“Invasive” Species Discourse in Ontario Elementary and Secondary Curricula: A Critical and Decolonial Analysis

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Abstract

“Invasive” species are generally viewed with contempt. Yet many Indigenous peoples have more nuanced approaches to newcomer species informed by kinship relations, and some ecologists suggest that ecosystems have always been dynamic and these species occasionally play beneficial roles in their new homes. A critical and decolonial discourse analysis of nine Ontario elementary and secondary curriculum documents revealed that when “invasive” species were mentioned, anthropocentric and settler-colonial logics dominated and Indigenous perspectives were ignored. Decolonizing the Ontario curriculum could offer more complex, humane, and reparative perspectives on newcomer species, especially important as Canadians grapple with climate change and Truth and Reconciliation.

Résumé

Les espèces « envahissantes » ne sont généralement pas très bien vues. Pourtant, de nombreux peuples autochtones portent sur les espèces non indigènes un regard plus nuancé, inspiré des concepts de « relations d’affinité »; en outre, certains écologistes suggèrent que, parfois, la nature dynamique des écosystèmes permet à ce type d’espèces de jouer un rôle bénéfique dans leur nouvel habitat. Une analyse du discours, critique et décolonialisée, de neuf programmes scolaires d’écoles primaires et secondaires de l’Ontario révèle que, lorsqu’il est question des espèces « envahissantes », la logique coloniale anthropocentrique domine, et que la perspective autochtone est ignorée. La décolonisation du programme scolaire de l’Ontario permettrait de faire place à des points de vue plus nuancés, bienveillants et réparateurs sur les espèces non indigènes, des approches particulièrement importantes au Canada dans le contexte actuel des changements climatiques et des démarches de vérité et de réconciliation.

Keywords: invasive species; curriculum; discourse analysis; anthropocentrism; Indigenous knowledge systems; decolonial pedagogies; environmental education

Mots-clés : espèces envahissantes, programme scolaire, analyse du discours, anthropocentrisme, systèmes de connaissances autochtones, approches pédagogiques décolonisées, éducation à l’environnement

Introduction

The subject of "invasive" species regularly makes Canadian news, with at least nine items posted on the CBC website alone in the first three months of 2023. From "super pigs" (CBC, 2023a) to "sea vomit" (CBC, 2023b), most reporting focused on the problems these critters cause as well as the funding allocated to eradicating them (e.g., CBC, 2023c). Typically, media discourse around "invasive" species is fraught with sensationalism, inconsistencies, and misconceptions (Maggiulli, 2022). According to the Canadian non-profit, Invasive Species Centre (2022a), "invasive" species are organisms who have been introduced to a new ecosystem—either accidentally or intentionally—and been deemed harmful to human or ecological health or to cause economic damage. Some organizations extend this definition to include organisms who have the *potential* to cause harm, even when the impacts of the newcomer species[1] are not fully understood (United States Department of the Interior, n.d.).

One common method used to distinguish long-established "native" species from more recently introduced "non-native" species is to separate them in relation to colonial timelines (Reo & Ogden, 2018), despite the arbitrariness of using European settlement to demarcate species (Van Dooren, 2011). While newcomer species are typically viewed with contempt, many Indigenous communities and ecologists recognize the dynamic nature of ecosystems and the "services" that some newcomer species may provide (Reo et al., 2017; Reo & Ogden, 2018) hence we have chosen to put "invasive" in quotation marks to signal how contested the term and rhetoric remains.

Earth is full of dynamic systems, and organisms have migrated from their place of origin for as long as life has existed on our planet. Of those species introduced into a new habitat, approximately 10% survive its environmental conditions, and only 10% of this subset (or 1% of the total) actually cause harm (United States Environmental Protection Agency, n.d.). Instead, most newcomer species who can adapt to their new habitat will become a neutral or important component of the local food web and integrated into local culture (e.g., dandelions on Canadian lawns, salmon in the Great Lakes). These species are then referred to as "naturalized," echoing language used to describe the process of humans gaining citizenship in Canada (Statistics Canada, 2022).

Newcomer species are most often found in landscapes that have been disturbed by natural events or human activity (Pearce, 2015), including human migration associated with colonialism and settler colonialism. Spaces that have been transformed through deforestation, agriculture, urbanization, and pollution disrupt local ecosystems and populations, creating openings for newcomers (Scott, 2010). Climate change also impacts species distribution; the increase in forest fires, flooding, tornadoes, hurricanes, and droughts places pressure on long-established species and the warming of land and water habitats can encourage cold-loving and warmth-loving species to shift to more suitable habitats (Finch et al., 2021).

As newly introduced species often appear when long-established species are in decline, the newcomers are often misrepresented as causing that decline. Thus "invasive" species (e.g., phragmites, water hyacinth) are frequently blamed for the extinction of other species when environmental degradation, rampant extractivism, and overharvesting are root causes (Pearce, 2015; Scott, 2010). While some introduced species are undeniably harmful to other species and ecosystems, Mark Davis et al. (2011) and Matthew Chew (2015) suggest that to claim that "alien" species pose as substantial a threat to biodiversity as habitat loss is inadequately substantiated. Some ecologists also have come to believe that, on occasion, newcomer species can promote biodiversity by increasing hybridization and speciation, with both newcomer and "native" species adapting to a changing environment (Davis et al., 2022; Schlaepfer, 2018).

What is telling is how those newcomer species who cause more immediate economic damage are those first targeted for eradication rather than those who threaten ecological or human health (Invasive Species Centre, 2022b), redolent of the resourcism and extractivism inherent in settler colonialism (Willow, 2016). "Invasive" animals are baited, trapped, gassed, poisoned, or deliberately infected with lethal viruses (Pearce, 2015; Seymour, 2013), arguably practices that would be less tolerated by the public if the animals were "native" or domesticated (Van Dooren, 2011). Introduced species often are described as killers who are "butchering," "choking," "slaughtering," "smothering," and "suffocating" members of their new communities (Larson et al., 2005). Eradicating "invasive" species, then, is sometimes portrayed as patriotic (Pearce, 2015; Ram, 2019), and colonial, xenophobic, and militaristic metaphors abound in writing about "invasive" species (Druschke et al., 2016; Larson et al., 2005; Subramaniam, 2001).

In contrast to dominant Western onto-epistemologies that cast species as being "in" or "out" of place (Van Dooren, 2011), many Indigenous knowledge systems view "invasive" species as belonging in their new homes (Bach & Larson, 2017), emphasize co-relationality with other life as central to Land kinship (Lees & Bang, 2023), and suggest that all beings need to be respected, considered teachers, and cherished for their respective gifts (Kimmerer, 2015). Drawing on Land-based wisdom practices, such as those of Anishinaabe *aki*, ecosystems are viewed as dynamic and the arrival of new species into an ecosystem is considered a natural form of migration. As Nicholas Reo and Laura Ogden (2018) state, "Being new to an area, human-introduced, or even leading to environmental change does not make an animal or plant unwelcome or inherently bad" (p. 1448). Indigenous knowledge systems suggest that one should look for ways to develop relationships with these new relatives (Bang et al., 2014). For example, plantain (commonly known as "White Man's Footprint" in North America) is used to treat various ailments; as Robin Wall Kimmerer (2015) observes, "It's a foreigner, an immigrant, but after five hundred years of living as a good neighbor, people forget that kind of thing" (p. 214).

Indigenous communities do recognize the threat certain "invasive" species present and will use various techniques to manage them as needed (Reo & Ogden, 2018). For example, the Malanbarra Yidinji clan in Queensland, Australia traditionally use plants as poisons to selectively control two populations of tilapia fish severely impacting long-established fish species (Gratani et al., 2011). In North America, hand-pulling is by far the most common method employed by First Nations to remove "invasive" plants, and mowing, chemical treatments, fire, hunting, and grazing are also used as strategies to manage newcomer species (Reo et al., 2017). Indigenous communities also actively educate members about "invasive" species, share prevention strategies, save threatened seeds, transplant threatened species, and document traditional knowledges regarding "native" species (Reo et al., 2017; Willow, 2011). Contrary to how government funding is allocated mostly to managing those "invasive" species perceived as having a detrimental economic impact, Reo et al. (2017) suggest that Indigenous communities are primarily concerned about decreased access to traditional foods, medicines, or building materials.

Clearly, Western and Indigenous perspectives on newcomer species can differ significantly. These diverse perspectives are reflected in environmental education scholarship as well. While far more research in environmental education approaches "invasive" species uncritically (Maggiulli, 2022), recently there has been more problematization in the field. Katrina Maggiulli, for example, observes how dominant discourse "maps onto xenophobic anti-immigrant ideology such that these fear tropes work to reinforce one another" (p. 1394). Similarly, Joe Henderson and Stephanie Morningstar (2022), in their discussion of the rise of eco-fascism, note how "invasive" species rhetoric resonates with racist anti-immigration, purity, and eugenics rhetoric. Discussing formative influences on his relationship with the more-than-human world, Taiji Nelson (in Hecht & Nelson, 2022), shared, "It's hard for me to not draw immediate comparisons between discussion of invasive species and the discrimination I've experienced as an Asian American. I feel a complicated but protective kindship with beings that are labeled 'invasive' or 'unnatural'" (p. 1368). Offering an alternative discourse for environmental educators, Dax Ovid and Fortunate Mafeta Phaka (2022) discuss the journey of the Idwi (African clawed frog), now considered "invasive" in the United States, offering counternarratives informed by decolonial and postcolonial theories, Indigenous knowledges, and critical race theory. Similarly, Megan Bang et al. (2014) discuss how their pedagogical work with buckthorn and other plants "forcibly migrated" to Chicago encouraged them to reflect on the impact of settler colonialism on their "plant relatives" and to engage in a "form of critical border thinking [where] we began referring to these plants formerly named 'invasive species' to 'plants that people lost their relationships with'" (p. 47).

Particularly relevant to our study are recent analyses of school curricula, programming, and learning materials. In New Zealand, Michael Morris (2022)

analyzed educational resources published or approved by the government and found these "encourage children to kill non-native mammals, show them how to set traps, and emphasise to teachers how they need to impress on children the importance of eradicating 'pests'" (p. 174). Sally Birdsall and Tim Kelly (2022) reviewed the values mandated in the English-language New Zealand curriculum, concluding that students learning about and, even participating in, killing "invasive" predators is educationally and ethically appropriate in that context. Rajesh Ram (2019), Lauren Willing (2022), and Morris (2022), however, disagree and argue that there is an inhumane and nativist hidden curriculum at play in New Zealand, and each call for less violent and more nuanced approaches. In the United States, Maggiulli (2022) examined materials used in classrooms there and found that these offer "problematic and oversimplified messaging that narrowly frames the issue as binary: good-native vs. evil-invasive" (p. 1391). Our study builds on these recent analyses, adding to the conversation by focusing on the elementary and secondary school curriculum in Ontario, Canada.

Methodology and Methods

Many methodologies and methods are used by environmental education researchers interested in our relationships with other beings (see reviews by Fawcett, 2013; Spannring, 2017). Some researchers take a more anthropocentric or speciesist approach, primarily interested in how other life serves human needs (educational or otherwise) rather than how our educational efforts could improve these species' material conditions (Russell & Spannring, 2019). Theoretically, the three of us are informed by more critical approaches to environmental education that seek to disrupt anthropocentric constructions of nature, honour Land and Indigenous knowledge systems, and cultivate conditions for multispecies flourishing. Such work can be messy and require learning how to "stay with the trouble" (Haraway, 2016; Nxumalo & Pacini-Ketchabaw, 2017), an approach we deem necessary for a complex issue like "invasive" species.

The three of us are white settler scholars who live and work in Thunder Bay,[2] the Treaty Territory of the Fort William First Nation, signatories to the Robinson-Superior Treaty in 1850, and a sacred place originally known as Anemki Wajiw Wequedong. We strive to be responsible treaty partners who are engaged in respectful relationality, critically reflexive in unlearning our inherent colonial identities, and working to ensure that curriculum is accurate, appropriate, and honours Indigenous knowledge systems and perspectives (Korteweg & Fiddler, 2018). In our teaching and research, we emphasize the role that all settler educators must enact to implement the Truth and Reconciliation Commission of Canada's (2015) Calls to Action in education (#62-65) as their professional duty. We also forefront the inspirational work of Indigenous scholars and Land protectors who expose and challenge settler colonialism's inherent extractivism and insistence on human/nature binaries, who offer insights into Indigenous

knowledge systems that recognize kinship and the interdependence of humans with all life and Land, and who seek approaches that prioritize decolonizing with Indigenous futurities (e.g., Bang et al., 2014; Lees & Bang, 2022, 2023; Simpson, 2014; Twance, 2019). In addition, we are informed by the work of intersectional environmental educators who seek to understand how settler colonialism, colonialism, racism, classism, ableism, heterosexism, sexism, and sizeism interconnect with anthropocentrism and speciesism (e.g., Maina-Okori et al., 2018; Lloro-Bidart & Finewood, 2018).

These framings meant that in our analyses we needed to keep a keen eye out for anthropocentrism, settler colonial logics, imperialist Western or exclusionary Eurocentric onto-epistemologies that avoid, deny, or erase Indigenous knowledge systems, and other oppressive moves. Given our interest in how "invasive" species are represented in this time marked by climate change, species extinction, and ongoing disparities and inequities for Indigenous communities post-Truth and Reconciliation, a critical and decolonial discourse analysis seemed an appropriate approach. Other environmental education researchers have used similar approaches in their own curriculum analyses (e.g., Chambers, 2008; Hufnagel et al., 2018; Lowan-Trudeau, 2022; Lowan-Trudeau & Fowler, 2021). Like Greg Lowan-Trudeau (2022), we focused on the *explicit* curriculum (what is in official curriculum documents), the *hidden* curriculum (the implicit messages students receive from curricula), and the *null* curriculum (what is absented). The latter, we felt, was particularly important for holding responsible the "intentionally inattentive industrial and imperial practices" (Tsing, 2018, para. 20) at the root of climate change challenges faced by all species. We also found Wade Tillett and Jenna Cushing-Leubner's (2022) writing about the *material* curriculum useful because it accounts for effects on learners and the world, which for us involved considering possible impacts on "invasive" species themselves as well as the development of students' relationships with other life.

Nine Ontario curriculum documents were analyzed. The first document was the Science and Technology curriculum for grades 1-8 (Ontario Ministry of Education, 2007) and the second its recent replacement (Ontario Ministry of Education, 2022a). The third was the Social Science curriculum for grades 1 to 6 and History and Geography for grades 7 and 8 (Ontario Ministry of Education, 2013), and the fourth and fifth its replacements (Ontario Ministry of Education, 2018, 2023). The sixth was the recent "de-streamed"[3] Science curriculum for grade 9 (Ontario Ministry of Education, 2022b). The seventh was the Science curriculum for grades 11 and 12 (Ontario Ministry of Education, 2008), which includes a grade 11 Environmental Science course that is not offered by all schools but does mention "invasive" species. The eighth and ninth were the Environmental Education documents for grades K-8 and 9-12 (Ontario Ministry of Education, 2017a, 2017b), which refer to numerous courses across the curriculum. A keyword search for "invasive" was used to identify the relevant

sections, then each section was reviewed to determine where the content appeared (e.g., subject, grade), how "invasive" species were described, and if any resources or pedagogies were recommended. The curriculum analysis was contextualized by the first authors' reflections on her experiences as a new teacher of secondary school science in Ontario reaching out to colleagues to learn how they taught "invasive" species content.

Findings

Within the Ontario elementary school curriculum, "invasive" species were covered most frequently in the 2007 grades 1-8 Science and Technology curriculum document. Here, "invasive" species appeared under "Life Systems" in grades 4, 6 and 7, in the "Habitats and Communities," "Biodiversity," and "Interactions in the Environment" units respectively. The definition of "invasive" species used in this document stated that they are introduced species, in contrast to a "native" species "that originates or naturally occurs in an area" (Ontario Ministry of Education 2007, p. 205), as if species migration is inherently unnatural. Newcomer species were also described as having solely negative effects on their new environment. For example, in the grade 4 curriculum, "invasive" species were listed as a factor in the "depletion or extinction of a plant or animal species" (p. 85); in the grade 6 curriculum, "invasive" species were said to explicitly "reduce biodiversity" (p. 114); and the presence of "invasive" species were referred to as "an infestation" in the grade 7 curriculum (p. 127). Zebra mussels, purple loosestrife, and the Asian longhorn beetle were listed as examples. In the new (2022) grades 1-8 Science and Technology curriculum, "invasive" species are only mentioned once in passing, in a grade 6 expectation that teachers ensure students learn to explain "how invasive species reduce biodiversity in local environments" (Ontario Ministry of Education, 2022a, p. 150).

Turning to elementary social sciences, "invasive" species featured a few times in the 2013 grades 1-6 Social Sciences and grades 7 and 8 History and Geography curriculum (Ontario Ministry of Education, 2013), and these did not change in the updates (Ontario Ministry of Education, 2018, 2023). The way "invasive" species are described in these curricula vary by grade and subject. Grade 6 students have an opportunity to learn about "invasive" species in their Social Studies course in the unit on "People and Environments: Canada's Interactions with the Global Community" that focuses on "globalization and global solutions" (Ontario Ministry of Education, 2013, p. 126). Grade 7 teachers could also introduce this topic in Geography within the units on "Physical Patterns in a Changing World" and "Natural Resources around the World" (Ontario Ministry of Education, 2013). The grade 7 Geography curriculum describes "invasive" species as neither good nor bad and invites students to come to their own conclusions on the "economic and environmental impact of invasive species" (Ontario Ministry of Education, 2013, p. 172). The grade 7

Geography curriculum mentions the connections between human activity and the introduction of "invasive" species, although no specific activities were offered as examples (Ontario Ministry of Education, 2013).

The K-8 Environmental Education document (Ontario Ministry of Education, 2017a) encompasses much of the same information as the grades 1-8 Science and Technology document (Ontario Ministry of Education, 2007), grades 1-6 Social Sciences, and grades 7-8 History and Geography document (Ontario Ministry of Education, 2013). What stood out when examining the K-8 Environmental Education document in comparison to the 2007 and 2022 Science and Technology documents was how "invasive" species received decreasing attention over time. In the 2007 Science and Technology curriculum, "invasive" species were included in expectations in grades 4, 6, and 7. In the 2017 Environmental Education document, only expectations in grades 4 and 6 were mentioned, and in the most recent 2022 Science and Technology curriculum, "invasive" species are referred to only once, in an expectation for students in grade 6.

In the secondary school curriculum, the topic of "invasive" species showed up in a few different courses, one of which no longer exists. The grade 9 Science (academic) curriculum introduced the topic of "invasive" species in neutral language, and explicitly connected the introduction and propagation of "invasive" species to human activities (Ontario Ministry of Education, 2017). It was replaced, however, by the 2022 de-streamed grade 9 Science curriculum, which makes no mention of them whatsoever (Ontario Ministry of Education, 2022b). In the grades 11 and 12 Science curriculum, "invasive" species are defined as "[n]on-indigenous species that have adverse [...] effects on the habitats they invade" (Ontario Ministry of Education, 2008, p. 256) and zebra mussels, purple loosestrife, and the round goby are listed as examples.

"Invasive" species also feature in the grade 11 Environmental Science course. Like the grade 9 Science curriculum, the grade 11 Environmental Science course defines "native" species as "species indigenous to a particular area or region that have evolved over thousands of years, adapting to their surroundings, and have become an important part of the local ecosystem" (Ontario Ministry of Education, 2008, p. 256). "Invasive" species are described in neutral language and the curriculum links the introduction and propagation of "invasive" species to human activities like "agriculture, travel, the purchase of exotic pets, importing and exporting, releasing domesticated fish into freshwater environments, [and] the use of live bait" (Ontario Ministry of Education, 2017, p. 169). It is important to note here that the grade 11 Environmental Science course is an elective that is not offered by all schools. The remaining three secondary courses that are featured in the secondary school Environmental Education curriculum document, grade 11 and 12 Green Industries and grade 12 Canadian and International Politics (Ontario Ministry of Education, 2017), tell a different story. In the grade 12 Green Industries course, "invasive" species are described as a "biotic factor"

that negatively affects natural resource harvest and product quality (p. 248), and the focus is on "pest and disease control techniques" (p. 249) and "disposal methods for invasive plants" (p. 244).

None of the curricula we reviewed offered explicit recommendations of materials to help teach about "invasive" species. Thus, as a new teacher, the first author reached out to colleagues for advice based on how they teach the topic. Given so little guidance, each teacher sought out their own resources online. All the materials used by her colleagues reinforced problematic approaches to the topic, such as anthropocentric ways of relating to non-human beings (e.g., Canan, 2022), derogatory illustrations of introduced species, like "dog-strangling vine" attacking a young couple and their dog (Osborne, 2019), fearmongering videos about newcomer species "terrorizing," "wreaking havoc," or "bullying" other species "to extinction" (e.g., SciShow, 2021), and an inhumane lesson plan that encouraged students to invent devices like the "lionfish zapper" without concern for the impacts of violent interventions on individual animals (PBS, 2017).

There were also several examples of the null curriculum, which is not surprising since, as Tillett and Cushing-Leubner (2022) observe, the null curriculum is near infinite and what is noticed reflects "the values and preferences of the researcher" (p. 7). Given our theoretical frameworks and interests, two facets that were particularly glaring to us were the omission of alternative ecological perspectives and Indigenous knowledges around newcomer species. Ecological concepts that could have been included, but instead were absented, concerned the recognition that ecosystems are dynamic and thus change over time (Reo et al., 2017) and the theory of "ecological fitting" that suggests a species performing a specific role within an ecosystem can be replaced by another performing the same role (Janzen, 1985). As well, some newcomer species may contribute to biodiversity (Schlaepfer, 2018) and relevant examples from Ontario could have been used as examples, such as dandelion and plantain (Scott, 2010).

No Indigenous approaches to, or Elder wisdom on, "invasive" species were mentioned. Nor was there a single mention of an Indigenous perspective on Land relations and kinship (ecology) or Land defense and protection (conservation), such as water being understood as living versus abiotic (Lees & Bang, 2022, 2023) or non-extractivist rationales for protecting biodiversity common in Land education (e.g., Simpson, 2014). Instead, the dominant settler-colonial narrative that contrasts "native" and "invasive" species separated by Eurocentric timelines (Reo & Ogden, 2018) is embedded in the curricula.

The privileging of Western worldviews is not an oversight and, indeed, was recently revealed publicly to be egregiously intentional. In the summer of 2022, three weeks before the release of the new elementary Science curriculum (Ontario Ministry of Education, 2022a), the Conservative Minister of Education directed staff to remove Indigenous knowledge expectations from the curriculum. An education reporter made an Access to Information request and found, "Three expectations were crossed out in red, which includes having students

'explore real-world issues by connecting Indigenous sciences and technologies and Western science and technology, using ways of knowing such as the Two-Eyed Seeing approach'… [that] emphasizes the simultaneous appreciation of scientific knowledge through both Western and Indigenous perspectives" (Alphonso, 2022, para. 9) and "the expectations of having students examine the knowledge systems of various cultures and analyze the contributions from people with diverse experiences" (para. 10). Despite having worked with Indigenous partners, knowledge holders, and education experts as members of the curriculum writing and review team, the government made a unilateral decision to remove or substantially modify 16 Indigenous-related expectations. This move was highly criticized by Indigenous members of the curriculum writing panel, including Jodie Williams (as cited in Alphonso, 2022), and by First Nations organizations (e.g., Anishinabek Nation Head Office, 2022; Matawa First Nations, 2022). As David Paul Achneepineskum stated, "Attempting to minimize or erase Indigenous knowledge in Ontario's curriculum further divides and perpetuates the roots of systemic racism at the elementary school level—the education system should be building bridges and understanding between all cultures" (Matawa First Nations, 2022, para. 1).

Discussion

Our analysis of Ontario curriculum documents revealed a number of interesting findings. "Invasive" species content initially appeared most often in the elementary and secondary Science and Technology curricula and emphasized the negative impacts of newcomer species, with a nod in grade 9 to the fact that the introduction and propagation of "invasive" species is a result of human activity. When the elementary Science and Technology curriculum was replaced in 2022, however, the topic was mentioned only once, negatively, and the topic was removed altogether from the 2022 grade 9 curriculum. The grade 11 Environmental Science course, in which newcomer species are described in neutral language and human activity is acknowledged, remains in place, but it is an elective course that is not offered in all secondary schools across the province. "Invasive" species feature minimally in the elementary Social Sciences, but at least are described in neutral terms and the influence of human activity is mentioned, albeit only once. In the other remaining courses where newcomer species are mentioned, namely grade 11 and 12 Green Industries and grade 12 Canadian and International Politics, negative economic impacts, control, and disposal are emphasized.

None of the curricula mention concepts such as the dynamism of ecosystems, ecological fitting, or the occasionally positive role some newcomer species can play in their new environments. "Native" and "invasive" species were distinguished along colonial timelines and Indigenous contributions were willfully ignored. This curricular erasure is particularly alarming in our context

in Thunder Bay where a high percentage of students are of Indigenous identity or heritage and our schools are located on Anishinaabe *aki*/Land with rich knowledge and language systems that inform how to engage with more-than-human kin relations. The overall lack of nuance and negative rhetoric reflects dominant "invasive" species discourse and colonial logics that reproduce the binary of good "native" versus evil "invasive," an onto-epistemology that has been critiqued in analyses of educational materials and programming in other countries (Bang et al., 2014; Maggiulli, 2022; Morris, 2022; Ovid & Phaka, 2022; Ram, 2019; Willing, 2022). This negative othering is amplified by the derogatory, fearmongering, and inhumane materials that the first author's teaching colleagues adopted in the absence of recommended resources.

The explicit, hidden, and null curricula described above may result in a material curriculum that negatively impacts newcomer species and humans. For example, it can lead to cruelty directed toward individual members of targeted species, as recent analyses of the treatment of possums in New Zealand educational contexts have illustrated (Morris, 2022; Ram; 2019; Willing, 2022). It also continues the settler-colonial project of erasing Indigenous peoples, their knowledge systems, languages, and contributions, and feeds the alienation and push-out of Indigenous students from formal education. It can also feed xenophobic and anti-immigrant sentiments, which other environmental education scholars have raised as a concern (Hecht & Nelson, 2022; Henderson & Morningstar, 2022; Ovid & Phaka, 2022; Ram, 2022). Xenophobic rhetoric is evident when describing the uncontrollable fertility, reproduction, and "parasitism" of both "invasive" species and human immigrants (Subramaniam, 2001). At the same time, "native" species are often portrayed "as 'defenseless,' 'delicate,' 'fragile,' 'susceptible,' 'vulnerable,' and 'weaker' than invaders" (Larson et al., 2005, p. 251). The "invasive" Canada thistle, for example, is criticized for its reproductive zeal, and the "native" female thistles are often cast as "passive helpless victims of the sexual proclivity of the foreign/exotic males" (Subramaniam, 2001, p. 31). Likewise, purple loosestrife is despised for its foreignness and fecundity (Ellis, 2022), even though many species of bees love it (Pearce, 2015) and loosestrife has the capacity to clean water and be used for medicine (Scott, 2010). Another way in which dominant discourse around "invasive" species others living, breathing beings is through the use of militaristic terms such as "attack," "defense," "combat," "casualties," "victims," "biosecurity," and "border control" (Larson et al., 2005). Indeed, the "war" against "invasive" species has led to an entire sub-field: "invasion biology" (Davis et al., 2011). Such militarized language has material consequences for the beings with whom these wars are being fought.

One finding that did surprise us was the decreased attention to newcomer species in the most recent Ontario curriculum documents, considering how continuous media attention (e.g., CBC, 2023a, 2023b, 2023c) fuels public concern about the issue. This curricular move, however, is indicative of the general anti-environment slant of the current Ontario government (Winfield, 2022). Certainly,

the present provincial government shows a determination to make its own right-wing mark on curricula, as revealed in their attempts to surreptitiously remove the Indigenous Science Framework from the elementary Science curriculum (Alphonso, 2022). The absenting of "invasive" species as a topic and the erasure of Indigenous ways of knowing in new curricula can be interpreted as a form of ongoing colonial refusal, where the provincial government rejects their duty to educate about complex socio-ecological systems and their duty to abide by The Truth and Reconciliation Commission of Canada's (2015) calls to action explicitly focused on education (#62-65), notably the inclusion of Indigenous content and worldviews into school curricula.

Mere inclusion is, of course, insufficient. Max Liboiron (2021) makes a compelling case that all fields need to reflect on the coloniality of their practices and engage in the work to change them. Environmental educators must actively work to dismantle the structures that allow dominant settler-colonial worldviews to erase Indigenous worldviews. As Leanne Betasamoke Simpson argues, Indigenous knowledges are "threatened by land-theft, environmental contamination, the legacy of residential schools and state-run education, colonial gender violence, [and] climate change" (IWL Rutgers, 2019, 28:41-28:53). Erasure of Indigenous knowledges matters to environmental and climate change education generally, and to education about newcomer species specifically (Bang et al., 2014; Ovid & Phaka, 2022) as these offer vital counterpoints to dominant colonial discourse and approaches. For millennia, Indigenous peoples have demonstrated how to "live in ethical relationality with more-than-human others, where humans are not figured in hierarchical order in relation to others" (Nxumalo & Cedillo, p. 102) and all beings are understood as relatives, cherished for the gifts they offer, including as teachers (Kimmerer, 2015). Further, Land and ecosystems are viewed as dynamic and constantly changing, and being a newcomer is not inherently bad (Reo & Ogden, 2018). Recognizing, respecting, and engaging Indigenous knowledge systems in education about newcomer species could offer less anthropocentric, more nuanced, and reparative approaches to help students (and teachers) think critically about why some species are demonized, why certain historical multispecies communities are valued over others, and how we might grapple more humanely and collaboratively with the challenges "invasive" species pose.

Conclusion

Certain newcomer species are undeniably harmful to other species and ecosystems. Others may be deemed harmful initially, but later are shown not to be a significant threat. For some "invasive" species, their new home may be the only one they have left, and they may be regarded as both "invasive" and endangered thus under threat in both their native and new habitats, albeit for different reasons. The relationships amongst species, new and more established,

and their relationships within dynamic ecosystems are far more complex than what is currently being taught in Ontario schools. That is not surprising since "invasive" species feature so little in the explicit curriculum and when they do, the focus is primarily on their negative impacts while Indigenous onto-epistemologies are ignored. Further, Ontario teachers are not offered sufficient guidance on how to engage with humane and Indigenous pedagogies, and the materials they can easily access in the North American context about newcomer species, such as those prepared by ENGOs and conservation authorities, are likely to reinforce dominant anthropocentric and settler-colonial discourses. If recent curriculum revisions offer any indication, Ontario will continue to miss opportunities to braid Indigenous and Western knowledge systems together to help teachers offer more relevant, relational, and humane approaches to teaching about newcomer species. For now, as environmental educators, we need to be more mindful of the hidden, null, and material curricula that is being communicated to learners through the explicit curriculum and strive to offer more critical and decolonial approaches to learning about and with newcomer species.

Notes

1 When we use the term, "newcomer species," we are referring to non-humans.
2 At the time of writing, all three authors lived in Thunder Bay.
3 Ontario was the last province in Canada to "stream" students in grade 9 by "dividing students into differentiated groups based on their perceived academic ability and/or prior achievement" (Follwell & Andrey, 2021, p. 1); the shift to de-streaming began in 2020.

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