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Land-Based Education and Tuxá Cultural Resilience in the Opará River, Brazil

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Abstract

Recent discussions on land-based education emphasize its importance for sustaining territorial relationships and knowledge systems. This article explores how the Tuxá people in Rodelas, Brazil, displaced from their ancestral lands, transmit traditional knowledges in a new environment. Despite being displaced from ancestral areas, land-based education places a crucial role in reclaiming traditional Tuxá knowledge and strengthening their territorial rights. Through *radarãiedea*, a holistic framework of ancestral inheritance, Tuxá youth collaborators reinterpret their relationship with the land, waters, bush, and dunes. The findings show that Tuxá peoples transmit knowledge through a dynamic process that blends ancestral wisdom with adaptive learning and emphasizes multispecies relationships. By means of a small number of young people engaging in land-based education, they preserve their cultural identities and reinterpret their knowledge systems. This integration of environmental stewardship, spiritual engagement, and multispecies interactions ensures resilience in the face of land dispossession and ecological changes.

Keywords:
Land-based education, Tuxá youths, *radarãiedea*, ancestral knowledge, multispecies relationships

Introduction

Land-based education has been integral to Indigenous pedagogies, shaping lifeways, knowledge creation, and the transmission of wisdom across generations (Cajete 1994). It is rooted in Indigenous epistemologies (Wildcat et al. 2014, 6; McDonald 2023, 5), where land itself is seen as an active participant in the co-production of knowledge, and is closely linked to traditional ecological knowledge (TEK) (Berkes 2012). TEK, a dynamic body of knowledge arising from ongoing interactions between humans and their living environments, is interwoven with spiritual beliefs and ecological practices (Davidson-Hunt & Berkes 2003; Berkes 2012; Turner and Clifton 2009). As McGregor (2004) points out, Indigenous peoples view traditional ecological knowledge as a way of life, intrinsically woven into spiritual experiences and connections to the land. Indigenous-led land-based education is essential for sustaining knowledge transmission, as it reinforces the deep interconnections between territory, ancestral wisdom, spirituality, community values, and well-being (Cajete 1994).

This perspective challenges Western views of the land as passive, instead recognizing its multispecies inhabitants as active agents in shaping knowledges (Kohn 2013; Tuck & McKenzie 2015; Virtanen et al. 2024). In the case of Tuxá peoples in Rodelas, in the Brazilian northeast, this relationship reinforces the importance of Indigenous-led land-based learning and the re-signification of cultural and ecological knowledges despite displacement.

Previous studies on land-based education (e.g. Wilson et al. 2021; Virtanen 2022, Ermine 2024; Datta et al. 2024), place-based learning (e.g. Hohenthal & Veintie 2024; Roze des Ordons and Hill 2024), and traditional ecological knowledge (e.g. Witharana et al. 2025), focus on the role of land-based education in adapting to climate change, fostering sustainability, and promoting cultural resilience. It also explores how Indigenous youths integrate ancestral wisdom with contemporary environmental and political awareness. However, a gap exists in understanding how Indigenous communities, specifically through multispecies perspectives, actively reinterpret and adapt their knowledge systems in response to land dispossession and ecological degradation. This study addresses this issue by examining how such adaptations take place through the lens of multispecies relationships and spiritual connections to the land. I explore how Tuxá people of Rodelas transmit their traditional knowledge in a radically transformed environment from which they were displaced.

The Tuxá peoples of northeastern Brazil, who originally resided along the São Francisco, or as the Tuxá of Rodelas called it, the Opará River, faced significant disruption in the 1980s with the construction of the Itaparica hydroelectric dam, nowadays known as Luiz Gonzaga dam (Cruz 2018, 40–41; Vieira 2016; Durazzo & Fiori 2021, 10). This project submerged vital cultural sites, fragmented their territories, and scattered the Tuxá into three groups, who resettled in Inajá, Ibotirama, and New Rodelas. Despite displacement and the loss of their ancestral lands, the Tuxá of Rodelas have fought to revitalize their ancestral language—silenced during 18th-century religious missions—as a way of sustaining their deep cultural and spiritual connection to their territory, which they perceive as a living, sentient entity. However, this relationship is not solely based on physical land but on continuous interactions with the more-than-human world, which have forged the core of Tuxá identities and knowledges.

This research is grounded in radarãiedea (rada= terra/land, arayêde= ancestral, antigo – ancestral land), a holistic Tuxá framework

of ancestral inheritance within Indigenous methodologies (Virtanen et al. 2021; Kovach 2021; Smith 2012). Integrating Tuxá ontologies, epistemologies and axiologies, and following Tuxá ethical and cultural protocols, radarãiedea emphasizes respect, reciprocity, and interconnectedness, guiding Tuxá youths' relationships with the land, both historically and, for some peoples, still today. These connections extend beyond human interactions to encompass all living beings, shaping individual lives and entire communities (Lacan et al. 2024). They include cosmological beings and spirits, reflecting the agency of more-than-human entities in shaping knowledges.

During my first visit to the territory in 2022, a Tuxá woman explained that the land manifests itself differently to each non-Tuxá person, as "eles" (the guardians) will reveal to me what they want me to see and know. This emphasizes the active role of non-human entities in guiding and shaping experiences, knowledges, and understandings, a concept aligned with multispecies ethnography (see Chao & Kirksey 2022; Taylor 2024).

The fieldwork for this study was conducted between 2022 and 2024 in collaboration with the Tuxá people of Rodelas, employing conversations, field notes, photographs, and participatory methods, including youth-led audiovisual documentation. It also incorporated Tuxá knowledge production practices, such as observation, co-living, walking, and direct engagement with the territory. The targeted group consisted primarily of a small number of young Tuxá collaborators aged 15 and older (10 young collaborators), who are actively engaged in land rights advocacy and have close interaction with the territory. To understand how the territory was in the past, material was also produced in collaboration with adults, educators, and knowledge keepers (approximately 35 people).

This study's objectives are: 1) to explore how Tuxá people of Rodelas transmit and adapt their traditional knowledges in response to land dispossession and ecological changes. 2) To examine the role of land-based education and rituals in protecting and reinterpreting ancestral knowledges for contemporary challenges. 3) To identify Tuxá's understanding of their territory as a multispecies system, emphasizing the interconnectedness of humans and more-than-human beings in the knowledge transmission process.

As a non-Indigenous researcher, my positionality was shaped by my Latin-American cultural background and professional formation in cultural heritage, Indigenous studies, and archaeology. Thus, I aimed to engage in community-led projects, learning to conduct research in ethical ways with, rather than on, Tuxá. My role was to observe, collaborate, and ensure reciprocity while respecting their cultural inheritances, protocols, and land rights.

The material shows empirically that Tuxá peoples of Rodelas transmit traditional knowledges in new natural environments through a dynamic process that blends ancestral wisdom with adaptive learning. Because some of them still engage in Indigenous-led land-based education, they maintain and evolve their cultural identities through embodied practices, multisensory experiences, and ritual interactions with the land and other-than-human beings. Despite the challenges of land dispossession and ecological changes, the young Tuxá collaborators reinterpret their knowledge systems by attempting the integration of environmental stewardship, spiritual engagement, and community-driven ecological practices. This evolving approach ensures that traditional knowledges remain relevant, resilient, and capable of addressing contemporary environmental and social realities.

Theoretical basis for land-based education

Indigenous land-based education is deeply rooted in epistemologies and ontologies that emphasize the interconnectedness between land, language, and knowledge production, as Tuck and McKenzie (2015, 13) suggest. This approach prioritizes storytelling, ecological practices, and embodied experiences, ensuring the transmission of ancestral knowledge through engagement with land, rituals, and multispecies landscapes. The recognition of Indigenous land rights further strengthens this educational framework by embedding environmental sustainability and sovereignty into learning processes (Datta et al. 2024). By reclaiming control over their ancestral lands and natural resources, Indigenous peoples assert their autonomy and ensure the ongoing stewardship of the environment. This is central to both cultural identity and ecological resilience (Datta et al. 2024, 180).

Scholars like McDonald (2023) argue that land-based education fosters cultural identities, resists dispossession, and reinforces sovereignty through ecological and ceremonial practices. These practices, as noted by Hohenthal and Veintie (2024) and Roze des Ordons and Hill (2024), ensure the continuity of Indigenous worldviews, viewing land as a living entity with memory, agency, and presence. Legal battles and grassroots movements further highlight the role of Indigenous governance systems in protecting traditional territories from environmental harm while reaffirming relational ontologies that position the land not merely as a physical space, but as an active participant in cultural and environmental sustainability (Datta et al. 2024, 180).

Schroeder (2006) describes how land-based education emphasizes the pedagogical significance of the environment, while place-based education functions as a broader framework that situates learning within localized ecologies and relationships between humans and more-than-human beings. Moreover, rather than adhering to universalized models of knowledge transmission, Hohenthal and Veintie (2024) argue that place-based education grounds learning in specific territories, fostering a critical engagement with land and colonial histories. As Virtanen (2022, 345) points out, Indigenous education is deeply grounded in the land, where knowledge emerges through place-based relationships among diverse life forms, and where stories, languages, and traditions are rooted in local contexts (see also Wildcat et al. 2014). This approach resonates with Furman and Gruenewald's (2004) argument that place-based education is closely connected to place-conscious pedagogy, which challenges the capitalist and ecologically damaging assumptions of mainstream schooling. Consequently, this perspective aligns with Indigenous visions of sustainability and relationality, reinforcing the importance of localized, culturally rooted pedagogies.

Similarly, Virtanen (2022) discusses how relational ontologies expand the understanding of knowledge production as a co-constitutive process involving both human and more-than-human entities. Likewise, Indigenous education models have long emphasized interdependency within ecosystems, demonstrating that learning occurs through reciprocal relationships, as Whyte (2018) points out. Consequently, knowledge is not merely extracted from the land but instead emerges through dynamic intra-relations between beings, reinforcing the idea that learning is an ongoing, interactive process rather than a unidirectional transfer of information (Virtanen 2022).

Van Dooren and colleagues (2016) extend this framework through multispecies studies, recognizing that all living beings emerge and evolve within entangled ecological and historical relationships. Accordingly, this perspective challenges

anthropocentric views of knowledge production, emphasizing that learning is co-constituted through relationships among plants, animals, microorganisms, and other life forms. Haraway (2008) argues that multispecies relationality reveals the reciprocal entanglements between beings, positioning education as a practice of becoming-with rather than an isolated process of knowledge acquisition. Likewise, Kohn (2013) aligns with Indigenous perspectives by conceptualizing learning within complex ecologies of selves, where meaning, agency, and intersubjectivity are distributed among diverse life forms rather than being confined to human experience.

While Tsing (2015) does not directly advocate place-based learning or pedagogical frameworks, her discussions of collaborative survival and multispecies assemblages suggest a way of knowing that moves beyond humancentric perspectives. This intersects with place-based learning and advocating for pedagogies that acknowledge the agency of more-than-human entities in shaping knowledge systems. Consequently, this approach challenges dominant anthropocentric narratives and fosters attentiveness to the interdependent processes of living and dying, being and becoming, within multispecies communities. Furthermore, as van Dooren and colleagues (2016) point out, multispecies perspectives open up new discussions on responsibility, conservation, and justice in educational practices, prompting scholars and educators to reconsider the ethical and political dimensions of land-based and place-based learning.

Cleaver (2024) also argues that Indigenous land-based sustainability reveals how education is not merely the transmission of ecological knowledge, but rather an active engagement with the ethical responsibilities of living in reciprocal relationships with the land. Moreover, as Cajete (1994, 2005) emphasizes, centering Indigenous ways of knowing and being through land-based education fosters processes of resilience, empowerment, and healing, offering pathways toward decolonization grounded in relational and ecological understanding.

Both land-based education and relational ontologies provide complementary insights into Indigenous learning systems. On the one hand, McDonald (2023) suggests that land-based approaches prioritize tangible interactions with land as a primary source of knowledge. On the other, Kohn (2013) highlights that relational ontologies emphasize the entangled nature of knowledge production, extending beyond physical landscapes to include more-than-human entities. Speed (2017), for her part, explains that place-based education intersects with these frameworks by fostering a critical territorial consciousness, particularly in regions affected by environmental degradation and resource extraction.

The integration of land-based pedagogy within formal educational systems remains a challenge, as traditional Indigenous practices often conflict with institutionalized structures, as Fleuri and Fleuri (2017) note. However, scholars argue that revitalizing land-based learning can recover epistemologies disrupted by historical and colonial contexts, as Ermine (2024) suggests. The incorporation of relational ontologies, multispecies perspectives, and Indigenous land rights into these discussions underscores the need to recognize Indigenous knowledge as fluid, collective, and embedded in reciprocal relations with the living world.

Ultimately, land-based education, place-based education, relational ontologies, and Indigenous land rights provide a multidimensional understanding of Indigenous learning, reinforcing the importance of lived experiences, ecological relationships, and the interdependent nature of knowledge systems. As McDonald (2023) underscores, by integrating these

perspectives, Indigenous education can continue to evolve in ways that resist dispossession while honoring traditional epistemologies and ontologies.

Tuxá ways of life and well-being before 1988

I first became aware of Tuxá peoples and the realities faced by Indigenous communities in northeastern Brazil during an online event on Indigenous rights in 2018. There, I met a Tuxá social anthropologist with whom I developed a strong friendship. Over time, I gradually learned more about the Tuxá peoples and their situation. Given my longstanding interest in territorial issues and my desire to use my academic background to support Indigenous groups, I initially focused my research on multispecies heritage, exploring traditional ecological knowledges.

As my engagement deepened, I began discussing the possibility of conducting collaborative research with the Tuxá peoples in Rodelas. We held virtual meetings with the local school via Meet, where we explored potential sustainability projects. My first in-person visit took place in 2022, with one of my doctoral supervisors, the social anthropologist Leandro Durazzo, alongside during a workshop on the revitalization of Dzubukuá, the Tuxá ancestral language. This visit provided me with the opportunity to propose a potential research project in person. Since then, we have been working together, refining the preliminary proposal based on the Tuxá peoples' most pressing needs.

Tuxá peoples once inhabited over 33 islands, each serving distinct purposes. However, natural floods and expropriations gradually reduced their territory. Until 1988, they lived in Old Rodelas (Velha cidade, old city), as Tuxá refer to their dwelling in the ancestral territory situated on the riverbanks, retaining only the islands of Ilha da Viúva (Widow's Island), referred to as Ilha Mãe (Mother Island) by the Tuxá, and Surubabel.

The Surubabel island was expropriated by non-Indigenous people, who established plantations there, and where some Tuxá worked until a flood submerged it. Consequently, Tuxá arrived to their Island, Ilha Mãe (Ilha da Viúva), a vital space for their sustenance, ecological practices, and *ciência* (ritual complex). Ciência is a mode of communication between Tuxá peoples and between Tuxá and Encantados (cosmological forces) (Durazzo 2019, 19). A female knowledge keeper emphasized that Ilha da Viúva had a learning environment, with well-being and healing potential.

A woman Tuxá adult collaborator explained to me that Tuxá knowledges are expressed through *arâyede* (ancestral, ancestors), *dzu* (water, river), *liedse* (forest, bush), *radawa* (rada = land, wa = to walk – walking sand, walking land – dunes), *hewi* (air), and *dzunerada* (dzu = water/river, ne = to see/to take care/to protect, *rada*= land – land protected by water, island), reflecting that learning is shaped by the reciprocal ties of multispecies with the land, co-producing *radarãiedea*.

Before the flooding, children learned land science through daily life on the *dzunerada* or Ilha da Viúva, developing care, reciprocity, and respect for the land and its cycles. Mornings were spent helping their fathers with agricultural work on Ilha da Viúva before attending school the afternoon and evening, gaining knowledge through caregiving, patience, and time awareness (Santos 2021).

Agriculture was central to the Tuxá economy (see more Nasser 1975), but the Opará River, as the Tuxá refer to the São Francisco River, was equally vital (Tuxá & Tuxá 2020, 26). One adult Tuxá collaborator and specialist in revitalizing the Dzubukuá language explained that *Opará* -word probably stems from the Tupi

language, meaning river-sea, a reference to its vastness. In Dzubukuá Tuxá, the word for a river or water (depending on the context and usage) is *dzu*, *wodzuie* (big river; to evoke the sense of the sea). Known as canoe people, Tuxá saw the river as a nurturing father, sustaining body, soul, and mind. Even after displacement, young collaborators today still find its waters restorative, embodying ancestral ties despite its changes.

In the past, the Tuxá used to have a deep understanding of their environment through long-term observation and interaction, acquiring ecological knowledge through hands-on experience through oral but non-verbal communication. River behavior dictated life rhythms—when the waters were steady, agriculture and *ciência* took priority. They practiced polyculture, cultivating guava, mango, banana, grapes, sweet potatoes, beans, manioc, red rice, onion, and later, sugarcane, among other things. Manioc and sweet potatoes were grown along the riverbanks, harvested before natural floodings, then replaced with other crops. Tuxá used to have a flour house that was located in the old city and played a crucial role, where families took turns producing manioc flour and *beiju* for year-long storage. When natural floods arrived, hunting capybara (*Hydrochoerus hydrochaeris*) and chameleon became essential, reinforcing social bonds as families shared the meat, mirroring harvest-time solidarity.

Before the major flooding, the Tuxá relied on local medicinal plants—gathering leaves, bark, and herbs from Ilha da Viúva, as well as paths full of healing plants, or stones found underwater or from the bush. However, after the intentional flooding, many species vanished. The bush, where there was once a plentiful supply of plants, was replaced by coconut and mango plantations. Now, finding these medicinal plants requires traveling longer distances, and only those with knowledge of the plants can harvest them with the guidance and permission of bush spirits. In the past, as well, to harvest a medicinal plant, the Tuxá were guided by moon cycles, river behaviors, and bush spirits' permissions. The drying up or increasingly winding path of seasonal streams also influenced access to the bush and to natural resources.

Respect, reciprocity, and sustainability remained central — people understood the right time for planting, hunting, and harvesting. A female knowledge keeper, sitting in her hammock in the backyard and smoking a *paewi* — a pipe in Dzubukuá Tuxá, whose etymology is rooted in the lifeways of the Kariri and Dzubukuá peoples (*pa* = to kill, *e* = to charge, to carry, *wi* = to be; in Tuxá *ciência* = to remove evil from someone) — explained that reciprocity means respecting the land's cycles, as it provides both physical and spiritual sustenance. For instance, *lhédzihe*—a sacred tree or plant known as jurema—refers to the smooth, thornless jurema variety. It includes two species: white jurema (*Mimosa hostilis*) and black jurema (*Mimosa tenuiflora* [Willd.] *Poiret*), both of which have been used in the past and continue to be used today in private as well as in public ceremonies. While these species were once commonly found on the islands, they have become increasingly scarce. In contrast, the thorny jurema variety has been and still is more commonly found in the Caatinga biome, where the Tuxá people inhabit. Lhédzihe holds healing power and serves as a communication means in rituals. Tuxá still harvest only select parts of plants, ensuring their regeneration, as each root, leaf, and flower carries a specific function. For instance, bark is used to make infusions that strengthen the immune system, or biting a small piece of *lhédzihe* bark can relieve toothache, among other uses.

This knowledge system extends beyond human actors. *Radarãiedea* is protected and guarded by *Eles* (them), the *Encantados de luz*, *Encantados*, or *mestres Encantados* (various names are used to refer to cosmological forces), while some also

acknowledge the *pajé* (spiritual leader, healer) who *ancestralizou* (passed away) some years ago. Everything—*dzu*, *liedse*, *radawa*, and *rada*—has owners and guardians, requiring permission before use or entry. A female knowledge keeper, while crushing *lhédzihe* bark, recalled how rituals were once performed before, during, and after any practice to express gratitude and seek permission from guardian spirits. Nowadays, some people follow the same rule. Even I had to request permission to enter certain sacred sites or to enter the territory, river or the bush. Traditionally, children learned these values of respect, gratitude and care through everyday behaviours, absorbing land rhythms and understanding the guardians of *radarãiedea*.

Yet, during my visits, I noticed that not all Tuxá members actively seek permission in *radarãiedea*. Those most connected—mentally, physically, and spiritually—understand its necessity and the consequences of neglecting this responsibility. Watts (2013, 23) asserts that ecosystems and habitats possess ethical frameworks, interspecies treaties, and agreements that shape human understanding and behaviors. More-than-human beings are active participants; just as they permit hunting, fishing, planting, and gathering, they can also enforce consequences when obligations are ignored, such as not being successful in the ecological practice one wishes to carry out or not finding what one is looking for. Tuxá permissions may involve placing a flower at a specific spot, directing smoke toward a tree, or engaging in private rituals. Nowadays, many youth collaborators have learned these practices from their grandparents, similar to observations made by Virtanen (2022, 348) among the Apurinã in the Purus River region, where children learn to act in relation to the invisible more-than-human world.

However, this way of life was profoundly disrupted by an intentional flood caused by anthropic actions, threatening not only Tuxá livelihoods but also their ecological knowledge, non-linear cultural continuity, and spiritual connections.

Cultural ruptures and resilience: Tuxá post-flood

In the 1970s, the Itaparica hydroelectric project began and was completed in the 1980s. By the end of the decade, a major flood submerged Old Rodelas and Ilha da Viúva. Oliveira (2022, 118) notes that while other Indigenous groups in northeastern Brazil, such as the Pankararú, Pankararé, Atikum, and Truká, faced similar challenges, the Tuxá were most affected. The Tuxá were dispersed into three groups and forced to leave their ancestral lands, with each group resettling in a different location: Inajá, Ibotirama, and New Rodelas. This displacement severed their ties to their ancestral territory, causing a profound cultural and spiritual rupture (Silva & Arruda 2013, 140) and erasing traditional practices and legacies, and de-subjectivating the ancestral territory.

As Santos (2017, 229) asserts, Indigenous groups impacted by river damming in the region have developed distinct ways of perceiving and accessing natural resources, each engaging uniquely with their environments. The flooding also altered several socio-cultural aspects such as ecological practices, reducing local flora and fauna and affecting culturally significant species like catfish (*Pseudoplatystoma corruscans*), golden dorado (*Salminus franciscanus*), capybara (*Hydrochaerus hydrochaeris*), and *lhédzihe*, as well as impacting their land-based learning, their socio-environmental relationships, and their social organization.

For the Tuxá of Rodelas, moving away from the river led to a cultural breakdown: family groups distanced from their territory, ecological practices were disrupted, and the river's significance faded. Oliveira (2016)

studied how the distance to the river influenced lifestyles in the islands (the ones who lived on its riverbank compared to those living inland) in the São Francisco River area during the religious missions, highlighting its impact on social and cultural dynamics. A Tuxá knowledge keeper shared that they were peoples raised in the riverbank, and nowadays there are children raised away from the river who are losing vital knowledge coming from it, including the ability to swim, which disconnects them from their roots and the territory. This is a consequence of the increased distance to the river. She explained that a child who does not learn to swim will grow with fears.

With the same cultural symbolism as *dzu*, the Tuxá peoples also acquire knowledge from *liedse* (see e.g. Houart et al. 2025), which encompasses plants, clay, leaves, and all the agencies dwelling there, as well as forest guardians. Like *dzu*, *liedse* has strengthening and healing potential, particularly spiritual healing. However, *liedse* is not a specific location; it is an area, an ever-present entity. It is not limited to plants—it can be a clay-rich creek used as raw material for houses and ceramics, or a cluster of leaves that serves as a resource for various purposes.

The use of each resource is learned through knowledge of the ancestors—whether for healing, building settlements, or gathering honey and beeswax, and each resource has its own function. Yet, *liedse* is not just a bush; it is all beings that coexist and become-with, through the intrinsic relationships among them, through which things acquire form and meaning. Though it is farther from the river, at times people must go to *liedse*, and at other times to *dzu*, to connect deeply with ancestral knowledge or primordial knowledge.

A Tuxá woman adult recounted that in their history, one Tuxá group lived in *liedse* and another in *dzu*. Between them, values of solidarity and care were strong, as they exchanged food and knowledge—such as between families who fished and those who hunted. They also shared spiritual wisdom.

In 2010, the Tuxá began reclaiming part of their ancestral land in D'zorobabé, also called *Aldeia Avó* (Grandfather's village) by the Tuxá, reorganizing into 11 family groups with varied ties to the territory. They self-demarcated the area in 2017, with rotating families guarding it to prevent encroachment. This fragmentation disrupted daily life and education, creating disparities in the transmission of knowledge, especially regarding traditions, spirituality, and environmental management.

Yet, during my participation in a workshop about the language revitalization organized at the local school in 2022, an adult Tuxá woman collaborator explained that, after losing their land, education became their main tool in the fight for land rights. Recognized for their educational skills, the Tuxá's history traces back to a time of ethnic recognition when Indigenous groups in the Northeast had to prove their Indigenousness (Carvalho & Carvalho 2012, 113), often through cultural markers like the *toré* dance (Grünewald 2005). The Tuxá were central in revitalizing this tradition in groups where it had disappeared (Reesink 2000, 373), while later on these groups also re-signified their chants, rhythms, and dances, they reinforced Tuxá's solidarity with neighboring communities.

During my fieldwork, I spent several days helping the local school systematize the content of the subjects. I attended many meetings with educators, talked with educators, and observed and learned about their educational system. Today, Tuxá children attend school, where they receive a blend of national and Indigenous education. As part of this curriculum, they dedicate one day a week to learning *Dzubukuá* (*Dzu* = water, river, *bu* = appearance, *ku* = white, *a* = plural: water of white appearances, clear

river, river of crystal-clear waters), their ancestral language, which is currently undergoing a revitalization process (Durazzo 2019). Projects like language revitalization, traditional knowledge, poetry, and music aim to strengthen ties with the land and ensure knowledge development. However, as a male educator noted during a coffee break in the educators' meeting, while school-based education is valuable, it alone cannot fully reconnect children and youths with the land. Indigenous-led education, guided by elders and rooted in lived experiences in the territory, is essential. This is especially true when learning Dzubukuá, as the language is best acquired through direct engagement with the territory rather than in a classroom, reflecting how Tuxá cultural dynamics emerge through the deep interplay between their ancestral language and the land.

Integrating traditional knowledges into formal education remains a challenge, as many youths are disconnected from their roots. While they attend the local school, which operates throughout the day, they are not engaged in the *ciência*, where specific Tuxá knowledges are passed down. Only a small number of young research collaborators dedicated to land rights and to maintaining traditions, participate in these practices. However, adult collaborators stress the importance of youths connecting with the land alongside knowledge keepers to learn about plants, the river, and the territory through observation and other forms of communication.

Youth collaborators speak nostalgically of Ilha da Viúva, the Opará River, *radawa*, and *liedse*, emphasizing the strong bond with the environment and its guardians, which shape daily life and *ciência*. They believe that *dzu*, *liedse*, and *rada* contribute to the co-construction of personhood for the Tuxá and other-than-humans, such as the river, bush, and land, reflecting a worldview where subjectivity is not exclusive to humans. As Viveiros de Castro (2004, 469) explains, in animist ontologies, the "intentional stance" is universalized rather than reduced, attributing agency and consciousness to non-human entities. This understanding resonates with a young Tuxá girl's reflection that, although the Opará River has changed, its presence is embedded in *toré*, chants, graphisms, spirituality, and even in their bodies—flowing in their blood—highlighting the enduring, reciprocal relationship between people, place, and spirit. While Opará has traditionally been considered a father or a friend, for the younger generations it has become an internalized being—alive within their bodies and everyday experiences. This shift illustrates the ontological multiplicities that link the Tuxá with their ancestral territories, where beings transform, endure, and take on new forms of presence across generations.

During a school activity in the main square of the village, a young girl collaborator explained that from childhood some are taught that *D'zorobabé*, *liedse*, *radawa*, and *dzunerada* are the dwelling places of their ancestors, fostering a sense of belonging and forming Tuxá identities. A young boy continued by explaining that some of them learn to respect and care for these sites, from plants to precolonial material items like *paewi* and arrowheads, as these things hold their history, ancestry, and identities. They learn the values of respect, responsibility, care, and reciprocity through these connections.

Nowadays, youth collaborators acknowledge the importance of knowledge (re)generation through *ciência*, since they believe that key knowledges come from the *Encantados* (cosmological beings), who protect and guide Tuxá decision-making and life. Knowledge generation and transmission happen not only verbally through stories, but also oral but nonverbally. I observed during *toré*, *handicraft*, *graphisms*, etc., that bodies play a key role, being an epistemological source for Tuxá peoples with interdimensional communication and in the interconnections

with the land. Human hands, for instance, create objects that are capable of being subjectivized with cosmological forces, showing intrinsic relationships through interaction and the motion of bodies (*dzu* - body, *liedse* -body, *radawa* - body, *rada* - body) constituting *radarãiedea*, namely being in a condition of constant protection, learning, and guidance by *mestres encantados* (cosmological forces).

Paewi, for instance, is a means of socializing with cosmological beings and spirits and is both important in ritual contexts and in the daily life of Tuxá culture (Bigá forthcoming). *Paewi* is an essential object made of *lhédzihe* roots and Tuxá craftsmen know exactly from which part of the plant they need to take not to kill the plant. This extraction needs cosmological permission in which reciprocity, care and respect are shown. It is never borrowed and is only destined for one person.

Kaklodi, *kakrodi* (the action of smoking the *paewi*) happens through the interaction between *toe* (fire, lightning, using fire, lighting the *paewi*, in regard to elders' words and actions during ritual contexts), and *badze*, *badzé*, *paka* (tobacco) that produced *Pukuá* (*soprar em branco*, smoke), signifying the presence of cosmological and spiritual dimensions. Children are taught *kaklodi* from an early age to learn respect for the environment, sustainability, and the acquisition of specific Tuxá knowledge. *Paewi* is a sign of reciprocal interdimensional communication through smell, sight and gesture, denotating protection, healing, and connection and it has a strong cosmological force.

Knowledge production and transmission also occur through body and face paintings. Here geometric patterns, which are distinct for men and women, represent the connection between *dzu*, its current, and *dzunerada*, ancestral dwellings. These graphisms, made with *jenipapo* (*Genipa Americana*) (using the fruit to make black dye) and *urucum* (*Bixa Orellana*) (using the seeds to make red dye) fruits, are part of Tuxá and other-than-human personhood, making visible their cosmologies of ancestral *dzu* and *dzunerada*. Tuxá also acquire knowledge through *ciência*, occult practices where they receive specific wisdom from cosmological forces. They also acquire knowledge through public rituals like the *toré* dance, involving all the senses and human and more-than-human interactions. After dancing the *toré*, a young girl collaborator emphasized the importance of rituals in *radarãiedea*, as they hold deep cosmological and spiritual significance that is often related to healing. For instance, as a woman knowledge keeper noted, performing the *toré* during self-demarcation created a powerful spiritual connection.

Youth collaborators outlined that strengthening the bond with the territory is essential to ensure that ancestral knowledge is passed down to future generations. In this way the intrinsic relationship between culture, living surroundings, community, and ancestry is respected. To achieve this, it is crucial to carry out activities that promote both the connection of youths with their roots and the practice of ecological actions. These practices are manifested as activities such as waste collection from D'zorobabé, among other activities that are currently being planned to be carried out regularly. Environmental care is key to keeping the traditions alive and to ensuring the well-being and balance of Tuxá peoples with the land.

Conclusion

The transmission of traditional knowledges among the Tuxá peoples of Rodelas is a dynamic process, particularly as they navigate shifting environmental and social landscapes. As Ermine (2024, 63) explains, land-based education reconnects Indigenous roots through engagement with the living natural world, thereby fostering a regenerated connection to the environment.

This form of education has historically been central to Tuxá knowledge systems, integrating verbal and oral but non-verbal communication while emphasizing embodied practices, multisensory engagement, and relational interactions with other-than-human beings. Moreover, rooted in their cosmological framework of forest/bush, water, and air, the Tuxá self-identify as people of these elements, reflecting a holistic worldview that co-produces *radarãiedea*, a cultural framework that understands their ancestral territory as an interconnected system of knowledge, spirituality, and ecologies. Although this knowledge has been passed down, it is not uniformly retained by all Tuxá youths. Nevertheless, the evolving educational practices of the Tuxá reflect both an attempt to maintain an ancestral connection to the land and an adaptive response to contemporary challenges.

Two primary forms of Indigenous education are identified in Tuxá culture: *ecological practice-based land learning*, which is based on direct engagement with the land and aligns with the concept of traditional ecological knowledge (Davidson-Hunt & Berkes 2003), and *ciência* as Tuxá collaborators call it, or as Durazzo named it "bush education," which integrates ancestral language and cosmological-pedagogical connections (Durazzo 2019, 31). Specifically, while *ecological practice-based land learning* historically required direct interaction with the living environment, it is now undergoing a re-signification as land dispossession limits access. Conversely, *ciência* remains deeply embedded in the land and highlights the active agency of the land in the learning process, fostering a co-learning relationship between humans and the living environment. It makes its transmission reliant on proximity to the ancestral territory and emphasizes the importance of multispecies place-based learning in recovering disrupted knowledge. Tuxá youth collaborators engage in *ciência* through ritual practices that encompass decision-making, healing, territorial claims, and interactions with cosmological forces.

These practices allow young people to engage actively in a dynamic process where the land remains an agent of co-learning. In fact, in Tuxá cosmology, the environment is not a passive backdrop but an active participant in the learning process, aligning with Virtanen (2022), who describes how animals and natural elements serve as "messengers" that humans must learn to observe and interact with. Historically, Tuxá knowledge transmission has been relational, requiring individuals to co-sense with the land and interpret the signals of other-than-human entities.

As some Tuxá youths reconnect with their ancestral land, this process represents more than a physical return; instead, it embodies a spiritual and epistemic transformation that directly addresses contemporary environmental concerns. Elders worry that the younger generations are losing touch with traditional practices. However, youth collaborators are reshaping them by integrating a new environmental awareness, such as territorial care, maintenance, waste collection from D'zorobabé, and deeper spiritual engagement. Witharana and colleagues (2025) emphasize that traditional ecological knowledge fosters resilience in changing conditions, thereby challenging the notion that tradition must remain static. Instead, Indigenous knowledges are inherently adaptive, evolving in response to environmental degradation and land dispossession.

Hohenthal and Veintie (2024) argue that this transformation contributes to a broader socio-environmental consciousness, enabling Indigenous youths to recognize the interconnections between social and ecological systems. They also stress that ecological consciousness fully develops when students understand the holistic relationship between humans and the

environment (Hohenthal & Veintie 2022, 365). This suggests that Indigenous youth are not only adapting traditional knowledge but are also engaging for land rights activism, positioning themselves as defenders of their territories. Some fear that integrating political and environmental awareness may distance youths from traditional ways of knowing. Others see it as a necessary evolution, ensuring the relevance of Indigenous knowledge in resisting threats to their land. These perspectives highlight different facets of the same process: the resilience of Indigenous knowledge systems as they adapt while honoring traditions and responding to current challenges.

As Virtanen (2022) and Ermine (2024) argue, this evolution is part of the process of decolonization, wherein Indigenous knowledge is reshaped to address contemporary challenges, asserting sovereignty and self-determination. Comparatively, Indigenous-led land-based education contrasts with Western systems that prioritize abstract, fact-based learning. Tuxá adult collaborators, however, emphasize relational knowledge that is rooted in direct engagement with land, animals, plants, and spiritual connections to the living environment. Consequently, this education transcends ecological stewardship to become a form of cultural resurgence in which land is experienced as an embodied presence engaging all senses. Wilson (2008) defines relational knowledge as a way of knowing grounded in ongoing relationships with the land and its beings. While his work is not based on research with the Tuxá people, this perspective does align with Tuxá practices, where young people learn not just survival skills, but cultural and spiritual practices embedded in the landscape and in the collective memory. Likewise, this perspective resonates with Roze des Ordons and Hill (2024), who argue that Indigenous epistemologies persist through bodies, memories, and daily practices.

The case of the Tuxá people reflects broader trends in Indigenous-led land-based education, which, as Datta and colleagues (2024) suggest, evolves with contemporary challenges such as climate change and land rights advocacy. Clearly, schools alone cannot fully reconnect Indigenous youths to their land, making Indigenous-led learning in the territory essential. Consequently, Tuxá youth collaborators are actively planning to promote regular ecological activities aimed at engaging more young people in visits to the land, inspired by initiatives previously introduced into schools. These activities are central to the decolonization process, as they enable Tuxá youths to reclaim not only physical space but also cultural identities, epistemologies, and sovereignty.

Datta and colleagues (2024) emphasize that Indigenous land-based learning serves as an intersectional framework that encapsulates diverse aspects of Indigenous knowledges, cultures, and identities. Thus, by integrating traditional teachings with contemporary understandings of environmental stewardship, Indigenous communities worldwide revitalize their connections to the land while addressing pressing social justice issues. This holistic approach acknowledges the interdependence of ecological, cultural, and social systems, and emphasizes reciprocity, respect, and responsibility toward the land and all its inhabitants (Absolon & Willett 2005; Wilson 2008). Moreover, engaging in reciprocal relationships with the land and each other cultivates empathy, understanding, and shared responsibilities toward environmental sustainability and social justice (Marker 2020), as demonstrated in this paper.

Ultimately, the Tuxá experience underscores the fact that Indigenous knowledge systems, particularly Tuxá-led land-based education, are dynamic and continually evolving in response to ecological and political challenges. Hence, these practices do not merely preserve

knowledges; they adapt them, ensuring their relevance in a changing world. By reconnecting with the land and cultural practices, Tuxá youths not only navigate new environments but actively participate in the decolonization of their knowledges, land, and beings.

Accordingly, this highlights the resilience and adaptability of Indigenous knowledges, emphasizing their role in shaping a sustainable and just future for both Indigenous communities and the broader world. In conclusion, as the Tuxá navigate unfamiliar living environments, they adapt their traditional knowledge transmission by integrating ancestral practices with new ecological understandings. Through Tuxá-led land-based education, they evolve cultural identities by engaging in multisensory learning, ritual practices, and relational interactions with the living environment. Despite challenges such as land dispossession and ecological changes, Tuxá youth collaborators actively reinterpret teachings through ecological stewardship, spiritual connections, and collective memory. This dynamic process ensures the resilience of their knowledge system, allowing them to sustain non-linear cultural continuity while responding to contemporary environmental and social realities.

Future research could explore the impact of land-based education on Indigenous youth's political activism, particularly in relation to their participation in land rights movements. Such studies could explore how traditional ecological knowledges shape youth perspectives on environmental justice and sustainability, and how these teachings influence their engagement in activism. By examining the intersection of land-based education and political action, researchers can gain insights into how cultural and ecological awareness empower young Indigenous people to advocate for their rights and the environment.

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