



Grounding futures: Trans-disciplining learning and community-building research

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ABSTRACT

The terms interdisciplinary and transdisciplinary research are adopted institutionally across the globe. To envisage the research ecosystems for sustainable futures and multi-species flourishing, we propose that such visions should acknowledge and honour potentially uncomfortable and vulnerable unlearning of taken-for-granted disciplinary norms, hierarchies, and assumptions about who has or has not been included in the discipline. In this essay, we share our own learning from our interdisciplinary collaboration across Education, Soil Sciences, Sustainability Studies, and Indigenous Sciences/Mathematics, which is grounded in our emerging transdisciplinary community. We see transdisciplinary work as a verb—one that involves questioning, negotiating, unsettling, and renewing the discipline. In pursuing transdisciplinary collaboration, we argue that the act of unlearning is necessary to question the status quo, colored by colonialism and speciesism perpetuated through dominant disciplinary norms. Longitudinal community building is also key to holding together each other's limits of knowing and the discomfort of confronting academic harms, while grounding ourselves in the lives of (human and more-than-human) Peoples. Through a data-based collective reflection on our key (un)learning moments in our co-designed project, we highlight four axes of trans-disciplining that moved us beyond a human-authored future that neglects human and more-than-human relationships: a) knowing as grounding, b) experiencing time deeply, c) listening to the more-than-humans (the soil) with humility and reciprocity, and d) co-learning together and with the land. We see the act of trans-disciplining as creating a space and a path for alternative ways of knowing that are rooted in community wisdom and our learning with the land.

1. Introduction: Situating transdisciplinarity in refiguring the future of research ecosystems

How can we make space for alternative ways of knowing, being, and living by collaborating across disciplines, toward the future of postsecondary research ecosystems? We take on this question from the shared futurities of nature-culture entanglements, beyond a

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human-centered future (Granjou et al., 2017). Instead of being entrenched in the future of individuality, neoliberalism, and hyper-competitiveness that is perpetuated under the guise of education (Amsler & Facer, 2017), we ground ourselves in here and now, learning from ancestral wisdoms that enriched human kinship with non-humans (Krenak, 2024). Critical scholarship in environmental justice futures similarly argue for the need to engage with ancestral knowledge systems, and address continuing impacts of colonial violence to enact socially and ecologically sustainable futures that include multispecies flourishing (Granjou et al., 2025). To engage with the processes involving the necessary transformation in educational spaces and research ecosystems, in this article, we turn our focus to soil as the literal substrate to ground our critical reflections on transdisciplinarity. A mere six inches of topsoil is proverbially understood as the source of 99.7 per cent of the food produced (Pimentel, 2006). Yet, an estimated 36 billion tons of soil is degraded every year, primarily due to industrial agriculture and deforestation activities (Rhodes, 2014). The cascading effects of decreasing soil fertility range from heightened food injustice, biodiversity loss, and increased greenhouse emissions (Kopittke et al., 2019), as healthy soils have the ability to sequester large amounts of carbon (Lal & Bruce, 1999). The extractive, narrow parameters of efficiency focused on crop yields in formal agricultural institutions have historically marginalized soil health and systematically neglected the perspectives offered by Indigenous knowledge systems espousing an integrated view of farming (Heckman, 2006; Prasad, 2016). Transdisciplinary dialogues to foster non-extractive relationships with the soil are crucial as we shape future curriculum and pedagogy in K-12 and higher education. In the context of land use science, for instance, Zscheischler and Rogga (2015) discuss the shortcomings of transdisciplinary research that continues to emphasize science and process-centred perspectives that are embedded in efficiency, control, and economies of scale narratives, rather than embracing the contributions of marginalized actors and knowledge systems that are more suited for respectful engagement with complexity.

Transdisciplinary research has emerged as a central framework guiding institutional agendas worldwide, given its particular appeal in engaging with complex global challenges and real-world problems (Kligyte et al., 2025; Pohl, Truffer, & Hadorn, 2017). Two special issues in *Futures*, published in 2004 and 2015, respectively, attest to the diverse contributions to expand the scope of transdisciplinary inquiry, while highlighting the power asymmetries in co-production of knowledge, as well as the limitations in defining and scoping problems to be addressed through transdisciplinary research (Lawrence, 2015). The problems that are intractable or difficult to solve due to incomplete, contradictory, and changing have been characterized as “wicked problems” (Rittel & Webber, 1973). The necessity to address wicked problems has been one of the motivations behind institutional agendas for transdisciplinary research and scholarship (Pohl, Truffer, & Hadorn, 2017). We take a critical stance toward the characterization of complex, global-scale, and entangled issues as wicked problems, while articulating our visions for transdisciplinarity. Before presenting our critique, we first review institutional discourse around transdisciplinary research and scholarship.

Globally, traditional academic structures have long been critiqued for their failure to account for the interconnected nature of real-world problems (e.g., Stember, 1991). Bursztyn and Purushothaman. (2022) argue for different integrative conceptualizations and methodologies to enable universities to evolve into citizen-inclusive hubs that can engage directly with real-world problems. Key attributes of transdisciplinary research include its focus on real-world problems, its adaptive, evolving, and reflective methodology, and its emphasis on collaboration and responsiveness to societal issues. Collaboration in transdisciplinary research encompasses disciplinary experts and external stakeholders with shared interests (Russell et al., 2008). The institutional discourse around transdisciplinary research often highlights the potential of such collaborations in innovation and problem-solving, along with socially relevant and action-oriented impact (Gibbons et al., 1994).

Recent decades have seen a global surge in policies and institutional initiatives to foster transdisciplinary scholarship, primarily as a techno-scientific enterprise, to align with Sustainable Development Goals, for example (Sianes, 2021). The 2020 Organisation for Economic Co-operation and Development states that transdisciplinary research “offers a practical way to address issues that are highly contested and where stakes are high. It can expand on existing scientific evidence and give rise to more innovative, holistic solutions. It can generate both new scientific insights and practical societal benefits” (Organisation for Economic Co-operation and Development OECD et al., 2020, p. 9). Funding agencies internationally have been adapting specific grants and objective framing to encourage transdisciplinary research. Such examples include the National Science Foundation’s (NSF) Convergence Research Initiative to support research that addresses complex issues through cross-academic collaborations (National Science Foundation NSF, n.d.); India’s National Educational Policy for a multidisciplinary and transdisciplinary approach in higher education (Ministry of Education, Government of India, 2020); the Canada First Research Excellence Fund (CFREF) to promote large-scale, transdisciplinary research initiatives (Canada First Research Excellence Fund CFREF, n.d.); Horizon Europe to encourage cross-sectoral research that combines scientific, industrial, and societal perspectives (European Commission, n.d.). However, despite the enthusiastic uptake of the concept as a policy, funding and institutional framework, the epistemic assumptions underlying the seemingly promising collaborations are rarely scrutinized.

1.1. Trans-disciplining as a verb

Beyond the institutional discourse, transdisciplinarity and interdisciplinarity have been theorized across the fields. We use the term transdisciplinarity to distinguish itself from the amalgamation of two or more disciplines and consider non-additive, synergetic, and emergent renewal of dominating disciplinarity that has long been marked with “the monopoly of scientific competence” (Bourdieu, 1975, p. 19) (Takeuchi et al., 2020). Such distinction can be useful to situate institutional discourse and distinguish certain dispositions and commitment to colonial history of the discipline, in particular the fields of Science, Technology, Engineering and Mathematics that are overshadowed by the history of militarism, environmental devastation, and harm against suppressed groups of humans and more-than-humans (Alonso Yanez et al., 2019; Bang et al., 2012; Philip et al., 2018, 2025; Strong et al., 2016; Takeuchi & Marin, 2022). For instance, drawing on her experience in a transnational science setting, Dannecker (2023) argues that it is crucial to

interrogate the premise of transdisciplinary inquiry, which is largely based on Western conceptions of scientific understanding, thereby precluding opportunities for authentic collaborations capable of generating transformative knowledge. A stronger critique has been voiced by scholars such as Streck and da Rosa (2024), who argue that in order to avoid replicating the harms of colonising research, transdisciplinary inquiry must embed itself and learn from socio-cultural movements that have questioned the political, institutional, and contextual premises of knowledge generation.

Underlying transgressive and transformative forms of trans/interdisciplinarity is the disposition and commitment toward “desettling” (p. 308) the settled norms in the apparatus of colonial knowledge production (Bang et al., 2012). Nicolescu’s (2014) perspective anchored the epistemological question of knowledge in complex realities. Critiquing traditional academic structures for their rigid disciplinary boundaries, Nicolescu (2014) argued for a framework that acknowledges multiple levels of reality, the possibilities of contradictions and ambiguities to exist under “the logic of the included middle” (p. 11) and methodologies that integrate diverse perspectives. In *Dear Science and Other Stories*, McKittrick (2021) shines a light on Black people’s collective wisdom for liberation as interdisciplinary: “Black people have always used interdisciplinary methodologies to explain, explore, and story the world, because thinking and writing and imagining across range of texts, disciplines, histories, and genres unsettles suffocating and dismal and insular racial logics” (p. 4). Positioning artists as theorists, Gordon (2008) maintains: “Not owned by anyone yet, this interdisciplinary is in the public domain, which does not guarantee anything except that there is still some room to claim rather than discipline its meaning into existence” (p. 7). McKittrick (2021) and Gordon (2008) both show us futuristic values and ways of knowing that are often overlooked in elitist capture of the discipline.

Vossoughi et al. (2023) call for researchers in diverse disciplinary fields to work together to design and reflect on ethical and transformative possibilities of learning. Our essay grounds the theory of transdisciplinarity, highlighting potentially uncomfortable unlearning of taken-for-granted disciplinary norms, hierarchies, and assumptions about who has been included or excluded in the discipline, toward the vision of re-figuring more grounded futures. Each of our co-authors is in a different field and collaborated to design land-based pedagogical and learning experiences. Our essay has a distinctive focus on the learning process of scholars located in divergent fields converging through our co-learning with each other and with the land, as we envisage a new community.

Unlike the institutionalized discourse around transdisciplinary research and scholarship, we treat transdisciplinary work as trans-disciplining, *a verb* that involves questioning, negotiating, unsettling, and renewing the discipline. Our approach finds resonance with the work of scholars such as Giri (2023), who similarly argue that transdisciplinarity is both a noun and a verb, involving action and meditation to find creative ways of unbounding disciplines to build “new transdisciplinary commons of love, learning, and labor between and beyond disciplines, traditions, and cultures” (p.139). Lewis Gordon (2006) maintained that siloed, hierarchical, and reproductive formation of the discipline could lead to critical decay of knowledge. Teleological suspension, which emerges “when a discipline suspends its own centering because of a commitment to questions greater than the discipline itself” (Gordon, 2006, p. 34), is necessary to avoid this decay of knowledge. The “question greater than the discipline itself” is not a synonym for “wicked problems.” Since its proposal in the 1960s and even today, the framing of wicked problems has perpetuated widespread rhetoric around the dichotomy between wicked versus tamed problems, with an emphasis on the evil quality of certain critical problems (Termeer et al., 2019). Such rhetoric is particularly problematic when applied to environmental degradation, food distribution crisis, or global forced displacement and migration. In fact, the tendency to value control, and disinclination to uncertainty are the very perpetrators of these anticipations. For the goal of envisaging futures for multi-species flourishing, we need to cease the anticipatory dispositions to control and seek certainty, while facilitating human agency to unlearn anthropocentric disciplinary norms.

We voice against the reproduction of academic norms for the sake of maintaining the academic apparatus. Our voice is grounded in our work together to witness how such norms have long excluded or undermined “Othered” (Said, 1978) bodies and voices. From “terra nova” to “sustainability,” we questioned well-consumed terminologies that shaped research questions, methodologies, and theories, by interrogating the colonial zero point (Domínguez, 2019). Like the Greenwich Mean Time, the colonial zero point, taken-for-granted starting point of knowledge production, normalizes racial and geopolitical hierarchy. We feel the urge to go beyond the most audible and loud voices of a small group of humans and listen carefully to the voices of more-than-humans (Kimmerer, 2013).

Trans-disciplining does not exist without the transformation of existing disciplinary norms and practices. This process of questioning the taken-for-granted disciplinary norms demands our own change as researchers. The trans-disciplining act that orients toward multi-species flourishing invites us to be the subject of constant learning: co-learning with fellow learners, collaborators, and more-than-humans. Fully attuned listening is the condition for trans-disciplining: listening to the resonance and dissonance in diverse ways of knowing, being, and valuing. As Smith (2012) wisely cautions against researchers, sharing knowledge is a long-term commitment that comes with the responsibility of researchers to be transparent about theories and analyses that informed the ways in which knowledge was constructed. Listening to trans-discipline can be disharmonious as we notice contradictions, conflicts, and past wrongdoings; yet it affords the opportunities to transcend disciplinary boundaries while contouring our responsibilities as researchers.

2. Our research and pedagogical design

We illustrate our conceptualization of trans-disciplining rooted in our research and design partnership, which we call “Soil Camp” (<https://soilcamp.ca/>), situated in Moh’kínstsis (Blackfoot), Wincheesh-pah (Nakoda), Otos-kwunee (Cree), Kootsisáw (Tsuu’tina) and Klincho-tinay-indihay (Slavey), the land called “Calgary,” Canada, after colonization. Soil Camp sprouted as a summer camp research–design partnership on a community urban farm during the COVID-19 pandemic in 2020, in response to an invitation from our community partner at a local refugee resettlement agency. We have implemented five iterations of design over the past five years. In the past five years, a total of 135 children (aged 5–15 years) and 39 facilitators, including 21 teachers/teacher candidates, joined our program. Over time, Soil Camp grew beyond our summer program to a network of like-minded teachers (including teacher

candidates), community workers, researchers, youth, and families who care for the land, soil, plants, animals, and each other, and are connected by our shared visions. Many of the children and youth used to be intimately connected to the land in intergenerational and embodied ways prior to their forced displacement as refugees. A large proportion of the participants in the Soil Camp was identified as Yazidi refugees who resettled in Canada with the Survivors of Daesh

Program (Immigration, Refugees and Citizenship Canada, 2021). Other countries of origin of the participants include Cameroon, Ethiopia, Eritrea, Syria, New Guinea, Pakistan, South Sudan. Seeing the land-based embodied knowledge as a gift for learning, our soil-centered pedagogy draws from the intergenerational land-based wisdom of families with farming backgrounds, focusing on food, plants, and soil. Socioenvironmental visions for reconnection to the land, soil, plants, animals, and each other are at the root of our network of teachers, community workers, researchers, youth, and children. Aligned with the *Calls to Action proposed by the Truth and Reconciliation Commission of Canada*, we facilitate the creation of space for newcomers in Canada to learn about settler-colonial histories while also learning the worldviews rooted in local Indigenous communities, particularly those related to the soil.

We learned from the methodology of social design experiments that centers historicity, diversity, equity, and ecological resilience as design principles (Gutiérrez & Jurow, 2016), and from participatory design research that aims to co-design just practices and futures in partnership with a range of communities (Bang & Vossoughi, 2016). Children and youth actively contributed to the documentation of learning alongside the research team. The social and participatory design orientations in our research allowed us to engage in longitudinal and iterative engagement with the participants and the land. Our research does not aim for generalizability but instead aims for deeper understanding of the historicity and particularity embedded in human-to-human, human-to-more-than-human relationships (Bang & Vossoughi, 2016).

We, as co-authors and a part of the core design team, bring diverse disciplinary expertise (Education, Soil Sciences, Sustainability Studies, and Ancestral/Indigenous Sciences/Mathematics <https://www.relationalsciencecircle.com/>). We also bring our early interactions with the soil rooted in various ancestral lands. As co-authors, we collectively bring Indigenous, racialized, gendered, Southern, and queer experiences along with settler, white, and straight experiences; however, both in our design and our interactions, we were mindful of not positioning each other or our participants merely with flattened categories, as we believe in non-dichotomous, complex, and contradictory voices within us and others (de Oliveira, 2022). Through cycles of dialogues and negotiations, we each came to refine what our responsibility is, as researchers and program designers who were gifted with teachings and wisdom from Elders and Knowledge Keepers of the land that we currently reside in. In this essay, our focus is not on the analysis of children's learning but our own (un)learning as researchers who envisage the future of the research ecosystem that centers transdisciplinarity.

3. The axes of trans-disciplining acts toward grounding futures

Through a data-based collective reflection on our key (un)learning moments in our co-designed project, we illustrate key axes of trans-disciplining acts where disciplinary boundaries came to be stretched, extended, ruptured, and pushed for the design team comprised of researchers with diverse disciplinary affiliations. These axes are the sites where some of the taken-for-granted epistemological, ontological, and axiological assumptions in the discipline were questioned, revisited, negotiated, and at times renewed. They are the points of contention and epistemic alternatives—the forms and processes of knowing that have not yet been centered or fully taken up in each of the disciplines that we engage in. These themes together illuminate how each of us came to live within or at the margin of the discipline, as for all of us, trans-disciplining acts are often experienced as “transgressions—a movement against and beyond boundaries” (hooks, 1994, p.12). The themes we highlight are the traces of us maneuvering tensions as we attempt to push the boundaries of what is acceptable and thinkable, toward reimagining the future of research ecosystems (Hampson, 2012). As we interrogate underlying assumptions on “progress” and contemplate on the meanings of environmental futures and planetary health in our research and educational praxis (Granjou et al., 2017; Redvers et al., 2023), we identified the following key axes of trans-disciplining acts: a) knowing as grounding, b) experiencing time deeply, c) listening to the more-than-humans (the soil) with humility and reciprocity, d) co-learning together and with the land. These trans-disciplining acts were experienced as interconnected and inter-woven, instead of being experienced as isolated acts. These trans-disciplining acts were the necessary tensions and points of emergence, as we envision building a community that is “not here yet” (Muñoz, 2019).

3.1. Knowing as grounding

On “ancestral futures,” Krenak (2024) poignantly said, “if there is a future to imagine, it is ancestral, because it is already present... we are everywhere, because our ancestors, the river-mountains, are in everything, and I'm sharing the unrestrained wealth of being able to experience these presents with you.” Deeply knowing the ancestral stewardship and the histories of land and water can lead to the reimagination of futures that are grounded in ancestral wisdoms and worldviews.

Each year, Soil Camp opened with grounding ourselves in gratitude to the land. We started our program with a sharing by Kataisnibakii Liana Wolf Leg, Blackfoot Knowledge Keeper and one of the facilitators, about the history of the land. The following is a vignette from this opening.

Vignette 1:

All the children and facilitators were standing in circle. It is a sunny spring day. Wind is gently blowing to us as we listen to Kataisnibakii Liana Wolf Leg. She teaches us: “We need to understand that while we are here, Canada has changed a lot. This area wasn't known as Canada, this was Blackfoot territory, you know, a bit farther is Cree territory, Tsuut'ina territory. We didn't see it as Canada, we had our own spots, and we were nomadic, and we moved around very much. Where we are at Soil Camp, we wouldn't have really made it a camp. This is where we would have got medicines — sweetgrass, or mint, because it is so marshy.” Then she invited all

of us to ground ourselves and feel where we were standing, while sharing, “with a lot of Blackfoot teaching, we were always told to ground ourselves.” Receiving this invitation, some of us closed our eyes. We became quiet.

Reviewing this vignette with video, Mathew (Author 5) acknowledged a tactile way Blackfoot people knew about the ecosystem. From the conversation he had at Soil Camp, he learned that Blackfoot people danced before setting up an encampment on a particular place of the land. In the process of dancing barefoot, if their foot got damp, they decided not to set up a camp. As a soil scientist, Mathew said, “It’s a soil test essentially,” a way to know that the land was a wetland. Blackfoot people traditionally avoided encampment in a wetland. While Mathew honoured their intergenerational, land-based wisdom, he also underlined a significant difference between the soil tests that are more procedural and Indigenous ways of knowing the land, which had spiritual significance.

Such grounded ways of knowing cannot be easily reconciled with disembodied and displaced knowledge. As educators and educational researchers, Miwa (Author 1), Kori (Author 2) and Deborah (Author 3) discussed the tensions between standardized curriculum and land-based Indigenous knowings. In discussing the critical braiding approach, [Czuy and Eagle Speaker. \(2019\)](#) maintained “the first strand is always the Indigenous worldview, the story from the land” (p. 4). They intentionally chose the word “knowing(s)” over static and objectified “knowledge.” As warned by [Smith \(2012\)](#), Eurocentric knowledge systems extracted a part of knowing that can be abstracted and generalized. During our analysis session, Kori asked us: “All (scientific) knowledges are connected to a Land somewhere, but have been disconnected through colonization and global/western scientific methods. How do you reconnect with the lands these knowledges originate from?” Without a critical interrogation of the origin of the land, knowledge can be extracted and displaced from the people who have been the original stewards of the land and grounded knowing. Kori gave an example of the discovery of aspirin, acetylsalicylic acid, where credit is often given for a French chemist, Charles Frédéric Gerhardt, who identified salicylic acid’s chemical structure in 1853 or a German chemist, Felix Hoffman, who produced stable acetylsalicylic acid in 1897. For centuries, Indigenous Peoples across the world used plants such as willow bark, which contains salicin, to treat aches, pains and fever, but never used for commercial purposes. The land-based medicinal knowing differs from extractive knowledge, which reduces medicinal plants to a chemical compound which can be patented and commercialized. As [Kimmerer \(2013\)](#) said, “the traditional ecological knowledge of Indigenous harvesters is rich in prescriptions for sustainability. They are found in Native science and philosophy, in life ways and practices, but most of all in stories, the ones that are told to help restore balance, to locate ourselves once again in the circle” (p. 179). In this sense, Indigenous knowings are fundamentally embodied and situated in/on the land. The moment we tried to extract such knowings as disembodied, decontextualized knowledge removed from the land, we are crashing their underlying onto-epistemological foundation.

Recalling his conversations with Blackfoot Elder Herman Many Guns through the Soil Camp project, Mathew (Author 5) emphasized that Elder’s teaching is “a message he gave me in that moment in time.” This specificity of knowing—on where, when, to whom—can be easily erased when decontextualized knowledge is brought to the classroom context without the efforts for relationship building. Oracy-based culture, like the one in the Blackfoot community, sees knowing as a situated and idiosyncratic act ([Bastien, 2004](#)). Knowing is embedded in ceremony and deeply situated in the specific moment, place, and embodied relationality ([Wilson, 2008](#)). In this context, at Soil Camp, we collectively came to see arrogance in our assumption that all the knowledge and what we learn can be verbalized. Elder’s teachings and Knowledge Keeper’s teachings grounded us in the plural acts of knowing (Czuy & Eagle Speaker, 2019), as knowing is fundamentally relational, embodied, and emplaced.

Our tensions stem from fundamental epistemological differences between disembodied, reproducible knowledge and knowing that emerges from relationships. For example, in an undergraduate course with many students, it is often impossible to enact the situated ways of knowing that emerge from the specificities of relationships and time, embedded in the land. The mass production of knowledge or knowledge transmission prioritizes efficiency. Thus, placing Indigenous Elders’ teaching in the paradigm of decontextualized knowledge transfer is not an authentic way to desettle the discipline ([Bang et al., 2012](#)). We have been figuring out alternative ways to desettle disciplinary norms. For example, in his soil science courses, Mathew (Author 5) has been questioning the notion of terra nullius in land management history prior to European colonization with forest ecology. In his teaching on soil genesis course, while unpacking a soil map of a town called “High River,” Mathew brings in its Blackfoot name, Ispitsi, which means a place of high trees, to contextualize the history of the land. He also teaches about the environmental consequences caused by the forced removal of Indigenous Peoples’ controlled fire practices ([Christianson et al., 2022](#)). Bringing these histories affords students in soil sciences to picture the landscape prior to colonization and development.

The tension we point out here relates to what [Latour \(1987\)](#) illuminates on the social dimension of scientific knowledge; yet extending further to consider inherent power hierarchy and neoliberalism, which could cease the acts of trans-disciplining. Grounded works are necessarily slow and do not follow the rigid production timeline. Opportunities to learn from the ground, feel in the ground, and stretch our assumptions are not necessarily valued in the evaluation system of our “performance.” Yet, we learned that ground-ness and intentional slowness are necessary for futuristic trans-disciplinary acts to question, revisit, and extend one’s preconceived concepts, methods, and assumptions.

3.2. Experiencing time deeply

One of the central loci of trans-disciplinary negotiation was around the concept of time embedded in the land. On the time-space connection from the Indigenous worldview, [Yunkaporta \(2019\)](#) stated: “kinship moves in cycles, the land moves in seasonal cycles, the key moves in stellar cycles, and time is so bound up in those things that it is not even a separate concept from space” (p. 39). This expansive conception of time is contrasted with linear and measurable time for progress. Forces to unify and standardize time go against pluralistic futures. [Visvanathan \(2009\)](#) named macro forces of globalization and capitalism that unify and flatten our relationship with time to the time of progress: “Globalization and citizenship today are built on the instant time of financial capital, on

speed, on factory time. Tribal time, body time, festival time, the varieties of ecological time have no real place in the official timetables of citizenship.” During our collective analysis of Vignette 2, generative tensions arose around heterogeneous conceptions of time.

Vignette 2:

At 11:30, the bus arrived earlier than the expected start time. Miwa (Author 1) asked the camp leaders to help set up tents and tables for the soil painting station. Miwa then invited two children, Afra and Naza, to put up flags for the day’s activity. The starting point was set at the entrance of a tipi built by a community partner working with urban Indigenous youth. Afra and Naza placed 12 flags at 10-footstep intervals. When Miwa asked how old they were, Afra and Naza said they were both 10. Once they finished setting up the 12 flags, she posed a question: if one footstep represents 100 years, what would 10 years look like? They both pointed to the next flags. Miwa showed her thumb, making a fist in the middle and said, if a foot is 100 years, 10 years should be around this thumb length. She said that, compared to the length of her thumb, the entire length of the 12 flags would represent approximately how long Indigenous people have been on this land. Afra’s facial expression changed. She then shared that she learned in school how Indigenous people were killed by Europeans and forced off their land. An Indigenous Elder had come to her school when she was in Grade 3, she added.

As we collectively reviewed this episode, the use of timescale and archeological evidence became the center of our conversation. The time marker represented in the form of a number line, a mainstream mathematical tool to represent time, brought questions for Kori (Author 2): “There are a lot of creation stories, but we think of a singular creation story that is accepted by global science.” The claim for 12,000 years has been backed up by the commonly accepted theory called “Colvis First” Theory, which does not honour the voices of Indigenous people whose oral histories suggest the “time immemorial” of their presence (Steeves, 2021). Kori highlighted the danger of merely using the commonly accepted numeration, which has been maintained with academic violence against Indigenous peoples (Steeves, 2021). During this discussion, Miwa appreciated Kori’s question as the time marker of “12,000 years” is identified through the method of radiocarbon dating, which is based on the decay of the carbon-14 isotope, and should not be the only method to validate the origin. Kori brought up the star stories passed down generation to generation among Indigenous communities (Buck, 2018). Juxtaposing Indigenous creation stories with other well-consumed scientific narratives (such as the ones formulated through a radiocarbon dating method) is not enough; instead, trans-disciplinary works require us to question academic norms perpetuated through racism and colonialism in the academy, by problematizing what has been numerated and how. The act of trans-disciplining invites us to meet with the worldviews embedded in the land and in stories, and to honour them in their own light.

Based on this realization of plural and conflicting understandings of time, we engaged in pedagogical re-design at Soil Camp. Toward the fourth iteration in 2024, we sought advice from Blackfoot Elder Many Guns to deepen our understanding of land-based learning. While showing the land where he grew up, which was sacredly preserved as “estipah-skikikini-kots,” the Elder told us the significance of newcomers to learn from the land by visiting the sacred land for the Niitsitapi. The Elder told us that the soil underneath estipah-skikikini-kots holds tens of thousands of stories of life, stretching over time immemorial. As stories are the entry points for the spiritual world, the world underground serves as the connector between the physical world we live in and the spiritual world. These perspectives challenged previous iterations of our design. The first iteration of the design, represented in Vignette 2, created a space to discuss with children the histories of the land now called “Canada,” emphasizing that the history did not begin in 1867. Yet, this design fell short, as it did not challenge the mainstream archeological norm. In our re-design under the guidance of Elder Many Guns, we came to experience the magnitude of land stewardship that led to preserving native plants and the bones of bison.

3.3. Listening to the more-than-humans (the soil) with humility and reciprocity

At the core and the beginning of trans-disciplinary acts, we see humility. As Liboiron (2021) distinguishes, humility is not a synonym for modesty. Humility, which is underlying many Indigenous teachings (Bastien, 2004; Smith, 2012; Wilson, 2008), is about how “you are connected to others, and it is the recognition that you cannot do anything without these many others” (Liboiron, 2021, p. 30). Kimmerer (2013) states: “In Native ways of knowing, human people are often referred to as ‘the younger brothers of Creation.’ We say that humans have the least experience with how to live and thus the most to learn – we must look to our teachers among the other species for guidance” (p. 9). Exercising humility, we have been questioning speciesism underlying our respective disciplinary fields. Speciesism places *Homo Sapiens* at the top of a hierarchy that is often used to justify sacrificing other animals, plants, fungi, and microbes for the benefit of humanity. From the hydrogen bomb tests to experiments involving mass sacrifices of animals, speciesism and settler colonialism underlie some of the dominant disciplinary practices of STEM. Beyond the STEM discipline, disciplines such as Sustainability Studies and Education are also implied by speciesism (Bang, 2017; Hill et al., 2024; Sands et al., 2023). To question speciesism and settler colonialism, as a design principle, our team has been seeing the soil as our guide to envisage past, current, and future relationships between humans and more-than-humans.

From this place of humility, we have collectively developed our vision as follows: “We aim to listen: listen to silenced voices; listen to the soil and the land, and listen to one another. Through ‘Listenings,’ we embrace ethical, attentive, relational, and embodied experiences and commitments grounded in the land.” The act of listening here is inherently plural, and we do not necessarily mean auditory activities. We mean the act of taking the perspective of the soil. Listenings to the soil refers to the disposition to see the soil as alive and acknowledge that the soil has lived histories and stories to tell. We are trying to interrogate and unsettle destructive and extractive practices and assumptions on more-than-humans, including the soil across disciplines (as pointed out by Bang et al., 2012; Hill et al., 2024; Sands et al., 2023). The land is our teacher and relative (Betamosake Simpson, 2014). Elder Many Guns has taught us to see the soil as a partner, instead of seeing it as an object to extract from: “We came from clay and go back to clay.” Our acknowledgement of the intimate relationships between human bodies and the soil has been the guide in our design and collaboration. Kori (Author 2) has been guiding us to see the soil as our ancestor from the beginning of our design, which has challenged some of the taken-for-granted assumptions, including the way rocks and soil have been treated in traditional educational spaces. Kori said,

“Listening to the soil goes back to being a part of the land. Soil is our ancestor. We are from the soil. You go back to the soil. We take so much from the soil like nutrients, but we’re not taking care of the soil enough.”

Along with humility, the concept of reciprocity that Kori (Author 2) touches on here has been the guiding teaching for our collective work. In Blackfoot teaching and many other Indigenous teachings, the law of reciprocity is central. Bastien (2004) maintains, “our lives are interdependent and interconnected with nature, that we are part of alliances that we actively need to engage in” (p. 36). Learning humans’ reciprocal responsibilities and maintaining balance is the essence of observing nature, knowing humans’ relatives and alliances (Bastien, 2004; Kimmerer, 2013). To embody reciprocity, Elder and Knowledge Keepers in our team guided us to offer tobacco to the land. The ceremonial act of offering tobacco to the land made us realize the importance of having a spiritual intention to give back to the land, which pushed us to rethink taken-for-granted disciplinary norms. For example, Tatenda (Author 4), who has academic training in Geography and Sustainability Studies, told us that he used to have “a very logical transactional approach” to the land. From this view, the application of compost was mostly for crop productivity. In a similar vein, when “the importance of taking care of the planet” is discussed in Sustainability Studies, the discourse often reflects a human-centric view—framing taking care of the planet *for the sake of humans*. This instrumental value is reflected in the discourse behind environmental conservation policies and critiqued from the perspectives of intrinsic values (for nature’s sake) and relational values (for the human collective). The instrumental value of environmental protection risks separating humans from nature, instead of seeing humans as a part of nature. In contrast, the act of reciprocity and care-giving responsibilities with the land that are rooted in Indigenous worldviews, ceremony, and spirituality, treat all the animals, plants, and fungi as ancestors, relatives, and “more-than-humans” (Betasamosake Simpson, 2014; Kimmerer, 2013).

The conversation around our central value of listening to the soil also revealed the tensions we have experienced in our former academic training and in the way academic norms are reinforced. Contemplating on the act of licensing to the soil, Tatenda (Author 4) said, “A lot of my validated academic knowledge comes from the Western perspective of science. So, this idea of listening to the soil and learning with the soil... I don’t feel like I have developed the sensors to be able to absorb those lessons. I’ve learned a lot from all of you, especially, challenging my mind frame. I definitely do respect the lifeforms in the soil, but I didn’t know there was a whole academic line of thinking and documenting with the concepts such as reciprocity and more-than-humans. This whole idea of not putting my imprint on the soil and how it functions. Now I ask myself: How much am I letting the soil express itself?”

Similarly, Mathew (Author 5), who has academic training in Soil Sciences, commented on how his ways of seeing the soil changed over time. Now he asks a central question, “What does the soil want to be?” Mathew said, “For the listening aspect... I come from a classically Western science-trained background, and for a long time, that’s kind of just how I viewed: you just measure the pH, you get the sand, silt, clay, soil organic carbon, some soil mesofauna, bacteria, fungi. But going to different places, like ravines, made me think of the long-term progression of things. Take the hill eroding. Is it just mechanistic things happening, such as a big rainfall and a slope event? Or is it just what it wants to do? I now ask what the soil wants to be here. It is a consequence of many things, but it is like giving the soil a sense of agency versus just seeing the soil as a massive stuff that’s just on the ground.”

These emergent perspectives that center the agency of the soil led us to imagine the particular land where we held our Soil Camp project, from the soil’s point of view, by taking a chronological trace of human activities (Swallow et al., 2023,2025). On this particular land, until 2009, the soil experienced the cycle of harvest, which involved the disruptive effects of annual soil tillage, vehicle traffic and the application of biocides for plants and animals deemed pests. In 2010, the soil’s life-rich surface was stripped away, and it was then pressed for the construction of a highway. This caused soil compaction, where the soil pores are pressed, and the soil became more rock-like. In this single event, human activity undid the thousands of years it took for the soil to be a space where life could thrive in harmony with the local climate. Together with teachers and children, we tried to imagine the detrimental impacts of human activities and listen to what the soil wants to be. We noticed how some plants were still growing on the compacted soil and how the pasture soil was still acting as a refuge for native plants and some animals. Under the guidance of Mathew and also with the oral histories of Blackfoot Elder and Knowledge Keeper, we came to know that the land was originally a wetland, and that is the state the soil wants to be.

Instead of treating the soil as a mere object of scientific inquiry, trans-disciplinary ways of listening to the soil oriented us to reciprocity and responsibility. For example, Mathew (Author 5) has been guiding ways to experiment with the ways we could help the compacted soil return to their native state. Grounded in soil sciences expertise but also drawing from Indigenous ways of living with the soil, Mathew led us with planting cover crop root vegetables such as Daikon radish that could help the compacted soil horizon to be more permeable. He has also led an experiment using stone mulching practices rooted in Indigenous ways of mulching in Rapa Nui, to conserve moisture (Swallow et al., 2025). Because many family members at Soil Camp engaged in traditional, family or community-based agricultural practices before the forced migration, some children shared embodied agricultural knowledge with us. As children were helping us set up stone mulching experiments, one of them made a comment that their father used to use stones in his agricultural practices in Syria. Trans-disciplining acts emerge when intergenerational, Indigenous ecological knowledge dynamically yet ethically interacts with inquiries of scientists. Instead of learning about the soil for the sake of learning, we were learning with the soil, by taking their perspective and imagining their lived histories. Learning with the soil was oriented toward reciprocity: To learn what humans can do to be a better partner with the soil.

3.4. Co-learning together and with the land

Trans-disciplining acts were enacted as our commitment to questions greater than the discipline itself, aiming for the emergence of new epistemological and ontological realities by embracing historically silenced voices to liberate learners from colonial knowledge production (Gordon, 2006; Takeuchi & Marin, 2022). In the face of the unknown, which is larger than us and continually emerging, we are all co-learners learning together. We experienced awe, wonder, surprise together with children, and with each other. Such a

disposition of co-learning gradually came to be shaped over time as the relationships among us, other team members, and with children and their kin matured. Without the many walks we shared and the various faces of the soils we have met over time, we might not have a quality relationship that allowed us to be vulnerable and open to the unknown.

Instead of settling with disciplinary norms, our co-learning led us to stay with the unsettled ways of naming, framing, and practicing disciplinary ways of knowing. For example, an emerging understanding of spirituality and the humble positionality of humans to more-than-humans presented some disciplinary dilemmas. Tatenda (Author 4) pointed out that the body of literature on regenerative agriculture mainly was rooted in Eurocentric epistemology and ontology. Among all the literature on regenerative agriculture he has reviewed recently (Mambo & Lhermie, 2024), the limited number of studies (e.g., Sands et al., 2023) acknowledged spirituality and humility. Drawing from Tuck and Yang (2012) argument that decolonization should be about repatriation of Indigenous land and life, Sands et al. (2023) proposed to redefine regenerative agriculture from the perspective of honoring Indigenous land/food sovereignty as well as Indigenous ways of knowing and worldviews. Beyond regenerative agriculture, the aspect of care and love has long been pushed away from the mainstream, laboratory ways of practicing science or the ways in which disciplines such as science and mathematics have been formulated (El Halwany & Alsop, 2023; Kimmerer, 2013; Takeuchi & Marin, 2022). Instead of taking a linear pathway, trans-disciplining acts are meandering with openness to the unknown.

We co-learned *with* the land, who has agency and presented us with a full of surprising gifts and mysterious stories. Under the guidance of Mathew (Author 5), we excavated a soil pit of one cubic meter on the land, trying to understand the cause of the surfacing issue, such as a water absorption problem. Seeing the compaction in the area where human activities for construction were active, we wanted to understand the state of the soil as close to the native state. We had an assumption that the soil profile would be akin to a typical grassland soil. Our assumption was wrong, and we were met with a mysterious white layer that did not feel like clay. We were all puzzled by the fine-grained, white powder on our hands. After a while, with excitement, Mathew hypothesized that this might be volcanic ash. In his lab, he closely observed this potential volcanic ash under a microscope, which showed tiny glass fragments. About 7700 years ago, the volcano now known as Mount Mazama (in Oregon, Washington) or Tum-sum-ne or Moyaina (in Klamath-Modoc) erupted. This volcanic ash that travelled 7700 years ago is known to be found in the Banff area (Westgate & Dreimanis, 1967). However, we were presented with a mystery of the volcanic ash that had travelled all the way to where we were located in Treaty 7 lands. This encounter with the unknown left a strong impression on the children, and many shared their awe, surprise, and wonder with us. Children were together with us in joy and grace to witness this (hi)story buried under the top horizon of the soil, as we all imagined the stories of how the ash travelled and preserved, and what the experiences of such a dramatic event to Indigenous Peoples, plants, and animals might have been.

4. Conclusion

The trans-disciplining acts we highlighted were the necessary tensions and points of emergence, in our own process of learning to build a community and alternative ways of researching and collaborating that are “not here yet” (Muñoz, 2019). In response to the current trend for transdisciplinary research and scholarship, we showed the possibility of transdisciplinary work as a verb and a process that involves questioning and rewriting the dominant disciplinary norms. The act and process of trans-disciplining can be uncomfortable and unsettling, yet also can be liberating and expansive. Toward the vision of ancestral future of human and more-than-human entanglement that was and is already here (Krenak, 2024), we collectively nurtured our dispositions to stay with the unknown and be vulnerable in the process of not-knowing, through grounding ourselves in the learning with the land. Trans-disciplining is necessary to make space for ways of knowing that have long been overlooked in many institutionalized academic disciplines and the spaces of K-12 and higher education. As we learned from and with local Indigenous Elders and Knowledge Keepers while being grounded in the land, we see the urge to re-center ways of knowing that are relational, reciprocal, humble, and non-anthropocentric. Learning from/with Indigenous ways of knowing is crucial as we continue to witness repercussions from human-caused environmental degradation. We see the process of historicizing knowledges and contexts as an integral part of creating future narratives that exist as a continuum of the present rather than abstract, human-authored predictions. Our experiences affirm that the collective imagination of ecologically sustainable futures cannot be separated from the narratives and histories of our enduring inter-dependencies with the land and more-than-humans.

The act and process of trans-disciplining are necessarily slow, as we need to learn, re-learn, and unlearn while building relationships and trust among collaborators and community members who bring in various conflicting ways of knowing, being, and valuing. Trust and value in the process of co-learning may not necessarily fit neatly into the outcome-oriented, fast-paced knowledge production systems expected in the current neoliberal universities. However, resilient ecosystems grow slowly. Each of us believes in the human condition for continuous learning and unlearning, to grow to be a better friend to the soil and other more-than-humans. Our essay is an open invitation.

CRedit authorship contribution statement

Miwa A. Takeuchi: Writing – review & editing, Writing – original draft, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kori Czuy:** Writing – review & editing, Formal analysis, Conceptualization. **Deborah Dutta:** Writing – original draft, Formal analysis, Conceptualization. **Tatenda Mambo:** Writing – review & editing, Formal analysis, Conceptualization. **Mathew Swallow:** Writing – review & editing, Formal analysis, Conceptualization.

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Data availability

Data will be made available on request.

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