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Socio-ecological factors associated with eco-anxiety following the 2023 wildfires among Northern and Indigenous youth in the Northwest Territories, Canada: Cross-sectional findings

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Abstract

Eco-anxiety is an emerging mental health concern among adolescents, particularly in regions affected by climate-related disasters. Following the 2023 wildfires in Canada's Northwest Territories (NWT), this study examined associations between wildfire exposure severity, socio-ecological factors, and eco-anxiety among adolescents in the NWT. We conducted a cross-sectional survey with 290 adolescents aged 13–18 years across NWT secondary schools during the 2023–2024 school year. Structural equation modelling examined pathways linking social factors (gender, sexual orientation, Indigenous identity), living conditions (rural residence, caregiver status), structural conditions (food insecurity, wildfire exposure severity) and eco-anxiety. Self-esteem was examined as a moderator. Participants had a mean age of 13.7 years; most identifyied as Indigenous and lived in rural communities. Greater wildfire exposure severity and food insecurity were associated with higher eco-anxiety. Girls, LGBQ+ youth and rural youth reported higher eco-anxiety. Indigenous identity was indirectly associated with eco-anxiety through food insecurity and wildfire exposure severity. Higher self-esteem was associated with lower eco-anxiety and buffered the relationship between wildfire exposure and eco-anxiety. Findings suggest that eco-anxiety among NWT adolescents is shaped by climate-related disruption and social conditions. Interventions can address psychosocial resources and material conditions to support NWT youth mental health following climate-related disasters such as wildfires.

Impact statement

Eco-anxiety is an increasingly important mental health concern for young people in Canada, particularly in regions that are experiencing more frequent climate-related events such as wildfires. This study examines eco-anxiety among adolescents in the Northwest Territories following the 2023 wildfires, with specific attention to the experiences of Northern and Indigenous youth.

The findings show that eco-anxiety among adolescents is linked to both wildfire-related disruption and broader social conditions. Youth who reported higher wildfire exposure severity and greater food insecurity also reported higher eco-anxiety. Differences were also observed across social groups. Girls, LGBQ+ youth and those living in rural communities reported higher levels of eco-anxiety, highlighting how climate-related emotional distress intersects with existing social and structural inequities in Canada's North. Self-esteem was linked to lower eco-anxiety, particularly among youth reporting higher wildfire exposure severity, indicating its importance as a psychosocial resource.

These findings highlight the need to recognize eco-anxiety as a distinct and meaningful form of distress among young people in Canada. Supporting youth eco-anxiety may require approaches that extend beyond individual counselling. In wildfire-affected communities, schools and youth services may benefit from acknowledging eco-anxiety, screening for related stressors such as food insecurity and supporting young people's confidence, coping skills and sense of connection. Community-led and culturally grounded approaches, including those that strengthen relationships with land and culture, may be especially relevant in Northern and Indigenous contexts.

By centring eco-anxiety within a Canadian northern context, this study contributes evidence to inform youth mental health responses as climate-related hazards continue to affect communities across Canada.

Introduction

Climate change is widely recognized as one of the most pressing global challenges of our time. As weather and climate patterns shift, extreme weather events (EWEs), such as droughts and wildfires, are occurring with increased frequency and intensity, driving rapid environmental change across regions (Walsh et al., 2020; Richardson et al., 2022; Calvin et al., 2023). In Canada, the impacts of EWEs are particularly acute in northern regions such as the Northwest Territories (NWT) in the Arctic and Sub-Arctic, where climate change is unfolding at an accelerated pace (Thompson, 2023; Thoman et al., 2023). In 2023, the NWT experienced their warmest summer and sixth-warmest year on record, during which 300 wildfires burned 4.16 million hectares of land following prolonged high temperatures, minimal rainfall and severe drought (Thompson, 2023; Thoman et al., 2023). These wildfires prompted evacuations, displacing two-thirds of the NWT's 46,000 residents and disrupting daily life, including loss of homes and businesses, interruption of traditional activities, and threats to food and water security (Thompson 2023; Thoman et al., 2023).

While climate change affects all age groups, its consequences for youth are especially profound, impacting not only physical health but also emotional well-being and socio-economic conditions (Woog and Kågesten, 2017; Wu et al., 2020; Earnshaw et al., 2022; UNICEF, 2023). Adolescence is a critical developmental period characterized by rapid social, physical and cognitive transformations, which may heighten sensitivity to environmental disruption and intensify emotional responses when youth are repeatedly exposed to climate-related stressors and disasters (Woog and Kågesten, 2017; Wu et al., 2020; Earnshaw et al., 2022; UNICEF, 2023). Climate-related stressors affect youth both directly, through infrastructure damage and displacement, and indirectly, by reducing community stability, social cohesion and everyday functioning (Hickman et al., 2021; Akpan et al., 2025). Among these emotional responses, eco-anxiety has emerged as a particularly salient experience for young people, reflecting distress linked to environmental change and uncertainty about the future (Coffey et al., 2021; Kurth and Pihkala, 2022; Léger-Goodes et al., 2022). Despite increasing attention to climate change and youth mental health, little is known about how eco-anxiety is experienced by young people following climate-related EWEs such as wildfires, particularly in rural and remote regions such as the NWTs.

Eco-anxiety, also referred to as climate anxiety, describes emotional response related to ecological change and perceived environmental threats (Coffey et al., 2021; Kurth and Pihkala, 2022; Léger-Goodes et al., 2022). It is commonly characterized by feelings of worry, helplessness, fear and concern for the future of the environment and humanity (Coffey et al., 2021; Kurth and Pihkala, 2022; Léger-Goodes et al., 2022). Importantly, eco-anxiety is not considered a clinical diagnosis, but rather reflects meaningful and contextually grounded emotional responses to environmental disruption and uncertainty, particularly among young people whose future prospects are directly implicated (Clayton, 2020; Hickman et al., 2021; Kurth and Pihkala, 2022). Recent research suggests that climate-related emotional distress is widespread among young people in Canada and may vary by gender and other social positions (Galway and Field, 2023; Aylward et al., 2025; Tiwari et al., 2025).

Eco-anxiety and climate-related emotional distress are not experienced uniformly across populations. Climate change disproportionately affects marginalized youth, exacerbating existing structural inequalities and limiting opportunities for health and well-being, particularly among Indigenous youth (Léger-Goodes et al., 2022). In the NWT, these experiences occur within a social context shaped by enduring colonial legacies. Indigenous peoples account for nearly half of the NWT population, and youth are disproportionately affected by child welfare involvement and historical family separation (Government of Canada, 2023a; Pollock et al., 2024). The NWT had the highest *per capita* number of children removed to residential schools in Canada, resulting in widespread intergenerational harms (Government of the Northwest Territories, Department of Education, Culture and Employment, 2013, 2016). These structural conditions may intersect with contemporary climate-related stressors, compounding emotional distress among Indigenous youth (Whyte, 2017; Cunsolo et al., 2020).

Canadian research indicates that experiences of eco-anxiety vary across social identification and location. National surveys show that girls and gender-diverse youth report higher levels of climate-related worry and emotional distress than their peers (Galway and Field, 2023; Aylward et al., 2025), and qualitative analyses suggest that girls more frequently describe future-oriented and functional impacts of climate change (Tiwari et al., 2025). These patterns align with broader evidence that gendered inequities in access to resources and decision-making shape vulnerability to climate-related stressors (Stone et al., 2022; Sidun and Gibbons, 2024). Evidence on climate-related emotional distress among Lesbian, Gay, Bisexual, Transgender and Queer (LGBTQ) youth in Canada remains limited; however, Canadian studies consistently document higher levels of housing instability (Ecker et al., 2019; Fraser et al., 2019), mental health challenges (Green et al., 2022), substance use (Moazen-Zadeh et al., 2019; Newcomb et al., 2020) and exposure to violence among LGBTQ youth (Newcomb et al., 2019), reflecting structural vulnerabilities that may intersect with climate-related stressors. Place-based and caregiving contexts may also shape youth experiences of eco-anxiety. Rural location may increase exposure to climate-related disruption, and living arrangements may reflect broader social and structural conditions influencing emotional well-being and access to support and resources (Leonhardt et al., 2022; Boyd et al., 2024; Pollock et al., 2024).

Beyond social identity and location, climate change may influence youth eco-anxiety through structural conditions that shape everyday security, including access to food. Food insecurity remains substantially higher in Canada's North than the national average, reflecting persistent challenges related to food access, affordability and availability (Layton, 2023), and has been linked to poorer mental health outcomes among adolescents in the NWT (Logie et al., 2021). Given that eco-anxiety often involves concern about future security, food insecurity may plausibly contribute to heightened climate-related emotional distress among northern youth, yet this relationship remains poorly understood (Myers, 2020; Boluda-Verdú et al., 2022; Darabi et al., 2023). Climate-related disasters may influence youth mental health through disruptions to social and material conditions. For example, wildfire events can interrupt transportation and food supply chains in northern communities, potentially exacerbating food insecurity. Food insecurity has been linked to psychological distress among adolescents and may represent one pathway through which climate-related disruptions shape eco-anxiety (Myers, 2020; Logie et al., 2021; Boluda-Verdú et al., 2022; Government of Northwest Territories, 2023).

Acute climate-related events may further compound these structural challenges. The NWT experienced an unprecedented wildfire season in 2023, involving widespread evacuations, prolonged smoke

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exposure and disruption to schooling, mobility and community life (Government of Northwest Territories 2023). Research in northern and Indigenous contexts indicates that wildfire events are experienced as disruptive and stressful, particularly when they involve displacement or prolonged interference with daily routines (Dodd et al., 2018; Montesanti et al., 2021). Among youth, greater intensity and duration of disaster exposure have been associated with elevated psychological distress and climate-related worry (Hickman et al., 2021; Thompson et al., 2021). Variation in wildfire exposure severity may therefore be relevant to understanding eco-anxiety among youth in the NWT.

Beyond exposure to structural and environmental stressors, psychosocial resources may shape how youth experience climate-related emotional distress. Self-esteem has been widely studied as a protective factor and moderator in adolescent mental health, particularly in relation to stress and anxiety (Yao et al., 2023). However, its role in the context of eco-anxiety remains underexplored. Most existing studies focus on self-esteem's buffering effects on generalized anxiety or depression (Choi et al., 2019; de la Barrera et al., 2022), with few examining whether and how self-esteem moderates psychological responses to climate-related stressors, such as EWEs (Qin et al., 2024). This gap is notable given evidence that has discussed how climate impacts can threaten social identities through reducing self-esteem and self-efficacy (Barnett et al., 2021).

Despite growing recognition of climate change's effects on mental health, the experiences of youth following EWEs remain underexplored, particularly in wildfire-affected contexts in Arctic and Sub-Arctic regions such as the NWT (Maxfield, 2020). To address this knowledge gap, this study examined associations between wildfire exposure severity, socio-ecological conditions, and eco-anxiety among adolescents in the NWT, including whether structural conditions such as food insecurity are associated with climate-related disruption to youth emotional responses. Structural equation modelling was used to examine pathways linking social positions (gender, sexual orientation and Indigenous identity), living conditions (rural residence and caregiver status), structural conditions (food insecurity and wildfire exposure severity) and eco-anxiety. Self-esteem was examined as a psychosocial resource that may moderate these relationships. We hypothesized that youth from socially marginalized groups (cisgender girls, Indigenous, LGBQ+, living in a rural area and living with other adults vs. a parent) would report higher levels of food insecurity, greater 2023 wildfire exposure severity and higher eco-anxiety. We further hypothesized that social marginalization would be directly associated with eco-anxiety, and that food insecurity and 2023 wildfire exposure severity would account for indirect associations between social marginalization and eco-anxiety. Finally, we hypothesized that higher self-esteem would moderate the association between 2023 wildfire exposure severity and eco-anxiety.

Methods

Study design and context

This study used cross-sectional baseline survey data collected as part of a community-based research initiative led by Fostering Open eXpression among Youth (FOXY), an Indigenous-led sexual health organization operating in the NWT. FOXY delivers school-based sexual health promotion programmes grounded in trauma-informed, strengths-based and arts-based approaches that attend to youths' emotional well-being, lived experiences and structural conditions shaping health (Lys et al., 2016). Following the unprecedented 2023 wildfire season, FOXY community partners identified climate-related emotional distress, including eco-anxiety, as a salient concern affecting youth well-being. The inclusion of eco-anxiety and related measures was therefore responsive to community observations and consistent with FOXY's trauma-informed framework, which recognizes environmental disruption and collective stress as relevant contexts for youth health (Lys et al., 2016).

Participants and procedures

During the 2023–2024 school year, FOXY staff recruited youth from secondary schools in 24 communities across the NWT (Aklavik, Behchokǫ̀, Délı̨nę, Fort Good Hope, Fort McPherson, Fort Providence, Fort Resolution, Fort Smith, Gamèti, Hay River, Inuvik, Kátł'odeeche First Nation, Łutselk'e, Kakisa, Norman Wells, Sambaa K'e, Tsiigehtchic, Tuktoyaktuk, Tulita, Ulukhaktok, N'Dilo, Wekweètì, Whatì and Yellowknife).

Youth were recruited by purposive sampling through school-based outreach, volunteer engagement and word-of-mouth referrals. To be eligible, participants needed to be between 13 and 18 years old, reside in the NWT, provide informed assent and parental/guardian consent or assent and commit to attending either a FOXY workshop, designed for young women and nonbinary youth or a SMASH (Strength, Masculinities, and Sexual Health) workshop, which serves young men and nonbinary youth. Each participant received a $25 gift as compensation. A total of 290 participants were included in this study.

Data collection

Interviewer-administered, paper-based surveys were completed immediately before participation in a FOXY or SMASH workshop session (Lys et al., 2016, 2023, 2018, 2024). Surveys were administered between September 2023 and May 2024, based on local school schedules and programme delivery. Accordingly, the elapsed time between the August–September 2023 wildfire season and survey completion varied across participants. All analyses examined associations between reported wildfire exposure severity and eco-anxiety; timing of survey completion was not included as a covariate because the wildfire exposure items referred to the same wildfire season for all participants. In this manuscript, "pre-test" refers to the baseline survey completed before any workshop activities. Although surveys were administered both before and after workshops as part of the broader programme evaluation (Lys et al., 2016, 2018, 2023, 2024), only pre-test data were included in this cross-sectional analysis. Trained research assistants facilitated the consent process, responded to participant questions and gathered the completed surveys, which were subsequently entered into a secure database for analysis. Ethics approval was granted by the University of Toronto's Ethics Review Board, and a research license was approved by the Aurora Research Institute. The full survey instrument is provided as Supplementary File 1.

Survey measures

Eco-anxiety was evaluated using the Hogg Eco-Anxiety Scale (Hogg et al., 2021). We included 10 out of 13 items after pilot-testing the scale with the study population, to measure affective symptoms, rumination and anxiety about personal impact (Cronbach's $\alpha = 0.95$, range = 0–30). A shortened version of the scale was used to reduce respondent burden in a school-based survey while retaining items capturing key emotional and cognitive dimensions of eco-anxiety.

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2023 wildfire exposure severity was assessed using an adapted version of the Traumatic Exposure Severity Scale (TESS), which has been previously validated and widely used to assess disaster-related exposure severity across diverse populations and disaster contexts (Elal and Slade, 2005) (Cronbach's α = 0.66, range = 0–7). We tailored this scale for the NWT context by prefacing the questions with: "When you think about the NWT fires in August and September 2023" and including the "Resource loss/being in need" six-item subscale (questions include items such as "Because of the fires did you have to spend the night somewhere other than in your home?" and "Did you need help getting water and food during the fires?"), as well as one item from the "Damage to home and goods subscale" ("Was your home damaged in the fires?").

Food insecurity was evaluated with a single Likert-scale item asking participants how often they went to sleep hungry due to a lack of food (1 = never to 5 = always). We have used this item in prior studies with this population (Logie et al., 2018a, 2021).

Self-esteem was measured using the 12-item Adolescent Self-Esteem Questionnaire (Hafekost et al., 2017), with acceptable internal consistency and reliability (Cronbach's α = 0.84). The sum score ranges from 17 to 60, with higher scores indicating higher self-esteem. Sample items include: "How I feel about myself depends on what others think of me" and "I feel that I am a valuable person who is at least equal to other people."

Social and socio-demographic factors included age, gender (cisgender girl vs. cisgender boy) and sexual orientation (LGBQ+ vs. heterosexual). We also assessed living conditions, including living in an urban setting (Yellowknife) or rural setting (outside of Yellowknife), as well as living with parent(s) versus living with non-parent caregiver(s).

Statistical analysis

We first conducted descriptive analyses of all variables for the entire sample, followed by bivariate correlations stratified by gender to assess preliminary associations. Unadjusted and adjusted linear regression analyses were used to estimate the regression coefficients of 2023 wildfire exposure severity, food insecurity and eco-anxiety. Self-esteem was examined as a moderator of the relationship between 2023 wildfire exposure severity and eco-anxiety. Interaction terms (e.g., 2023 wildfire exposure severity × self-esteem) were included to test moderation effects. Structural equation modelling (SEM) was performed using maximum likelihood estimation to examine both direct and indirect pathways to eco-anxiety, adjusting for socio-demographic factors. Direct effects refer to associations between social and contextual factors and eco-anxiety that are not explained through intermediary variables, whereas indirect effects refer to associations operating through mediating variables. In this study, food insecurity and wildfire exposure severity were specified as mediators because they were hypothesized to explain how social and contextual factors may shape eco-anxiety. Self-esteem was specified as a moderator because it was hypothesized to alter the strength of the association between wildfire exposure severity and eco-anxiety. Model fit was assessed using chi-square, root mean square error of approximation (RMSEA) and Comparative Fit Index (CFI). A non-significance level for chi-square of >0.05, a score of <0.08 for RMSEA with 90% confidence interval between 0.02 and 0.08, and a score greater than 0.90 for CFI indicate acceptable model fit (West et al., 2012; Mueller and Hancock, 2018). Multiple imputations (10 imputations) were used to address missing responses (Sinharay et al., 2001). All models were run in STATA version 17.

Results

Descriptive analysis

Table 1 summarizes participants characteristics (n = 290). The average age of participants was 13.68 (SD = 1.69). Nearly half identified as cisgender girls (47.57%), and nearly 18.37% identified as sexually diverse. Most participants identified as Indigenous (68.79%),lived in rural areas (79.10%) and resided with at least one parent (90.48%). Cisgender girls were more likely to report lower self-esteem ($p < 0.01$) and higher levels of eco-anxiety, compared to cisgender boys ($p < 0.01$).

Multivariate analysis

Results from unadjusted and adjusted linear regression models are presented in Table 2. Greater 2023 wildfire exposure severity was associated with youth who identified as LGBQ+ (Acoef: 0.25, 95% CI: 0.07, 0.42, $p < 0.01$), Indigenous (Acoef: 0.19, 95% CI: 0.03, 0.35, $p < 0.05$) and those living in a rural area (Acoef.: 0.48, 95% CI: 0.27, 0.67, $p < 0.001$). Higher wildfire exposure severity was associated with lower self-esteem (Acoef.: −0.01, 95% CI: −0.02, −0.01, $p < 0.001$).

Food insecurity was higher among youth who identified as cisgender girls (Acoef: 0.74, 95% CI: 0.35, 1.85, $p < 0.05$), LGBQ+ (Acoef: 0.49, 95% CI: 0.16, 0.82, $p < 0.01$) and Indigenous (Acoef: 0.28, 95% CI: 0.04, 0.52, $p < 0.05$), and was also associated with lower self-esteem (Acoef: −0.02, 95% CI: −0.04, −0.01, $p < 0.05$).

Eco-anxiety was higher among youth who identified as cisgender girls (Acoef: 2.21, 95% CI: 0.34, 4.09, $p < 0.05$) and LGBQ+ (Acoef: 1.68, 95% CI: 0.88, 3.23, $p < 0.05$), and was positively associated with food insecurity (Acoef: 1.13, 95% CI: 0.08, 2.18, $p < 0.05$) and 2023 wildfire exposure severity (Acoef: 10.64, 95% CI: 6.73, 14.55, $p < 0.001$).

Self-esteem moderated the effect of 2023 wildfire exposure severity on eco-anxiety (Figure 1). A significant interaction between wildfire exposure severity and self-esteem indicated that the association between wildfire exposure and eco-anxiety was weaker among adolescents with higher self-esteem.

Structural equation modelling

Results from the SEM are presented in Table 3 and Figure 2. Model fit indices for the final SEM model suggested that our model fit the data well ($\chi^2 = 2.61$, $p = 0.107$; CFI = 0.970; RMSEA = 0.059 (90% CI = 0.001–0.618); SRMR = 0.020).

Direct effects on eco-anxiety

Identifying as a cisgender girl ($\beta = 0.263$, $p < 0.001$), identifying as LGBQ+ ($\beta = 0.063$, $p < 0.01$) and living in a rural area ($\beta = 0.167$, $p < 0.05$) were each associated with higher eco-anxiety. Indigenous identity and living with a non-parent caregiver were not directly associated with eco-anxiety after accounting for mediators. Both food insecurity ($\beta = 0.213$, $p < 0.001$) and 2023 wildfire exposure severity ($\beta = 0.252$, $p < 0.001$) were positively associated with eco-anxiety.

Associations with mediators

Food insecurity was higher among LGBQ+ youth ($\beta = 0.237$, $p < 0.01$) and Indigenous youth ($\beta = 0.047$, $p < 0.05$), while gender and rural residence were not significantly associated. Living with a non-parent caregiver was marginally associated with lower food insecurity ($p = 0.055$). Greater wildfire exposure severity was reported by LGBQ+ youth ($\beta = 0.142$, $p < 0.01$), Indigenous youth ($\beta = 0.053$, $p < 0.05$) and youth living in rural communities ($\beta = 0.114$, $p < 0.001$).

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Table 1. Demographic characteristics among adolescent participants in FOXY and SMASH in the Northwest Territories, Canada (*N* = 290)

Variables	Total (*N* = 290)		Cisgender girls (*N* = 138)	Cisgender boys (*N* = 150)	
	No. (%) or mean (SD), range	Missing (N)	No. (%) or mean (SD), range	No. (%) or Mean (SD), range	*P**
Age	13.68 (1.69), 13–18		13.82 (1.84), 13–18	13.56 (1.55), 13–18	0.101
Gender identity		2	N/A	N/A	
Cisgender girls	137 (47.57)				
Cisgender boys	145 (50.35)				
Other gender	6 (2.09)				
Sexual orientation		7			<0.001
Heterosexual	231 (81.63)		101 (74.81)	135 (92.47)	
LGBQ+	52 (18.37)		34 (25.19)	11 (7.53)	
Indigenous	194 (68.79)	8	100 (74.04)	94 (64.83)	0.094
Living in a rural area (other vs. urban: Yellowknife)	212 (79.10)	22	109 (81.34)	102 (77.27)	0.412
Living with a non-parent caregiver	25 (9.26)	20	11 (8.33)	14 (10.14)	0.608
Food insecurity	1.87 (1.01), 1–5		1.85 (1.10), 1–5	1.84 (0.84), 1–5	0.437
2023 wildfire exposure severity	0.97 (1.23), 0–7	49	0.86 (1.08), 0–4	1.03 (1.31), 0–7	0.283
Self-esteem	43.17 (9.35), 17–60	53	41.71 (9.47), 19–60	44.90 (8.87)	<0.01
Eco-anxiety	4.99 (7.23), 0–30	53	6.30 (7.44), 0–29	3.81 (7.00), 0–30	<0.01

Note: **p*-values estimated from *t*-test for differences in means, and Chi-squared test for differences in proportions by gender.

Table 2. Multivariate analysis of 2023 wildfire exposure severity, food insecurity and eco-anxiety among adolescent participants in FOXY and SMASH in the Northwest Territories, Canada (*N* = 290)

Variables	Exposure to 2023 wildfire		Food insecurity		Eco-anxiety	
	Unadjusted coef. (95% CI)	Adjusted coef. (95% CI)	Unadjusted coef. (95% CI)	Adjusted coef. (95% CI)	Unadjusted coef. (95% CI)	Adjusted coef. (95% CI)
Cisgender girls (vs. cisgender boys)	−0.14 (−0.65, 0.37)		1.06 (0.05, 2.16)*	0.74 (0.35, 1.85)*	2.48 (0.61, 4.35)**	2.21 (0.34, 4.09)*
LGBQ+ (vs. heterosexual)	0.12 (0.05, 0.29)**	0.25 (0.07, 0.42)**	0.52 (0.21, 0.82)**	0.49 (0.16, 0.82)**	3.66 (1.28, 6.03)**	1.68 (0.88, 3.23)*
Indigenous (vs. non-Indigenous)	1.60 (0.98, 2.23)***	0.19 (0.03, 0.35)*	0.47 (0.23, 0.72)***	0.28 (0.04, 0.52)*	1.99 (0.63, 4.05)*	−1.28 (−3.76, 1.21)
Living in a rural area vs. an urban area	2.47 (1.50, 3.45)***	0.48 (0.27, 0.67)***	0.46 (0.16, 0.77)		2.99 (0.55, 5.42)*	2.48 (−0.30, 5.26)
Living with a non-parent caregiver	−0.12 (−0.99, 0.75)		0.39 (−.0.80, 0.01)		3.32 (0.16–6.48)*	1.12 (2.26, 4.51)
Food insecurity	N/A	N/A	N/A	N/A	1.86 (0.95, 2.77)***	1.13 (0.08, 2.18)*
2023 Wildfire exposure severity	N/A	N/A	N/A	N/A	1.31 (0.59, 2.03)***	10.64 (6.73, 14.55)***
Self-esteem	−0.03 (−0.04, −0.01)**	−0.01 (−0.02, −0.01)***	−0.04 (−0.05, −0.03)***	−0.02 (−0.04, −0.01)*	−0.31 (−0.40, −0.21)***	−0.03 (−0.23, 1.71)
Food insecurity* self-esteem	N/A	N/A	N/A	N/A	0.01 (−0.08, 0.11)	
2023 Wildfire exposure severity *self-esteem	N/A	N/A	N/A	N/A	−0.20 (−0.28, −0.12)***	−0.21 (−0.31, −0.12)***

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Indirect effects

Indirect effects indicated that food insecurity and wildfire exposure severity accounted for a substantial proportion of the association between social factors and eco-anxiety. For LGBQ+ youth, the total standardized effect on eco-anxiety was $\beta = 0.149$, with ~58% explained through indirect pathways *via* food insecurity ($\beta\_indirect = 0.050$) and

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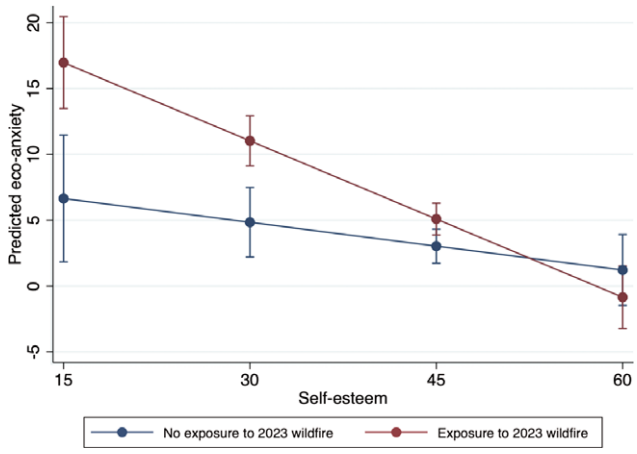

Figure 1. Moderation effect of self-esteem on the relationship between 2023 wildfire exposure severity and eco-anxiety among adolescent participants in FOXY and SMASH in the Northwest Territories, Canada (N = 290).

wildfire exposure severity (β_indirect = 0.036), consistent with partial mediation. Indigenous identity was associated with eco-anxiety primarily through indirect pathways (β_*indirect* = 0.023), with no significant direct effect, consistent with full mediation. For youth living in rural communities, wildfire exposure severity accounted for a modest indirect effect (β_*indirect* = 0.029), representing ~15% of the total effect (β_*total* = 0.196), with most of the association remaining direct.

Discussion

This study examined associations between wildfire exposure severity, socio-ecological factors and eco-anxiety among Northern and Indigenous adolescents in the NWT following the 2023 wildfire season. Our findings indicate that eco-anxiety among NWT youth is shaped by intersecting social positions, living conditions and climate-related experiences. Cisgender girls and LGBQ+ youth reported higher levels of eco-anxiety, while food insecurity and wildfire exposure severity emerged as key pathways linking social marginalization to climate-related emotional distress. Additionally, self-esteem moderated the relationship between 2023 wildfire exposure severity and eco-anxiety. These findings offer new insights into multi-level factors shaping eco-anxiety among Northern and Indigenous adolescents in this Arctic and Sub-Arctic region.

Gender differences were evident in both exposure and pathways to eco-anxiety. Identifying as a cisgender girl (vs. cisgender boy) was associated with greater wildfire exposure severity and food insecurity, both of which were directly associated with eco-anxiety. These findings are consistent with the emerging research indicating that girls report higher levels of eco-anxiety and climate-related emotional distress (Coffey et al., 2021; Clayton et al., 2023). Stigma and societal norms around emotional expressiveness and empathy may partly explain why cisgender women and girls tend to show higher levels of eco-anxiety (Parry et al., 2022; Chou et al., 2023). It has been suggested that, in some contexts, boys are taught to suppress their emotions, which may lead them to be more subtle in expressing their concerns about the environment (Kankawale and Niedzwiedz, 2023). Others suggest that girls and gender-diverse youth may also express stronger concern for community

Table 3. Path analysis on eco-anxiety among adolescent participants in FOXY and SMASH in the Northwest Territories, Canada (N = 290)

Parameter	Coefficient (SE)	Critical ratio	*p*-value	Standardized estimate (SE)
Food insecurity ON				
Gender (cisgender girls)	0.085 (0.148)	3.55	<0.001	0.043 (0.075)
LGBQ+	0.621 (0.199)	3.11	0.010	0.237 (0.073)
Indigenous	0.228 (0.137)	2.10	0.050	0.047 (0.088)
Living in a rural area	0.130 (0.207)	0.54	0.592	
Living with a non-parent caregiver	−0.457 (0.239)	−1.92	0.055	
2023 wildfire exposure severity ON				
Gender (cisgender girls)	−0.079 (0.181)	−0.44	0.659	
LGBQ+	0.446 (0.244)	2.98	0.010	0.142 (0.077)
Indigenous	0.136 (0.234)	1.98	0.050	0.053 (0.090)
Living in a rural area	0.320 (0.253)	3.08	<0.001	0.114 (0.089)
Living with a non-parent caregiver	0.236 (0,292)	0.81	0.419	
Eco-anxiety ON				
Gender (cisgender girls)	2.937 (0.510)	2.93	0.010	0.204 (0.068)
LGBQ+	1.206 (1.397)	2.94	0.010	0.063 (0.072)
Indigenous	0.04 (1.300)	0.86	0.388	
Living in a rural area	2.879 (1.408)	2.04	0.050	0.167 (0.081)
Living with a non-parent caregiver	2.083 (1.636)	1.27	0.203	
Food insecurity	1.562 (0.510)	3.06	<0.001	0.213 (0.069)
2023 wildfire exposure severity	1.553 (0.416)	3.72	<0.001	0.252 (0.066)

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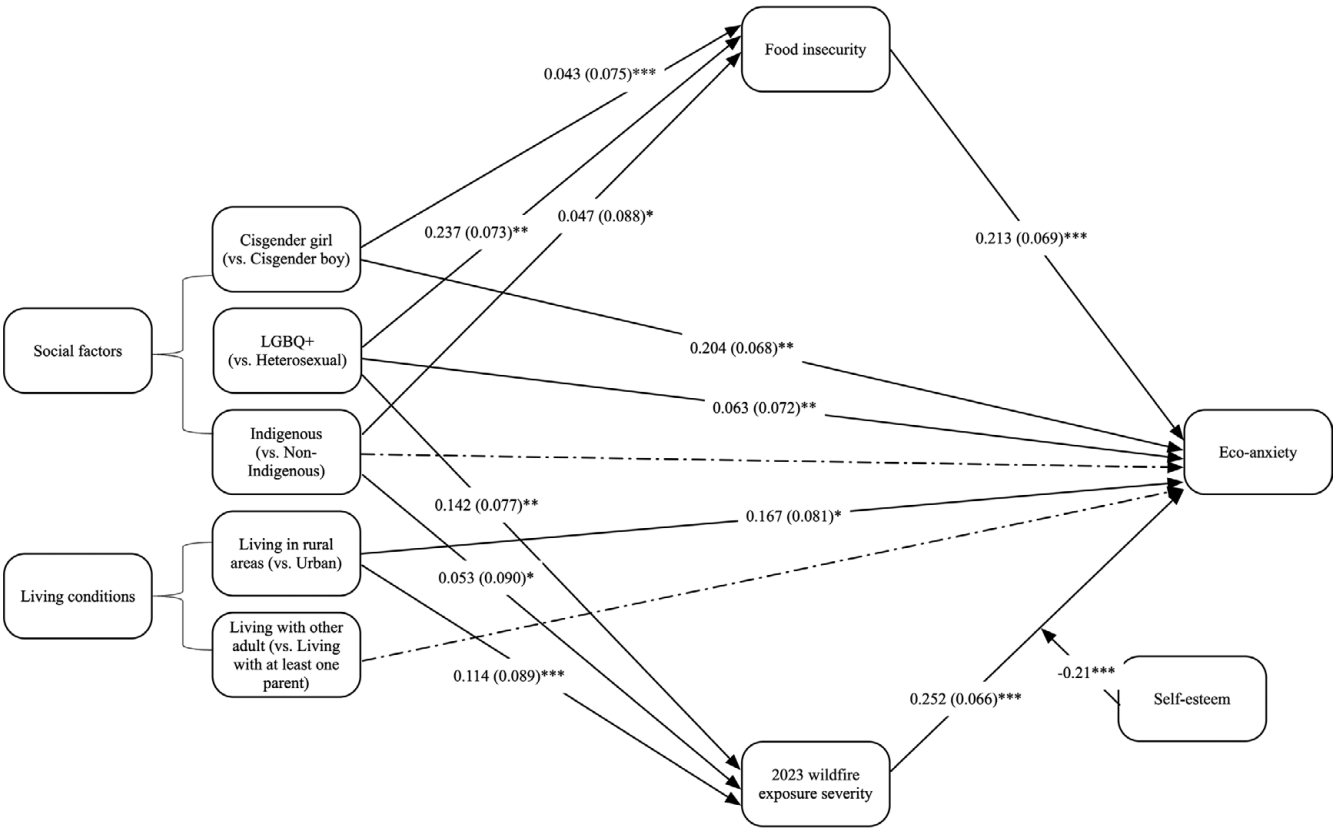

Figure 2. Final path analysis on eco-anxiety among adolescent participants in FOXY and SMASH in the Northwest Territories, Canada (*N* = 290).

and future generations – values often tied to higher environmental awareness (McCright and Xiao, 2014; Drake et al., 2024). Eco-anxiety may reflect not only vulnerability but also a sense of social and ecological responsibility. These gender-based differences in emotional responses highlight the influence of socio-cultural context (Closson et al., 2025). Future research is needed to explore the experiences of gender diverse groups and to address the specific needs and priorities of adolescent girls in managing eco-anxiety.

Eco-anxiety was also patterned by social marginalization and living conditions. Social categories of Indigenous youth, LGBQ+ youth, those living in rural communities and youth living without a parent were indirectly associated with eco-anxiety through food insecurity and wildfire exposure severity. Previous studies have indicated that LGBQ+ individuals face greater losses of community during environmental crises, are often excluded from shelters and other resources due to heteronormative policies, encounter inaccessible healthcare systems, experience harassment and face higher rates of homelessness, among other challenges (Goldsmith et al., 2022; Goldsmith and Bell, 2022; Whitley and Bowers, 2023). Within the NWT, documented experiences of stigma and social exclusion among sexually and gender-diverse youth (Logie and Lys, 2015; Logie et al., 2018b) suggest that climate-related stressors may compound pre-existing inequities, underscoring the importance of tailored and inclusive supports for LGBQ+ youth in the context of future EWEs.

Living conditions further shaped pathways to eco-anxiety. Youth residing in rural communities reported greater wildfire exposure severity, which was associated with higher eco-anxiety. Rural youth may experience more direct and prolonged exposure to climate-related disruptions, while also facing reduced access to healthcare, mental health services and educational resources compared to urban peers (Sanson et al., 2019; Brophy et al., 2023; Chou et al., 2023). In contrast, living with at least one parent appeared to be protective, potentially reflecting better emotional, social and financial support to cope with the impacts of climate change, as parental guidance and family resources can help mitigate the stress and anxiety associated with climate-related disruptions (Sanson et al., 2019; Brophy et al., 2023; Chou et al., 2023). In the NWT, the long-lasting impacts of colonization and the residential school system have contributed to significantly higher rates of child removal by the welfare system compared to the national average (Pollock et al., 2024). Therefore, there is an urgent need to better understand the extreme weather-related needs and eco-anxiety experiences of youth involved in child welfare systems. Indeed, future climate-related research within child welfare systems could be a priority in the NWT and other settings at the nexus of child welfare disparities and EWEs.

Food insecurity emerged as a key pathway linking social marginalization to eco-anxiety, suggesting that concerns about environmental change are embedded within everyday experiences of uncertainty and material precarity. In northern contexts, where food access is closely tied to environmental conditions, food insecurity may amplify climate-related distress by reinforcing fears about future stability and well-being (Logie et al., 2021; Boluda-Verdú et al., 2022; Government of Canada, 2023a). Addressing food insecurity may therefore support youth mental well-being in ways that extend beyond nutrition, including reducing climate-related worry and emotional strain.

Wildfire exposure severity was independently associated with higher eco-anxiety, underscoring the emotional impacts of lived exposure to EWEs. Rather than reflecting abstract concern, eco-anxiety

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appears directly linked to experiences of disruption, displacement, and loss during the 2023 wildfire season. Prior research in the NWTs shows that wildfires can have sustained emotional effects on youth by disrupting daily routines, schooling and relationships to place (Dodd et al., 2018; Government of Northwest Territories, 2023). These findings highlight the importance of incorporating youth mental and emotional well-being into wildfire preparedness and recovery efforts, including trauma-informed supports that normalize emotional responses to environmental threat (Hickman et al., 2021; Montesanti et al., 2021).

These pathways should also be understood within the broader structural context shaping climate vulnerability in northern and Indigenous communities. Many communities in the NWT experience longstanding inequities related to colonial policies, infrastructure gaps and high costs of food and essential goods, all of which can contribute to resource insecurity (Layton, 2023; Government of Northwest Territories, 2023; Pollock et al., 2024; Whyte, 2017). Climate-related disasters, such as wildfires, may exacerbate these conditions by disrupting supply chains, transportation, schooling and access to land-based activities that support well-being and cultural continuity (Dodd et al., 2018; Montesanti et al., 2021; Reyes-García et al., 2024). In this context, the associations observed between food insecurity, wildfire exposure severity and eco-anxiety likely reflect both individual experiences and also broader structural determinants shaping youth well-being. Recognizing these conditions helps to avoid framing eco-anxiety solely as an individual psychological response and instead situates youth distress within intersecting social, environmental and historical contexts.

Importantly, self-esteem represents a potentially modifiable psychosocial resource. In our model, the interaction between wildfire exposure severity and self-esteem remained statistically significant after adjustment, suggesting that higher self-esteem may buffer the association between wildfire exposure and eco-anxiety. Community-based programmes such as FOXY and SMASH incorporate arts-based learning, peer support and land-connected activities that may help strengthen youth confidence, identity and coping skills in the face of climate-related stressors (Lys et al., 2016, 2023, 2024; Logie et al., 2018b; Gittings et al., 2022, 2024).

Implications and limitations

There remains limited evidence to fully understand how young people cope with the stress associated with climate change (Godden et al., 2021), and more research is necessary in this area (Doblas-Reyes et al., 2021) — particularly in Arctic and Sub-Arctic regions such as the NWT, where social and structural disparities shape youth well-being (Government of Canada , 2023b). Several factors have been identified to support young people in managing climate change-related distress in other global settings, including having a sense of agency to address the stressors, having their values and emotions validated and being able to alleviate ongoing stressors (Hickman et al., 2021).

Interventions that support emotional resilience and self-esteem may be particularly important for youth experiencing climate-related distress. Pihkala (2019) argues that while taking action can help manage anxiety, simply prescribing action might be more about avoiding underlying emotions than addressing them directly. Effective interventions should integrate both action and mental health support, helping individuals process their feelings in a constructive manner (Aylward et al., 2024).

Social and healthcare professionals have a vital role in supporting individuals dealing with eco-anxiety, especially in the aftermath of EWEs. Strategies that facilitate meaning-focused coping, helping youth find personal significance in their experiences and the broader climate change narrative, can foster purpose and motivation (Baudon and Jachens, 2021). Creating environments where youth feel safe to express fears related to climate change and environmental disruption, and where emotional responses are validated, may further support emotional resilience (Baudon and Jachens, 2021; Hickman et al., 2021).

In northern and Indigenous contexts, these approaches should build on existing cultural strengths. Participatory and community-based strategies that incorporate Indigenous knowledges, land-based learning and culturally grounded teachings have been shown to support empowerment, self-esteem and leadership among youth, and may offer important pathways for addressing eco-anxiety linked to environmental change, food systems disruption and wildfire exposure in the NWTs (Gittings et al., 2022, 2024).

This study has several limitations. The use of non-random sampling limits generalizability, and the cross-sectional design precludes causal inference. Surveys were conducted across the 2023–2024 school year, which may have introduced variability in proximity to the wildfire events. Because surveys were administered across communities at different points during the school year, the interval between wildfire exposure and survey completion varied among participants. This variation may influence recall of wildfire experiences or the intensity of eco-anxiety reported. As with all self-report data, reporting bias is possible. Several measurement considerations should be noted. Food insecurity was assessed using a single-item indicator, which may not capture the full range or severity of food access challenges experienced by youth. The wildfire exposure severity scale also demonstrated modest internal consistency, likely reflecting the diverse ways wildfire events affected communities across the NWT. In addition, eco-anxiety was assessed using a shortened 10-item version of the Hogg Eco-Anxiety Scale to reduce respondent burden in a school-based survey. Future research could incorporate more detailed measures of resource insecurity and disaster exposure and apply longitudinal designs to better understand how eco-anxiety develops over time. Despite these limitations, this study focuses on extreme weather event severity with adolescents in an Arctic and Sub-Arctic region, with implications for working with other rural, remote and Indigenous communities of climate-affected adolescents. This is particularly important as the NWT is highly prone to facing wildfire risks, with climate-driven warming, extended drought and increased fuel loads turning the region into a hotspot for severe and growing fire activity (Gaboriau et al., 2023).

Conclusion

This study highlights the experiences of eco-anxiety among Northern and Indigenous youth, including LGBQ+ youth, and those in rural environments. Findings reveal that social factors, living conditions and structural conditions can shape risks of eco-anxiety among adolescents in the NWT. Self-esteem moderated the pathway between wildfire exposure severity and eco-anxiety, suggesting the importance of multi-level responses that strengthen youth resilience while addressing structural determinants such as food insecurity. Addressing climate-related mental health among youth in northern regions, therefore, requires approaches that integrate psychosocial supports, community resilience, and structural interventions.

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Data availability statement. Data are available upon reasonable request from C. Logie (carmen.logie@utoronto.ca) and upon obtaining required research ethics board approvals.

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Competing interests. The authors declare none.

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Patient and public involvements. This community-based study was developed and implemented in collaboration with community-based organization (CBO) in the Northwest Territories and local peer navigators in each study site, and addressed CBO priorities to advance youth sexual and reproductive health and well-being.

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