

Encounters in the Garden:
Learning to 'Become-With' in Urban Spaces

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2022 by the
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ARIZONA STATE UNIVERSITY

May 2022

ABSTRACT

In this three-article dissertation, I explore the history of Western gardens in educational literature as well as the ontologies and epistemologies that underpin contemporary learning in gardens. Through a critical posthumanist and Indigenous scholarship lens, I collaborated with a school garden, a community garden and an indigenous garden to examine onto-epistemologies that permeate the relationships between humans and more-than-humans in gardens, revealing ways of being and knowing that are favored and the ones that are pushed out of gardening experiences, while exploring entryways to non-Western ways of being and learning in the garden.

While each article stands on its own, taken together they paint a complex, rich and nuanced picture of more-than-human relationalities that occur in gardens and of human engagement deriving from different ontoepistemological orientations. This research contributes to the existing literature by exploring issues regarding environmental and sustainability education's (ESE) approach to learning in gardens, specifically the salient role of gardens in ESE's strategy in attenuating the climate crisis, by examining how gardens are conceptualized, who has agency in gardens, and what knowledges are privileged in gardens as learning spaces.

DEDICATION

Para minha mãe, pra quem a educação sempre foi única saída.

To my mother, for whom education was always the only way in, and the only way out.

ACKNOWLEDGMENTS

I am in debt to the many people who walked alongside me offering companionship, guidance and support while I took on this PhD journey. Family members who offered encouragement, friends who believed in me and offered advice, attentive professors who took time from their research to listen and offer guidance. Scholars cited in this dissertation study and the many others who shaped my thinking, for their commitment to scholarship, to each other and to life. The many non-human beings that crawl, buzz, fly, grab, sway, and still others that do not emit sound yet nevertheless have quite a lot to say. To all of these supporters—human and nonhuman— my gratitude for the experience and encouragement.

My dissertation chair, mentor, and friend, Dr. Iveta Silova, for always being a safe port, for encouraging and nurturing my interests, and for the privilege of walking on your shadow. My committee members Dr. Mirka Koro, for pushing me to look further and be open to the beyond of inquiry; and Dr. Andrea Weinberg, for offering guidance and gentle waters in the agitated seas of academia.

Dr. David Carlson for helping me find words to translate my feelings into academic language. Ivet Parra-Gaete, for being a loyal friend, and for always listening to what my eyes had to say. Joanne Peers, my dissertation sister, for always meeting me halfway. Kevin Winn for being a calm source of truth and wisdom in this journey. Thank you for always being honest. Janna Goebel and April Camping for offering

encouragement and companionship in thinking and writing. My dear friends Cibele and Junior for reminding me that I can, and that there's always time.

My husband Flavio, for his adventurous spirit and support in this foreign journey. To my dogs Ernesto and Brás for the peace, comfort, connection, and so much love every day. For never giving up, and for reminding me to experience the joy of multispecies care and connection every day.

To my parents for their example, words of encouragement and for giving me the space to pursue my intellectual interests. To my siblings for not taking me too seriously.

To my grandmothers, for so much love.

I am grateful.

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Chapter 1

Introduction

Throughout my work on this dissertation project, I have immersed myself in Posthuman and Indigenous theoretical and methodological frameworks. Grappling with the complexities of the environmental sciences in which I was formerly trained, and the scientific and bureaucratic nature of working in environmental management and education, I found those frameworks to offer provocations and illuminations on better ways to relate to the natural world. Despite the difficulties inherent for a beginning scholar transitioning to a new country, language, and field of study, I found myself enchanted by posthuman ideas, both theoretical and methodological. In reading, thinking with, and exploring these texts, I became acquainted with its roots in and resonances with the Indigenous scholarship, which connected so much with the ways of being and learning with which I was brought up in Brazil. I remembered my relationships with plants and animals, and how I was always enchanted by the stories of more-than-human worlds of possibilities. I knew I had found something that resonated with me when, based on this assemblage of theories and memories, I began to envision my work as an educator differently.

At this point in time, I was a practiced educator, having worked in environmental education for over a decade, and I had already cultivated a vast repertoire of teaching and learning strategies that I believed engaged a wide variety of communities. I was immersed in my field, leading projects in environmental education, policy and management across formal and informal learning settings. As I progressed through my career though, I found myself swamped attending curricular and administrative demands

to apply the scripted knowledges and practices that I had previously witnessed to be useless for those same communities. I continued writing projects and reports, to be moved across many desks, for many months, only to be deemed outdated by the time of their approval. The needs of those I served, both human and nonhuman, and the needs of their environments could not bear the procedural detached nature of such protocols.

I remembered my engagements within worlds of multispecies conviviality, material scarcity, poverty and resourcefulness, and realized how my daily practices and interactions embodied posthuman and Indigenous scholarship at work. I was simultaneously disturbed and fascinated. I had not quite figured out how to make sense of those complex theories or how to practice them through my new field of scholarship, but continued to trudge along reading more of the literature and pondering how it could be helpful to the people and places from which I came. I remembered that one of the reasons I chose to pursue doctoral studies was my desire to work in the São Paulo Botanical Gardens, a beautiful park that I frequently visited growing up, which also harbored the Sao Paulo State's institute for botanical research, including a center on environmental education. The São Paulo botanical garden offered educational activities for school children and undergraduate students alike, being fertile grounds for thinking and engaging with nature in the middle of the largest city in Latin America. As I became more convinced that I wanted to continue my work with Environmental education, Posthuman, and Indigenous scholarship, I began to explore dissertation topics, knowing that gardens would most likely somehow fit into my project. I soon began to conduct small studies in schools and gardens, only to find similar constraints to those I had encountered while working in other institutions: human desires above more-than-human

needs, confining, constraining and sanitizing entire landscapes for the sake of profit, death and extinction swept below the rugs of commercializable beauty. I soon discovered I would have to go beyond my beloved gardens, beyond their potential to offer humans pleasure and profit, beyond my own conceptions of what a garden was, and what it should be. As a beginning posthuman scholar, I started to apply the works of posthuman scholars to my projects, challenging the status quo of my own assumptions of what learning and education were, as well as embarking on exciting opportunities to bring more-than-human worlds to the forefront of scholarly discussions in environmental education. I found that despite the fact that Indigenous and posthuman scholarship have been discussed for decades, they have been largely underutilized in the education field, including in environmental education, especially concerning gardens. I also found that despite the fact that gardens have been used in formal and informal education settings for many centuries, critical examination on the scholarly literature concerning the motives and modes of engagement between education and gardens is sparse and often superficial. Not only have these theories and underlying philosophical, ontological, and epistemological frameworks been generally overlooked by education scholarship, but their engagement has been deemed secondary in the face of the “urgency” to emphasize scientific ways of perceiving and knowing the world as “the” way - the only way - to solve environmental problems via technological fixes. Though the field of environmental education has seen important shifts in its history, the fact that its scholarship ignored the very political and power systems it was created to illuminate (and change) baffled me.

I began to investigate the tensions in the discourse around gardens throughout history, especially in the field of education, as an opportunity to make evident how

ontological views of ‘humans versus nature’ create the power imbalances I was witnessing not only in the material structures and composition, but in the epistemologies that permeate gardens and gardening. I found all of these ideas to be fundamental to making sense of both posthuman and Indigenous scholarship, especially applied to education’s role in addressing the environmental crises. The implications of posthuman and Indigenous enmeshed ontologies and epistemologies, or onto-epistemologies as they are better described, offered the inquiry process critical analytical tools with which to investigate the accepted common practices that perpetuate exploitative rationales of objectivity, detachment, empiricism and extractivism, as the only mechanisms to achieve static and absolute ‘truths’ under the guise of ‘progress.’

The foundational critical analysis of what is a human and our place in the world, as well as what counts as knowledge and who knows in the world, are the foundational markers of posthumans and Indigenous scholarship and are considered from multiple angles in this dissertation study. Following the threads of this corpus of scholarship, I attempted to address some of the larger dilemmas I found in my work with learning gardens across the past 12 years. In my research, I worked to interrogate the garden practices of the present moment in education, revealing how knowing and learning occurred through the power and oppressive relations established through gardens, as well as the delicate relations of care and interspecies communication. Throughout this project, I faced my own relationships of consumption and selfish exploitation, as well as witnessed a creative expansion that became some of the core work in the process of inquiry. I observed and engaged in the cultivation of various ways of being and knowing

in urban gardens in the Southwest United States, allowing for a rich experience that span theoretical and methodological contributions to education scholarship.

The journey of this dissertation begins with a historical overview that showcases the main philosophical frameworks employed in Western approaches to learning in gardens since early modernity. This historical overview presents a critical literature review that traces how gardens have been used as tools for learning since the 16th century, revealing how gardens are conceptualized through mechanized, utilitarian, and colonial and (post)positivist relations, as well as what counts as agency and knowledge in the garden (Ostertag, 2015; Erbacher et al., 2014; Tallbear, 2011; Nxumalo, 2021, Merchant, 1990, Taylor, 2017), serving as a foundation for the exploration done in the subsequent articles.

In the second article, inspired by post-qualitative inquiry, I use the concept of matters of concern (Latour, 2004, Stengers, 2005) to notice and engage with soil relationships in the three gardens. By using stories of soil agential entanglements, I examine the shift from soil as a scientific static object of study, a matter of fact, to soil as a “lively beingsness” (Puig de la Bellacasa, 2014, p. 32), a matter of concern and care that acts upon itself, the garden, human, and more-than-human worlds co-creating reciprocal relationships garden.

The third article focuses both theoretically and methodologically on non-Western ontoepistemologies, relying on Indigenous scholarship and critical posthuman theories to follow the learning paths that emerge when the more-than-human world is rooted at the center of garden relationalities. Centered on the Indigenous ontological notion of the animacy of the living world (Kimmerer, 2013), I accept a bird’s methodological

invitation into the quiet dark corners of the garden to find a flourishing more-than-gardening assemblage under the debris. This more-than-human journey led to a relational exploration of more-than-human communication and agency, proposing an opening to more-than-human attunement and pedagogical engagements (Jensen et al., 2016; Kimmerer, 2013).

Combined, the chapters in this dissertation bring together a critical overview of gardening in educational literature, while opening up theoretical and methodological opportunities for building more-than-human pedagogies through entanglements and becomings-with more-than-human urban nature. This research contributes to environmental and sustainability education (ESE) studies, as well as research in posthuman frameworks applied to early childhood studies. Additionally, this work contributes to critical ESE while taking into consideration that learning is not only rational, but a relational, affective, embodied and spiritual process that must be response/able (Haraway, 2016) towards more-than-human communities. Despite the discussions regarding the adoption of the terms environmental and sustainability education -ESE, versus the international push for the education for sustainable development -ESD (Leicht et al., 2018), I adopt ESE in a move away from Western notions of development as infinite economic growth at the expense of social and political critique, as well as broader ecosystemic health (Silova et al., 2019; Bowers, 2021). The dissertation also considers implications for future educational research on gardening as well as methodological approaches for critical posthuman inquiry.

Purpose and Significance of the Study

The purpose of this dissertation study is to elucidate how posthuman and Indigenous scholarship may be put to work in education research and practice to explore the use and importance of gardens in education, while working with practices of attunement and care with all forms of life in gardens to better develop a critical prism from which to develop garden pedagogical practices and more-than-human relationships.

Research Questions

This study is guided by the following research questions:

1. What more-than-human encounters, intra-actions, and relationships occur in different gardens, including a school garden, a community garden, and a private garden?
2. How do material aspects of these gardens matter in these relationalities?
3. What kind of learning occurs with/from these emerging multi-species relationalities, including who is learning from whom?

Reflective Positionality: Identities and Difference Shaping the Inquiry Process

In attunement to my heritage, as well as theoretical and methodological frameworks, I present here a reflective positionality in the form of a narrative introduction that honors my ancestors, the land I grew up in and the multitude of persons who co-create the worlds I inhabit. I was born in Brazil, on the territory once inhabited by the Tupiniquim people, a fertile land bursting with life and possibilities. I belong to families who had a deep connection to the lands where they lived. Much of my understandings of the worlds I inhabit are shaped by my experiences as a child raised by people whose worlds had long been gone. As a late daughter in a large working class

family, I was raised by my older parents, but also by my teenage siblings, aunts and uncles, and both my grandmothers. Before I knew much about myself my parents were in their fifties, my grandmothers in their seventies, my grandfathers gone. My grandmothers were ambitious women for their time, who passionately pursued their goals while moving, learning, building and creating homes again and again over the course of their lives. They loved their many grandchildren and were frequently the ones looking after me. One grandmother was a proud woman who taught me the power of dreams in guiding one's life. She was deeply linked to her heritage and her ancestor's ways of being in the world, especially their link to land and foods. In a house where everyone was always busy, she took the time to sit and play with two year old me, and I followed her every move, both of us carefully observing each other's ways. She always kept me very close, creating a synergetic bond between our frequently locking eyes. Another grandmother, busy with her housework and sometimes other grandchildren, let me play freely while she went about her day's chores. She tended to her garden early in the morning, a space filled with plants brought back from distant lands, gifted to her by family and friends, and cared for as kin. In one of those early cold mornings in her garden, I heard the first call to get to know a plant, as something moved inside of me and attracted me to just get close to a bush and pay attention. My grandmothers gave me space to be curious, they taught me to observe, to listen, to remain alert and attentive to what is not always said, to other's ways of being and communicating in the world. With my feet planted deep in the earth, longing to listen, to create, and to respond, I explored their worlds with curiosity, joy, confidence and determination.

At home, our backyard had two large trees, and was otherwise haphazardly filled with sizable pots, plants of all shapes and sizes, Guppy aquariums, turtles, dogs, an occasional rabbit, and a suspicious looking box that turned out to be a mealworm farm. My father was very interested in horticulture, and took soil preparation very seriously, devoting hours of experimentation into composting, sifting soil, curing manure, and selecting seeds. With an abundance of time and space, I too collected leaves, flowers and handfuls of soil to make foods for my dolls, and potions to heal wounded animals. On our regular trips to my Aunt's ranch, I spent all of my time playing in the forest, jumping over the creek, climbing on boulders, naming and recognizing trees, digging into the soil, and having the plants and animals as my companions. I was amazed at the beauty of the birds that visited, enchanted by the callid waters that never ceased to flow, and when certain plants called to me, I sat with them and it felt so natural. I quickly learned how to quiet down and attune to their ways of communicating back. Trees are wise, but you need to become very quiet inside to be able to listen. Rocks mumble, it's better to keep questions short. Plants like kind words and enjoy being touched, but they prefer if you visit often. Move slowly if you are approaching a bird, or better yet, let them approach you. Water washes away much more than dirt. Don't stare into an animal's eyes. Always walk barefoot.

Whenever I had a sore throat, which was extraordinarily frequent, possibly related to the fact that I was always outside barefoot, my mother would put together a concoction of medicinal herbs, honey and other mysterious bits and pieces that emerged from the kitchen drawers and the neighbors' yard whenever disease lurked around the house.

My sister got me poetry books and always told the most detailed folk tales, the kind that left my young spirit full of questions and feelings regarding my own life (Toliver, 2021). She was also the one who sternly reminded me of the different time spans in which plants grew when, older, I played explorer in the woods with my machete. I always felt connected to the trees, animals, winds, and especially the waters I encountered. I felt both their calming demeanor and exciting presence in each encounter, in what felt like staring straight into the eyes of life itself. I immersed myself in relationships with these beings, experimenting with touch, taste, sound and thought/feeling. I wrote poetry sitting on top of boulders, picked leaves and fruits for the chickens, collected magic rocks by the ocean, and cried when I saw the forest burn.

When I started school, I grew interested in science, and learned that someone else knew the inner workings of this so-called “nature,” only it was not from feeling, or listening, but from methods based on experiments and measurements. School and science offered me the possibility to have the deeply felt entanglements I shared with the natural world growing up, flourish into a professional goal, and so I grew up to become a biologist. I studied Biology and Chemistry in College and worked with environmental education and environmental policy for a number of years. I learned to apply the scientific method to inquire and conduct research, and learned about the potency of coupling methods with logic to make scientific arguments. I came to understand my father’s work with soil, not as playful explorations, but as experiments, and his labor with seedlings, not as a tentative crossing into the future, but as selection as methodology. I engaged in ecological research, and spent many hours in the lab dissecting, calculating,

and looking for meaning in the numbers in the data. I always missed talking to the trees though.

In learning what science can do, I also faced its shortcomings. Working in environmental policy, I learned that science's best modeled predictions sometimes escaped human ingenuity in times of scarcity, and I learned that for science to be effective, it's methodological components must fit neatly into certain categories, in which several of life's phenomena didn't, at least not all of the time. And although science could do a lot of important things, it fell short in the many aspects of life that leaked through its method, in anything that didn't follow a standard path, or a controlled progression. I longed for a science that would embrace all things relational, creative, and spontaneous, all of the things that existed beyond reason.

That's when I started to remember the sunny mornings in my grandmother's garden, learning the importance of offering gentle touch and kind words to plants. I remembered my mother caressing her violets on the kitchen windowsill, and that the power of her tea was not only in the mix of herbs she selected each time, but in the intuition and love that guided her in each recipe. I remembered how to introduce myself politely to the forest, and not to use too many words to communicate with animals. Quoting Kimmerer (2013) "I think now, that it was a longing to comprehend this language I hear[d] in the woods that led me to science" (p. 48). These two ways of knowing have permeated my experience in research and in life, one knowing by science and the other knowing by heart.

As a woman educated and employed within the bounds of western positivism for 15 years, I face my own positivist training while co-(re)creating this research. I am

entangled with the cognitive, objective, empirical methodological practice, at the same time that I tune back into my own connections with more-than-human worlds of which I always already am a part. My interest in a posthuman, Indigenous and post-qualitative frameworks stem from my background, my ancestral knowledge of the world, my awareness of the constant entanglements with the more-than-human world, including experiences in and with gardens, forests, rocks and waters, in a (re)turning process of doing inquiry differently.

During the journey of this dissertation, I have engaged in formal and informal process of inquiry where my previous experiences with gardening and more-than-human relationality played a role each time I got entangled with a new garden. I relied on posthuman theories and Indigenous knowledge systems because they too see agency in non-human beings, like I had learned early in life, and post-qualitative inquiry allowed me to explore methodologies that made sense to the way I have learned to communicate with the more-than-human worlds. I relied on modes of inquiry that recognize researchers as part of the inquiry process, and I described my participation and processes of data generation. Employing these strategies helped me reconnect with my own mixed-race, Latina origins and ways of being, while remaining deeply connected and attending to the agential assemblages that I currently fold into with gardens to help re-configure my gardening research practices and open up new ways of becoming *with* the encounters in these gardens.

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Chapter 2

Tracing the History of Gardens in Environmental and Sustainability Education: a Critical Review

Abstract

This article presents a critical literature review that showcases the main philosophical frameworks employed in gardening by Western education literature since early modernity. This article traces the onto-epistemologies that have permeated gardens as tools for learning, revealing how gardens have been conceptualized and used through detached, mechanized, utilitarian, and instrumentalist relations (Merchant, 1990; Tallbear, 2011; Ostertag, 2015; Taylor, 2017). This analysis draws from posthuman and decolonial frameworks, examining how the garden educational literature privileges human-centered epistemologies, including in environmental and sustainability education (ESE). This article reveals how human-nature relations in and through gardens continue to be cultivated in terms of Western humanism, coloniality and whiteness, discussing how this inheritance remains prevalent in current learning gardens frameworks. Finally, this article urges scholars and practitioners to attend to decolonial and posthuman frameworks to disrupt human and more-than-human oppression in gardens, embracing reciprocal relational encounters and experiences with the garden.

Introduction

Gardens have been used as learning spaces since the beginning of modern Western schooling (Jacob, 2002; Ostling, 2014; Hartigan, 2015). However, the ways of conceptualizing gardens and the focus of gardening practices have shifted throughout time, accompanying the change in the dominant ways of seeing and understanding the world. Gardens have been used as educational tools since early modernity, and are currently frequently used in environmental and sustainability education contexts. Despite varying ontoepistemological orientations, scholars in science, as well as environmental and sustainability education frequently approach gardens ahistorically and apolitically, using gardening as an experiential learning tool for enhancing students' outcomes (Williams & Dixon, 2013; Chawla et al., 2014).

The word 'garden' has been employed to represent spaces that employ a variety of plant cultivation practices, from botanical gardens (Hartigan, 2015), to landscaped gardens (Pierce, 2000), community gardening projects (Pudup, 2008), private home gardens and yards, and various spaces used for food production (Pierce, 2010; Pálóczi Horváth, 2014; Federici, 2018, Thacker, 1985). The origins of the word garden refer to enclosed, protected, cultivated spaces (Thacker, 1985, Hunt, 2000), and even though the term "garden" lacks specificity (Pudup, 2008), it is nevertheless used to represent the expectation of a managed, idealized, enclosed space where people and nature come together (Pierce, 2010; Jagger, 2014; Archambault, 2016). While imprecision may offer some confusion, a more concise definition of gardens may be undesirable (Ferris et al., 2001) as it may impose limits to the needs, solutions, and participation of local communities (Kurtz, 2001). This paper embraces this multiplicity for gardens and

gardening, remaining open to its plurality of possibilities (Wapenaar & DeSchutter, 2018), while showcasing how these terms have been conceptualized by scholars from the 17th century to today (21st century) and how these conceptualizations shifted over time.

This article explores how modern scholarship about gardens predominantly reflects the dominant Western ontoepistemologies of humanism and positivism, privileging rationality, empiricism, and human stewardship over nature (Leiss, 1994), while perceiving human beings as different, separate, and better than the natural world (Bang et al., 2014; St. Pierre et al., 2016). This Western inheritance of human exceptionalism is materialized in scholarship about gardens - and approaches to gardening projects - that represent and uphold views of nature that are at the same time lesser than, and at the disposal of man (Bang et al., 2014, Nxumalo, 2019, 2021). Given the prominent use of gardens as educational tools since early modernity, and their reinforced importance amidst the current environmental crisis (Glowka et al., 1994; Draper & Freedman, 2010; Sonu & Snaza, 2015), this paper critically analyzes the scholarship about gardens and gardening in the educational literature, revealing the ways of being and understanding the world that have permeated scholarship about gardens through modern history, while tracing, describing, and highlighting the influence of Western humanism that has been prevalent in educational gardening from the 16th century to present times. Specifically, this critical analysis reveals how gardening is used as a positivist educational tool, including in the fields of environmental and sustainability education (ESE), at odds with ESE's goals of collective action against human overexploitation of nature. Thus, this article reveals the philosophical inconsistencies of

employing positivist ontoepistemology in learning gardens (including in ESE), which uphold oppressive and exploitative values towards other species as well as other humans.

In this paper I argue that to disrupt the logics exploitation in place in and through gardens, learning gardens must be conceived under ontoepistemologies that displace the human from its position as master of the world. This article begins with a historical overview of the education scholarship that approaches gardens and gardening since early Modernity, highlighting particular moments when positivist philosophy applied to gardening transformed gardens from liminal spaces that mediated our physical and metaphysical relationship to the remainder of the natural world (Purkiss, 2000; Ostling, 2018) to enclosed guarded spaces, where only species that are of human interest - by beauty or yield (and thus profit) - are allowed to be cultivated (Ostertag, 2015; Marder, 2013). This first section highlights how gardens became important spaces for teaching social, political and economic values (Jacob, 2002), and for replicating models of citizenship where the exploitation of nature would be justified (Erbacher et al., 2014).

Importantly, the human described here as the master of the garden was the emerging thinking human — specifically the White wealthy ‘Man’, the subject privileged by Euro-western modernity and elevated above other species and above other humans (Wynter, 2003). Born as as the subject of intersecting rational secular science, nascent capitalism, colonial imperialism, and subsequent slavery (Snaza, 2019), Man imposed his ontological superiority and ownership over natural environments, as well as other humans. Women, children, and People of Color (POC)- especially Black and Indigenous persons—were not considered fully human, and thus targets of capture, ‘domestication’ and colonial conquest, cruelly subjected to the

domination of the white Man alongside natural landscapes (Merchant, 1990; Plumwood, 2009b). Similarly to nature at large, Man established dominant colonial relations with gardens, based on the principles of fragmenting, comprehending, extracting, and replicating other species' bodies and existence. Gardens, as the acceptable 'nature' allowed by man to exist within civilization, were created and used to replicate values associated with the domination of nature and those not considered to be fully human. Similarly, colonial values associated with Man's ideal of western modernity were translated into educational values through gardening, and used in educational settings, where gardens played an important role as an idea and a praxis (Pierce, 2000).

This article will delve into how those values emerged and changed throughout time, culminating in the contemporary uses of gardens in educational settings, including in environmental and sustainability education (ESE). This critical analysis highlights how human-nature relationships in and through gardens, although questioned in some fields like early childhood education, continue to be conceptualized in terms of positivist colonial relationalities, built on the oppression of BIPOC, women, children, and other species. Finally, this article discusses how Western onto-epistemologies impedes the accomplishment of ESE transdisciplinary goals of bringing awareness to, and mobilizing action against anthropogenic environmental issues, such as the Earth's overexploitation. This paper urges educational scholarship to accept invitations from decolonial thought and more-than-human frameworks to foster reciprocally relational encounters and relations in the garden.

Gardens in Educational Settings since Early Modernity

Gardens have been designed and used for teaching and learning since the 16th century.

While accompanying the main philosophical ideas of the times, the design and use of gardens has helped establish and maintain the idea that humans are separate from nature, stewards of the natural world, being in charge of nature's care and management.

Similarly, the use of gardens as the representation of nature in educational spaces reveals how values associated with Western humanism have been materialized through gardens and gardening and how gardens have been used as a tool for teaching and learning those Western humanistic relationalities. The following section will delve into Western ontologies and epistemologies permeating gardens in modern times.

XVII Century: Enlightenment and Colonial expansion

A garden usually describes an enclosed space, where select plant species are cultivated. With the growth of cities in early modernity, the enclosure of "nature" into gardens also took shape, bringing the many conceptualizations of nature into the controlled environments of gardens.

As explained by Cooper (1999), due to wars and famine reminiscent of medieval times, there is little documented material about early modern gardens, but pieces of reminiscent literature such as poetry, oral traditions, and folk and fairy tales provide some evidence of how these spaces were inhabited and used. The scholarly literature on gardening in western modernity begins to reference gardens in the 16th century with early renaissance royal palace's gardens (Pálóczi Horváth, 2014), monastic medicine gardens (Ostling, 2018) and university gardens (Hartigan, 2015). Royal gardens were symbols of wealth (Pálóczi Horváth, 2014) that were organized as orchards and designed for

their aesthetic values (Cooper, 1999), as well as areas for leisure and contemplation. Universities and monasteries, on the other hand, cultivated private medicinal gardens (Hartigan, 2015) for the study of medicine, formalizing folk botanical medicinal knowledge in the first higher education institutions.

In the same period, in early cities, most homes had individual or communal gardens for growing food and medicinal herbs, as well as for ritualistic purposes including spiritual rituals and protective magic (Ostling, 2018) as were the customs of the time. Women were particularly important in such gardens, since the ‘female earth’ (Ostling, 2018) and ‘mother nature’ (Taylor, 2013) were central to the cosmologies of European earth-based spiritualities, as well as personified in Christianity in the figure of the mother of God (Taylor, 2013). While the work of gardening in the 17th century was mostly performed by females, women's relationship to the natural world was put under scrutiny by the expansion of Christianity, as women's relationships to plants, especially regarding their botanical, medicinal, and spiritual knowledges, was problematized under suspicions of witchcraft (Zwissler, 2018).

With the growth of Christianity in Europe in the 17th century, human environments began to be purified of “evil’pagan’ powers (Ostling, 2018, p. 226), setting a clearer boundary between a safe ‘exorcized’ inside (of persons and of homes) and a dangerous, impure outside. Liminal spaces, between the inside and the outside, such as the garden, began to represent a risk of outer aggression, and the garden's spirits were either expelled and abandoned (Ostling, 2018) or transformed (Purkiss, 2000). For example, the home gardens and surrounding forests were known to be inhabited by various non-human beings like fairies, goblins, and elves (Purkiss, 2000) that had power over plants, animals,

and also over aspects of human life (Ostling, 2018). With the rise of Christianity, however, the presence of those non-human beings instilled caution and fear. Fairies for example, inhabited the dark corners of the home garden and the wild parts of the woods, governing most of the transitions in human life, such as birth, adolescence, pregnancy, and death (Purkiss, 2000), being seen as morally ambiguous (Ostling, 2018) liminal creatures on the borders between nature and humanity. This ambiguity caused some European cultures that favored Christianity to perceive fairies and other nature inhabiting beings as an ‘other’ to be feared (Purkiss, 2000). The Christian demonization of folklore expelled the spirit world that used to inhabit the home, the garden, and the wild forest—in fact, the existence of any ‘other worlds’ outside the strictly Christian and early scientific explanations of the world was relegated to the realms of superstition (Querejazu, 2016; Silova, 2020) or fantasy in the minds of either children or delusional adults (Ostling, 2018).

Fairy tales became part of children’s folklore, and the ontological permeability of the spirit-filled garden between the house and the wild forest was substituted by the unified, God-filled ideal of the Garden of Eden, a paradise-themed garden filled with edible plants where peaceful humans did not have to work to survive (Nash, 2014). In contrast, in Christian cosmology, sinful humans were separated from God’s garden and thrown into a wilderness, a hostile desert “cursed land full of thorns and thistles” (Genesis 3:17-18; Nash, 2014, p. 9). This unknown wilderness symbolized an evil world (Merchant, 1990) needed subduing and overcoming by humans in order to obtain purity, sustenance and create modern civilization (Merchant, 1990; Nash, 2014). This binary nature/culture way of perceiving the world, which intensified in the 17th century, turned

gardens into a living metaphor of the human attempt to gain control over nature (and of male control over women and children), turning wild areas into organized cultivated “improved spaces” (Nash, 2014), and (re)establishing proximity to the Judeo-Christian God (Merchant, 1990). Ontologically, God’s creation was to be worked by humans in order to improve nature, as well as humans' condition as sinners.

The Christian doctrine influenced the scholarship and practice of major western philosophers in the 17th century, including education philosophers who advocated for school gardening. These scholars relied on teleological arguments to provide rational argumentation to explain natural phenomena while giving them divine ‘purpose’ within the Christian scriptures (Hauerwas, 2013). The natural theology ontology, coupled with the mythology of the garden of Eden, placed humans as the epitome of God’s creation, and nature as a mirror of God’s perfection to be administered by humans. For example, Comenius in 1650 and other early advocates of school gardens associated the work of the gardener with the work of the educator, where the role of the educator was to plant and shape knowledge in the empty, uncorrupted fertile soils of the minds of children, so they could learn to contemplate and love God’s creation (Jacob, 2002).

However, the 17th century saw the establishment of modern science and the scientific method (Leiss, 1994) in which empiricism and rationalism impulsed the development of modern technologies to resolve practical problems often related to the domination of nature (Leiss, 1994). Bacon and Descartes, for example, advocated that rationality and science were the highest accomplishments of man, being what made humans, humans, further separating mankind from “nature” (Leiss, 1994). This was the birth of modern objective science, where Man, the subject, could study nature, the object,

from a detached, impartial position (Latour, 2018), an epistemology known as positivism. The ideas of control and detachment that permeate the scientific rationale of positivism gave way to what Haraway (2016) calls the “god trick” (p. 40), assigning universality to truths and knowledges generated by disembodied scientists who can rationally and empirically analyze anything. Through the “god trick” of empiricism, the Western scientific method was solidified as the only legitimate way of knowing, presenting an illusion of neutrality from philosophical or political views.

At the same time, the European colonial expansion took settlers as well as naturalists along on quests. Naturalists collected and categorized flora from the New World, which were displayed in the first collections of the newly-created Botanical Gardens as symbols of colonial strength, making plants and gardens consumable objects of knowledge and power (Hartigan, 2015). Colonial relations between colonizer nations and the colonies was based on extractivism, in which the land and the newly found ecosystems were treated as endless resources to be exploited and transformed in the development of colonial-capitalist relations (Tallbear, 2011; Nxumalo, 2021). Colonial principles of extraction and exploitation coupled seamlessly with the scientific logic of detachment, categorization and replication of nature, making the New World a suitable scenario for the enlightenment ontoepistemologies. Since the scientific method’s epistemology is based on empiricism, objectivity and rationality, (Thorpe & Hold, 2008), the philosophical paradigms behind the scientific revolution and of positivism in the 17th century were an attempt to comprehend the patterns of nature through the scientific method in order to understand the environment so that it could be conquered, controlled or replicated (Leiss, 1994; Hunt, 2000) - like a machine (Merchant, 1990).

Thus, 17th century thought was permeated by the contradictions of the philosophies of the time, the theologian logic of divine purpose permeating the natural world, and the colonial and scientific goals of empire extension and conquest. Natural landscapes in the New World were both proof of divine abundance, and an opportunity to improve wilderness into productive land, bringing order and beauty to an otherwise ‘chaotic’ and ‘horrendous’ nature (Glacken, 1967; Purdy, 2015). Nature, increasingly separated from humans and civilization, was now believed to harbor unknown, yet decipherable laws and patterns (Glacken, 1967; Taylor, 2013). Early school gardens in Europe in the late 17th century incorporated this tension between a symbolic wealth, a desire for a holistic religious experience of contemplating nature, and an outdoor experience of the scientific description of nature, a tension that is still present in school gardens today (Jacob, 2002).

XVIII Century: Landscaped Gardens, Enculturation and Farming

Colonial expansion continued into the 18th century with the conquest and clearing of landscapes in the Americas, and scientific efforts to reveal natural ‘laws’ and ‘facts’ (Taylor, 2013). Gardens gained an element of artistic expression into the composition of the first landscaped Victorian gardens (Pierce, 2000). With the rise of the middle class and the expansion of modern cities (Habermas, 1991), smaller versions of the landscaped garden began to appear attached to middle class houses, bringing nature into city life. The home garden, still assigned to women, became “an idea, a place and an action” (Pierce, 2000, p. 744), meaning, a place of metaphorical connection with the bounties of nature (the past), with art (values of the present), yet assigning to urban nature a controlled, contained space.

Economically, farming in the 18th century was seen as ‘a key evolutionary stage to becoming civilized’ (Ostertag, 2015; Purdy, 2015). Consequently, school gardens shifted from being a place of contemplation and scientific ordering, to being a place for deliberate teaching of gardening and farming techniques to children. The metaphor of the teacher-as-gardener and children-as-garden that had begun with Comenius in the 17th century remained employed in the work of prominent 18th century educational scholars like Pestalozzi, who promoted school gardens for cultivating good citizens in harmony with nature and with God (Jacob, 2002).

Some scholars of the 18th century, however, were more closely aligned with ideas linking ‘nature’ with ideas about harmony and Godliness, like Jean-Jacque Rousseau. For Rousseau, all good, true, and pure things, including nature and children, were Godly, while impurity was the work of men (Malone, 2017; Taylor, 2013). In his educational research, Rousseau investigated how nature's moral authority made it a suitable teacher for young children, who in turn, should grow in harmony with natural settings, in a romantic coupling of children and nature (Malone, 2017) that would persist into the 19th and 20th centuries. Taylor’s (2013) analysis shows how Rousseau’s work sought to model an ideal society, advocating children in close connection to nature in order to remain pure and uncorrupted, ideas that still permeate contemporary discourse about early childhood education.

In North America, the European ideal of cultivating rational and Christian citizens through school gardens and gardening was weaponized for cultural assimilation, especially of indigenous peoples (Ostertag, 2015). During the 18th century, Indigenous youth were taken from their families and from their land to be held captive in residential

Indian schools both in the United States and in Canada. They were taught western ways of gardening coupled with Christian religious and gender values as a part of strategic efforts to break the communal and sacred bond they had with the land (Milloy, 1999) and thoroughly be incorporated into Western society (Ostertag, 2015). Indigenous peoples had cultivated and maintained native plant species used for food in agroecosystems (Kurashima et al., 2019) and agroforests (Turner, 2005), while maintaining reciprocal relationships to animated nature spirits (Basso, 1996; Kimmerer, 2013). Settler colonists, on the other hand, had a positivist approach, with a rational, empirical and utilitarian relationship to plants, cultivating often exotic plants in a linear fashion, focusing on crop productivity, while teaching values associated with Christian education (Ostertag, 2015).

Similarly, enslaved African and African Americans were involved in planting and gardening, both to provide and compliment the settler-enslavers diet and to provide for themselves. The personal gardens grown by enslaved African Americans for their own food consumption were highly diverse, containing varieties they managed to bring with them through the horrors of transatlantic trade, to exchange with other enslaved folks and adapt to the new land (de Andrade Bressan, 2005). These gardens were used to grow plants both for food and medicinal purposes (Esquivel & Hammer, 1992), to maintain connections to their cultures of origin, and to perform spiritual rituals (Price, 1991)—all while connecting and learning with the land in which they were forced to live. While the personal gardens cultivated by enslaved and formerly enslaved folks (in the 19th century) afforded physical, moral and spiritual well-being, they also became symbols of resistance as they offered a small chance of making a profit. Botanical gardens of the dispossessed (Carney, 2009), slave gardens, or provision gardens (Davis et al., 2019) were cultivated

by highly skilled “scholars of the plantation” (Davis et al., 2019, p.5) serving the more-than-human community by offering refuge for biodiversity amidst the plantations (Haraway, 2015). There is a gap in the educational scholarship concerning enslaved people's gardens, as well as the knowledge of gardening that was shared amongst groups of enslaved African Americans in North America, and that is still present in African American communities. Academic discussions about the slave gardens, mostly present in the ethnobotanical scholarship, are centered on epistemically White narratives, particularly concerning the varieties of plants that were grown and the organization of the gardens.

Thus, the 18th century solidified positivist approaches to gardening, especially school gardening, emphasized a delivery model of education, where children were seen as pure, innocent blank canvas and the teachers were perceived through their work at the school much like God through the church, as the deliverers of all valuable knowledge. In this positivist epistemological model, there is unidirectional flow of ideas, where both the garden and the children have little to no agency. The garden inhabitants, children, and women were thus seen as having no valuable knowledge with which to contribute to their communities. Even worse, the ontologies and epistemologies that were not associated with those of the rational white men, should be erased and replaced by Western, Christian, and scientific ways of thinking and being in the world (Wynter, 2003; de Souza Santos, 2018). Gardens in the 18th century represented human aesthetic and modern qualities, reinforcing ideas about the separation of humans from the natural environment, the domination of nature, and the duality between men and women, and proximity to God-like qualities. In 18th century ontoepistemologies, BIPOC, women, children and

nature at large became part of a system of repression, treated as ‘resources’ to be dominated and used for the purposes of (male) colonial capital accumulation and scientific progress (Federicci, 2018; Merchant, 1990). Women, children and nature represented purity and passivity, and needed to be put under the control of either God or science, and thus, of man (Leiss, 1994, Hunt, 2000). Recent studies in the field of environmental justice have added a social and racial dimension to this discussion, and they will be discussed later in this paper.

By the end of the 18th century, the United States was seen as a pastoral land, where land was cultivated alongside a superior morality to that of a corrupt England (Erbacher et al., 2014). The garden had become the symbol of the country, representing an idealized middle between wilderness and civilization, “an artful balance between nature and culture” (Erbacher et al., 2014, p. 148). In the late 1800s and early 1900s, there was an important expansion of school gardens (Lawson, 2005) in the U.S. with the goals of instilling good rural, agricultural values and love of nature (Pudup, 2008).

XIX Century: Urbanization and Romantic Philosophy

In the 19th century, urbanization and capitalism bloomed, and the machine, especially the railroad in the U.S., disrupted the pastoral image of the land in North America, as well as the settler relationship with the land (Erbacher et al., 2014). The time of machines had come to stay, but humans had conflicting attitudes about technology and progress. While some thought that the railroad would transform the landscape in the direction of human progress and liberation from nature, others resisted what was imagined would destroy the idyllic land filled with good moral values (Erbacher et al., 2014), a duality that extended well into the 20th century (Marx, 2000). Nevertheless, settlers’ perception of nature and of

gardens in the 19th century was still permeated and enforced by white hegemonic power structures (Erbacher et al., 2014) that further emphasized male domination over women and humans over nature, where “the gendered view of nature allowed for the exploitation of the land as well as of women” and children (p. 149).

The 19th century saw the peak of romantic philosophy, thus views of nature gained a romantic appeal as well. The root of romantic ideals of nature is much older, dating to the 17th century with Natural Theologians and carried into the 18th Century, mainly by Jean-Jacques Rousseau, but was epitomized in 19th century philosophy. 19th century Romantic thought only considered as “natural” those environments that had not been modified by humans, meaning, the pristine unspoiled landscapes that were thought to be completely void of human influence, serving as refuges for the wildlife that was now threatened by growing industrialization and urbanization (Cronon, 1996). Nature philosophers like John Muir began referring to nature as a sanctuary, where the civilized man could escape to and find leisure (Evernden, 1992). At the same time, the new and growing environmental conservation movement shared the romantic transcendental ideals of a pristine temple of nature, giving birth to the first natural parks in North America. By further solidifying an ontological framework where humans are completely removed from the realm of what is considered ‘pure nature’, the romantic ideals erased the long and successful history of indigenous peoples' environmental management and creation of foodscapes (Kolodny, 1975) and further reinforced the nature/culture binary separation. They also erased the ongoing history where the domination of this so-called wilderness was accompanied by the displacement and genocide of Native Americans (Kolodny, 1975).

Influenced by romantic ideals, in the 19th century, school gardens in North America functioned as tools to teach socialization and acculturation, according to White Western principles. While the enforcement of gendered Christian values persisted through the teaching of Western gardening practices, the main epistemic focus shifted from farming practices to a romantic ideal of the garden as a natural refuge where people could escape urban industrialized life, further enforcing the positivist binaries between nature and culture (Evernden, 1992).

In 19th century Europe, school gardens became a part of educational policy, and subsequently, with the growth of public educational systems, school gardens spread across Europe (Desmond, 2002; Jacob, 2002). Extending the romantic child/nature coupling, students weren't seen as empty fertile soil to be filled with the seeds of knowledge anymore, but as growing flowers that nature itself would tend to; a foundation for subsequent knowledge (Robin, 2001; Sealy, 2001). Similarly, in Europe school gardens continued to be used to condition children in ethical and moral values through hard gardening work (Robin, 2001), but now they were also seen as therapeutic places that could counter the negative effects of urbanization, and promote nation building and identity, by nurturing the ideals of a homeland (Jacob, 2002). This was manifested through a gardening movement that emphasized an opposition to industrialization and urbanization by proposing gardening as an activity that took people back to previous customs (prior to the industrialized era) of gardening and consumption of local native plants. This care for the native plants and local production of foods had the goal to inspire a care and love for the homeland (Ostertag, 2015) and protect it from internationalization (Jacob, 2002). Later, in 20th century Germany, these values that linked physical labor,

and love for the homeland would help build the nationalist ideals present in the German “Kriegs-Schüलगärten” (war student gardens) to prepare children for war.

XX Century: Wars, Industrialization, and the Environmental Movement

In the 20th century, school gardening grew in popularity, heavily influenced by the effects of the World Wars. In Europe, school gardens were used in Nazi Germany to indoctrinate students and reinforce values associated with nationalism, colonialism, patriarchy and human control over nature, by removing children from the influence of family and teachers by taking them into school gardens to be taught by Nazi officials (Walder, 2002; Ostertag, 2015). Reinforcing the detachment of humans from nature, children would be detached from familiar educators’ influence to be taught race education and eugenics in residential schools, in an effort to root children to the soil “where the soldiers and mothers of the nation would be raised” (Ostertag, 2015, p. 47).

In North America, the War periods served as catalysts for the growth of school gardens, reinforcing patriotic values, and providing both physical labor and food at a time of scarcity (Jacob, 2002). Food shortages combined with economic depression helped to extend 19th century romantic ideals of gardens associated with a peaceful rural past, with an emphasis on food sovereignty and anti-urbanization (Ostertag, 2015), and working in the school gardens was seen as a chance for children to increase health and physical strength, exposing children to hard work and the elements, hardening them off (as seedlings must be hardened off before transplanting) in preparation for adulthood (Jacob, 2002; Ostertag, 2015).

Later in the 20th century, concerns with industrialization, pollution, and urban restructuring gave birth to the emergence of the current environmental movement in the 1960s and 1970s (Lewis, 1996; Pudup, 2008). These influences could be seen in the school garden movement of the 1970s, with its emphasis on valuing romantic ideals about returning to a peaceful bucolic nature and escaping the cold war apocalyptic fears (Ostertag, 2015). Beyond school gardens, community gardens gained significance for their role in social movements. For example, In the 1970s, community gardens emerged as part of a social movement to counter the effects of urban restructuring and gentrification (Pudup, 2008). Likewise, pioneer guerrilla gardens in New York City became resistance spaces as community gardens were leveraged as a stage for poor and working-class folks to claim and negotiate their presence in urban spaces (Tracey, 2007).

In the 1980s, the gardening movement in the U.S. kept growing with a strong collective drive, taking on the goals of community organization, community building and resistance against the marketization trend in the realm of social life (Pudup, 2008). In the late 1980s therapeutic gardens emerged, backed by a romantic ideal that through individual gardening in collective settings, people could tap into nature's transformative powers, and thus transform their individual subjectivities (Pudup, 2008). The premise was that there would be a reciprocal relationship where people would transform nature through gardening, and in turn, nature would transform the human spirit (Lewis, 1996).

Urban gardens in the 1980's functioned as far more than source of food; they were "centers for sociality, knowledge production, and cultural and intergenerational exchange" (Fenandez, 2003, p. 106) especially through the labor of immigrant communities (Federici, 2018), functioning as hubs for social transformation.

Transforming the home and the neighborhood into places of resistance and political reconstruction sought to produce a ‘commons’, meaning, to (re)create spaces and social relations based on “solidarity, the communal sharing of wealth and cooperative work and decision-making” (Federici, 2018, p. 183). Federici (2018) explained that because private abandoned urban land was appropriated as a common, the relationship that was established to the space shifted from an individualistic, to a communal relationship, “restoring people’s symbiosis with the natural environment” (p. 127).

In the U.S. in the 1990s, community gardens also began to provide gardening instruction, especially to teach children how to garden in urban areas. Also, during the 1990s, environmental activists' concerns with the depletion of natural resources and natural areas in urban centers, led to efforts to preserve open green spaces in large cities, culminating in the creation of numerous new community gardens as compliments to city official park systems (Pudup, 2008). In the 1990s, there was a shift in the goals of community gardening from community organizing and resistance to more individualistic goals (Pudup, 2008). For example, through gardening and contact with nature, it was thought that marginalized individuals could be transformed (Pudup, 2008). As shown before, shaping and socializing youth into the values of the time using gardening as a tool, is a much older idea, with its roots in the 18th century, but as Pudup (2008) reveals, neoliberalism shifted both who should be in charge of gardening projects (formal education institutions), and who should be the targets of such transformations - from school children and society and a whole, to individual persons.

XXI century: Contemporary Gardens, Environmental and Sustainability Education (ESE) and the Climate Crisis

The 21st century environmental and gardening movement presents an amalgamation of the main ideas of the preceding centuries, some associated with nature-based spiritualities (Magliocco, 2018), some rooted in Judeo-Christian beliefs of humans as God-assigned stewards of nature on Earth (Glacken, 1967; Leiss, 1994), some rooted in 17th and 18th century scientificism's aims to control and change nature through science and technology (Leiss, 1994), some rooted in the Romantic and Transcendental ideals of the 19th century where nature would be a heaven of leisure and where humans can get connected to the mystery of the divine (Cronon, 1996), and some relying on 20th century conservation and individual improvement rhetorics (Pudup, 2008).

The 21st century is already characterized by widespread concerns about environmental overexploitation (IPCC, 2021; UNICEF, 2021). Through the use of scientific epistemologies humans have comprehended, replicated, and transformed nature with little regard to the natural world, to the extent that human survival is threatened, clearly showing the deep interconnectedness between the human species and the remainder of the natural world. Yet, this interconnectedness is ignored by the rationale of human exceptionalism that underpins scientific discourse, and by economic goals of capital accumulation, culminating in that which is considered as "nature" being either consumed and discarded, or pushed out of the human realm of "culture" to enclosed reserves uninhabited by human beings (Nash, 2014).

Education, like virtually all aspects of 21st century life, is driven by economic goals of development and accumulation at the cost of virtually all else, even when we

know better. The environmental and economic crises have once again stimulated the growth of private, community, and school gardens throughout western societies (Draper & Freedman, 2010). Yet, human ontological perceptions about nature and about gardens still sustain ideas about humans as separate from nature, assigned as stewards and managers of what are, through neoliberal lenses, called ‘natural resources’.

Deepening the use of gardens in ESE: Current ontologies and epistemologies

Current practices for learning in gardens reflect the epistemologies that sprouted and spread in gardens across the previous centuries, materializing positivist ideals of human exceptionalism and human control over nature. Although the change from positivism to postpositivism acknowledges the researcher participation in the outcomes of research resulting in postpositivism, the framework remains firmly rooted in ideas of detachment and control over a nature that is separate and below humans (Lindolf, 2017). To indicate that strong linkage of philosophical underpinnings, postpositivism will be referred to here as (post)positivism.

School gardens as outdoor classrooms for example, an idea introduced by Comenius in the 17th century, has become very popular in schools across the U.S. (Hirschi, 2015). In this model, the garden is used as an outdoor classroom, where STEM related content can be taught using living beings and their relationships as concrete examples, facilitating hands-on experience (Graham et al., 2005, Cross & Khan, 2018; Christensen & Wistoft, 2019). Popular educational projects using the garden as an outdoor STEM classroom include the Life Lab Curriculum and the Edible School Yard (ESY), where learning is focused on the production and consumption of organic local food (Pudup, 2008).

Use of gardens as outdoor classrooms often focuses on science, mathematics and literacy (Christensen & Wistoft, 2019), which are framed within a (post)positivist epistemology (Cramer and Ball, 2019), aiming at reaping benefits related to improved academic outcomes and overall well being (Williams & Dixon, 2013; Berezowitz et. al, 2015, Broad 2016). Interestingly, emphasis is given to direct academic outcomes, which are evaluated through accountability measures driven by (post)positivism, meaning, standardized, universal, quantifiable ‘tests’, in which success is indicated by the accumulation of curricular knowledge often captured in test scores (York, 2015).

While positive relationships between outdoor learning and educational outcomes are celebrated desirable impacts within formal schooling (Williams & Dixon, 2013; Chawla et al., 2014), especially in teaching science mathematics and literacy, garden pedagogies framed within a (post)positivist effects or outcomes framework limit the experiences of learning and working in the garden to those aligned with scientific epistemologies of rationality, objectivity, detachment and productivity— thus, reinforcing the idea of a binary between humans and the natural world represented by gardens. Additionally, using the garden to improve children’s direct educational outcomes, objectifies children themselves as incremental educational outputs to a future society, and limits the experiences “that matter” in the garden to a fixed set of measurable educational impacts. Moreover, epistemologically, an outcome-based garden learning experience reinforces a view of nature as a “mute site for young learner’s meaning-making and their universalized cognitive, physical and social-emotional developmental progression” (Nxumalo, 2021, p.1) focused on abstract and patterned scientific skills such as observing, dissecting, evaluating, categorizing, predicting and replicating. Thus, using

the garden as an outdoor classroom under a (post)positivist framework reinforces human exceptionalism by solidifying the human versus nature binary, promoting extractive views of nature, as well as a colonizing stance, where humans are in charge of exploiting, improving, and protecting the passive natural world (Taylor, 2017).

A positivist outcomes-based developmental approach is not strictly used for teaching science, but has been taken up by environmental and sustainability education (ESE) as well, which critics point out, has turned from a holistic perspective towards an almost exclusively scientific one, with an instrumental and behaviorist stance (Jickling & Spork, 1998; Gruenewald, 2004; Wals & van der Leij, 1997; McBride et al., 2013). Reid (2019) specifically discusses how anthropocentrism is predominant in environmental education scholarship, despite its original concern with the interconnectedness between human and more-than-humans. Critical scholars have shown how outcomes-focused developmental epistemologies in ESE erase realities of social injustices by overlooking issues of access and equity (Meiners, 2017, Selman, 2004), erasing Black and Indigenous relationships with the land, perpetuating a discourse where white innocent children belong in nature (Nxumalo, 2021) and where BIPOC children and youth can be lead to salvation (Cecire, 2015). The (post)positivist outcomes-based developmental framework in ESE limits children's everyday experiences and interactions with others by excluding the personal, social, racial, economic and ecological relations (Cairns, 2018) that they experience everywhere, including in the garden. Children are often aware of those environmental injustices they face, as well as of the need for environmental conservation (Spiteri, 2021), revealing themselves not as pre-adults (Holloway & Valentine, 2000, p. 5), but as active mutable beings that are relevant in the present (Silova et al., 2018)

constantly ‘negotiating the injustices of capitalism and white supremacy’ (Cairns, 2018, p. 529).

In recent decades within ESE, garden-based learning (GBL) has risen as a valuable instructional strategy based on experiential education in school gardens. GBL relies on hands-on experiences to introduce interdisciplinarity in the curriculum and prepare students to participate in STEM related activities (Weinberg & McMeeking, 2017). These hands-on learning activities tend to prioritize science standards, following scientific epistemology with a focus on human centered classifications, categorizations, and experiments. Garden-based-learning then uses the garden as an interdisciplinary outdoor classroom (Desmond, Grieshop & Subramanian, 2002), aiming to offer opportunities for students to be differently engaged with the curriculum through hands-on activities, and thus improve their outcomes (either academic or behavioral), framing children as educational outputs.

GBL uses gardens as a laboratory for environmental learning, contributing to ecological and sustainability literacy (Rilla & Desmond, 2000). The concepts of ecological and sustainability literacy have been characterized differently in the ESE literature, yet predominantly positivistically. Some definitions include the capacity to recognize and classify a natural environment in accordance with curriculum standards (Gardner, 1999; Desmond, 2002), the understanding of how ecosystems sustain life on the planet while acting to ensure the sustainability of life (Desmond, 2002), as well as the ability to understand critically how society and nature are connected and how to act to influence society to support current and future generations (Stibbe, 2007). While Stibbe (2007) offers a more holistic approach, considering a critical analysis of the

entanglements between society and nature, their definition of literacy still subscribes to the binary between the two, and focuses on change that supports the survivability of humans. Critical scholarship has problematized the idea of ecological literacy, or sustainability literacy, by revealing how the concept of literacy itself is associated with the domain of certain knowledges over others, and thus, how literacy as a concept is imbedded in a hierarchy where “some kinds of literacies matter more and are superior to others” (Truman, 2019, p.111) where literacy is built around white western knowledges (Springgay & Truman, 2018). In the fields of environmental and sustainability education, to be literate necessitates “to know in advance what literacy is and how to perform literate acts” (Springgay & Truman, 2018) with/in nature, necessarily being separate from “it.” Despite discussions that move the idea of ecological literacy away from the mastery of some knowledges and omission of others, towards more holistic and complex approaches to consider the future that positivist literacy creates (Orr, 2006), the field of ESE remains connected to the latter. Thus, the ideas of sustainability ecological and literacy need to be problematized in ESE, especially in learning gardens, where (post)positivist epistemologies in science and mathematical literacy are prioritized, reinforcing anthropocentric concepts embedded in white western epistemologies. The scholarly literature on GBL, like it’s often the case in ESE, does not incorporate land or gardening histories of oppression, nor accounts for more-than-human relationalities and co-creation of knowledge outside of what is prescribed in the science school curriculum (Tuck & McKenzie, 2015; Seawright, 2014).

Another important problem with GBL’s (post)positivist outcomes-based approach is the romantic coupling of nature and children, dominant in the 19th century, which

resurfaces through a developmental learning model that frames children as innocent and passive, that through hands-on experience growing food would be molded by nature into “fully human adults” (Silova, 2018, p.5), capable of making better food and ecological choices, thus shaping a better future society for all (Cairns, 2018). The romantic ideals resurface in contemporary gardening by emphasizing youth’s idealized peaceful relationship with the natural world, obscuring and diminishing the hard mental and physical labor involved in growing and maintaining plants. Gaddis and Coplen (2018) point out the hidden hard work behind producing food and reveal the gender, class, and race issues behind producing food. The hidden facet of the work it takes to keep a food-producing garden reinforces a romantic ideal that serves only affluent children, for whom the garden is a place of leisure and recreation. By not experimenting with the work, but still enjoying a well-maintained garden (and its fruits), affluent children assimilate the injustices of labor in capitalism by learning that the garden is a place of work of ‘other’ people, and a tranquil refuge for their enjoyment.

The topic of the hard-physical labor involved in gardening is surprisingly scarce in school gardening literature, possibly due to the frequent hiring of consultants by affluent schools, who do most of the heavy labor associated with working the land. Another possibility is that due to heavily relying on an (post)positivist outcomes-based framework, educational scholarship focuses on the effects of gardening in the school curriculum, leaving out the labored processes involved in maintaining a garden, or relegating it to the (mostly female) teachers without consideration for costs, time, and energy. In either case, the messiness of youth’s garden relationships, with its multi-

species, multi-mattered encounters and potentiality remains beyond the possible educational outcomes, and thus absent in gardening scholarship.

Garden education projects that do not address historical and social issues associated with the history of gardening and farming, are abstract and deny both humans and more-than-humans the specificity of their history. Haraway et al. (2015) question the extractive epistemologies that are promoted in the absence of a historical critical approach, by showing how narratives that escape White western thought, such as those of the slave gardens, recognize human-nature relations as kinship that transforms oppression into resistance, of both humans and more-than-human beings. The messy shifting relations that occur in gardens reveal children, youth, and more-than-human agency in co-constitutive relations, but those fall outside of positivist epistemology and are usually left out of educational scholarship. Those reciprocal relations that escape positivist epistemology, and are unwelcomed and erased when an outcomes framework focused on white Western rational outcomes sets the goals and boundaries of the experiences in the garden.

The colonialism and commodification forces in gardens has also not been acknowledged in ESE literature, translating into rationales of profit (focused on food production), individualism (care for one's own benefit and/or self improvement) its cultivation of goals related to an Euro-centered 'colonial project of domestication' (Plumwood, 2009, p.1), both in species composition (and introduction) and in aesthetic values.

Beyond the issues brought by an outcomes-based framework, scholars have shown that the current uses of gardens as outdoor classrooms frames children and adults

in a dichotomized, hierarchical, and developmental way, privileging what are considered to be adult ways of being and knowing over children's. Ontologically, adults represent and enforce the humanist positivist framework prevalent in formal education, being the knowing subjects, while children's epistemologies are considered unscientific, unimportant and then dismissed (St. Pierre, 2016). Adults' epistemologies most often direct the design, goals, and discourses of garden-related activities, while other garden inhabitants and children are assigned managed and highly surveilled passive roles (Pudup, 2008). Overall, the scripted behaviors allowed by adults in the garden as an outdoor classroom limit students' time and ability to establish their own relations with the garden, functioning as an adult lead cultivation of future consumers (Pudup, 2008) and decision-makers.

Another ESE environmental education approach taken up in school gardening is Wild Pedagogy, which focuses on the ecological crisis and youth's social awareness. Jickling et al. (2018), focus on place based ecological engagement by revisiting the concept of wilderness as a free-from-constraints will, similar to what is considered to be a wild-child. They propose a shift in education practices to allow children to navigate different learning spaces, favoring a deeper immersion in their discovery journey in (but not with) the more-than-human world, in an attempt to avoid "human-centric, colonial ways of being" (p. 44). While a productive movement towards child-led experiential learning in nature, Jickling (2018) maintains the human/nature binary by centering humans as the agents in the learning process, and framing learning in and about nature as a human activity, where nature is still portrayed as passive.

Scholarship in the field of posthumanism and Indigenous knowledge systems, bring forth multispecies and relational onto-epistemologies, and have both been influencing the field of early childhood education promoting ideas about how the human world and the natural world are enmeshed and produce mutual relationships, moving beyond romanticizing children's relations with the natural world, and recognizing heterogeneity and power asymmetries that come with those relationships (Taylor, 2017). Posthumanism discusses very engaging possibilities of more than human relationships that recognize children and more-than human agency (Sommerville, 2017; Malone et. al, 2017) and could be useful in undoing the historical oppression of both youth and non-human beings in and through gardening. Posthumanism in educational research also promotes more interdependent and cooperation-based education approaches to address environmental issues and climate change (Komatsu et al., 2019), but those ideals have not been taken up widely by the scholarship in educational gardening projects. A few critical scholars in environmental education, particularly in early childhood education criticize the lack of environmental justice awareness in gardening (Nxumalo and Cedillo, 2017), while bringing forth the colonial heritages of slavery, displacement (Nxumalo, 2016), and racism (Ramirez, 2015) related to producing food, which are often ignored when involving youth of color in urban garden projects. Unfortunately, these are exceptional cases in educational scholarship, revealing the lack of a critical analysis of gardens as learning tools.

Broadly missing from the educational literature concerning learning gardens, is a critical stance of the positivist relationships established in gardens, and a historical perspective that contains the weight of the colonial oppressive manner that humans relate

to the natural world revealed in and through gardens. However oppressive, this positivist relationality reveals a becoming between humans and gardens, one permeated by domination, by bordering, and by keeping certain beings inside the garden while maintaining others out of the garden, what Marder (2018) calls the “guardening” of species as well as of epistemologies. Domination and “guardening” are integral parts of the ideas behind the exploitations of other species, matter and knowledges on this planet.

Despite ESE’s use of gardens in an attempt to generate environmental awareness and positive experiences between children and the natural world, given that both theory and practice about gardening seem to be dominated by positivist frameworks and the accompanying logics of human exceptionalism and coloniality, it is unlikely that such garden engagements would help address the climate crisis. In fact, the logics of human exceptionalism embedded in dominant approaches to learning gardens may actually contribute to aggravating the climate crisis (see Silova et al., 2019) for example, while claiming to support a view of intertwined humanity and nature, ESE philosophical underpinnings and practices make humans more prominent instead, framed as the ultimate agents of Earth’s salvation.

Conclusion

Gardening's prominent role in modern education has been permeated by Western positivist and (post)positivist ideals of human exceptionalism, scientific objectivity and detachment, guided by economic and political values associated with colonial and capitalist exploitation. These ideas have materialized in gardens that are bordered and guarded, detached from local histories, stolen from local Indigenous peoples, and

overworked by women and BIPOC folks. Epistemologically, learning gardens sediment science as the only source of knowledge and truth, framing both nature, children, women and BIPOC as mute and empty fields, in which values associated with whiteness must be cultivated. Environmental and sustainability education, despite aiming to foster behavioral change towards sustainability, follows in the same (post)positivist footsteps, when solidifying an exclusively scientific curriculum that largely ignores the social, historic and more-than-human contexts of learning, and uses gardens as outdoor classrooms and laboratories framing nature as passive, and children as educational outputs in a developmental path to become future consumers. We must remember that the master's tools will never dismantle the master's house (Lorde, 2018).

By exposing these incongruences in the educational literature, this article offers an alternative path that reconsiders the Western Enlightenment ontological stance of human exceptionalism and rationality as constitutive of agency. This article proposes an ontological shift that acknowledges scientific contributions, while recognizing the living world as agential, moving the validity of the epistemological field to encompass embodied, affective, sensual and spiritual ways of knowing. The shift proposed here includes other ways of knowing and being in the world that together have a better chance of addressing the current planetary challenges, in a mutually beneficial way of reconfiguring human relationalities to the more-than-human worlds in and through gardening as a pathway to (re)create futures of mutual flourishing on Earth.

Reflecting on the history of gardens it becomes clear that learning through gardening has in fact reinforced a relation of othering (nature, children, women, BIPOC) characteristic of (post)positivist science and human exceptionalism, and the various ways

in which humans have learned to engage *with* gardens throughout history has influenced how people relate to nature and the natural world more broadly. From this perspective, gardens haven't been simply physical natural spaces that humans transform and occupy, but rather the materialization of the *relationships* between humans and the more-than-human worlds around them.

In order to address the role of environmental and sustainability education (ESE) in the climate crisis, specifically garden's role in sedimenting oppressive relationships between humans and the natural world, there is a need for a shift in the ontological conceptualization of gardens as idealized portions of "nature" orderly maintained for (white) human's recreation or BIPOC people's emancipation, to politicized situated gardening that favors place experiences, attends to historical and political conditions, and tells contextualized stories of both place and people (Nxumalo and Cedillo, 2017). In gardening, such politicized engagement would mean to contextualize gardening activities in the history of gardens and of gardening, as well as in the history of the land, the peoples of the land, and the ecological communities of that land, and the political situation of that particular community and/or school. That would entail decentering humans as scientific masters of a guarded and bordered garden in an effort to re-situate humans in place and time alongside the more-than-human worlds (Davis & Todd, 2017; Haraway, 2016; Lövbrand, et al., 2015; Malm & Hornborg, 2014; Moore, 2016; Romm, 2018; Tsing, 2015). There must be a shift in our imaginaries of what a garden is and who are its inhabitants so that gardens can be a mutually beneficial interspecies community that blurs the dualism between nature and culture and the boundaries of agency in the garden. Thus, decentering humans is an ethical implication for anti-colonial gardening,

recognizing that there are ‘earth-others with prior claims’ (Plumwood, 2009a, p. 4), while aiming for more-than-human relationships based on a mutually beneficial conviviality for all involved.

This shift would also mean decentering science as the only pathway to achieving a more sustainable future, breaking from the illusion of scientific ways of knowing as absolute apolitical truths that through the next technological advancement can “fix” the machine that constitutes the Earth’s system. This proposed shift is not an attempt to deny scientific discoveries, or to belittle science’s importance in bettering human quality of life, but instead, a movement towards truly acknowledging human responsibility in the climate crisis that decenters science in sustainability discourse, while bringing forward all of the others already always present ways of knowing by engaging with the social, affective, emotional, and spiritual aspects of our more-than-human relational worlds.

Thus, gardening in education would benefit from a shift from a rhetoric of effects and measurable (post)positivist educational outcomes to a ‘focus on practice, experience and contextual specificity’ (Gaztambide-Fernandez, 2013, p. 531) that would recognize more-than-human agency, and see youth as agents of cultural production and social reproduction, both symbolic and material. Moreover, a shift away from (post)positivist gardening would allow a transformation in learning experiences from rational knowledge accumulation to a relational co-creation of multiple ways of knowing, often led by more-than-humans. This shift could make space for pedagogical imaginations that include human and more-than-human meshworks as agential assemblages of cultural (re)production and social transformation in the creation of possible worlds - worlds where

humans engage in reciprocal relations with more-than-humans in an attempt to change the path of the future.

The ongoing COVID-19 pandemic has once again highlighted the intra-connectedness (Barad, 2007) of our more-than-human world. During the pandemic, gardening has grown exponentially, revealing its potential for local food production, experiential learning, community building, and as a pathway to reconnect to our nature as creatures of the Earth. Many school gardens have been either abandoned or taken up by community organizations to supply local food for neighboring communities and outdoor educational opportunities for youth. More-than-human relationships have continued in the absence of human beings in case of abandoned school gardens, or become the scenery of informal community learning. According to Richter & Armstrong (2020) gardening since 2020 has once again taken up the meaning of envisioning futures in the Anthropocene, an invitation also extended by Taylor (2013) in her work about re-configuring human-nature relationships, specifically, re-envisioning children in ‘natureculture’ worlds. As tools for coping while living in a global pandemic scenario filled with despair, people have turned to activities that reinforce imagination, hope, beauty and play, and have found that gardening helps to reconfigure politics of care (Richter & Armstrong, 2020, p. 21) through the intergenerational, interspecies practice of gardening as an activity that can generate futures.

The ontoepistemological shift proposed in this article, moving away from a utilitarian, instrumentalist and detached (post)positivist relationship with the natural world is in fact aligned with the very crisis we are experiencing as a planetary whole, offering instead a call for an ethico-onto-epistemological engagement with more-than-

human worlds, in an attempt to explore reciprocal ways of engaging with more-than-humans in gardens, imagining and constructing mutually beneficial futures for all.

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Chapter 3

What Lies Beneath the Surface? Encounters With Learning Through Soil Stories

Abstract

This article examines the relationships in which soil is engaged in and outside of gardens. Inspired by post-qualitative inquiry, I use the concept of matters of concern (Latour, 2004, Stengers, 2005) to notice and engage with soil in a school garden, a community garden and an indigenous garden. By using stories of soil agential entanglements, this paper engages with careful encounters with soil in everyday messy entangled garden experiences allowing for a shift from soil as a static scientific object of study, a matter of fact, to soil as a “lively beingness” (Puig de la Bellacasa, 2014, p. 32), a matter of concern and care. Foregrounding soil as a co-creator of garden and learning worlds, this discussion explores how reciprocal garden relationships may help counter Western logics of nature’s exploitation by teaching humans not only to care for soil, but to be cared for it, in mutually beneficial garden practices.

Soil awakenings

Early mornings had a very particular feeling. The glistening of fresh dew resting on grass blades, the scent of damp soil, and a breeze that brought the fresh smell of the herb garden. The cold air invited us outside, to see the sun rising from the horizon, and hear the birds chirping as they too saluted the day. Bees buzzed on their way to the flowering trees, and a burrowing owl watched carefully at a distance. We walked barefoot down the hill, often slipping in the wet ground, leaning on our hands and knees down the incline towards the water. The muddy pond hid the fishes and frogs, only showing themselves quickly as they swam away from the vibration of our steps on the ground. We walked around the pond sinking into the mud, all the way to a flat spot on the other side. Shoving our hands in the ground, we grabbed chunks of soil filled with worms, and into our small bucket they went. Even though the terrain around was steep and rocky, the soil on the pond border was always so soft, as if it was cradling tadpoles and children's feet. Going up the hill on the other side, we crossed the chicken coop, where the birds scratched the ground, gulping beetles and crickets that emerged from under tree roots. Later, dad would gather manure from the chicken coop, compost it, and spread it under the fruit trees. We never tasted sweeter oranges in our lives.

Touching soil: A matter of concern

Soil gathers interests in various knowledge communities, ranging from soil science, biology, ecology, urban infrastructure, and human-nature relations. The ghosts of industrial expansion haunt soil scientists across the world who investigate the worrisome

condition of soil and attempt to maintain and reestablish the fundamental food webs that sustain human life on Earth (Puig de la Bellacasa, 2014, Tsing et al., 2017).

Much like in the memory story that opened this article, when this research began, soil touched upon every aspect of my gardening research and practice. Soil is the very basis of gardening, making possible human involvement in the growth of plants, building structures and moving across the land. Soil was a frequent topic across all gardens, and with frequent encounters with soil, it quickly became a matter of attention in this inquiry process. Soil quality, health, and sustainability have also appeared as frequent topics in gardening scholarship, including in education research. In the discussions regarding the role of education in the context of growing environmental concerns, education scholarship in learning gardens operates under the assumption that gardens offer interdisciplinary learning experiences about science (including soil science) that are necessary to enhance people's skills and performance in scientific literacy (Rilla & Desmond, 2000). Given the reliance on the assumption that science is capable of addressing environmental problems (Merritt & Bowers, 2019; Gunckel & Tolbert, 2017; Bowers, 2021), it is commonly believed that teaching effective science would ultimately contribute to a better and sustainable future society (Rilla & Desmond, 2000; Cairns, 2018).

With the growing popularity of learning gardens used as interdisciplinary outdoor classrooms and outdoor laboratories for teaching science and environmental education (Desmond, Grieshop & Subramanian, 2002; Rilla & Desmond, 2000; Hirschi, 2015), gardens have become frequent settings for learning about soil composition and health across the environmental sciences, agricultural sciences, and learning sciences (Magee &

Wingate, 2014; Ero-Tolliver, et al., 2013; Kwiatkowska-Malina, 2018). In learning gardens soil is portrayed as a key natural resource, the most common medium for plant growth, habitat for various organisms, and as a structural foundation for urban construction (Willison et al., 2020). Educators' interest in soil extends into environmental and sustainability education (Nichols & Samson-Liebig, 2011), since soil is capable of filtering and purifying water as well as performing carbon sequestration, thus helping to mitigate climate change (Willison et al., 2020). Even though soil is present at every garden interaction, its importance for its own sake is frequently overshadowed by that which it produces for humans - food (Puig de la Bellacasa, 2014).

This overshadowing can be seen in the utilitarian approach to soil in schools under the science standards, observed by the Next Generation Science Standards (NGSS). In the NGSS standards, soil is portrayed as a scientific object, a gathering of inert matter and organic components, which foster the growth of microbes, plants and animals. Soil science focuses on composition and evolution, processes of erosion, the carbon, nutrient, and water cycles, and the roles of microbial soil life treating soil as a capitalist resource, to be “rapidly consumed and trashed” (Puig de la Bellacasa, 2014, p. 35). Learning about soil in gardens then operates under a scientific paradigm that values logic, rational, empirical, replicable and consumable ways of investigating and knowing other beings and the environment (Leiss, 1994; Hunt, 2000; Thorpe & Hold, 2008). Within this Western scientific paradigm, soil is perceived as functioning like a machine, composed of biotic and abiotic parts that work together to produce a local ecosystem (Merchant, 1990; Erbacher et al., 2014). The NGSS precludes place-based engagement in the curriculum, and instead emphasizes rational knowledge transmitted through reading and listening to

rational scientific explanations (Feinstein & Kirchgasser, 2015; Gunckel & Tolbert, 2017; Merritt & Bowers, 2019) framing soil as a resource for human food, showcasing soil as a static, decontextualized, universal constant in the environment, “as if it existed as such, as a matter of fact” (Stengers, 2011a, p. 85). Perceiving soil as a scientific matter of fact, detaches humans and other beings’ entanglements with soil, reducing soil and its processes to concrete, rationally knowable entities that can be managed by humans. Soil as a matter of fact also appears in public discourse showcased in narratives about soil as a manageable resource for food production, a sink for anthropogenically produced carbon, contamination and correction (Ontl & Schulte, 2012; Parikh, 2014). Learning gardens engage soil in a utilitarian relationship not only through soil science per se, but also to embed soil science in STEM-related content (Bryce, 2015; Krzic et al., 2014) to facilitate learning in disciplines such as mathematics (Taylor & Graves, 2010; Pascoe & Wyatt-Smith, 2013) and chemistry (Willison et al., 2020), as well as to occasionally provide hands-on sensory experiences (Taylor et al., 2021; Schneider & Farren, 2020).

While approaching soil as a matter of fact helps to recognize a priori soil types, structures and functions as scientific objects of study (for humans), the practices, processes, and powers involved in bringing soil into existence are often left unnoticed. Thus, scholarship on gardens used as outdoor classrooms is primarily geared towards directed learning and focused on academic outcomes, especially in STEM, reinforcing human needs and convenience above the coexistence and survivability of other species. Similarly, environmental education practices often uses the garden under a scientific utilitarian paradigm, working under a detached empiricist scientific framework that assumes that only science and technology could lead to fixing the environmental

problems that humans face (Gunckel & Tolbert, 2017; Jickling, 2017; Bowers, 2021). Perhaps in our scramble to find “solutions,” we escape the problem.

The detachment from soil as a matter of fact object of scientific study can be seen in school gardens’ scholarship and practices. While soil is an inherent part of engaging and learning in gardens, learning about soil is typically disconnected from physical engagement, being described in the literature in either detached or sanitized ways. Activities including soil, for example, are suggested to be performed by adults instead of children, in efforts to maintain kids away from the perceived risks associated with ‘dirt’(Taylor & Graves, 2010; Grosvenor & Myers, 2020). Educators and other adults are urged to engage in practices that allow children to visualize natural processes that include soil, but are often advised to keep young children at a distance to allow “children to make observations without inhaling dust or mold spores” (Ashbrook, 2016, p.22). Especially younger children are encouraged to observe, to add elements to soil or to compost, but are often not allowed to perform harder and potentially messier tasks, such as using heavier tools to dig soil. While some garden-based educational projects include learners in messier activities with soil (Williams & Anderson, 2015), those often conceptualize soil within a postpositivist outcomes framework, where soil is a mute garden component that allows learners to experiment and improve their understanding about the science curriculum and about themselves (Williams & Anderson, 2015; Kelley et al., 2021).

Thus, children’s opportunities to connect with school garden soil are often permeated by adults narratives of scientific and utilitarian relationships with soil, frequently taking the form of either an alert against its dangers (pollution, contamination, presence of dirt, mold and bugs), or a deficit discourse, where soil lacks the appropriate

composition to grow desired plants, and thus needs to be corrected, replaced, or supplemented (Taylor & Graves, 2010). These discourses and their associated practices showcase soil as a static, poor and risky medium, further distancing learners from the environment, solidifying a matter of fact human-centered view of soil, where humans are agents in charge of managing a passive nature (Leiss, 1994, Taylor, 2013; Bang et al., 2014).

Similarly to the growing interest in soil in school learning gardens, in community and private garden scholarship, soil science has become relevant for matters related to learning sciences (Magee & Wingate, 2014; Ero-Tolliver et al., 2013), soil contamination (Barthel et al., 2019), local food production and distribution (Egerer et al., 2018), and urban soil ecology (Douglas et al., 2010). Especially since the beginning of the Covid-19 pandemic, interest in community and home gardening increased dramatically, revealing various gardens capacity to offer learning experiences, provide urban dwellers with fresh foods, improve health and overall well-being, and afford opportunities for people to reconnect with nature (Draper & Freedman, 2010, Hartig et al., 2016; Richter & Armstrong, 2020). Much like the matter of fact, utilitarian relationships established with soil in school gardens, community and private gardening also typically view soil with specific human-centered goals in mind, engaging with soil to maintain or intensify it's productivity, to "pace its fertility with human demand" (Puig de la Bellacasa, 2015, p. 691), relegating ecosystemic health and non-human species' well-being to secondary concerns. This way of relating to soil privileges scientific rationales of detection, composition, and correction of soil, creating a supposedly ideal medium for the growth of

plants of human interest, either for consumption, or to create an environment that favors educational outcomes.

Situating the gardens in this study in this particular place, Arizona, in the Southwest United States, reveals that the entangled webs of soil, plant, animal, human and more-than-human life are suffering from the influence of anthropogenic change in land use, overuse of waters for agriculture and human consumption, soil pollution, and erosion, resulting in soil becoming “another objectified natural resource brought to exhaustion by a deadly human-centered productionist ethos” (Puig de la Bellacasa, 2019, p. 391). Beyond the immediate and long-run effects of soil depletion and pollution, the multi-layered effects of a utilitarian relationship with soil are not yet fully grasped – though they clearly extend beyond the human-centered focus of concern with agricultural and economical impacts (Lahmers & Eden, 2018).

Despite soil narratives in urban gardens being portrayed mainly through the lens of soil science as one component of terrestrial ecosystems under a deficit or suspicious narrative, soil is more than a physical support to plant growth, but a lively ecosystems in itself, “a living web of interdependent beings” (Puig de la Bellacasa, 2014, p. 32), an assemblage of companions (Haraway, 2007) that communicates, exchanges nutrients and energy, while producing itself in a circular manner (Ponge, 2015). Soil exists as a lively assemblage of minerals, water, gasses, organic matter, fungus, bacteria, algae, animals and plants. Soil is a complex “lively beingsness” (Puig de la Bellacasa, 2014, p. 32) that creates conditions for its own continuity at the same time that it invites the participation of other beings who do not compose or inhabit soil in mutual relationships. While a myriad of living organisms contribute to its production, soil contributes to the existence

of all life through the very interdependent relationships that soil creates and mediates. As an example, the encounters and interdependent connections between soil, fungi, plants, animal and human life are complex and multifaceted, starting from the symbiotic relationships between soil and decomposing (micro)organisms, a relationship that is primordial for shaping the conditions for vegetal life as well as human and more-than-human existence for millions of years (Gilbert & Neufeld, 2014).

The recent recognition of soil as a “living organic web of being” (Puig de la Bellacasa, 2014, p. 35) reveals soil in a matrix of relations that do not circumscribe humans, but portray soil itself as a lively participant of the world, as well as the scenery for multispecies symbiotic relationships (McIntosh, 2004; Lowenfels and Lewis 2010; Puig de la Bellacasa, 2014). Multispecies engagements have coevolved to produce quick communication and knowledge exchange between plants, fungi and bacteria through their mutual entanglements with soil (Baluska & Mancuso, 2013). Soil–plant relationships have sprouted interest in scholarship focused on symbiotic relationships and plant communication (Bouwmeester, et al., 2007) bringing attention to more-than-human life, communication and cooperation. Fungi are now known to form an in-soil network of nutrient exchange and communication between plants, through which trees can transmit warnings of predation to other trees, send nutrients to each other’s seedlings, learning with each other in a communal interspecies alliance that is capable of influencing plant survival and local species diversity (Simmard, 2018; Segnitz, 2019), as well as optimizing the overall environment (Simmard, 2018). Soil holds the possibility and connection to transmit messages, warning and sustenance from plant to plant, harboring a multispecies network that can permeate entire biomes.

It is in these messy garden soil spaces of entanglement and social, political, economic and environmental mutual vulnerability that this article brings into focus soil as a matter of concern (Latour, 2004b; Stengers, 2011a), inherently situated and emergent, unsettling its nature and uncovering the multitude of relations in which soil is involved. Approaching soil as a matter of concern means to surpass the scientific idea of recognition and its matter of fact implications of similarity, likeness, universality (Stengers, 2005, 2011b), and instead makes us think *with* soil. Thinking with soil brings forth the very qualities that soil offers, like soil's openness, its multispecies acting assemblages, the emergence of vibrant participants in a situated more-than-human kinship, opening up fertile grounds for mutually beneficial relational processes with and through soil.

Nevertheless, despite the recent investigations concerning relationships with soil in science and technology studies as well as the environmental humanities (Puig de la Bellacasa, 2014 and 2015), and criticism towards decontextualized education research that ignores the specificities of local environments, relationships, and ways of knowing (Silova, 2019), scholarship in learning gardens has not embraced a critical view of human-centered, matter of fact scientific relationship towards soil. This article investigates how the shift from relating to soil as a matter of fact to a matter of concern may alter the present by disrupting the idea that soil is only worth what it can produce for humans. Instead, this article approaches soil as kin, opening the space to engage with it as an active participant that co-creates the living matrix of which humans are also part. This move towards the involvement in lively garden soil relationships may also change what soil does. "In other words, the soil might never be the same after reappropriations of the

science of soil within a quest aiming to benefit all earthlings, not only humans” (Puig de la Bellacasa, 2014, p. 38). Soil may reveal future configurations of our multispecies world, and by doing things differently we may open up possibilities for constructing new worlds together. This article reveals stories that cultivate relational and creative worlds through soil relationships. People, plants, animals and soil come together in these stories letting go of the expectation that the soil only serves the purpose of providing nutrients for edible plants, and instead reveal pushed out ways of being and knowing that emerge from soil relations that go beyond Western scientific boundaries. Countering the adult and school centered view of soil as a problematic, potentially troublesome medium for food production are soil stories that reveal the reciprocal relationships that include the multitude of life that lies beneath the surface.

To showcase how relational onto-epistemologies that escape the matter of fact logic materialized in garden relationships, this article will begin by focusing on such pushed out relationalities, telling stories about caring relationships with soil that sprout when soil is perceived as a matter of concern and a matter of care. Next, drawing from textual narratives gathered from a three-month multispecies inquiry with soils, school children, educators, community gardeners and more-than-human co-inhabitants of three gardens in the Southwest United States, this article presents stories that about noticing soil as a matter of concern in lively entanglements that inspire kinship and care. I put noticing soil as a matter of concern to work, as a methodology that attunes to and responds to soil relationships in ways that bring close attentiveness to the engagements that nurture learning with the more-than-human world of soil, and to the mutually affective relations that garden soil offers.

Soil stories are read through a post-qualitative inspired diffractive analysis that interrupts easy moves to human-centric interpretations of facts and meanings (Jackson and Mazzei, 2012). Rather than presenting a descriptive and singular account of soil relationships in gardens and what was created and learned in each encounter, the intent is to invite readers to the intensive affects of these multispecies worlds, with the goal of offering a glimpse into different modes of relating to more-than-human worlds in current times of environmental precarity through the example of soil. I invite readers to consider the new ways of relating, teaching and learning that open up through multispecies ethical and caring relations that interrupt the matter of factness of human exceptionalism and exploitation. In these times of environmental and human survivability precarity, this article provokes the reader to consider what kinds of perhaps more livable multispecies worlds we might co-create together with soil.

Inquiry considerations: Noticing soil beyond the dirt

The modes of inquiry created in this article rely on posthuman theories to think with the concepts of noticing soil, observing how humans and more-than-humans relate to soil as a matter of fact and as a matter of concern and care. Acts of noticing soil means to be open to soil's slow modes of renewal and communication as well as the fastness of the changing elements in desert gardens (Puig de la Bellacasa, 2015; Tsing, 2015). Soil was a major participant in gardens as a medium for growth, but it was also a constant in human gardeners' narratives about their practice, about caring for their crops and for the land, about situatedness, belonging and about fun. Soil was part of the narratives about relationships that are established in contempt, fear and lack, and at the same time that

others told stories about home, comfort, nourishment and respect. Soil was part of the lives of worms and insects, birds and people, carrots and tomato seeds. Soil was where our feet stood, it was on our skin, on our feathers and hair. Soil was everywhere, and thus, soil *became with* the process of inquiry.

Noticing soil means to engage with soil as soil shows up in the inquiry process, noticing how beings entangled with soil engage with it, through mind and body, through ideas, observations, touch, taste and smell. Most adults' narratives of soil showed up in books and theories, representing facts and figures, showcasing soil as a rich source of both food and fear. Most of children's engagement with soil, on the other hand, was playful, filled with embodied discovery. By noticing, engaging and thinking with soil I was moved to think differently. Following Kimmerer's (2013) example of plants, who "communicate by what they do" (p. 128), I noticed what soil did, and how soil's acting upon the world was "laden with meaning" (Kimmerer, 2013, p. 20). This meant noticing the relationships in which soil was involved in gardens, what soil did and what soil accomplished. By spending time noticing what soil assemblages did, I got entangled with soil as a matter of concern, an assemblage of shifting relations that acted upon its surroundings, as well as upon themselves. The process of inquiry with soil became deeply involved in, and a part of, the assemblages that came together in the research process, and intra-acting from within them. Thus, data generation became a fluid and leaky process that occurred as part of the ongoingness of soil inquiry, permeating human and more-than-human bodies as soil grabbed on to our hands, shoes, wings and fur, while holding and sharing stories about matter, space and time. Through noticing soil as a matter of concern, intra-acting in and beyond gardens, I attended to how soil acts within

more-than-human assemblages and to notice the realities, and garden-worlds they dynamically create together, all of the time.

During a field research period of 3 months I frequently visited a school garden, a community garden and a private garden. These gardens offered a variety of material structures, gardening goals and relationships, embodying various ways of relating to the more-than-human world, and to soil as a matter of concern, rather than a matter of fact universal medium for food production. Co-creating the inquiry process with soil lead to an ontological and epistemological shift where thinking with soil's creative potential, noticing difference across the agency of more-than-human assemblages which are typically left out of educational scholarship, allowed crossing boundaries between language, reality, interpretation, nature and culture (Koro-Ljungberg et al., 2018). Inquiry's multiple becomings with soil lead to "thinking the unthinkable" (Koro-Ljungberg et al., 2015, p. 618; Haraway, 2016) and welcoming the new methodological directions. This way of conceptualizing qualitative inquiry with soil, allowed research to open up to the more-than-humans different modes of being and knowing, making space for sensibilities and affects in a practice of "thinking differently about the world and about our possibilities of acting within it not only scientifically and practically but also ethically" (Glăveanu & Sierra, 2015, p. 342).

I embarked on a journey to "think about qualitative research differently, often in creative ways, continually questioning existing grand narratives and dogmas" (Koro-Ljungberg, 2015, p. xvii). I engaged with soil by planting, weeding, walking, sitting, observing, smelling and even tasting soil. I got soil in my eyes one windy afternoon and soil under my fingernails most days. My shoes still have mixed soil from the gardens, as

do the feet of the ground squirrels and chickens. I watched as soil engulfed seeds, cradling them together with water, opening up for plants to emerge only a few days later. I noticed how children played with the loose dry desert soil, and how a bird peckered through rocky soil looking for insects. I fled when a garden roach climbed from the ground onto a wall, and felt crushed when a sand storm knocked down most of the kale seedlings. I laid on soil looking up, and dug holes in it to try to see the fungi networks beneath the mushrooms. I followed soil relationships through children's stories, and through their play. I listened to adult gardeners and teachers talking about soil's deficiencies, and about how much hard labor goes in working with the land. I saw soil being ignored and cast aside, and saw soil being at the center of all that happened in the garden. I noticed soil receiving gifts, and got to know some of the land's children that grew in native soil. Much like soil's multispecies creative web of being doesn't end at the edge of the garden, I didn't cease to be a part of soil relationships when the research ended. Soil is still at the bottom of my boots, still stuck to the edges of my trowel, still often under my fingernails. Above all, soil and I became close, sharing and learning about grounding, about reaching out, about being receptive, adaptable and reliable. Soil turned out to be a lively co-creator of gardens, but also of life outside the garden, offering care, life, shelter and meaning while directing, suggesting and participating in relationships that arise and are dissipated. Soil shared many stories and messages, all firmly rooted in soil's main way of communicating - touch.

Digging into Soil's stories of learning

While noticing the many relationships in which soil is engaged, it became clear soil's potential to work as a powerful link to (re)create and maintain mutually beneficial

more-than-human relationships in gardens. Soil stories highlight how a shift to engage with soil as a lively matrix challenges unjust utilitarian systems that disconnect humans from the natural world, while offering possibilities to reconfigure the relationships of kinship through soil. By digging into soil stories, learning and meaning that exist and are created through soil relationships emerge in caring engagements.

Soil establishes tactual relationships. Soil relates and communicates through its dispersed materiality, its capacity for physical contact. Engaging with humans in the garden, soil grabs our skin, clings to our clothes, lodges itself under our nails, making us transport it from place to place across great distances. Engaging with water, soil immerses itself, mingling with water and becoming mud, which attracts insects and birds that move it across land and air in their feet. Soil embraces seeds, keeping them from the dry air and the hot sun, gaining air tunnels as the seeds sprout and shoot roots to the depths of the earth. Soil holds plant roots offering support and structure so they can grow tall, soil houses a network of invisible fungi mycorrhizae in its pores helping to send nutrients and messages across space and species borders. In turn soil gains a vibrant network of vegetation that protect it from erosion. For insects soil is home, offering burrowing grounds and protection from predators, who in turn give soil seeds and nutrients that allow for the continuity of vegetal and animal life. Through its tactual ways of relating, soil holds organic matter, making it available to plants, which pass it along the food chain to all forms of life on Earth, including those that make up and continuously co-create soil itself. Soil reaches out to other beings through touch and receives tactual information back.

The reverse is also true, other beings can communicate with soil by touch, children stomping their feet as they run after chickens, insects digging tunnels and nests below soil's surface, plants shooting roots to the depths of soil, forming partnerships with microorganisms to get sustenance and strength. Humans communicate with soil in the garden when we push our hands into soil poking holes to plant seeds, or pile soil up in mounds for garden beds, when we step on it to run and play, when we pick it up with our hands to feel the moisture. Soil is a being that relates through physical contact, thus, the stories that compose soil relations in this article reveal the many ways that soil is involved in touching, grabbing, holding and otherwise contacting all forms of life around it.

School garden

In the school garden, interactions between soil and children involved a lot of observations. Soil was observed during science lessons, emerging initially as a topic of scientific knowledge in science books, where children learn about soil types, composition and fertility, then learn about soil-plant ecologies and human uses of soil. Since children were discouraged to pick at the garden when school is not in session, as to not disrupt any lessons that may use it later in the day, they didn't play closely or touch the soil near the garden in their free time. Younger kids seemed interested in sitting on the ground to play with soil, and a few of them played on the ground at a distance from the garden, where they could run their fingers across the ground, gathering little mounds of soil as part of their play. "We're building houses," they said, "for the fairies and the mushrooms." Once the children left, the little mounds of soil were carried away by the wind, its particles easily transported due to the prominent shape of the "houses." The children did not play

with the soil in the vegetable garden, but they played in the native soil, away from the garden and the grass, where they were free to touch and gather soil in imaginative play. They didn't play with the garden soil, because "that [soil] is not good for building houses, it doesn't hold," plus they were told not to dig or move the soil away from the garden beds, so they didn't.

The soil in the school garden was bought from local garden centers, delivered in bags marked "vegetable garden soil for in ground use." The garden specialist explained that that was the most important purchase they made, because the local soil is one of the poorest in the country for gardening, too compacted, alkaline, filled with rocks and salts, and they were also concerned with soil pollution. While concerns with soil pollution and toxicity are pertinent and forefronted in urban gardening, posing important reflections about the urban and industrial impacts on human health and environmental protection (Willison et al., 2020; Ramirez-Andreotta et al., 2013), the soils in the gardens in this study were tested for contaminants according to USDA directives and cleared to be cultivated (USDA, 2021).

So in order to make the garden successful, they needed to buy better quality soil. They used a large sum of the grant money to buy bags of vegetable gardening soil that was tested and fertilized by the teachers with the help of older students. The garden soil was placed on the back of the lot where the garden was being built, and was spread into rows on top of the native soil, divided with straw guards and mulch. That is where all the vegetables were planted, and that is where students engaged with the garden and otherwise investigated matters related to soil health, biodiversity and ecological relations. Whenever the word "soil" was used, it referred to the bought soil used in the garden beds.

Children sparsely handled soil during class activities in the garden, in lessons that focused on the water cycle, nutrients cycle, plant nutrition and soil fauna. The school had recently built a chicken coop, and the chickens were often let out of the coop in the mornings if a class came to visit. The chickens were not very interested in the garden, perhaps due to the fact that they were let out of the coop after being fed in the mornings. Nevertheless, the chickens were very interested in pecking and scratching the native soil looking for insects, and they spread around the coop foraging, digging and rolling around in the soil, giving themselves dust baths. A 4th grade teacher took her students every morning to visit the chickens before class started. Some of the chickens enjoyed being held by the children and would allow kids to pick them up, carry them around and sit with them under a tree. Other chickens preferred to be pet, but not held, and the kids followed those ones around offering them some more food or helping them corner crickets and other small insects. The class played and observed, sometimes harvesting eggs, other times running with their chicken friends and naming the new ones. After a short while, little dust devils rose up as the kids ran away back to class, seemingly waving them goodbye. Every morning after the class leaves, the soil all around the coop was marked with small shoe prints, scratch marks and children's finger drawings, which shared space with small holes dug by both. The soil was deeply involved in the child-chicken-soil-insects multispecies engagements, made evident by the marks left by children's and chickens' feet, feathers, scent and droppings, housing the stories of the chickens, and the children that love them. The native soil shared its tactual way of relating to other beings and knowing their common (hi)story in ways that left marks sketched in soil itself and in the bodies of all other beings involved. Neither the chickens

nor the children engaged with the ‘actual’ garden during those early mornings, even though they were enjoying somewhat free and unscripted time in the school yard. The native soil, however, was a lively participant in those relationships, gladly receiving the chickens' scratches and dug holes that aerated its compacted nature, while offering a safe playground, where they could run and dig without worry. The chicken in return got insects and a fun time of foraging, and the kids got to play with their chicken friends while enjoying worry free play time.

Community Garden

The community garden was established many years ago, and to start the garden off, the first gardeners mixed native topsoil with store-bought soil they were able to purchase. Since soil is expensive, they found that loosening the topsoil and mixing it with store bought was a more economical solution to be able to grow vegetables on a tighter budget. The gardeners have maintained that practice and still mix both soils whenever they are able to build another garden bed. They have found that mixing native soil does not decrease productivity, and it saves them from having to spend more funds. The community gardeners compliment this mixed soil with the products of the compost pile they maintain, adding compost to the garden beds twice a year. While the compost pile offers rich nutrients to the soil and garden plants, it has been a source of conflict for the senior gardeners, who do most of the labor regarding soil management. After running into issues with new gardeners bringing materials from home that attracted rodents and insects, senior gardeners moved the compost pile to the back of the garden and are now the only ones allowed to handle it.

The gardeners have another reason for mixing native soil and store bought soil, besides cost issues. They want to ‘harden off’ the plants, making them more resistant to the local conditions. They believe mixing native soil introduces the plant’s roots to the harshness of the desert conditions, which the roots will encounter as they grow further below the mixed soil. While we had our hands in the soil planting seeds, I asked a couple of senior gardeners how the soil in this area was for gardening. One of the older gardeners, with her fingers forcefully plucking weeds from the garden bed edge said:

You have to work with what you have. It is what it is. The soil... The soil here is salty, did you know that? There is no way around it, it’s a fact. But it's not sustainable to use store-bought soil. To buy it I mean. We gotta work with what we have. We use the soil, add compost a few times a year.... This is much more sustainable, I mean, for the community. What’s the point of a [community] garden if they have to buy a hundred dollars worth of stuff to even begin? That won’t bring people [to the garden]. My grandmother had a garden, and they didn’t have Home Depot then! So... It’s possible.

Another gardener interrupted:

Plus, some plants actually prefer alkaline soils, you know? Like the winter crops, they prefer a lower PH, so the desert soil... It brings the PH down and they grow really well, did you know that? And the plants keep the soil healthy too, like the beans. But you know, for vegetables.... They need more. So the [store bought] soil is the only way for the veggies and the two [soils] work really well together.

The first community gardener talked about mixing the two soils as an economically sustainable option to use the native soil as a free natural resource. She also talked about maintaining the soil fertility by enhancing it biannually with local compost. Perhaps using the native soil wasn't her first option, but she recognized it as a component of the environment that could contribute to their gardening practice, therefore acknowledging the soil's existence and incorporating it into the gardening assemblage. The second gardener mentioned another interesting assemblage between the native soil and the store bought soil, and how they worked well together. While the first one seemed reluctant, or perceived local soil in a somewhat dichotomized relationship between native soil and 'fertile' soil, the second gardener focused on the soil-to-soil relationship, revealing her attention to how the two soils were working together to favor the growth conditions that were actually optimum for some of the crops, and thus for humans as well.

Community and home gardening differ from school gardening by affording a slower pace of human activity, where gardeners linger in the garden for several minutes or hours, offering space for the (more-than-human) community to negotiate their presence in urban areas (Tracey, 2007). In the community garden kids and adults engage with the mixed soil in the garden beds digging, planting, harvesting and weeding together, although the younger kids often gather near the hose to play in the mud that forms under the dripping faucet. One afternoon, one of the parents gave the kids a packet of native flower seeds and told them they could plant those to attract bees in the spring. The kids grabbed a hoe and a trowel and headed to the edge of the lot by the fence. They walked around looking down and then up before beginning to dig a few shallow holes.

Once they returned to the garden beds a 7 year old said: “We planted them in our secret spot. I can’t tell you. But it’s because the flowers... These flowers... The flowers are from here, I mean, they will get born here, like my sister.” His mom explained that they boy was born when they lived on the east coast, but his little sister was born after they had moved here. The 7 year old continued: “These flowers grow here in the desert, so they like the hard rocks. And... And also...the rocks like them too. And the bees fly through the fence, so they can smell the flowers over there by the fence.”

The boy’s explanation pointed to his perception that the native flowers will grow well in the native soil, therefore that is where they planted them, instead of planting them in the garden beds, which don't have rocks. The children felt it was best to plant the flowers in the native soil, both for the plants' sake, and for the soil’s sake. They both liked each other and together would attract bees to the garden. The native soil by the fence would serve as an in-between space that would work together with the native flowers to attract the bees to the rest of the garden, something that apparently the soil rich in organic matter that grew vegetables could not do. They were happy to dig the hard rocky soil, and proceeded to carry heavy watering cans to the fence to water the recently planted flower seeds. The children seemed to already have learned soil lessons about taking time to get to know their neighbors, and about belonging to a place on Earth.

Native Garden

In the native garden, even though soil engagement was just as frequent - planting, harvesting, walking around in the garden - the word ‘soil’ was never mentioned. Instead, the native gardener spoke about the land, and the land’s capacity to provide. Whenever

we were going to pick something from the garden, she placed something on the ground, or dropped a bit of water from her bottle.

In my backyard I'm really fortunate that I have these plants, this cactus is one of the plants that has the most amount of calcium in the world. Before we are allowed to take anything from the desert we always have to offer something for thanks. We consider... We consider that everything... Everything is alive, and the plant is one of our relatives. So I give the plant some tobacco, or offer it a little bit of water, because you want to always have balance. In order to take something from the land, I'm giving the plant some water. When we take, we are also giving too.

Her gestures towards the land and its gifts showed her appreciation for the land, as well as a recognition of soil as a living being with whom she engaged in a reciprocal relationship. She acknowledged soil's message of abundance and sharing by responding equally, with gratitude and with an offering in return. Her care and appreciation extended beyond offerings, to how much she took from the land. She never harvested the entire plant, always leaving some fruits for the animals and some leaves so that the plant could regrow. She frequently talked about native plants and her relation to them as relatives, part of the same family, mentioning their personality and how the conditions of the desert land favor such sweet or spicy flavors. She explained how the native plants and other plants that grow well in deserts have evolved to live well with the desert's conditions, their roots are adapted to the dry and rocky conditions and their leaves retain water. Their bodies are suited to living in this land. In the native garden, soil was not a component of

the garden, or a medium for vegetable production, or even a component of the landscape, but kin, a friend or a family member.

Diffraction through soil stories

As I noticed soil relationships and collected the threads of soil stories, those stories were no longer isolated, hidden, or bound by time and space. Oftentimes following one soil relationship, for example the relationship between native soil and store bought soil, evoked other stories - stories about connection, disconnection and cooperation. This crossing of relations and stories, created an interference pattern (Haraway, 1997) and opened up the “possibility of a diffractive mo(ve)ment” (Davies & Gannon, 2012, p.371). Together, soil stories revealed new pasts, presents, and futures. Noticing soil inherently entangled multispecies multimattered stories among and across each other as an exploration of the multiplicity of soil relations, allowing for embodied relationships to remain entangled and affecting me “in a process of becoming different” (Davies & Gannon, 2012, p. 361). I experienced noticing soil as a matter of concern and matter of care not as reflective but as diffractive work (see Davies & Gannon, 2012). Diffraction is “the practice of reading insights through one another while paying attention to patterns of difference” (Barad, 2011, p. 3) revealing soil worlds and opening them to us.

Diffraction through soil stories helped me understand the multiple worlds that were entangled in soil’s becomings providing “a way to illuminate the complexity of the always/already entangled processes of dis/continuous becomings that make up what we are used to calling ‘world’” (Thiele, 2014, p. 207). The concept of diffraction also helped me through the weaving of soil’s stories by “a mapping of interference, not of replication,

reflection, or reproduction” (Barad, 2014, p. 168) where difference in stories, and in the relations established with them, is constitutive of those entangled worlds.

The concept of diffraction was also present in the analysis of soil stories. Working through soil stories I strived to dissolve the illusion of separate, preexisting entities or selves (Davies & Gannon, 2012) and did not search for sameness (Mazzei, 2014). This diffractive analysis of soil stories moved away from an attempt to reflect theory and away from a search for themes that emerged from the stories. Instead, I identified entry points that invite the reader into stories of common worlding. Mazzei (2014) describes this process as reading the data “through multiple theoretical insights [moving] qualitative analysis away from habitual normative readings toward a diffractive reading that spreads thought and meaning in unpredictable and productive emergences” (p. 742). A diffractive reading of soil stories allowed reading stories *through* one another to discover how they made differences and produced situated interferences (Haraway, 1992). It helped me to “resist the urge to separate in order to clarify” (Thiele, 2014, p. 209) and allowed me to follow the entry points that the stories triggered, according to what rippled in my mind and body.

As I engaged with soil in the three gardens, my attention shifted to the ways that soil engages and communicates, remembering the “many power producing binaries relevant for education: real/fantasy, human/animal, inside/outside.... work/play. They structure what counts as real learning and who and what is included and excluded” (Adams, 2011; Haynes & Murriss, 2017, p. 7). In this context, slow engagements and pedagogies of care re-emerge as central elements of learning with more-than-humans, disrupting not only the notion of a binary distinction between humans and others but also

our understanding of our own place in the world(s). In this inquiry practice, careful engagements with soil as kin transform all kinds of beings into lively co-creators of reality. Noticing soil relationships exposed “a complex network of human and nonhuman agents” (Mazzei, 2017, p. 680), which exposed “the possibilities for the iterative reconfiguring of the materiality of human, nonhuman... and other such forms” (Barad, 2007, p. 178).

Learning with soil as a matter of concern came through soil stories of embodied relationships. In contrast, learning about soil as a matter of fact occurred mostly through disembodied relationships with local soils, including exclusively cognitive activities such as reading, and distanced observations of garden soil. In the school garden, teachers directed children to observe soil at a distance or touch it through plastic bags. Children held and squeezed the plastic bag in order to take notes regarding soil color and granulation. By presenting soil as a universal medium for food production through disconnected or disembodied experiences perpetuate soil as a matter of fact, keeping students away from soil’s lively engagements, its ways of being and doing, its stories. Garden soil was treated as a resource for producing food and scientific knowledge, being limited by adult narratives for those purposes. As a result, children in school did not engage with the garden soil on their own or when they were allowed time to play. Instead, children played with the native soil away from the garden, building houses and running around with chickens, in joyful, lively entanglements.

Additionally, by design, in the school garden, vegetable garden soil was placed on top of native soil, in a material-discursive practice that showcased that local soil did not matter, as it does not have utility for human purposes. Although the garden offered many

scientific opportunities for learning about soil, the very practice of ignoring the local soil in favor of more “productive” soil for vegetables imposes a further disconnect of people from soil, from the land that is being cultivated. By focusing solely on scientific ways of knowing, native soil was approached an unproductive matter of fact and therefore deemed useless, discarded, and silenced. Store bought soil, on the other hand, was placed on top of it, replacing native soil and erasing its presence from the garden. The store bought soil too was silenced and portrayed as lifeless matter to be observed and studied (but not touched) as a recognized, productive component of the garden, difficulting a relationship with the local soil, with the land. What is learned then is a detached utilitarian relationship with the land, that reveal that more-than-human and their stories do not really matter, instead, they can be buried under that which is fast-producing, easily modifiable, and useful to (re)produce the status quo of learning about (but not with) the local environments.

Similarly, adult’s frequent comments about soil in the school and community garden portrayed soil in a permanent state of insufficiency, reflecting a perception of soil as poor, inadequate or possibly contaminated, and thus in need of human intervention towards improvement and productivity. In the school garden store bought soil was not only placed on top of native soil, but treated and balanced with the exclusive purpose of growing food for humans, revealing the story of soil/human engagements permeated by a state of insufficiency in need of correction in order to remain productive, a marker of nature’s “adequacy” in humanist terms.

If the experiences that we create to favor people’s engagement with urban nature are utilitarian - detached matter of fact experiences with a perceived dead and inadequate

soil - that is what we are favoring to be learned. Kimmerer (2013) reminds us that caring is not abstract. Even if science teaches us facts and figures about the soil and its implications in helping solve the environmental crisis we face, does that mean that people learn to care? Kimmerer (2013) reminds us that “caring is not abstract” (p. 239), meaning that one cannot claim to care while remaining detached or engaged in exploratory relationships. To engage in care-full relationships with soil, it’s necessary to engage in reciprocal and ethical response/ability, having time and opportunities to act, to be not only intellectually but affectively and physically engaged with the land. “In learning reciprocity, the hands can lead the heart” (Kimmerer, 2013, p. 240).

In the community garden, people have more time and opportunities to get involved in labor-intensive gardening activities. Children that attend the community garden with their parents stay for an extended period of time and have the time to free play with soil while parents are doing other gardening activities. They are generally allowed to touch soil with their hands, carry its heavy body on buckets, poke holes to plant seeds and remove weeds’ roots from underneath the soil with their bare hands. Their tactual experiences bring them closer to what local soil is and where it lays, and gives them more opportunities to engage and learn with soil, through soil’s ways of being and doing, which is touch. These children, covered in soil by the end of their gardening day, had soil clinging to their clothes, their hair, latched under their fingernails. They continued engaged with soil beyond their garden work, on their way home, when their parents helped scrub the “dirt” off of them at home. Soil is relentless in sticking to those who engage with it, and they carry soil with them home, having the opportunity to experience learning what it means to be part of the land, to not only be on top of it, but be

immersed in it, to have it filling your imagination with its stories, connecting you to the land. Similarly to what happened at the school, children in the community garden often engaged with the native soil more often than with the mixed soil in the garden beds. In the wildflowers seed story, children knew the native soil, and knew what would grow well in it.

Community building extended beyond the human gardeners into the more-than-human communities through children's knowingness of soil, their perception of soil entanglements beyond the garden fence, inviting bees in a cyclical matter of care and resistance against utilitarian and disposable relationships (Pudup, 2008). Children's relationship with soil revealed their awareness of the companionship between native soil and wildflowers, acknowledging the compatibility and friendship between local soil and local plants. They knew that the native soil by the fence was an important actant in the gardening assemblage, and purposefully engaged with it, disrupting logics of detachment and utilitarianism, relating to soil on the pace of care.

In the native garden, soil-non-human relationships were established as reciprocal care. There was acknowledgement, exchange, understanding and respect. Soil is not spoken about (or to) as a component of the landscape, or as a deficient medium for plant growth. The word soil was hardly even mentioned. The indigenous gardener instead spoke frequently of the land, as a being, an entity that at the same time gives life and sustains humans and more-than-human beings alike. Stories about inhabiting the land, and the gifts the land and the rain brought were at the center of attention, in a reciprocal relationship of care and respect. No plants or plant parts were taken from the land without giving a gift in return. Touching the soil to plant and harvest was done slowly, with care

and reverence. The stories of soil and the land were not only stories about food, but of place, situatedness, and of time. Visions of soil told stories about the landscape, creating mounts, valleys, and mountains. The native gardener's perspective of soil as kin, to be treated with care and respect told stories of past, present, but also future, by making sure to leave some fruits for other animals and leaves for the plant to regenerate.

On the opposite side of the deficit discourse that permeated the school garden regarding soil, the native gardener did not perceive native soil as lacking or dangerous to engage with. Much like the community gardeners, the native gardener also discussed how certain plants thrive in desert conditions, including the soil conditions. She explained how the land held the knowledge to grow certain as did the plants to grow on the local soil. The soil remembers not only plants, but also those that “grow on the land.” Greeting and making an offer showcased how the land knew her, as no introduction was needed; instead, she simply offered a greeting as a friend who returns after a time of absence. She also offered a gift in return for her harvest, to let the land and the plants know that she was thankful, and to strengthen their bond. Kimmerer (2013) discusses the gratitude-based relationships that many native cultures share with the land, explaining that the land knows and recognizes people, especially “the ones who know how to say thank you” (Kimmerer, 2013, p. 36).

Younger children's perceptions of soil as life-giving and playful companion are approximate to the relationships that permeate the indigenous garden. For the indigenous gardener, soil is not treated as a component of the environment, something that needs correcting or complimenting, but soil is treated as the land from which all living beings come. Soil makes up the landscapes and its shapes tell stories of the past and of the

future. Much like the young children that told stories of inhabiting a world where soil is in close relationships with and even reaching out to people, soil stories in the indigenous garden teach us about the land, about our relationships to other beings and about ourselves. “In indigenous ways of knowing, we understand a thing only when we understand it with all four aspects of our being: mind, body, emotion, and spirit.” (Kimmerer, 2013, p. 47). Understanding soil through “relationships, stories.... and multiple other methods” (Windchied & Cummins, 2022) enable practices of care not only for soil, but with soil. Knowing soil required embodied, emotional, situated ways of knowing (Law, 2004) Extending to non-scientific nonhuman ways of knowing as exemplified in children's stories of soil and in the native gardener relationship with soil allows us to perceiving soil’s ways of relating, knowing, and creating, disrupting the idea that soil is out there in nature, passive in the field or in the garden waiting to be deciphered, collected, or enhanced for human purposes. Instead, engaging with soil through a more-than-human inquiry process revealed soil as a co-participant and knowledge maker within the assemblage. This understanding of soil is capable of sedimenting a shift in qualitative research, from working within binaries (human/nature; researcher/participant; subject/object, data/analysis) to soil relations as emergent co-creators of reality, allowing the materialization of new thinking.

Careful engagements with soil fostered “moment[s] of meeting, where things and forces and human and non-human beings come together in spaces of difference” in which “we decide how to respond—whether to follow, join with, intervene, provoke, [or] perhaps work against” (Pacini-Ketchabaw et al., 2017, p. 34). Choosing to join, both children and the native gardener experienced powerful moments that opened up space for

“learning to be affected” (Latour, 2004a), learning to care not only for their own survival but to care for and with those they encounter through soil. Humans, water, insects, plants, fungus and chickens were intra-active participants in soil encounters, affecting each other, listening and responding with minds and bodies, becoming affected, becoming different together. Carefully and respectfully noticing soil taught that even though soil may look still, it is in “care-full motion” (Woods et al., 2018, p. 52) with the world in ways we may not have imagined. Soil caring relationships with wildflowers and humans, revealed how soil also shapes humans, in a reciprocal relation where the “cared for conforms the carer too” (Puig de la Bellacasa, 2017, p. 219), even when we might think that humans are the ones doing the caring.

But soil’s capacity to inform and co-create better garden worlds does not depend on soil or humans alone. It is not only a matter of human initiative. The capacity to change the course of exploitation into a direction of care is always relational. Soil’s ability to engage in relational reciprocity may change depending on where it is, on who is engaging with soil and how. That is the importance of soil engagements as a matter of concern and of care. Opening up relational channels of cooperation, of give and take, creates an attunement to the rhythms, cycles, and doings of other beings, inserting humans and non-humans in a common matrix of care and ethical relationality, grounding the future in reciprocity. By inhabiting that relational more-than-human matrix of care enable humans to further deconstruct the detachment from so-called natural spaces such as the garden, as existing separate from human spaces, noticing soil’s persistent existence beyond designated garden spaces, crawling on to the sidewalk, falling into cracks in the pavement, sticking to shoe soles, being blown by the wind into our eyes. Soil is

everywhere, reminding us of its liveliness, it's capacity to contribute and inform our ways of living and thinking, shaping and co-creating our worlds.

Focusing on the agential assemblages and lively soil stories works as “a strategy that makes room for relationality.... the ways in which humans and more-than-humans are integral parts of the universe” (Blaise et al., 2017, p. 39). Learning with soil stories offer opportunities to reconceptualize pedagogies of care, learning to understand what it means to care together with soil (instead of exclusive human care for soil), enabling questions regarding “who gets to care, who is constructed as deserving of care or as a passive recipient of care, [which] shapes consequences and influences the way we world together” (Woods et al., 2018, p. 56). The pedagogical openings that emerge through the diffractive analysis with soil may help us articulate the kinds of conditions necessary for living “well together in the more-than-human common worlds that we inherit” (Common Worlds Research Collective, 2020). Following soil stories as entry points, we may elaborate new pedagogical practices that emerge from soil relations.

Through soil stories of careful reciprocal relations, we learn to consider more-than-humans as “narrative subjects” (Plumwood, 2002, p. 175), weavers of stories, and carers of place (van Dooren & Rose, 2012; Woods et al., 2018). Attending to soil's relational worlding and multiplicities of care “reminds us to shift our understandings and be care-full in our practice, to think with pedagogies that enmesh matters of concern with matters of care” (Woods et al., 2018, p. 56). Soil invites thinking with the intra-active, messy, affective, embodied moments of touch and care that bind us together. It also invites us to ponder the stories we tell ourselves about soil and our own role in these challenging times, to how we want to continue to engage and teach through soil relations.

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Chapter 4

Reattuning to The Living World: Life and Learning Under the Debris

Abstract

Shifting the focus to the garden spaces that remain out of sight of human-centered inquiry, this article pays attention to what happens under the debris in the abandoned corners of the gardens, suggesting that these spaces hold many creative possibilities for more-than-human engagement and learning. To learn more with this underworld of possibilities, it is important to shift the research focus to those areas that escape human care and control, attuning to these apparently lifeless (Marder, 2013) piles of debris, while moving beyond human-centered ways of perceiving the world, including the garden world. This shift could move education beyond human-centered ways of knowing and being, affording opportunities to learn with these perhaps unattractive and unproductive areas of the very spaces that are designed to offer humans natural beauty and bounty.

The Debris: Garden Life Without Human Guidance

Most gardens have an abandoned corner. Sometimes that's where the tools are gathered, other times it's the space near the compost pile, the area near the trash bins, a patch where it is too hot or too shaded, too narrow, too steep, or simply a corner behind the garden beds where nothing grows, where the wind gathers dry leaves and dust. There, out of sight of gardeners and researchers alike lie forgotten objects, broken items, discarded scraps, and organic matter. What may initially appear as abandoned and uninhabited is, on closer inspection, full of life. Under the piles of debris, insects may find shelter, moisture may be retained in the soil longer, birds, insects, and reptiles may find refuge, and weeds might find just enough space to sprout and sprawl. One thing is certain though, in these abandoned corners, there will always be life under the debris.

Much of Western research done in gardens, including education research in learning gardens, does not pay attention to these abandoned corners. Rather, it focuses on neat rows of cultivated land that showcase how humans make productive use of the land - maintaining and managing some plants and animals, while killing off others - foregrounding utilitarian and exploitative relationships between humans and gardens. Typically, educational research in gardens examines experiences with growing and harvesting food, and the educational benefits of learning and spending time outside (Williams & Dixon, 2013; Berezowitz et. al, 2015; Broad, 2016). If non-human beings (whether living or nonliving) are mentioned at all, they are usually depicted as passive or in need of human care (Merchant, 1990; Plumwood, 2009; Taylor, 2017).

Shifting the focus to the garden spaces that remain out of sight of human-centered inquiry, this article pays attention to what happens under the debris in the abandoned

corners of the gardens, suggesting that these spaces hold many creative possibilities for more-than-human engagement and learning. To learn more with this underworld of possibilities, it is important to shift the research focus to those areas that escape human care and control, attuning to these apparently lifeless (Marder, 2013) piles of debris, while moving beyond human-centered ways of perceiving the world, including the garden world. This shift could move education beyond human-centered ways of knowing and being, affording opportunities to learn with these perhaps unattractive and unproductive areas of the very spaces that are designed to offer humans natural beauty and bounty.

Drawing on Indigenous, critical posthuman, and non-Western scholarship, this research weaves together more-than-human theoretical concepts and methodological possibilities in a practice of attunement to the living world (Kimmerer, 2013; Jensen et al., 2016), embracing a way of being and gardening that is always mutually interferent, in constantly shifting reciprocal intra-actions with the world (Barad, 2007). This paper contributes to the scholarship on learning garden putting concepts and philosophy to work in an inquiry process focused on attuning to all forms of life that act and cocreate gardens. This article describes a gardening inquiry practice that focused on (re)engaging in relationships with multispecies, multi-mattered kin (Barad, 2007; Chandler, 2013; Haraway, 2015) over the course of three months in a community garden, a school garden and an Indigenous garden. This article embraces the enchantment (Simas & Rufino, 2020) that emerged through the cracks of Western scholarship when a porous creative methodological practice moved inquiry away from human-centered mastery and

exploitation, into a practice of attentiveness to the various agential multispecies, multimattered assemblages with the living gardens.

The article begins by weaving together concepts from Indigenous, non-Western, and posthuman scholarship to examine life and learning under the debris. Next, I explain how these concepts are put to work in a methodological practice of attunement (Jensen et al., 2016) to the living world (Kimmerer, 2013) of more-than-human agential assemblages (Barad, 2007) in the context of different gardens. Following the theoretical and methodological weaving, I present a narrative story of a bird's invitation to recognize an unexpectedly lively agential assemblage in the garden. As I followed the bird's invitation, the research attention moved beyond the cultivated areas of the garden, bringing into focus a dark abandoned corner with a pile of debris. Finally, I offer an analysis of how inquiring *with* the living garden enabled ways of knowing that are “not thought knowledges but rather lived knowledges” (de Souza Santos, 2018, p. 2). In this process, inquiry shifted away from human-centered, Western ways of knowing (and gardening), and instead opened possibilities to learn with the living world, recognizing the ontological and epistemological multiplicity that emerged from under a pile of debris.

Animating the debris by attuning to an enchanted bird path

Gardens are typically cultivated in urban areas to produce food, offer places to exercise, build community and offer places for people to engage with the natural world (Fenandez, 2003; Taylor, 2013; Cairns, 2018). Seeds, plants, fruits and flowers offer a bounty of opportunities to engage and learn with the land in close contact with both humans and more-than-human beings in the garden. Nevertheless, more-than-human engagement is not limited by the benefits gardens offer to human beings, nor does it end

at the border of the garden beds. Instead, more-than-human relationalities abound in the overlooked areas that escape human control and interest. These leaky lively entanglements often remain unnoticed in garden scholarship; but there too unsupervised encounters sprout new life - a life perhaps less ordained and less “productive” than that cultivated in the garden beds, sometimes even considered dangerous to human eyes.

Most of Western scholarship, including educational scholarship, stems from the underlying ontological framework in which humans are considered exceptional over other earthly creatures, due to the capacity to reason, to create knowledge about the world and communicate it to other humans (Bang et al., 2014; St. Pierre, 2016; Nxumalo, 2019). Reason, the beacon of modern Western civilization since the Enlightenment, is thought to make humans superior to other beings in the natural world (Hedge, 1998; Bang et al., 2014), and thus righteous to manage and explore it through science and technology (Leiss, 1994). Other forms of life, devoid of rationality, are perceived as lifeless (Marder, 2013), passive or reactive, and thus, devoid of creative or generative capacities, being placed under the sovereignty of human masters (Merchant, 1990; Taylor, 2017; Nxumalo, 2021).

The illusion of detachment and desire for controlling nature characteristic of Western scientific discourse (Leiss, 1994; Hunt, 2000; Latour, 2018) is materialized in gardens in unidirectional exploitative relations (Ostertag, 2015) that span from the selection of edible plants and their ordering into separate rows, to the elimination of native plants and weeds, and the abandonment of unproductive areas of the garden. Gardens’ material construction also showcases human-centered goals, which can be seen in the separation of cultivated beds with clear bordering walls, the composition of a

balanced and enriched soil used to grow select plants which are organized and labeled, then protected from animals until their fruits and flowers are mature for human consumption. Western ontology in gardens “comes to matter” (Barad, 2007) through material-discursive implications showcasing how rationalism, objectivity, and detachment work as a function of exploitation and profit in a gardening practice that separates thinking from care and responsibility. Ignoring what lies beyond human interests, human agency, and human rationality, (rational) humans feel entitled to take without giving back, to exploit without considering future generations (human and otherwise), and to abandon land that ceases to be easily managed, productive or profitable.

Similarly, learning in Western frameworks most often takes place through teacher directed opportunities to gain (rational) knowledge about specific topics in the world, rather than learning with the world, or rather “learning to become with the world around us” (Common Worlds Collective, 2020, p.3). These opportunities often focus on “thought knowledges” (de Souza Santos, 2018, p. 2) transmitted through reading materials that offer universalized cases in a static snapshot, which do not account for the “ongoing articulation” (Barad, 2007, p. 149) of the world, or “lived knowledges” (de Souza Santos, 2018, p. 2). Learning in Western gardens then is framed in human exceptionalism terms, where humans are the holders of all valuable knowledge (as are teachers), are superior and thus in control of the passive garden (Leiss, 1994, Plumwood, 2009; Marder, 2018).

Many non-Western ontological frameworks, like non-Western and Indigenous ontologies, offer worldviews in which humans are not centered or above other creatures, perceiving all things in the world as living beings who constitute a living world

(Kimmerer, 2013) through always emerging lively entanglements. A world full of animate beings, including humans, plants and animals, rocks, water, soil, and beyond (Kimmerer, 2013), offers possibilities to decenter humans in research as well. In order to engage with the living world, research needs to pay attention to other beings' ways of living, feeling, communicating and otherwise acting in the world. Indigenous understandings of the world are shaped by experiences of kinship amongst a living world, in which more-than-human beings are agents in constant co-construction of worlds. Similarly to Indigenous scholarship, non-Western scholarship, offers experiences and theorizing that is built in reciprocal relationships with the world, attending to the more-than-human assemblages that emerge in our everyday multispecies lives. In Western scholarship too, posthumanism and its associated methodologies resonate with Indigenous and non-Western scholarship most closely. Posthumanism rejects Western binary notions of human versus nature, considering instead the inherent enmeshment of more-than-humans (humans, non-humans, and matter together) that act together in the world, allowing for possibilities to reconfigure what counts as human in research while making room for inquiry that focuses on emerging ways of being, knowing, and becoming-with all Earth's others (Taylor, 2017; Haraway, 2016).

Threading together elements of Indigenous scholarship, posthumanism, and non-Western scholarship opens an opportunity to enter a world of theoretical and methodological possibilities beyond merely involving the more-than-human, and instead, allowing for inquiry that is “rebuilt again and again differently in each context and time-space-matter” (Koro-Ljungberg et al., 2020) *with* more-than-human beings. Guiding this shift from dominant Western scholarship to a more-than-human research created in

motion with the world requires a series of ontological, epistemological, and methodological shifts too.

Ontoepistemological shifts: Learning with the living world

In indigenous knowledge systems, learning with - rather than about - the living world is learned-in-practice through engagement and relationships that involve material, embodied, affective, and spiritual experiences *with* other beings on Earth regardless of their productivity for humans (Windchief & Cummins, 2022). This implies that mere ethical discourse is empty unless accompanied by material practices that uphold the value of all forms of life (Braidotti, 2013), reminding us that “caring is not abstract” (Kimmerer, 2013, 239). Relational ways of learning are therefore more than an epistemological framework, but an ontoepistemological one, co-constructed in relation with other beings, human or otherwise. Relational learning then may lead to radically different ways of knowing, departing from unidirectional rational and passive ways, mostly characteristic of Western learning.

Learning with the living world occurs through flowing relationships between living beings, in contextual, emerging, messy processes that, as such, allow for adaptation that fosters the continuity of the multiplicity of life. In the garden, this ontoepistemological stance materializes in perceiving life that may happen in a forgotten corner where humans don't ever go, engaging with beings that may not look neat and be productive, with life that may even be unwanted in the garden, while learning in real life shifting environments where not only humans, but other beings flourish together. Relational learning is co-created beyond rational knowledge learned from school books and necessitates spending time with, engaging and accepting the invitations to listen, to

touch, to ask questions and to go on journeys with the living world. Learning with the garden, can inform rational learning from books, as the letters too may come alive by being invited into the experience, the exchange with the world. This article tells the story of how life (and learning) happens and flourishes in one of those forgotten corners of the garden, under the debris.

Methodological shifts: Arts of noticing and modes of attunement

Attending to more-than-human relationships in gardens requires “learning to be affected by different entities and relations” (Jensen et al., 2016, p. 164), in what Japanese scientist Minakata Kumagusu calls a “tactful” encounter or “a mode of attunement” (Jensen et al., 2016, p. 149). Jensen et al. (2016) explain that to be able to attune to encounters with more-than-human worlds, one needs “tact” - an ability to navigate life as it unfolds as an “interweaving of visible and invisible webs” (p. 159). Tact can be seen as the limit point where that which one has consciously learned encounters worldly surprises that go beyond rational learning. It concerns the cultivation of a receptive attitude toward the surprises of (nonhuman) things; an attention into other beings' ways of living that Anna Tsing (2013) calls the “arts of noticing” (p. 17).

Kimmerer (2013) describes this attentive way of being as a way of “being awake in the world” (p. 36), a gratitude-based way of living, that focuses human attention on an ethical and reciprocal relationality in/with other beings who are animate and have agency in the world. Being awake to the agency and thus animacy of more-than-human worlds helps humans perceive the small, the slow, the visible and invisible qualities of more-than-human beings by channeling our attention to the possibilities of intra-acting with each of them as kin (Barad, 2007).

Kinship with the more-than-human worlds removes hierarchies amongst earthly beings by revealing relational character of existence in radical opposition to Western Cartesian model of human exceptionalism: “I think, therefore I am.” Instead relational ontoepistemologies say: “We are, therefore I am” (Ziai, 2019, p. 324). Thus, intra-acting with and through more-than-human kinship relations reveals the leaky entanglements that arise scattered at every corner of the garden, entanglements that humans may enter through tactful encounters, as well as those that may escape human perception altogether.

Brazilian scholars Simas & Rufino (2020) describe these leaky entanglements of multispecies and multimattered agencies through the concept of ‘enchantment,’ expanding beyond worlding through the entanglement of enlivened beings into a project of futurity. They explain how Western logics of nature and human exploitation are colonial projects that oppress, mute and erase those who refuse to be depersonalized, commodified and eventually discarded by coloniality (Quijano, 2005). They propose the animacy of the world as an act of disobedience towards Western oppression, affirming enchantment as a mode of transgression and creation of other meanings to the world (Simas & Rufino, 2020). Attuning to the living world then is a practice of freedom from the Western shackles of rationality, detachment, objectivity, exploitation and death, serving as a foundation for a future mutually beneficial common world (Federici, 2018; Simas & Rufino, 2020)

Weaving these ideas into modes of inquiry with the living world invited a research practice that pushed beyond Western paradigms, beyond considering humans as the only agents, beyond reason as the only form of knowing. Attunement to the ongoing relationalities of the living garden as an enchanted process allows for recognizing not

only alternative ways of being and thinking, but also “alternative thinking of alternatives” (de Souza Santos, 2018) that may be effective in resisting coloniality, the ontological inferiority of the other and their knowledges in gardens, while revealing the ways that meaning and materiality are inextricably linked (Barad, 2014).

With the goal of embracing attunement to the animate enchanted entanglements in gardens I embarked on a gardening practice permeated by “reading, thinking, writing, and living with theory” (St Pierre, 2017, p. 2), while weaving a porous creative methodological practice that “illustrates the infiltration of ideas and traditions” (Koro-Ljungberg et al., 2020) in “experimentation in contact with the real” (Deleuze & Guattari, 1980/1987, p. 12) world of gardens. In doing so, I also (re)attuned to my own experiences of attention and communication with the natural world growing up in South America and began attuning to new entanglements as I frequently visited and volunteered at three gardens while living and studying in the Southwest United States. Over the course of several months, I observed and practiced gardening in a community garden, a school garden and a Indigenous garden and re-engaged in relationships with multispecies, multi-mattered kin (Barad, 2007; Chandler, 2013; Haraway, 2015). I practiced this attunement in the gardens, spending time with them as I do while getting to know a friend, letting their agential assemblages take the lead in “what was happening” in the garden. In this process, the ongoingness of those lively entanglements as the lines between human, more than humans, rationality, affect, embodiment and beyond we no longer distinct, in a thinking/feeling/sensing ontological performance of the world in it’s “ongoing articulation” (Barad, 2007). This attuned inquiry process created openings to “receiving the [garden’s] gifts with open eyes and open heart” (Kimmerer, 2013, p.222),

even when those gifts happened to be buried in unexpected corners of the garden/under a pile of debris.

Attuning to the animacy of the world opened a pathway of inquiry that attended to embodied, affective and sensory experiences (Abram, 2012) shared with the more-than-humans while thinking/feeling/being with the gardens during data co-generation and beyond. These more-than-human agential entanglements (Barad, 2007) in the garden were at times sensorily felt (the wind blowing, a thorn, a smell, sounds), visually observed (plant growth, the abundance of bugs, a person tending a garden bed), sensed (a feeling of joy or sorrow, an intuition, a dream), or otherwise communicated in languages that are not necessarily verbal, like explained by Kimmerer (2013) in describing a conversation with plants:

I have a question for them, but since we don't speak the same language, I can't ask them directly and they won't answer verbally. Plants answer questions by the way they live, by their responses to change; you just need to learn how to ask. (p. 158)

Thus more-than-human communication entails noticing and attuning to other modes of being and acting in the world, remaining in close engagement, lingering with these beings and places through the flowing - and sometimes knotted and entangled - relationships that arise and dissipate in order to learn to listen, in order to learn how and what to ask (Kimmerer, 2013).

Noticing the more-than-human life in gardens is not a troublesome practice. Plants are abundant, animals are a frequent sight, and soil and water are part of daily engagements. Noticing the more-than-human relationships in the garden is constitutive of

gardening, humans, soil, water and sun working together in cultivating even more relationships with seeds, plants, animals, fruits, time and space. But noticing is not bound to individuals, events or categories of beings. Noticing paves the way to attune to messy entanglements that often lead to unexpected, even undesired results. Noticing often took me to the rotting wood of the bottom of an old planter, slowly dripping muddy soil on the soil below. I noticed the black droppings on the leaves of a caterpillar infested herb bed. I noticed the spread of bermuda grass across and around beds and trees, despite the many work days when we gathered to rip them out under the hot sun. Noticing took me to relationships that resisted human intervention, that presented repeated obstacles to the goals of gardening, leading me to the marginal relationships that commonly exist in gardens, but that are either ignored, fought, or suppressed. I began to attune to the spaces where nothing was being (intentionally) grown, to pay attention to what happened in those abandoned corners of the garden where more-than-humans resisted human influence.

Attuning closely to these marginal corners of the garden - and of human knowledge - is a productive endeavor, one that actively resists the epistemicide of nonhuman knowings and may foster humans to reconcile our desire for control over the garden as much as our our desire for control over what constitutes truth and knowledge. This movement away from human-centered ways of being and knowing in the world, where the human is characterized as white, male, cis-gendered, able-bodied and neurotypical, is a shift toward the more-than-human mutually flourishing conviviality, towards planetary survivability.

Notes From the Garden: Life and Learning Under the Debris

On a cold January morning in the garden, after the children had come running excited to pick radishes, and while I waited for the next gardeners to come, I sat quietly across from the path that led to the garden beds. Seedlings had recently been planted in a new bed, and I pondered whether they would make it there, and whether a lot of native plants had to be removed for the installation. I felt sad for the prior presences of this area (Plumwood, 2009), the native fauna and flora displaced even now by “clearing” the area for a new garden bed. The rising sun warmed my cold hands while I sat comfortably on a haystack that would soon be opened and scattered on top of new planters. These mornings were nice and quiet, and the drops of the overnight rain on the green leaves glistened with the sun, while hummingbirds visited the flowering herbs, and a few brown birds hopped around searching the rocks for insects. I sat quietly noticing the shapes and colors of various plants, their leaves’ textures and movements in the cold breeze. I walked around in silence, greeting the plants, admiring how the tree in the corner rose high into the sky emerging from behind the bushes. I hoped that the plants in that garden would accept my gestures, and I felt thankful to be able to visit such a beautiful flourishing space in the middle of such one of the largest and most unsustainable cities in the country. I had been there a couple of days earlier, before it had rained, and noticed that some new peas had sprouted, although it was a bit early for peas and I didn’t think they were going to make it. The Nasturtiums had begun to blossom to the delight of the gardeners that wanted to attract more bees to the garden, and all seemed to be going along well for the growing season. A long time went by, and it seemed like no one else was coming to the garden that morning. I sat back on the haystack and thought about sketching that tree behind the bushes. The tree was in a corner of the garden, a dark cold

corner due to the shade of the tree itself and the shade of the bushes on an early morning when the sun hadn't risen very high yet. But there wasn't a whole lot around the tree, no rocks, not that many plants, and it was hard to sketch somewhat empty and dark spaces. I noticed a brown bird once again, but instead of sifting through the rocks by the garden beds, he was on the tree trunk. The bird flew to the ground, landing behind some bricks from a partial wall that used to stand there. A few minutes later, the brown bird was back on the tree, then he flew away. A few minutes went by and he returned, landed on the tree, hopped to the ground disappearing behind the crumbling wall, then back to the tree trunk. I stood up and moved a few steps closer to the bird, but he stopped, turned his head and stared straight at me, making me feel like I was not welcome any closer. I stepped back for a few minutes, watching the bird hop from the tree, to the ground where I couldn't see him, and then fly away. A few minutes later, there he was again, from the ground, to the tree, sometimes rubbing his bill on the trunk a few times, looking around, looking at me, and flying away. I felt compelled to approach this dark corner of the garden, walking until I was under the tree, where it suddenly got very quiet, very cold. Looking around I couldn't see what was so interesting that kept the bird coming back again and again, in an almost predictable, steady route. Behind the crumbling brick wall there were some pieces of scrap wood, a few broken boards, old shovel handles, a small broken nursery pot, a busted garden hose, and a pile of decaying leaves brought by the wind. All these materials were loosely gathered in a few small piles of what could only be described as garden debris. I stood quietly looking, filled with curiosity about this cold, abandoned, secluded corner. That's when another quite small bird emerged from behind the nursery pot, flying right past me. Startled, I moved away from the wall and

closer to the tree. That's when I saw that behind the pile of leaves there was movement. Many tiny insects moving around at a frenzy pace. Under the leaves, over the leaves, moving behind the decaying pieces of wood, around the tree trunk, around a small puddle. Small feathers here and there showed me this was a frequent spot for birds to feed and collect nesting material. Ants marched in single file around the wall, while a few holes on the ground announced that a ground squirrel lived nearby. I moved a few steps away, and within moments the brown bird returned, hopping from the tree to the pile of wood scraps, sweeping the leaf litter around and picking at the soil, in agile movements that scattered a few pebbles around, revealing the abundance of bugs under the litter and a few sprouts in the moist soil, quickly flying away once again taking his food with him. I sat at a distance as I watched the birds now visiting the corner repeatedly, coming in and flying out, while the leaves moved and settled as various insects crawling under and over it, under and over it, in a seemingly never-ending multispecies dance.

Every inch of that dark corner was filled with life. From the birds to the bugs, from the puddle around the old hose to the pile of broken wood scraps, in the soil, on top of the soil, the entire corner was bursting with life. While there was a garden right next to it, full of flowers and fruits of the season, planted in rich balanced soil, it was the abandoned corner that attracted the bird the most. In the dark corner, life was spontaneous, emergent, and abundant. Competition, cooperation, organization and chaos, all pulsating together in a vibrant, lively entanglement. Life happened under the debris.

Learning through the bird path: attuning to the animacy of the debris

After sharing the story about the bird in the dark corner with an indigenous gardener, she said: “oh, so the bird called to you! He must have heard your question.” Surprised, I thought that I hadn’t asked any questions, I hadn’t even taken any notes that day yet. And I certainly hadn’t spoken to any of the birds, on the contrary, I was hoping to hear from plants that morning. She insisted that the bird had heard my questions and called me to offer a response. I asked her what she thought was the answer to my question, what the bird had shown me. She smiled and said: “I too have an abandoned, messy corner in my yard. Don’t you?” Indeed, I thought of the other dark corners in other gardens, attending to the out of sight relationalities and living processes that emerged in each one.

Entangled in a narrative story, the bird’s gestures directing my attention towards the debris invite analyses that foreground an animated, multispecies process of revisiting the dark corners, not only of the material gardens, but also of the ways of knowing that are accepted in learning gardens scholarship. Analyzing the bird’s story *with* gardens occurred by exploring other dark corners in gardens and experiencing the agential knowledge-producing entanglements that arose from them. The lived knowledges created in the dark corners portrayed reciprocal and vibrant networks of cooperation, competition, life and death, in an ongoingness of life independent of human guidance and control.

The relationships that emerged in the dark corner piled with debris seems to be similar to Kimmerer’s (2013) description of the relationship between ants, grass and soil: “they hand off life to one another. They understand their interconnections; they

understand that the life of one is dependent on the life of all” (p. 332). The reason why life bustles under the debris is that the entanglements there give life to one another in a messy ongoing process of birth, decay, death, competition, cooperation, in a mutual survival scheme beyond the margins of human interference in the garden. While there was certainly abundance of life in the garden itself, there, human control imposed a discrete organization, where the soil was foreign, plants were spaced and organized, and watering happened through a timed dripping system. Life in the garden beds happened in an orderly fashion, maintaining the desired more-than-humans in the garden, the undesired ones out, in a linear and consequential fashion.

This theorizing through a methodological approach that threads together Indigenous scholarship, non-Western ways of knowing, posthumanism and new materialisms allowed me to notice the bird not only as another species feeding in the garden, but as an agent in the research process, inviting me to notice something I had not seen yet. Something was drawing me to that corner and I had approached it once, but wasn't able to catch a glimpse of what was calling me, and retreated. The bird then, as a leader in the animal world, as explained to me later by an indigenous gardener, took the lead in inviting me to attune to his ways of being in the garden, and to follow him once again to move closer to the tree in the dark corner.

For Kimmerer (2013), “the animacy of the world is something we already know” (p. 57), something we only need to remember, in case we have forgotten or have been taught otherwise: “Our toddlers speak of plants and animals as if they were people, extending to them self and intention and compassion - until we teach them not to” (Kimmerer, 2013, p. 57). The bird's invitation was a reminder that nurturing more-than-

human attunement actively resists and disrupts the dichotomized logic of human exceptionalism and hyper-separation from nature, which “open the door to exploitation” (p. 57), transforming non-humans from kin into commodifiable resources, and making it such that “the only way to be animate, to be worthy of respect and moral concern, is to be a human” (Kimmerer, 2013, p. 57).

The moment when the bird invited me to follow him felt like a calling to join him, to attune to his ways of being in the world, to the places he inhabited and knew. I quietly followed him as if passing through a portal of awareness, stumbling upon this dark corner of the garden, unnoticed until then, an entire world that didn't begin as we approached it, but where life was already going on. My awareness shifted, blurring the supposed boundaries between the rational awareness of the present and other possibilities of existence. By noticing and tuning into the bird's life, I came to inhabit a becoming-zone that allowed me to attune into other worlds and intra-act with other beings in a process of mutual interference (Barad, 2007; Jensen et al., 2016).

Perceiving the bird as kin in the garden, as a being with something to say by communicating through his actions, both of inviting me in and of warning me not to get too close, allowed for the inquiry process to move beyond what was expected from a data generating session in the garden. By accepting the bird's invitation and stepping out of the productive, cultivated area of the garden into the dark corner was an ontological move, not only because it recognized the agency of the bird in communicating and calling to me, but also because it acknowledged the expansion of what the garden is, allowing me to perceive the garden beyond the cultivated beds and pebble paths, to the abandoned corner by the wall, to the debris and beyond. Through the bird's view, I was

able to see the garden as much bigger than the garden beds, bigger than the bordering walls of the urban lot it sits in. The bird explained that only for humans who don't know how to listen does the garden end after the pepper plants, or beyond the trellises where the cucumbers will climb. Plants, bugs, birds, trees, water *and* humans continue beyond the officially marked borders of the garden and certainly beyond the borders of the urban lot. The seeds carried by wind and birds sprout across miles of backyards. The children that come in the morning take the radishes and their excitement all the way to school and to their homes. The shade that tree provides cools the soil and the neighboring houses, the water that percolates keeps the working bugs around, breaking organic matter and aerating the soil. This entangled lively junction certainly goes beyond the garden borders, extending into a more-than-human animated and enchanted metropolitan more-than-garden space.

Attuning to the bird's ways of communicating was also an epistemological move, that led to a co-creation of the research process and of the data generation, letting the bird lead me to learn about what data could be and accepting the bird's actions as response to my questions. While I had planned to sketch the tree, listen to the way the plants were acting after the rain, and perhaps talk to human gardeners, I did not expect to be called into the abandoned corner of the garden, nor to follow the lead of a bird in finding a vibrant community of multiple life forms in what seemed like an otherwise common Western community garden. The bird led me to experience and think about not only other ways of being in the world, but also other ways of knowing that are pushed out by the acceptance of rational knowledge as absolute truth (Keane et al., 2016). The bird's approach revealed that his knowing was material, revealed in actions that changed the

world in its materiality – *a worlding practice* (Haraway, 2016; Barad & Gandorfer, 2021), or better yet, a “*a worlding-with practice*” (Silova, 2020, p. 150).

In subsequent visits, I went back to the dark corner in that community garden, and then visited the quiet corners in the other gardens in this research, including the one in my house. I had avoided the abandoned corner in my own garden, fearing the presence of various insects, but encouraged by the bird, I decided to move ahead and encounter whatever animate worlds it could hold. Each of them held a multitude of entanglements in what was a visually and ecologically generative process. Even more so than the rows of vegetables in the garden, the debris in the forgotten corners of the gardens proved to be a rich field of entanglement, filled with beings that were desired in the main garden, like decomposing insects, pollinating birds, rich organic matter, and shelter from the hot desert sun, but that may have chosen to gather elsewhere.

Instead of simply ignoring or purposefully clearing the debris piles in the gardens, we may look at them as agential assemblages, escaping the fast paced human-controlled garden towards a calmer area where they don't have the pressure to perform so much. Maybe older leaves, now tired from photosynthesizing at full speed would ask the wind to take them to a shaded area, the broken boards may be happy to finally serve as shelter to a squirrel, and the bird may just have planted some native bushes seeds to later gather twigs for his nest. The entire assemblage that composed the pile of debris was acting in the garden corner together, creating a world capable of telling their own stories, influencing the rest of the garden and being influenced by it.

Attuning to the existence of the more-than-human agential worlds in the dark corners revealed the pushed-out ontologies and epistemologies accepted and explained by

Western science, inviting practices, including pedagogical practices, that pay attention to those forgotten and erased ways of being and knowing in the world. Much like myself initially, most of the educational scholarship focuses on learning topics related to ‘managing’ the cultivated areas of the garden, missing out on so much creativity and diversity that the ‘forgotten’ or ‘abandoned’ areas of the garden have to teach about interdependent ways of multispecies learning and flourishing. Perhaps by spending time attuning to more-than-human ways of being in gardens may be a fruitful pathway to expand accepted ways of knowing to the realms of embodied, affective and spiritual ways of knowing, which may offer mutually beneficial opportunities for learning and worlding-with gardens.

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Chapter 5

In Lieu of Conclusions: Imagining Scholarly and Pedagogical Possibilities of Engagement with More-Than-Gardens

This dissertation study presents theoretical, methodological, practical and personal journeys in, with, and around gardens. This experience transformed my ways of thinking and doing research, inviting me to inhabit a space beyond interdisciplinarity, a liminal space of connection and (re)creation. Inspired by post philosophies, I moved with ideas and concepts - across gardens. Bringing with me the luggage of science and policy, I got to unpack my own conceptions of what a garden is, what it can be, as well as what academic and education research is, and can be. I reached to the past, recognizing the knowings and livings that informed and created my worlds until I got here, and I was able to reach into the future with the help of both human and nonhuman companions.

Across this three-article dissertation I explored posthuman theories, Indigenous theoretical and methodological frameworks as well as post-qualitative modes of inquiry to bring together a research practice that was rooted in gardens, that was conducted *with* gardens, and that materialized the politics of care that I've experienced from gardens. In doing so, this dissertation makes contributions to the learning gardens scholarship, as well as critical posthumanism, environmental and sustainability education, environmental humanities and philosophy of science scholarship. This dissertation also offers methodological contributions to education scholarship, putting more-than-human theoretical and methodological frameworks to work in gardens. This work offers a lens through which garden researchers and practitioners can re-situate encounters with gardens through practices that frame learning in gardens as more than a rational or

cognitive activity, but as a relational, affective, embodied and spiritual process that must involve critical and ethical considerations. I frame the concept of learning in posthuman and Indigenous scholarship as well, especially relying on Kimmerer (2013), Windchief & Cummings (2022), Tsing (2015), and Jensen et al. (2016) for whom learning is not confined to academic progress based on accumulation of rational knowledge, but is an intra-active activity that happens in practice *with* the world (including with non-humans) through encounters, entanglements, and relationships with other beings, human or not. Learning-with then is premised on *unlearning* human exceptionalism, on perceiving learning experiences beyond the borders of curricular knowledge (and the borders of garden beds), thus opening up space to learn “to be affected” (Jensen et al., 2016, p. 164) by other beings in a process of relational learning.

In this concluding chapter I first present an overview of the major contributions of each article illustrating the implications of all three articles for education research and practice. Finally, I discuss the ideas for future research directions and questions to be considered in future work.

The first article in this dissertation, “Tracing gardens throughout history in environmental and sustainability education: a critical review”, is a critical literature review of the history of gardens in educational literature, which brings together philosophical and practical approaches to gardening since early modernity, exposing how scientific views of the world as a machine, as well as (post)positivist epistemologies of detachment and control over nature largely underpin work in and around urban gardens, especially school gardens. This article reveals how a predominantly (post)positivist framework, where white, colonial, patriarchal ways of being in the garden are used to

oppress and exploit all that are not considered to be fully humans, including more-than-humans, BIPOC, women and children. This ontological stance is reflected in the (post)positivist episteme that privileges rationality, objectivity and detachment (associated with white western male ways of being) to the detriment of other ways of knowing such as sensory, embodied, affective and spiritual ways of knowing. The relevance of this critical literature review is made clear in (re)examining the role of Western education in the context of the climate crisis, especially focusing on the responsibility of environmental and sustainability education in addressing its human exceptionalist stance that contributes to the planetary threat of the climate crisis. This review serves as a foundation for the exploration in the subsequent articles. This article proposes an ontoepistemological shift that reframes learning in gardens, moving away from a utilitarian, detached (post)positivist relations with the garden-as-machine, to a relational ethico-onto-epistemological engagement with more-than-human inhabitants in gardens and in education, imagining and constructing mutually beneficial futures for all.

The second article, “What lies beneath the surface? Encounters with learning through soil stories” explores how the shift in the relationships between humans and more-than-humans in gardens can be put into practice through posthuman and post-qualitative frameworks. Relying on the example of soil, and the relationships in which soil is engaged in gardens, this article utilizes the concepts of matter of fact and matter of concern (Latour, 2004; Stengers, 2011) to deeply engage in a post-qualitative inquiry process with soil, embarking on soil stories that reveal how soil is not a matter of fact scientific object of study, but rather a lively entanglement of living agential assemblages that co-creates itself as well as the beings and worlds of which it is part. This article

reveals the multitude of possibilities of being and learning that are just outside of (post)positivist human-centered gardening, bringing into view more-than-human examples of how the garden can offer connection with place, history, time, matter and the multiplicity of life, inspiring slower, embodied, caring relationships between humans and the rest of the natural world.

The third article goes one step further away from Western (post)positivism, relying on Indigenous scholarship to create modes of inquiry as practices of attunement to the living world of gardens (Jensen et al., 2016; Kimmerer, 2013). This article is rooted in non-Western Indigenous relational ontologies, accepting this body of work's invitations to get engaged and communicate with more-than-humans as kin. Embedded in the animacy and agency of garden inhabitants, this article shares the story of a bird leading the inquiry process to reveal lively more-than-human entanglements that create living knowledges away from human guidance and management. This article discusses how letting go of human desires for control, measurement and productivity, which lead to human-centered utilitarian relationships in the garden, can foster pedagogical engagements that present mutually beneficial opportunities for learning and worlding *with* gardens.

The use of stories to bring the data forward in the second and third articles was intentional for slightly different reasons. In the second article, the stories of soil are told with a focus on soil entanglements, emphasizing soil's thinking in motion through touch. Bringing forward soil's ways of acting through stories is aligned with the article's posthuman framework, fore fronting soil as an active member of gardens and creator of garden worlds and stories. In the third article, the bird's story is aligned with the article's

Indigenous framework, coming from Indigenous traditions of storytelling as a mode of sharing history, culture, values and knowledge. In both articles, stories at the same time describe scenarios and acting assemblages, while leaving a lot of room to be filled by the reader. But this storytelling practice is not only aligned with the theoretical and methodological frameworks in this dissertation study, it is an important component in constructing this piece of scholarship. Instead of offering static images or sketches as a matter of fact snapshot of “what was happening,” the narratives constructed here describe moments easily relatable to the reader who may perhaps visualize their own memories of watching a child play with chickens, or of following a bird’s movements on a tree. This is a purposeful move that not only stories more-than-humans into the co-construction of the inquiry process, but that invites the reader to continue to diffract through these stories performing the work of the story listener while accompanied by more-than-humans in their contexts (Barad, 2007; Toliver, 2021). The story listener then is engaged in the co-creation of the scenes, being invited to add their own embodied, emotional, affective or spiritual experiences into the work that the stories do. Despite the constraints that words, language, and especially academic writing imposes on the description of such immanent and affective moments, the open-endedness of these stories allows the storied data to continue on with and through the reader, to counter the scripted, unidirectional, (post)positivist argumentative, explanatory language, and instead, work to affect the reader’s sense of what it means to create a process of researching *with* more-than-human companions in the garden, and beyond the garden, as more-than-garden kin.

Thus, the theoretical and methodological frameworks that are used in this dissertation study work with the fertile fields of more-than-human relationality, offering

productive possibilities to shift (post)positivist educational gardening scholarship and practices from exploitative, utilitarian relations onto reciprocal modes of attunement, care and ethical relationalities between humans and more-than-humans in urban gardens. The implications of this shift span both research in gardens as well as pedagogical practices for learning in gardens. The proposed ontological and methodological shift allows for pedagogies and scholarship to access multispecies knowings that have been ignored and pushed out, especially in education scholarship, generating new more-than-human assemblages that create research *with* gardens instead of simply *in* or *about* gardens, shifting attention away from, for example, human-centered goals of building scientific skills or inventing new technological fixes, to engaging with the material conditions and assemblages that are already available in our more-than-human common worlds, while mobilizing the knowings and beings in gardens to see beyond the narrow frames of humanism (Common Worlds Research Collective, 2020). Employing some of the methodological tools used in this dissertation, such as attunement and noticing in pedagogical practices that include non-humans as active lively participants in learning encounters, allows for learners to continue to inhabit the multi-species, multi-mattered worlds in formal learning environments, valuing children's as well as more-than human ways of being and knowing.

The pedagogical moves suggested in this dissertation emphasize the urgency of expanding the ideas that underpin education, especially ESE, beyond instrumental and utilitarian engagements with the garden directed by STEM related fields. In particular, I offer a pedagogical provocation, discussing a pedagogical shift away from the rationales of Western thinking that lead to the planetary challenges we face, proposing instead the

nurturing of slower careful encounters through gardens and the integration of more-than-human ways of being and knowing across those learning encounters. Pedagogies of care in the garden encourage encounters and relationships that recognize more-than-human agency and value nonhuman ways of knowing, fostering pedagogical practices of becoming-with urban gardens and worlding better futures for all, even if those futures may not look as neat and organized as a manicured garden. While recognizing the administrative and systemic obstacles present, especially in schools (Branch et al., 2016; Kang, 2019), this research points out the cracks and leakages in Western thinking that afford humans time and space to engage in more-than-human conviviality in various gardens, including in schools. Through multiple examples - such as that of a teacher who engages with care-full pedagogies by allowing her students a few minutes in the morning to play with native soil and chickens, of children, who despite being told not to “mess” with soil find time to befriend soil and seeds, and of a native gardener who in mere seconds performs and teaches gestures of connection and appreciation for the more-than-human kin in the garden - this dissertation exemplifies how nurturing more-than-human kinship as well as pedagogies of concern and care, may be a matter of attuning to the modes of being and acting of other beings. My hope is that gardens, as places that offer so many possibilities for this attunement, may be treated not as educational tools that build humanism, but as spaces that foster the (re)membering of our own human condition and place in the larger scheme of life on Earth.

Future research with gardens could extend this practical framework, encountering the garden as kin, as a place that facilitate opportunities for attuning to other forms of life, while engaging with garden inhabitants as co-creators of the research process. Education

scholarship would benefit from research that shifts attention to what's happening on the edges of gardens, outside of scientific view, encouraging learners to look for and respond to invitations to investigate marginal and liminal spaces of beings and knowing, including their own. Specifically, future ESE scholarship would benefit from accepting this dissertation's and other scholars' invitation to reexamine the philosophical premises that have shifted it away from embracing the social, historical and more-than-human aspects that make sustainability a concept worth pursuing. Especially in gardens, ESE scholarship may reconsider the directed and narrowly scripted nature of engaging with the garden as a food and science producing machine, instead making space for an embodied and affective practices that foster a productive terrain of more-than-rational learning.

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Chapter 6

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