine the dark side of care and its selectiveness, connecting these ideas to gardeners’ experiences of pollution. Thirdly, I analyze how perceptions of soil are shaped through multispecies caring practices in a polluted environment. Fourthly, I continue to explore chapter one’s modes of uncertainty, specifically in relation to the temporality and unsettledness of care as gardeners navigate contamination. Finally, I highlight the affective and sensory pleasures of caring for the garden, showing how care persists even amid polluted landscapes.

3.2 Matters of Care & Asymmetries of Politics of Care

In María Puig de la Bellacasa’s (2017) infamous book *Matters of Care*, she describes how Bruno Latour’s STS concept of “matters of concern” relates to care. It is understood that matters of concern are the material realities. Matters of concern, as well as matters of care, are not fixed objects but need to be considered as assemblages, in this Latourian sense. They are both complex knots of social and political interests. These “matters” of concern and care are socially constructed through dynamic networks of relations, where agency is co-enacted by both human and nonhuman actors. Therefore, her work explains how the material world is continually remade through these interactions. In the case of PFAS in the allotment garden, this comes to practice through the way the matters of concern and care are constructed through the body,

PFAS, and the garden. They interact with each other, not as fixed independent objects, but as relational subjects.

Forthwith, the matters of care and concern become blurred and are shaped through collective processes. The matter of care, as Puig de la Bellacasa (2017) explains, belongs to entangled, messy worlds, where facts and things are neither isolated nor stable, but vulnerable and contested. In these worlds, as described in *1.1 Methodology*, Tsing (2015) also emphasizes that world-making happens through situated practices and encounters that link multiple beings. By recognizing that *matters of fact* are always also *matters of concern*, it foregrounds the notion of the fragility of what we take for truth. For example, gardeners attentiveness to the growth of flowers and crops become both an enactment of care and a participation in the construction of shared, precarious worlds. This includes letting weeds grow temporarily before removing them, demonstrating how care emerges through material engagement in everyday practices.

Moreover, care is a situated, life-sustaining practice shaped by constraints. It is embedded in everyday work that maintains webs of relationality and conveys ethical obligations (Puig de la Bellacasa, 2017, p. 43). Caring for an allotment garden plot requires regular attention and engagement. The regular attendance at the garden involves watering the plants, planting seeds, constructing structures for the plants to grow, and more. Additionally, it includes drinking coffee together, greeting familiar faces, and sharing crops with others. The described obligations to care are relational and necessary to sustain life. They are forms of fostering care. If the gardeners did not care for their plot, there would simply be no vegetable garden, as the plot would be overgrown by other plants.

The trouble of staying *with* care requires that the established hierarchies of value of care be required to become exposed. In Puig de la Bellacasa's (2017) understanding of care, the 'divergent modes of valuing care coexist and co-make each other in non-innocent ways' (p. 12). No one can care for all at all times, and care is often contradictory and asymmetrical. For example, the asymmetry of power means that gardeners have a significant influence on what they grow in the garden through regular attendance to their plots. It also means that they could not prevent PFAS in the garden. Moreover, in the PFAS investigation, it meant that the garden was subjected to being researched by the municipality, and gardeners were forced to navigate between two options: submitting to the investigation or refusing by opting out. However, the final decision would have been made regardless of their individual choice, as the advice from the municipality was always intended to be applied to the entire allotment garden complex. Finally, realizing that preemptive measures for care to prevent pollution or contamination are no longer feasible, municipal care has shifted toward mitigating a polluted future rather than rectifying the past.

Ultimately, matters of concern highlight the ethico-political dimensions of the materiality of care (Puig de la Bellacasa, 2017); they are socio-politically formed through agencies and the selectiveness of attention. Puig de la Bellacasa's (2017) argument that matters of concern are *embodied* in the representations

and experiences of things, shaping the lives of both human and nonhuman actors within these assemblages, is also present in my case. Caring at *Volkstuin Hobuis* endures, embodied in the plants, soil, humans, and more. An example of this materiality of care has been in Rudi watering Esther's plants when she was unable to do so from the *Vignette of Chapter 2*. Overall, the gardens have chosen to continue caring for the allotment, as proven by the materiality of care and concern.

3.3 Dark Side of Care

A common notion within medical social sciences is that care is a situated, life-sustaining practice that is both relational and constrained by its context (Mol et al., 2010). It is embedded in everyday acts that maintain webs of interdependence. As Puig de la Bellacasa (2017, p. 167) notes, care does not belong to us; we belong to care. It therefore frames care around to the vulnerabilities of living. Additionally, especially, as said the affective entanglements through which matters of care emerge often involve invisible or unacknowledged commitment practices (Murphy, 2015; Puig de la Bellacasa, 2017). These are caring practices that sustain environments of interspecies relationality. This framing overall moves beyond individual responsibility, emphasizing how care is distributed, affective, and situated in shared worlds.

As Martin et al. (2015) argued that the politics of care exists through asymmetrical power relations: care is an attentive, selective mode of concern that directs attention to some matters while deflecting it from others. In their workshop's paper, the authors discussed the politics of care in technoscience and sociotechnical worlds. In the scholarship of the social sciences of chemicals, where the results of technoscientific progress are critiqued (Hendlin, 2021), critical care scholarship has called into question the overly positive notions of care (Murphy, 2015). As such, I continue to ask how care for a chemically polluted landscape is enacted, negotiated, and embodied amid material-PFAS contamination.

I will showcase how through praxis, the shadows of amelioration in the ambivalence of care become materially visible. Importantly, the darker side of care exposes how caring practices can reproduce aesthetic and moral expectations within the gardening community. Many of these practices unfold through subtle yet enduring acts of maintenance, where attention and neglect continuously shape the garden's appearance. PFAS is not directly visible; however, for example, in the absence of maintenance, its effects became noticeable through disruptions in the garden's multispecies relations at *Volkstuin Hobuis*. Additionally, the dark side of care emerges in the selectiveness of institutional attention. Taken together, care becomes visible in the aesthetics of maintenance as well as in that of absence.

3.3.1 The Aesthetics of Care

The gardeners took great care of their garden, and maintaining an aesthetically pleasing garden played a significant role in their daily lives. When I walked with gardeners through the allotment complex, they often pointed out gardens that they liked or disliked based on their material-aesthetic preferences. For example, the first time I met Johan, he walked directly to Rudi's garden, located in the middle of the complex, to showcase what he considered an exemplary, standard-setting garden. Commonly, the gardens of Rudi or Marie were cited as examples of good gardens. Rudi primarily had a vegetable garden, and Marie predominantly focused on flowers. Aesthetically, the gardens were sectioned plots, well-maintained, and free of displaced waste. It showed that these gardens were thriving through years of attentive care of the plot.

As the chair of the association, Maria highly valued the aesthetics of a garden. Not only would it be visually appealing, but it would also inspire other gardeners to cultivate similar gardens and encourage newcomers to join the allotment organization. They made garden maintenance a central responsibility. However, the first garden upon entering the complex was uncultivated; a plot of dry sand with an old fence. It was a point of nuisance, for Maria and others, that needed to be changed. So, when the previous tenant vacated the plot earlier this year, matters could be refined. Firstly, the volunteers, Hendrik, Anton, and Theo, were put to work building a new fence. Secondly, it could be rented out to a new enthusiastic gardener who could well maintain this garden.

Milena initially received this garden plot but later switched to a larger one in the middle of the complex. The garden was then given to Sanne. She got her plot in late February 2025. Sanne was made well aware of her task in cultivating an aesthetically well-maintained garden. She said during our interview:

"It is the first garden you see, so it's expected of you to keep it tidy. [...] I've already spent quite a few hours getting the garden into good shape, because it was, well, somewhat neglected. [...] It had just become too much for her [the previous plot tenant]. So, she gave up this garden. But yes, there was quite a bit of work to be done. There were a lot of stones in the soil." (Interview with Sanne, translated from Dutch).

Sanne has been well aware that she needs to maintain her garden and that it needs to look visually organized. To accomplish this, she now attends her garden every other day. It is a self-imposed obligation of care for the maintenance work on the garden plot, aiming to create an aesthetically pleasing garden that also hopefully produces fresh food one day. Sanne, like most other gardeners, comes to the garden individually, often without anybody noticing their presence. Most of this maintenance work, therefore, is not seen. The removal of the stones from the soil is an example of this. All this effort of care will hopefully result in luscious vegetables at the end of the year. As such, the effects of unseen care and maintenance are continuous to create a well-cared garden that becomes aesthetically pleasing.

Well-maintained gardens were visited multiple times a week, for at least a couple of hours per week in total. However, since anyone could choose when and for how long to garden at any moment during the day, it was difficult for anyone other than the gardener themselves to notice how the garden was maintained. Therefore, a metric to witness good gardens was through the aesthetics of the gardens. Likewise, the absence of care equally exposed how gardeners negotiated responsibility and ethics in the garden.

To continue, having a non-sprayed garden with biocides also means that a significant part of the maintenance practice involves weeding. However, with weeding, there needs to be time and space for weeds to grow. Removing every unexpected seedling might cause one to take out wanted plants as well. On the one hand, Rudi was one of the gardeners who was bothered by the unmaintained gardens. On the other hand, he has also learned through the years to let unexpected plants grow. The seedling might have sprouted from last year's plants and could be valuable to keep in the garden. It may have originated from seeds carried by wind or birds and ended up in a garden. Now, unexpected flowers that were previously preemptively removed have been allowed by Rudi to have a place in his garden. Therefore, adding a temporal window to allow plants to grow was also necessary to let plants grow, while controlling weeds simultaneously. *And if it is weeds, they can be removed anyway*, Rudi said (paraphrased from fieldnotes, 13.03.2025).

From a community perspective, the expectation was still to maintain the garden plot in the event of potential soil remediation and PFAS investigation in 2021-2022. Even as some gardeners, like Edward, stopped eating from the garden but, he still felt it was necessary to care for it. As such, he still removed weeds during the PFAS investigation period. And after a while, he replaced his vegetable crops with planting perennial flowers instead. For Edward, planting flowers also served as an aesthetic alternative to vegetable gardening.

Nevertheless, in the absence of maintenance, different plants are able to thrive. Concretely, this meant weeds could spread, overgrow, and overflow. During the research investigation, also amid the COVID-19 pandemic, about a dozen gardeners stopped tending to their plots, leaving them unweeded and unattended. As a result, there were visibly more neglected gardens than in previous years, when only a few plots had fallen out of care. In the absence of maintenance became strikingly visible in the garden's aesthetic: weeds took over the empty plots, disrupting the visual order that signified good and attentive gardening. These uncared-for spaces stood out against the well-maintained plots, and the spreading weeds also began encroaching on neighboring gardens that continued to be tended. Therefore, the abundance of weeds became a visible measure of the PFAS investigation.

3.3.2 Selective Institutional Care

The second example, in the darker side of municipal caring for the allotment gardens, was felt in the tension over the potential option for soil remediation. During my first exploratory visit to the garden in December 2024, Theo speculated that the reason their allotment garden did not have soil remediation was that its PFAS levels barely exceeded the safety threshold. He further cynically mentioned that it would have been too expensive for the municipality to remediate the *Volkstuin Hobuis* complex. *Volkstuin Walveld*, which underwent soil remediation, is a lot smaller than *Volkstuin Hobuis*. In response, Rudi remarked that if the government were to remediate the garden due to its PFAS levels, it would need to remediate the whole country and beyond, as everywhere has been polluted by PFAS (fieldnotes, 20.12.2025). And soil remediating the entire country and beyond is impossible. Furthermore, the efficacy of soil remediation itself was also questioned, as in the nearby *Volkstuin Walveld*, where only a new top layer of soil had been added without removing the highly PFAS-contaminated soil underneath.⁴¹

Loes also made a similar remark in our interview,

“It's unthinkable that you would drain the world and cover it with new soil. Because where would the old soil go? It's already in that system. You can't get rid of it. I think it will become more toxic in a hundred years, but God, what will it be like in a hundred years?” (Interview with Loes, translated from Dutch).

Nevertheless, Loes wished that the municipality had supported soil remediation to limit PFAS levels in the topsoil, so she began to remediate her own plot step by step. Self-soil remediation is hard physical labor. Her actions exemplified how, in the absence of collective or institutional care, individual gardeners enacted care themselves through embodied, material practices.

Non-soil remediation has been for her part of the long-term, continuous neglect. Wider arguments were voiced that the research investigation at *Volkstuin Hobuis* had been performative, at least to a certain extent. Firstly, these gardeners suspected that the investigation itself served more to demonstrate responsibility and prevent future blame than to address the contamination genuinely. Other cynical arguments were presented for non-remediation, citing the media attention that was present at *Volkstuin Walveld*. Heiko remarked that the other garden, *Volkstuin Walveld*, has had soil remediation partly due to their press attention. Numerous media coverages were released in local media about the PFAS investigation in Helmond's allotment gardens, and only a couple were concerned with *Volkstuin Hobuis*. Alie, as the previous chair who

⁴¹ *At Volkstuin Walveld, no contaminated soil has been removed, only a new layer of soil has been added on top of the surface layer. This layer needed to serve to limit the PFAS uptake for the crops. Removing PFAS contaminated soils would also add another layer of complexity, from bureaucracy to relocating to a different valued site to where polluted soils can be placed.*

continues to handle PFAS-related communication, attempted to limit media attention to mitigate the turmoil that press coverage could cause. This was a way for Alie to care for the peace of the garden, while the media informed the wider regional public about the situation surrounding PFAS contamination.

In contrast, non-remediation, also by some gardeners, was not seen as a lack of care, but rather as a convenient outcome of the research investigation. Not only was the act of conducting the PFAS investigation itself argued as a form of care by some gardeners, who considered it sufficient. Gardeners, like Johan, argued that the research investigation itself was good pastoral care from the municipality, and the outcome indicated that soil remediation was not necessary at all. Although the municipality failed to prevent increased local PFAS pollution previously and was criticized for that fact. Johan argued that investigating the garden upon realization and considering the new threshold measures was sufficient institutional care.

Therefore, both soil remediation as well as non-remediation were unsettled feasible solutions for the gardens. Overall, in its selective mode and various expressions of care to the gardening community, care became noticeable through its longstanding neglect of policy management loopholes and post-awareness concerns about toxic contamination. Intensified PFAS pollution has occurred in the local landscape in this part of the Dutch Southeast over the last 30 years. The gardeners had different expectations of care that they wished the municipality had performed. Foremost, it was about preventing pollution in the first place. Instead, they were left to navigate the consequences of contamination in their everyday gardening practices. Now they need to reconcile living in a troubled ecology while negotiating their wish to continue gardening. Municipal care practices did not solely prioritize environmental or health concerns; instead, they also focused on other matters, such as economic prosperity, regional technoscientific development, and administrative efficiency.⁴² This selectivity exposes the darker side of care: how care, while attentive in some domains, governing overall, can simultaneously sustain neglect and enable harm in others.

3.4 Soil Caring in Contamination

'Human-soil relations are a captivating terrain to engage with the intricate entanglements of material necessities, affective intensities, and ethico-political troubles of caring obligations in the more-than-human worlds marked by technoscience' (Puig de la Bellacasa, 2017, p. 169).

Attention to the soil as a space between life and nonlife is especially relevant when considering PFAS pollution as nonlife within the allotment garden life constitution. As discussed in Chapter 1(1), the

⁴² While broader questions remain about how the local area could have become so PFAS polluted, this thesis deliberately narrows its scope to examine how care is enacted, negotiated, and embodied within this polluted space of an allotment complex itself.

garden by itself is a multispecies space: the plants, humans, nonhuman animals, bacteria, soil, and more. A part of my ethnography has focused on the multispecies relationship that the gardeners have with their environment. Since 2021, the soil relations have already been constituted through PFAS pollution, with soil remediation on the one hand and soil fertility on the other.

In polluted landscapes, soil continues to be a multispecies space, a material ecology where life and nonlife continuously co-constitute one another (Puig de la Bellacasa, 2017; Tam, 2023). Following the understanding that PFAS circulate through all cellular life (Bond, 2022), including that in the soil, PFAS has been spread predominantly through the air from the southwestern Custom Powders, and to a lesser extent, through water. Therefore, PFAS-free soil would be sterile. PFAS particles eventually fell and settled into the soil, becoming part of the environment of *Volkstuin Hobuis* and beyond, as read in the chapter's vignette. The soil at *Volkstuin Hobuis* embodies this entanglement: a multispecies site that exists *with and through* the community of biota that makes it together with nonliving substances such as PFAS. In this sense, PFAS has become so intertwined with its soil ecology that the garden, as it exists today, that it could not exist without it.

The vitality of the soil thus depends on navigating this intimate relation between life and nonlife even as, PFAS, despite their omnipresence as nonlife, have been imperceptible in the soil.⁴³ As PFAS was not associated with plant deformation, instead, it was linked to a higher incidence of plot abandonment and weed accumulation, because of knowing that a plot could have had high PFAS concentrations. PFAS may become invisible, but their imperceptibility alone does not fully explain their absence in gardeners' concerns; what counts as pollution, and what requires care, is shaped by more than what is seen. This disjuncture between material visibility and affectiveness or ethical response complicates the relationship between contamination and care. Also, the disjunction between material visibility and affective or ethical response complicates how contamination and care come to be recognized and acted upon.

In this context, PFAS, being invisible and scientifically abstract, has been difficult to integrate into everyday garden care. Caring for the soil as a multispecies space within polluted landscapes requires witnessing. Even amid speculation about PFAS in the soil, garden care has been maintained, and there is limited individual agency to mitigate PFAS pollution. The threshold for recognizing pollution and responding to it is shaped not only by materiality but also by sensory engagement, habit, and perception.

⁴³ *It's worth noting that the gardeners did not notice PFAS' impact for soil and plant life. They considered plant growth variations to be typical outcomes. However, studies have emerged showing that physiological changes can be observed in plants grown on PFAS-infested soil (e.g. Groffen et al. (2023) <https://doi.org/10.3390/toxics11110922>).*

It was well-known that PFAS were in the soil, see Ahmed's quote in *1.3 Community Narratives*. Therefore, what was remarkable to me was that PFAS was never directly mentioned as part of the soil judgment when I asked about it during the interviews; it did not matter whether I had already asked questions about PFAS or not in the course of the interview. The soil was judged based on other life and nonlife aspects, such as whether it was: sandy, acidic, clumpy, too dry, or too wet, or whether it contained: earthworms or signs of microbial life. These were tangible indicators rooted in practical outcomes that influenced a soil's fertility, and therefore a plant's fertility.

Even in one of the most explicit interviews about PFAS with Edward, where PFAS was a topic at both the beginning and the end; it was notably absent from discussions of soil quality. Early on, Edward mentioned his speculation that PFAS could be recycled due to their persistence in decomposed plant debris. In the fifth minute of the interview, Edward recounts his decision to stop gardening during the PFAS investigation period in 2021. He said:

“And we did have a bit of a bad feeling about that whole story of lots of recycling and composting. And we thought, yeah, if it's PFAS... Then you read about it a bit and you realize, yeah, it's a persistent substance. It stays in there. So now we're recycling PFAS into our garden. Constantly composting and putting it back in” (Interview with Edward, translated from Dutch).

While composting is an act of garden care, it can also be a source of PFAS contamination (Khair Biek et al., 2024). Moreover, composting is a multispecies residue for life. Simultaneously, Edward is aware of the nonlife re-circulation of PFAS through composting. After hearing about the potential presence of PFAS in the garden, he realized that his previous care practices, such as composting, could have become harmful as well.

As we continue to talk about PFAS in our interview, and slowly move the conversation to “clean soil agreements”, since he is a landscape architect. I diverge from my prepared questions and ask him some expert interview questions on clean soil agreements relating to all kinds of pollution, including PFAS. These agreements are certificates provided by the government to confirm that the soil meets legal thresholds for safety and can be transported from one location to another. For example, years prior, in 2019, over 85 percent of tested soil exceeded the PFAS safety threshold, meaning it could not legally be excavated or transported, highlighting the importance of clean soil agreements. So, at minute 29 of the interview, as I inquired with him how a clean soil agreement is obtained, Edward responded to my question with an example of a project he was working on, concluding with the following:

“But for the top layer... You obviously need better soil. You need black soil. So, it's better to have pastures or something that you have access to, that you can dig up.” (Interview with Edward, translated from Dutch).

As pastures have fertile soils, it prompted me to ask the next prepared question, at minute 36 of our interview: *“And how is the soil here? For you?”* Edward answers, *“Here? Poor. It is really acidic and poor.”* (Interview with Edward, translated from Dutch).

There has been no mention of PFAS in his answer. PFAS only enters the conversation again at minute 48, when we talk about the physical labor of the garden and the body. Edward mentions that the strains of physical labor are unrelated to his concerns with PFAS. In his answers, although the theme of the interview and preceding conversation is PFAS, his judgment of the plot’s soil remains focused on other qualities; PFAS disappears from his response. Edward’s focus on acidity and fertility opens a space for analysis of how pollution is perceived, or not perceived, in soil quality judgments. As non-life, polluting materials, PFAS are vastly imperceptible. Rather, Edward was making sense of PFAS through clean soil agreements and the practice of PFAS-contained composting practices.

This absence of PFAS in judgments of soil quality revealed a broader pattern surrounding pollution. PFAS was not perceived to affect the soil’s fertility or plant growth. It did, however, enter conversations around consumption, especially when the vegetables grown were to be eaten by family members. The same holds for Edward when he expressed concern about feeding his children food from the garden. In these moments, PFAS became a matter of care and risk, not through soil, multispecies, and nonlife, but through the embodiment of cultivating in polluted landscapes.

While PFAS largely entered gardeners’ concerns through consumption rather than soil quality, other forms of pollution were more immediately perceptible in the garden. Therefore, this absence of visible matter and care, I wondered how it could differ if the materiality would be more perceptible. PFAS has not been the only material contaminating the soil. As plastic pollution was both visible and removable, I found it interesting to consider plastic in the soil to analyze how polluting materiality came into shape beyond PFAS. Not only did gardeners frequently encounter plastic fragments in the soil, such as those from leftover plant growth pots. But also, considering the role of plastic in soil pollution further situates the gardener's position when tending to polluted landscapes.

Mentioning plastic during my fieldwork interactions was a way to categorize pollution. PFAS and plastic are often grouped together as ubiquitous environmental health issues in media reports, as well as in people’s understanding. An example was a popular science magazine article, *“24 hours no microplastic: is it possible for a day to not consume plastic chips?”* (Schachtschabel, 2025), that Johan read just before our interview. The analogy between PFAS and microplastics also meant that they were sometimes confused, and PFAS was falsely labeled as a form of (micro)plastic. The reaction to plastic pollution, as well as to other types of pollution such as PFAS, was situated in the garden's polluting materiality. PFAS and plastic might both be synthetic materials; they are different human-made materials.

Larger pieces of plastic could easily be removed from the soil. Although microplastics and plastic waste were a general concern and frequently discussed *see 1.3.1 Entangled Toxicity*, the plastic waste that could be removed from the soil was rarely a problem for gardeners. Plastic waste and pollution were acknowledged, but they were not seen as interfering with growth, fertility, or the garden's purpose. It was its visibility that made them noticeable, but not necessarily more significant.

This became further clear in conversations with gardeners like Milena, who removed visible plastic from the soil. Milena's actions reflected a form of everyday maintenance and attentiveness to care for the garden a polluted landscape, but not necessarily as a further concern of a troubled ecology. When I asked her about plastic pollution, she responded:

"When I see plastic, I remove it from the ground and put it over there [pointed to the garbage bag]. There were little pieces of plastic, probably from the plant pots. I always do that. I just take it out."
(Interview with Milena, translated from Dutch).

Also, when I asked if the plastic waste said anything about the soil itself, she said, *"No, no."* Milena's response shows that even visible contamination was not seen as a threat to soil life. In that sense, pollution and care for a polluted landscape were decoupled, where neither plastic nor PFAS was a problem. Her response further highlights that care does not follow visibility necessity, and concern does not follow material presence. Removal of plastic pollution has been a matter of concern for the environment in general, but not for the soil life of their plots. The materiality of soil and pollution were separated because they did not align. Plants were still able to grow, possibly limiting root growth in the same way persistent non-anthropogenic polluting obstacles, like rocks, would do.

To go back to, as Puig de la Bellacasa (2015) argued earlier, good care practices occur within interdependent living webs. As such, composting is done to handle plant debris and to provide the garden with nutrients. However, as Edward pointed out, composting is a way to intensify in which life emerges together with PFAS contamination. In other words, the same practices that sustain soil life may simultaneously recirculate toxic contamination, producing tension between the gardener's intentions and material effects. In all, to care for PFAS-polluted environments means that certain forms of care itself become compromised. What is done to restore and sustain soil life may also serve to recirculate pollution. Therefore, the presence of PFAS turns soil care into an ambivalent act: one that oscillates between nourishment and harm, between regeneration and toxicity. In this entanglement, caring for polluted soil becomes not only difficult but disruptive as well.

3.5 Temporalities of Care

As previously mentioned, PFAS is commonly referred to as the “forever chemical” because of its persistent nature; it does not biodegrade but bioaccumulates and exists beyond a human timescale. Its materiality thus extends into a geological temporality (Bond, 2022). Coming from critical feminist scholarship, now I also want to raise awareness of, or critique, this notion of categorizing something as “forever” and explore what this perpetual temporality means.

Thinking with time offers ways to question such framings by foregrounding the ecological, symbolic, and material threads that shape the present and guide caring futures (Senda-Cook et al., 2023). As such, caring futures are imagined and enacted through practices of care. These practices unfold in time and through the body, what Puig de la Bellacasa (2015) calls an embodied time of care, emerging from affective involvement in environmental relations across different timescales. This becomes visible in the diverse experiences of PFAS’s temporality among gardeners.

In affective embodied time, as Puig de la Bellacasa (2015) further noted, the temporal imaginations contribute to alternative multiplicities of living speculations. For years, the gardeners were eating from the garden, assuming the crops were healthy. The moment they learned that the crops might have been exposed to PFAS, the crops became potentially toxic, and the gardeners became aware that they were cultivating in polluted landscapes. This moment of discovery marked a temporal rupture: what had once been ordinary and safe became reimaged through a new temporal lens of contamination and consequence. It allowed the gardeners to explore their speculations about the multispecies relations with the crops, themselves, and others, through toxic encounters.

There was concern that they had given their cultivated crops to others, which had been polluted without their knowledge at the time. This foregrounds post-care: a temporal form of care that emerges after acts of giving, when uncertainty and potential harm come to light. Gardeners do not know the effects of PFAS-contaminated vegetables on the ones they have given. However, they still might feel guilty about the possibility of having provided others with exposed vegetables. Edward has been an example for this, as they were worried that they might have exposed their families and others through their acts of care, see 2.5.1 *Potential Unhealthy Bodies*. Edward and others were concerned that they might have been unknowingly providing others with contaminated vegetables. Their acts of kindness and caring for their children and others were, in fact, acts of exposing others to pollution, as their supposedly healthy vegetables were toxic beyond their realization. When the PFAS investigation was announced, these gardeners felt worried and guilty for having given their children these vegetables.

When the gardeners did not yet know what the research investigation would reveal, estimates suggested higher toxic exposure than the eventual findings, prompting speculation about possible

outcomes. This uncertainty embodied a time of stress rooted in their post-care acts, as the food they had once given as gestures of care now returned as sources of worry. Additionally, the future held the possibility that bodily alterations from toxic exposure could emerge in themselves and to the ones they shared their crops with. In this sense, post-care became a temporal mode of care itself, where worry was a temporary form of caring, resulting from past acts of care.

The advice following the research investigation is to stop eating from the garden every day. However, everyone I spoke to in *Volkstuin Hobuis* said that they are unable to eat out of the garden every day anyway. Simultaneously, they overproduced in moments of harvesting, mostly during the summer months.⁴⁴ Then, gardeners shared their vegetables directly or made meals to share and eat with others. They firstly, shared their crops are among the people they live with, including partners, children, and other in-house family members. Secondly, crops could have been given away to friends, neighbors, or acquaintances. In this way, the vegetables grown in the garden are not only acts of care toward the garden itself, but are extended into multiple acts of care through sharing, feeding, and community. For example, Ahmed gives his vegetables to his parents, who make meals out of them for the whole family. Theo often put his leftover vegetables on the table at the outside corner of the Canteen. Loes sometimes puts a leftover courgetti or cucumber in her neighbor's shoes, as in the Dutch December gift-giving tradition. Johan eats the vegetables with Evi, his wife. And so, many of the vegetables grown in the garden are not acts of care on their own and care for a garden; they multitude to other acts of care in providing food.

Even as PFAS contamination introduced uncertainty about the safety of these acts, PFAS as a topic was also treated by some gardeners as no longer relevant. It was a topic of the day during the investigation years of 2021-2022. Now, the research investigation by the municipality has been finished, and the results have been published in a report. Thus, when I asked if there was something important to know about PFAS at *Volkstuin Hobuis* during the group interview, something I really should know, they responded:

Nelie: "*Shall I say something. I just forgot about it right away. I just put it [PFAS] behind me.*"

Evi: "Yes."

⁴⁴ *Actually, the traditional methods from Dutch gardeners often ended with temporary overabundance. This it could end up in food waste currently, as such the Dutch gardeners at Volkstuin Hobuis found Polish gardeners inspiring. They had learned from them that crops like lettuce could also be planted in installments, resulting in a summer-long harvest of lettuce, instead of once a year. At the same time, the Volkstuin Hobuis board, composed of Dutch gardeners, did not directly fully trust new Polish gardeners for their gardening skills. Polish gardeners often grew up in households in Poland, on the countryside, with large vegetable gardens, larger than the plots at Volkstuin Hobuis. Their families were able to maintain large plots. So, when Polish gardeners wanted to start vegetable gardening at Volkstuin Hobuis, they preferred bigger soil-based vegetable gardening plots over the raised garden beds, as they were familiar with the practice. The board on the other hand was likely to provide new gardeners with raised garden beds because they often confused enthusiasm for overconfidence, and they argued that new gardeners needed to realize how much work maintaining a vegetable garden would entail.*

Maria: *"I think everybody."*

Evi: *"Everyone, because back then, well, we felt safe. And actually, it wasn't really talked about anymore around here."*

Nina: *"I never think about it anymore, really."* (Group Interview, translated from Dutch)

Since they were no longer regularly confronted with it, Nelie, Evi, Maria, and Nina considered it no longer relevant. Caring for the garden, or the community, for them was no longer linked to exposure to pollution or toxicity. And their acts of caring for the garden and community could continue. PFAS became a topic of the past, another toxic event they had experienced (Renfrew & Pearson, 2021). For them, it was no longer relevant, and caring for the garden or community could continue without the burden of ongoing concern.

However, for Theo, while he was similarly confronted with PFAS daily as Nelie, Evi, Maria, and Nina, it remained a relevant issue that was always at the back of his mind, stirring strong emotions. Discussing PFAS, he expressed his frustration with a raised voice during our interview:

"I'm very angry, but there's nothing to be done. So, it's quite frustrating, but again, nothing to do about it. You can't actually be so worried that your life is going to suffer because of it. So, you kind of have to live with it. There's nothing to do about it" (Interview with Theo, translated from Dutch).

For Theo, the topic of living in a PFAS-polluted landscape remained a constant presence, while he actively tried to cope by continuing his organic garden practices. He negotiates cultivating his own vegetables within a polluted landscape, agreeing that his vegetables will remain healthier. He experiences a lack of agency to change the situation. Moreover, he enjoys working in nature and incorporating the garden into his routine and social life. Therefore, he continues to care for his garden while acknowledging the toxic future.

Even beyond Theo, PFAS was not entirely absent from the gardeners' concerns. Not only was I a reminder of PFAS pollution in the allotment garden, whenever it appeared in the (local) news again, it became a topic of renewed discussion at coffee mornings. Questions about future soil remediation remained unresolved, and the possibility of changes to PFAS threshold safety levels kept the threat of remediation, or even the closure of the garden, present in their minds.

So, when in late February 2025 the municipality received 8.7 million from the national government to support soil remediation in city-wide projects, the gardeners were worried that they might be suspected of soil remediation again as a result, as briefly mentioned in *1.3.2 Uncertainty in PFAS*.⁴⁵ This uncertainty could

⁴⁵ *The 8.7 million euros from the national government were announced during my fieldwork and first reached the gardeners through the local news. Earlier, the local municipality had covered the costs itself, but it was already under budgetary strain. The government pledged financial support, framing the issue as a public health concern. The municipality had hoped that Custom Powders would recoup the costs; however, its bankruptcy, which local news outlets argued was a tactic to avoid liability, made cost recovery unlikely.*

also not be settled, as governmental care remained contingent. Even a call with a local municipality representative could not resolve this uncertainty. During the call with the representative, Alie, the PFAS coordinator at *Volkstuin Hobuis*, informed him about the city's PFAS soil remediation efforts, noting that *Volkstuin Walveld* had already been remediated while *Volkstuin Hobuis* had not.

Uncertainty was amplified by the temporal dynamics of PFAS in the soil. In conversations about PFAS-contaminated soil, Heiko noted that between 2018 and 2021, PFAS levels in the *Volkstuin Walveld* topsoil had decreased. This raised the issue of PFAS mobility through soil and the decline in exposure over time. This mobility in soil called into question the assumption of long-term persistence at a fixed site, i.e., the allotment garden. It made gardeners speculate that adding a new topsoil layer was not the only remediation option, and that PFAS levels in the topsoil layer might also decrease over time as the compounds gradually migrated deeper into the soil. Waiting would not remove PFAS from the soil but would move it away from the topsoil layer used in gardening. Gardeners, like for example Heiko but also Sanne, mentioned this to me, wondering whether waiting a few years might allow PFAS to migrate deeper into the soil, thereby reducing contamination in the topsoil and limiting their exposure and associated health risks. In this sense, attending to the movement of PFAS through soil was not only a matter for potential remediation or measurement but also one of witnessing, of speculating on slow transformations that unfold beyond immediate perception. Through such acts of noticing, gardeners cultivated a sensitivity to the temporalities of contamination and care, remaining attuned to what persisted, what moved, and what might one day recede.

Since Custom Powders ceased handling PFAS by 2018 and declared bankruptcy in December 2024, it was no longer a source of local ongoing contamination. As a result, any potential for future timescape contamination has now shifted to other sources with lower PFAS exposures, which are also present in other locations. Additionally, since the garden sits above a groundwater zone, any effects on deeper groundwater could perhaps be mitigated through technoscientific means, such as drilling deeper or filtering the water, as the gardeners were speculating about as technosolutionist options. Ultimately, it complicated the notion of “forever.” Wondering what “forever” actually entails? And where does “forever” reside? And who gets affected by that? When PFAS moves deeper into the Earth, not into the produce and out of the bodies.

These experiences of waiting and uncertainty among gardeners stood in partial tension with what Onencan et al. (2024) describe as the temporality of PFAS exposure, *see Figure 3*. In their model, PFAS time unfolds through a series of linear stages, each tied to changing human responses and relations to contamination. The modes showcase primarily the chemosociality within PFAS pollution: 1. Pre-discovery, marked by the slow disaster and invisibility of PFAS pollution, 2. Discovery of PFAS, 3. Lifestyle changes, such as engaging in PFAS-free chemo-capitalism and altering planting and consumption from the garden, 4. Living with PFAS marked by continuing to garden, and 5. Restitution: hope for a PFAS-less future. The gardeners would be in a post-discovery phase; however, their experiences show that these phases are rarely

linear in affective practice. For example, for Edward, the potential for parental guilt was much more present in the second phase upon the direct discovery of PFAS exposure. He now continues to eat from the garden with his family. As the pollution persists and uncertainty continues, fatigue and resignation have also become part of this temporality of living in polluted landscapes.

Ultimately, gardeners at *Volkstuin Hobuis* were situated within an unsettled temporality of care, where futures are neither promised nor clearly foreclosed. An important insight from STS scholarship is that care itself is inherently unsettled (Murphy, 2015). Moreover, focusing on the unsettled entails ‘a politics of reckoning with a world already violated: it is a commitment to desedimenting relationships that set the political, economic, and geopolitical conditions of knowledge-making, world-making, forgetting, and world destruction. Unsettling does not promise good affect; it is against, as much as within, the alignments and orientations that stratify technoscience’ (Murphy, 2015, p. 732). In the context of the gardeners, this unsettledness manifests not only in acts of care that are constantly negotiated and incomplete, but also in the very futures toward which care is directed. At *Volkstuin Hobuis*, care practices such as tending gardens, sharing food, and maintaining community are oriented towards uncertain and contingent futures. In this sense, care is an ongoing engagement with the past and present and a negotiation with the future.

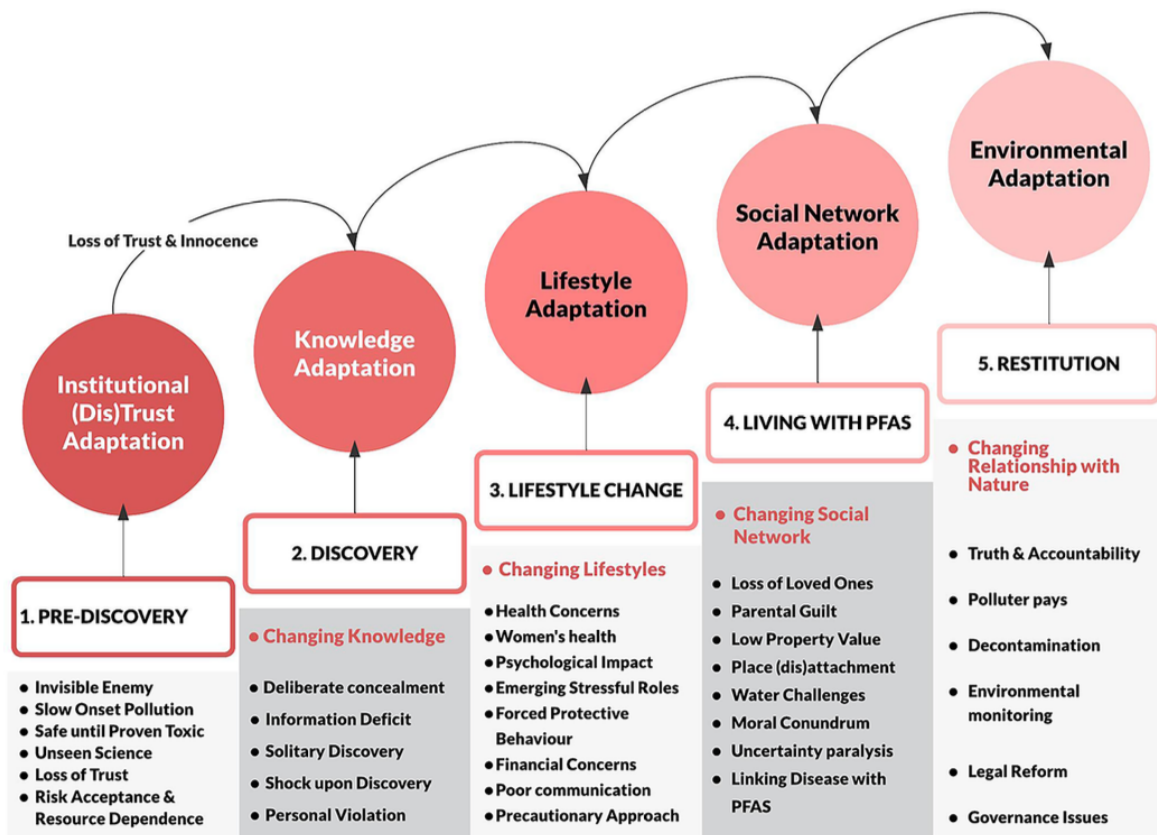


Figure 3: Five Phases of PFAS adaptation from Onencan et al. (2024).

3.6 Making Kin in PFAS's Chemosociality

Haraway (1985/2006) argues that pleasure and power are present in more-than-human relationships throughout the technologically mediated world. She famously called for “making kin, not babies” in her book *Staying with the Trouble* (2016). Haraway’s call to ‘make kin not babies’ means to take care of the relations that have been formed from chemical exposure. Making kin means making relations with more-than-human entities to live in this world that has been so deeply ecologically damaged. PFAS has been one of the factors contributing to the Earth’s troubles. It is a trouble that will extend human existence, as it has become part of the very fabric of our being.

Moreover, Kirksey (2020) called for multispecies chemosociality: the social relations and forms of care that arise within chemically entangled multispecies worlds. In this light, queer theorist Tim Dean (2009) demonstrates how pleasure can be connected to risk and increase *jouissance*. Exposure to chemical risks, therefore, holds the potential to heighten pleasure, with shared experiences of pleasure and risk fostering forms of community. While the gardeners’ community did not form explicitly around their chemical exposure, they are nonetheless collectively exposed. Drawing on Dean (2009), I suggested that pleasure and chemical risks do not oppose each other but might persist together. Caring within chemosociality does not diminish the potential harmful effects; rather, it refocuses on where pleasure is used to mitigate the risk of exposure.

It is what Dean (2009) uses as an example to illustrate how chemosocial communities can form around a shared pleasure. This is what chemosociality is about: the ways chemical exposure binds people through affect, intimacy, and shared experience. As such, care in social-chemical relationships has been argued to form around shared joy, where pleasure is valued over health (Adams O'Connell, 2003; Dean, 2009; Shapiro & Kirksey, 2017). Therefore, pleasure may be an integral part of, or an alternative to, chemosocial relations, even when health is highly valued.

Medical sociologist Virginia Adams O'Connell (2003) has further observed that, despite the importance attributed to good health, it must compete with other values. In the garden, these might include values of care, routine or daily activities, *jouissance*, a sense of connection to nature, and education, etc. Values, like pleasure, are able to compete with health or even be part of care. In the opening *Vignette* of Chapter 2, Esther values her health, but gardening in polluted soil continues, along with perceived exposure risks. Her negotiations reflect the entanglement of health care, environmental care, and community care. Within this entanglement, the act of tending the garden becomes a form of chemosocial care, a practice where pleasure, routine, and attachment persist alongside risk and uncertainty. Pleasure, then, may constitute not only an integral part of chemosocial relations but also a means through which care continues in the face of toxicity.

I would even argue that the pleasure of being in the garden has been one of the few, and main, reasons why the gardeners at *Volkstuin Hobuis* continue to garden, despite being aware of the toxic exposure. A lot of the reasons why gardeners have the plot are in some way directly connected to the pleasures of gardening itself: putting their hands into the earth, cultivating life, and even having a daily routine. While for some gardeners, their garden has been a replacement for paid employment, for others, their plot is a distraction to their regular employment. Many sought the opportunity to have a leisure activity, spend time outside, recreating in (created) nature as a pleasurable activity for them.

They came to *Volkstuin Hobuis* as a recreational third space because it was close by, they knew others who gardened there or had heard of it, or it happened to be the first available allotment garden option. Their allotment plots functioned as detached backyards, separate from their homes and apartments. Some already had small gardens or balconies attached to their living spaces, but these were too limited to create the kind of vegetable garden they envisioned. For others, those private spaces served mainly for relaxation rather than cultivation. Over time, the gardeners became deeply attached to *Volkstuin Hobuis* and often described it as the best and prettiest allotment complex in the area.

Collectively and individually, they have spent enormous hours creating this thriving multispecies environment. While part of it has been a feeling of continued maintenance, it has been done primarily out of pleasure. Plowing, seeding, harvesting, and weeding meant fingers were immersed in soil, and Chapter 2, I described how all of Maria's stress gets relieved when her fingers dug through the soil. That feeling of stress relief is pleasurable. Similarly, I could spot the joy in Esther's eyes when she talked about the amazement of witnessing plant growth. Even with new gardeners like Milena, who started on half-abandoned plots, I saw her joy and enthusiasm on her face as we walked through her new garden in the making, pointing out what had been growing and what she had already done in the last couple of weeks. Generally, talking about one's garden brought on laughter and smiles, and connections to positive affections.

Being able to cultivate life, when it worked, brought pleasure. A seed was able to grow into a whole plant that fruits and could be eaten. Gardeners saw themselves as part of the process of the plant's growth; however, they also knew they were not able to control it as well. Successful gardening came from experience and tacit knowledge, while being inspired and informed simultaneously by other gardeners, books, social media posts, magazine articles, etc. When it worked out in the end, there was a sense of accomplishment through weeks and months of care work and maintenance.

Teaching others, especially children, was for some also a reason to have the garden. It brought fulfillment, duty, and pleasure to teach the next generation how plants grow. Heiko spoke admiringly about his granddaughter and her curiosity about life and farming. Similarly, Jerry said about pleasure and the garden:

“And then I spend the whole day with my daughter, watching her play. It’s more because of the sense of fulfillment. You have the birds, the sounds, the sun, and the weather. You completely relax”
(Interview with Jerry, translated from Dutch).

Since his three-year-old daughter loved berries, picking and eating them, he planted more near where she plays.

Moreover, *Volkstuin Hobuis* has been a place that cultivates community. Coffee mornings were the most institutionalized form of cultivating community, where everyone was welcome to walk in, grab a cup of coffee, and chat with others at the table. It also created and fostered existing communities by introducing acquaintances to the garden. The community not only helped maintain the gardens, but it also brought joy through these opportunities for social relationships. Even jokes in the coffee mornings were made about PFAS’s ability to let plants grow better. These were created to navigate the dark situation, as the pleasures of the garden needed to be re-navigated after discovering the presence of PFAS in the garden.

Thus, these practices of joy for direct and indirect kin inspired people to garden, invest in the space, and cultivate the next harvest. Overall, the affective multispecies community provided joy, pleasure, and hope. The multispecies entanglements of living plants and birds, as well as the nonliving experience of feeling the sun, made the garden a site of ongoing attachment. While PFAS did not bring *jouissance*, the pleasure experienced through gardening helped sustain care over time, allowing gardeners to remain with the trouble rather than turn away. In this way, the temporality of care at *Volkstuin Hobuis* unfolds through persistence, repetition, and affective endurance amid PFAS contamination.

3.7 Concluding Observations

Care for a garden means being selective about what to tend, while committing to a continued embodied engagement (Puig de la Bellacasa, 2017). In *Chapter 1*, I discussed the uncertainty surrounding PFAS and the ongoing ambiguity about potential soil remediation. In *Chapter 2*, I briefly mentioned the situational relational aspects of care. In this chapter, I have extended that discussion by connecting the notions of time and care. Namely, I have explored how the temporality of care shapes and unfolds within uncertain futures, particularly in the context of “forever chemical” remediation and governmental management. The implications of PFAS in gardens at the soil remediation level remain unsettled. This means that uncertainty is not only part of living in toxic landscapes, but also how gardeners have been engaging with the temporality of the polluted landscape of PFAS in *Volkstuin Hobuis*.

Moreover, interspecies relationality through care, including neglect, caused some plants to thrive and others to disappear (Tsing, 2012). In deserted toxic landscapes, the presence of weeds can signal the absence of human tending (Tam, 2023). Neglect works in the period of absence of care. The neglect of the

garden not only led to undesirable conditions for the remaining gardeners and the *Volkstuin Hobuis* association, but also to weeds overtaking plots and encroaching on well-maintained gardens. But also, during the PFAS investigation, the spread of weeds made PFAS concerns more visible and became a sign of its impact on the darker side of care. As such, neglect becomes a material, moral, and aesthetic disturbance, revealing how the presence and absence of care are deeply entangled. In the selectivity of care, including its absence, the aesthetics of care at *Volkstuin Hobuis* reveals how attention emerges. The selective and contradictory modes of care reveal how care is unevenly entangled with uncertainty and inseparable from the tensions and pleasures of tending in a troubled ecology.

In the case of PFAS, care regarding pollution and environmental degradation involves addressing the environmental harm in material ecologies. The municipality cared for the gardeners by investigating the soil and advising them to limit consumption of its produce. Firstly, the results remained for the gardeners as unsettled facts. Secondly, the municipality's intervention was also experienced as intrusive, generating stress and shaping how gardeners related to their plots. As a result, gardeners navigated constant multiple temporalities of care within a landscape marked by chemical uncertainty and uneven human, more-than-human, and nonhuman temporalities.

Additionally, in this chapter, I addressed how PFAS's temporality exists beyond our human timeline (Bond, 2022); however, not necessarily beyond the gardener's timeline. For some gardeners, PFAS existed as a topic of another previous toxic event. They were aware that they were living in a polluted landscape, but it was no longer a topic of concern. For them, engaging with the garden and community could be separated from attention to PFAS exposure. This shift illustrates a mode of post-care, where time and materiality blur, and past acts of care continue to matter affectively and materially even when explicit attention fades. Even gardeners who were still concerned about PFAS continued their engagement to care for the garden. For all, taking care of the multispecies environment brought them enough pleasure to continue. As such, to conclude, care carries complex, embodied consequences, and the temporalities of care remain a persistent concern, entangled in the gardeners' negotiations with both the polluted landscape.

Conclusion

Vignette

These are my last days in the garden. I'm so glad I'm still here in time to witness the magnolia tree blossoming. The sun is shining, it warms my face, and I'm no longer freezing cold. I hear birds singing as I walk over the garden, while some cars zoom by in the background. I feel the calm and peace over the garden; it is pleasurable, joyous. Nothing reminds me directly of the pollution or toxicity of PFAS as the first seedlings start to grow, the soil is freshly plowed, and the perennials are starting to bloom. I began to say goodbye already before I leave this fieldwork, and I go back to Vienna to write my thesis.

As I walk my round around the complex, I see Marie working in her garden, and I strike up a conversation with her between her gardens' gates. I thank her for being so warm-hearted and welcoming from the first moment I set foot in Volkstuin Hobuis. I wish her a good season, in which her flowers and crops may grow well. In response, she says, that it would be nice if the plants grow well, but it doesn't matter, she says, "we don't live off it anyway." But then she corrects herself. Pointing at her heart, and says, "Maybe we do" (Based on fieldnotes Friday 21.03.2025 to Monday 24.03.2025).



Photo 10: The blossoming magnolia tree at Anna's quite in the back of the allotment garden complex, March 2025.

In June 2021, gardeners at *Volkstuin Hobuis* learned that their allotment plots contained elevated levels of PFAS, a group of persistent chemicals often called the “forever chemicals.” This revelation transformed the garden from a space of leisure and community into a site of toxic concern. Yet, despite the knowledge of contamination and potential health risks, gardeners continued to tend to their plots, cultivate crops, and nurture multispecies relations. In doing so, they enacted care not only for plants and soil but also for themselves, their families, and the wider garden community.

Through these continued everyday practices, Haraway’s (2015; 2016) infamous call to ‘make kin, not babies’ in troubled multispecies worlds resonates strongly: gardeners assemble multispecies relationships in landscapes altered by toxicant contamination, attending to both human and nonhuman life. In this context, kin-making occurs not only in the cultivation of plants, engagement with the soil, the acknowledgment of the potential protection from particle-catching trees, and the awareness of the ongoing presence of PFAS, but also through community and social bonds. Within this chemically altered, troubled environment, PFAS has become part of life itself (Bond, 2022), embedded in all parts of the garden. Therefore, attending to the livability of these more-than-human worlds has highlighted the entanglements of humans, plants, chemicals, and technoscientific practices (Tam, 2023). PFAS is no longer just a “matter out of place,” in which the boundaries beyond contamination are breached (Douglas, 1966); it has also become a matter of place for life in the garden.

Across the chapters in this thesis, I have examined how care is negotiated in an allotment garden contaminated by PFAS through three interconnected sub-questions and chapters. In Chapter 1, I focused on the community narratives of pollution and toxicity, highlighting how gardeners situated PFAS alongside the other toxic events they have experienced throughout their lives: the municipality’s investigation announcement itself marked PFAS as a toxic event (Renfrew & Pearson, 2021), yet the gardeners themselves situated it within broader histories of toxic pollution entanglements. Yet, they needed to navigate their everyday gardening practices amid continued uncertainties regarding this direct polluting event. The uncertainties of ‘living in a toxic’ world varied among gardeners (Nading, 2020). Yet, they shared broad themes concerning the negotiation of knowledge about pollution itself, the temporality of PFAS, the health effects of PFAS exposure, including contamination levels in crops and soil, and, lastly, the potential consequences of future governmental interventions, such as soil remediation. In Chapter 1, I covered these first two uncertainties.

Furthermore, in Chapter 2, I explored the role of the body and the environment in PFAS-contaminated spaces. PFAS is, on the one hand, linked to potentially altering bodies (Renfrew & Pearson, 2021). However, on the other hand, this alteration is difficult to link to specific individual bodies. Negotiating potential risks of chemical exposure in everyday life has attuned them to the mostly unnoticed PFAS in their bodies and environment. By the art of unnoticing PFAS (Lou, 2022), the gardeners found a way to live with

the dread of the uncertainty of chemically polluted landscapes. The gardeners' experience was mainly an embodied unnoticing of PFAS. They may notice bodily alterations of PFAS in the future, but adverse health effects have not yet been linked to PFAS.

Therefore, in Chapter 3, I examined temporalities of care, showing how interspecies relationality and garden practices shape what thrived and what did not within the gardens (Tam, 2023; Tsing, 2012). The selectiveness of care at *Volkstuin Hobuis* revealed what Martin et al. (2015) have called its darker side, in which tending and neglect become inseparable in care practices. Therefore, through Murphy's (2015) notion of unsettling, I highlighted how tensions of care remained uncertain. Simultaneously, care requires an ongoing material commitment (Puig de la Bellacasa, 2017), as otherwise, vegetable gardens become abandoned weed-overflowing plots. Care navigates tensions between relational practices and forms of governance. As such, care in *Volkstuin Hobuis* became a negotiation of joy, multispecies engagement, and awareness of toxicity, demonstrating that PFAS does not prevent gardeners from sustaining life and relational practices.

Overall, throughout this thesis, I have described how the embodiment of continuing to care in a PFAS-polluted world has been perceived and enacted. In turn, PFAS has become another toxic event for the gardeners, adding to the series of environmental disruptions and contaminations that have already shaped their lives through living through late industrial material ecologies (Shapiro, 2015). Living in a chemically polluted world raises the possibilities of future health risks that have yet to be experienced, as well as the forms of post-care that have emerged in response to being toxically exposed. These post-care practices require the gardeners' ongoing engagement so that the continuation of life in the garden becomes inseparable from embodied joy and attentiveness. Sitting at home and "staring at the walls," as was repeatedly argued



Photo 11: Ellie & Adriaan's allotment plot,
06.03.2025.



Photo 12: Garden sign stating: "Welcome to my garden.
To plant a garden is to believe in tomorrow." 26.02.2025

during coffee mornings, was not a feasible alternative to eliminate their toxic exposure. Not only would toxicity in other forms continue to exist (i.e., produce from the supermarket also contained PFAS). But also, being in the *Volkstuin Hobuis* meant having social contacts, as well as being close to nature and being out in the world, which was continuously associated with having positive life benefits. Attending a garden at *Volkstuin Hobuis* meant staying attentive to the rhythms of cultivating plants, sharing harvests, and maintaining a sense of belonging to their plots, both individually and as part of a wider gardening community.

Accordingly, building on these lived experiences, in this thesis, I have examined how uncertainty is part of what it means to live in a troubled ecology (Besky & Blanchette, 2019; Fisher et al., 2021; Nading, 2020). Living in a troubled ecology has meant rethinking safety and care. The tightened safety standards, intended to protect the gardeners from exposure, shifted from an absolute limit of not exceeding 4.4 ng/kg bw/TWI of PFAS to a more relative interpretation of thresholds. Since everyone in the Netherlands exceeds the PFAS safety threshold, both the municipality and the gardeners have treated exceeding it as negotiable: the municipality has chosen not to intervene further beyond investigating, and the gardeners continue their everyday practices to live with exposure.

This negotiation of safety and exposure has illustrated how pollution and toxicity are co-produced by bodies and environments; how thresholds, governance, and everyday care practices intertwine. In these troubled ecologies, exposures are unequal and shaped by environmental injustices and marginalizations, and the material presence of contaminants like PFAS has become inseparable from social and more-than-human relations (Besky & Blanchette, 2019; Shapiro, 2015). The gardeners' practices make this entanglement tangible. Their bodies, soils, and crops are interconnected through PFAS. Even though chemical exposures are often imperceptible and potentially bodily unnoticeable, they shape the gardeners' attentive practices and ongoing negotiations of care. Such selective care also involves the silences, unknowing, and partial attention related to PFAS-exposed spaces.

Therefore, the continued care and cultivation of food in *Volkstuin Hobuis* are accompanied by this uncertainty. In this case, gardening becomes a form of staying with PFAS, where care is continuously redefined amid uncertainty. There is uncertainty about what past chemical exposure to PFAS could result in, and uncertainty about how to navigate PFAS futures in toxic geographies. The temporality of living with PFAS and their experiences has complicated the notion of the "forever chemical" through speculation. At *Volkstuin Hobuis*, the troubled ecology is both a conceptual condition and a lived one. The gardeners' persistence in growing crops, sharing meals, and tending to their plots enacts what it means to live within, and not beyond, contamination. It shows how, in these co-constituted environments, care in a troubled ecology is about maintaining relations that sustain life despite toxicity.

Furthermore, even amid PFAS contamination in what Hendlin (2021) calls the "Chemical Anthropocene," gardeners continue to cultivate joy. Intimacy, attentiveness, pleasure, and care persist despite

the ubiquity of toxic exposures, which have become woven into everyday life. Gardeners deliberately choose to tend their allotment plots, engaging in practices that sustain multispecies life. This care, intimacy, and pleasure begin long before harvest: they turn the soil in late winter with rooting forks, nurture it through year-round composting, and attend to its needs season after season. In doing so, they reaffirm a commitment to life even within these chemically saturated altered environments. As such, the PFAS pollution in *Volkstuin Hobuis* illustrates how pollution is entangled with life, creating a troubled ecology in which affective relations and care are deeply intertwined (Chen, 2011).

In this way, the gardeners have illustrated how gardening is a material practice along with an affective space where care, worry, joy, and hope intertwine. For example, this is evident in the *Conclusion Vignette*, where Marie points to her heart and directly relates it to the symbolic practices of maintaining an allotment garden. Or in the moments of panic and stress relief from Loes, Maria, and Anna, which gardeners experience while navigating contamination and tending their plots. Throughout the thesis, I have described examples from my multispecies ethnographic fieldwork in which these came together.

Finally, as Puig de la Bellacasa (2017) argues, care has been an ethico-political commitment circulating in ambivalence, enacted in multiple simultaneous ways. Through everyday practices of joy and community, care coexists with awareness of toxicity. In the multiple modes of care, PFAS pollution was continuously socio-materialistically complexified. Therefore, care emerged at *Volkstuin Hobuis* through selective noticing, choosing to care for what was tangible: tending to plant growth, the texture of the soil, and the social life of the garden, while navigating PFAS that remained beyond the reach of practices for complete avoidance.

To conclude, talking about my thesis, I noticed how caring for a garden and community can easily be romanticized. Multispecies alignments and more-than-human interdependencies open space for imagining ways of living. Then, awareness of pollution and potential toxicity shatters the fairy-tale image of ecoleisure activities. It is then a fact that toxic entanglements intertwine with life, not as separate threads, but as part of the fabric of existence in a late-industrial world. Even practices of more-than-human care, such as composting, might intensify PFAS pollution. It is through individual actions and navigations, as well as collective practices and negotiations, that living knowingly in a PFAS-polluted environment takes shape. Yet, the site of *Volkstuin Hobuis* is embedded in uncertainty, and that has been attempted to mediate PFAS pollution through technoscientifically informed policies that set safety thresholds, conduct investigations, and potentially involve remediation. The resulting disillusionment emerges from confronting and embodying these modes of uncertainty.

Future research could build on this idea by exploring with people how to navigate uncertainty more deeply. Through engaged and participatory methods, people themselves can be involved in the processes of addressing and restituting chemical polluted landscapes. Such approaches would also allow policymakers

and researchers to understand better how the act of investigating places itself has been experienced as an intrusive form of care. Furthermore, it would be interesting to continue this work by attending to silences from people themselves and the absence of noticing long-term exposure to chemical pollution.

Along these lines, the gardeners at *Volkstuin Hobuis* have nevertheless exemplified how care in troubled ecologies is about sustaining life amidst the uncertainty of toxic, polluted landscapes. Through selective noticing, embodied engagement, and (post-)care practices, they demonstrate how affect, attentiveness, and relationality can coexist with attunement to toxicity. The practices at *Volkstuin Hobuis* show that continued existence with PFAS is done by multispecies entanglements, fostering community, and cultivating pleasure and hope within a chemically altered environment. Ultimately, this thesis demonstrates that care in toxic landscapes is a relational, situated, and temporal practice that continually negotiates the uncertainties of life in such environments. Thus, the gardeners' practices offer a way of understanding living with contamination that foregrounds entanglement, embodied knowledge, and the generative possibilities within more-than-human collaborations.



Photo 13: Rudi working in his garden.

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