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Examining Arctic Climate Adaptation Plans Through an Intersectional Lens: A Case of Alaska

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Research Article

Keywords: Gender, Arctic, climate adaptation plans, intersectionality, climate change

Posted Date: November 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11040362/v1

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Additional Declarations: No competing interests reported.

Abstract

The Arctic is experiencing rapid climate change that is intensifying and demands urgent attention. Changing climate also exacerbates social vulnerabilities, particularly among the Indigenous Peoples and other groups that are facing climate injustice. Climate adaptation plays a critical role in responding to these challenges, and many Indigenous communities have developed their own adaptation plans, positioning themselves as active agents in addressing climate change. However, climate adaptation plans should also empower the diverse communities they are intended to serve.

This paper examines whether Arctic climate adaptation literature and community climate adaptation plans address intersectional factors such as gender, disability, age, socioeconomic disparities, Indigenous rights and knowledge, and community participation and governance. Using a systematic literature review and thematic analysis framework, the study analyzes 15 peer-reviewed articles and 23 Alaska climate adaptation plans, with detailed case studies of Anchorage and Fairbanks.

The findings reveal that academic literature strongly advocates an intersectional approach to climate adaptation strategies and planning. In practice, however, while Indigenous Knowledge and community participation are increasingly recognized, most adaptation plans rely on single-variable approaches and inadequately address intersecting forms of vulnerability. Gender equity, disability inclusion, and the experiences of other marginalized groups remain particularly underrepresented. The study therefore calls for the adoption of an intersectional approach to develop more equitable, inclusive, and effective climate adaptation strategies in the Arctic.

1. Introduction

1.1 Background

In the rapidly transforming Arctic, climate adaptation planning demands a nuanced understanding of how environmental, social, and cultural factors intersect to shape community resilience (Malik et al., 2025; Vogel & Bullock, 2021). As a key part of the Arctic region, Alaska faces many of the same climate-related challenges, including permafrost thaw, rising temperatures, and increased socio-environmental vulnerability. Climate model projections emphasize that Arctic environmental changes will continue to intensify throughout the 21st century (Walsh et al., 2011; AMAP, 2024). These changes are primarily driven by human-induced greenhouse gas emissions, which are accelerating warming trends and introducing multiple risk factors with wide-ranging harmful impacts (Arctic Climate Change and Its Impacts, 2004). Additionally, permafrost degradation contributes to increased coastal erosion, slope instability, and thermokarst formation, posing direct threats to northern communities (Hjort et al., 2022; AHTNC, 2024). The findings emphasize that permafrost stores twice as much carbon as the atmosphere, and its thawing could increase greenhouse gas emissions, further exacerbating global warming (Streletskiy, 2021).

Studies have shown that adaptation plans generally align adaptation measures with projected climate risks in their respective communities (Stults & Woodruff, 2017; Kelly & Holen, 2024). However, evaluations of these plans have rarely considered intersectional dimensions such as gender, disability, age, race, or other forms of social vulnerability. As a result, adaptation planning has largely emphasized technical and governance-related measures rather than assessing whether the needs of diverse population groups are adequately addressed. Given that climate change does not affect all people equally, implementation plans should explicitly incorporate intersectional vulnerabilities to ensure that adaptation measures are equitable and responsive to the needs of all community members (Schapper, 2018).

Understanding the significance of climate change and critically examining climate adaptation plans is essential for addressing the accelerating impacts of global warming. This is particularly urgent in the Arctic, a region warming much faster than the global average, resulting in melting glaciers, sea ice loss, and permafrost thaw (Corell, 2006). These changes have far-reaching consequences, including rising sea levels, disruptions to ocean currents, and altered weather patterns. The resulting transformations threaten biodiversity, destabilize infrastructure, and severely impact Indigenous livelihoods, while also presenting complex challenges for sustainable resource development. Given that Arctic warming is projected to continue for centuries even if greenhouse gas emissions were halted today, the need for robust mitigation and adaptation strategies is critical (Vogel & Bullock, 2021). Incorporating an intersectional perspective into climate adaptation planning is especially urgent, as it ensures that the compounded vulnerabilities experienced by Indigenous communities, women, and economically marginalized groups are adequately addressed, leading to more just and effective responses (Hoogensen Gjørv, 2017).

Against this background, the present study assesses the role of intersectionality in Arctic climate adaptation by tracing how factors such as Indigenous rights, gender, and socio-economic disparities have been addressed in the broader literature and evaluating their incorporation into Alaska's climate adaptation plans. By connecting these two areas of analysis, the study seeks to identify gaps in existing adaptation approaches and demonstrate the importance of intersectional considerations for developing more equitable and effective climate responses.

1.2 Research Questions

1. How has Arctic climate adaptation literature historically incorporated intersectional factors such as Indigenous rights, gender, and socioeconomic disparities?
2. How do community climate adaptation plans in Alaska, specifically in Anchorage and Fairbanks, incorporate intersectionality to address the needs of marginalized communities, including Indigenous groups, low-income populations, people with disabilities, and gender-diverse groups?

2. Theoretical Framing: Intersectionality, Climate Justice and Indigenous Governance

Intersectionality, as theorized initially by Kimberlé Crenshaw, offers a framework to understand how intersecting dimensions of identity and systems of power can produce compounded disparities (Crenshaw, 1991). On the other hand, climate justice seeks to address the disproportionate effects of climate change on marginalized populations. The relationship between intersectionality and climate justice reveals how overlapping forms of inequality, such as race, gender, class, and disability, compound the marginalization of vulnerable communities (Mikulewicz et al., 2023).

Intersectionality not only sharpens the analysis of climate injustice but also informs transformative and participatory methodologies such as storytelling and narrative-based participatory action research that co-produce climate knowledge grounded in diverse epistemologies and foster agency among those most impacted by climate change (Rigon, 2025). However, studies show that climate justice scholarship has yet to fully explore and capitalize on its connections with intersectionality, a significant oversight representing a critical gap in the existing literature (Mikulewicz et al., 2023). Often climate vulnerability analysis relies on single-variable approaches, missing out on the complexity that intersectionality brings (Mikulewicz et al., 2023; Tschakert, et al., 2025).

Climate adaptation plans must not only address changing climate but also empower affected communities to manage these challenges. Strengthening resilience and mitigating future risks requires multi-scale governance, community engagement, and participatory planning (Bennett et al., 2015). The field of climate adaptation in Indigenous contexts has increasingly recognized decolonization, intersectionality, and Indigenous self-determination as key priorities (Hoogensen Gjørv, 2017; Malik & Ford, 2025b). Still, mainstream climate adaptation often marginalizes Indigenous perspectives by overlooking structural injustices they face. Research seldom explores how identity markers such as gender, age, and socio-economic status, intersect to shape Indigenous climate vulnerabilities and capacities (Johnson et al., 2021). In particular, although Indigenous women have been agents of change, they remain excluded from key climate policies (Prior & Heinämäki, 2017). To address these gaps, scholars advocate for adaptation strategies rooted in Indigenous Knowledge systems and relational ontologies, prioritizing governance frameworks shaped by Indigenous worldviews rather than imposed Western models (Johnson et al., 2021; Kuokkanen, 2019).

Integrating intersectional perspectives can mitigate maladaptation, ensuring that adaptation policies do not inadvertently reinforce power imbalances or exclude marginalized groups within Indigenous communities (Johnson et al., 2021). Thus, the intersectional lens on climate justice is crucial, one that recognizes the diverse experiences of Arctic populations, promotes the meaningful involvement of Indigenous women in climate policymaking, and challenges narratives that portray Arctic communities as passive victims rather than active agents of change (Friedrich, 2023). Effective climate adaptation policies should focus on prioritizing investments in vulnerable communities, implementing accountability measures, and integrating climate resilience with broader social justice objectives through a cross-sectoral approach (Poverty & Race Research Action Council, 2017).

2.1 Climate justice

Climate change is increasingly recognized as a deeply embedded social issue, with its impacts disproportionately affecting individuals and communities along lines of race, gender, class, and geographic location (Kronsell et al., 2021). Treating it solely as an environmental problem obscures the structural inequalities that shape exposure, resilience, and access to resources. A justice-oriented approach requires a shift toward recognizing these differentiated vulnerabilities (Mattar et al., 2020; Kronsell et al., 2021).

A recent study argues for a conceptual pivot in climate adaptation planning through an intersectional lens that explicitly acknowledges how race, gender, class, and other identities intersect to shape vulnerability and access to resources in urban environments (Amorim-Maia et al., 2022). The work critiques the inadequacy of traditional adaptation strategies that often adopt technocratic and siloed approaches, and proposes a five-component framework for intersectional climate justice: (1) tackling structural reinforcers of racial and gender inequality; (2) redressing the drivers of differential vulnerabilities through historical and structural recognition; (3) integrating ethics and politics of care into adaptation efforts; (4) adopting place-based and decolonial planning practices; and (5) promoting cross-identity activism and community-led resilience. These components emphasize the need to embed social justice into climate planning, not only in terms of outcome distribution but also by transforming the power relations that produce and sustain inequality.

Environmental justice must be understood within layered historical, biophysical, social, and cultural contexts that shape both environmental harms and responses to them. Together, these intersecting contexts highlight that environmental justice is not only a matter of technical policy reform but needs to confront deeper historical and systemic inequities embedded in political and institutional arrangements (Mattar et al., 2020; Kashwan, 2021). These legacies continue to inform contemporary governance structures and policy priorities.

Some components of effective climate justice policies include:

- **Equity and Fairness**: Policies should ensure climate action does not disproportionately burden vulnerable and marginalized communities. Fairness requires acknowledging historical emissions and considering the varying capacities of countries and communities to cope with climate impacts (Ayompe, 2025). Active involvement of all stakeholders, particularly those most affected by climate change, such as Indigenous people, low-income communities, and residents of vulnerable regions, should be a priority in decision-making processes (Brandstedt & Brulde, 2019; Hügel & Davies, 2020; Restrepo-Mieth et al., 2023). Transparency and public accountability in policy formulation and implementation are critical (Ayompe, 2025).
- **Recognition of Rights**: Effective climate justice policies must safeguard the rights of individuals and communities (Prior & Heinämäki, 2017). This includes the right to a healthy environment, Indigenous Peoples' rights to their land and resources, and protection of future generations' rights (Schapper, 2018).

- **Access to Resources and Support**: Adequate funding, technology transfer, and capacity-building efforts are essential to enable all countries, particularly developing nations, to mitigate and adapt to climate change (Hughes, 2013). Supporting green technologies, sustainable agriculture, and climate-resilient infrastructure are key priorities. Aligning climate justice policies with broader sustainable development goals ensures that climate action promotes social and economic progress without sacrificing environmental integrity (Ayompe, 2025).
- **Adaptation and Resilience Building**: Strategies aimed at helping communities adapt to the adverse effects of climate change should prioritize the most vulnerable populations. This includes improving infrastructure, forecasting, emergency preparedness, and social safety nets to enhance resilience (Ford et al., 2014).

2.2 Indigenous governance

Indigenous governance has increasingly been recognized as central to addressing climate change and environmental governance (Wilson et al. 2022). However, its representation in scholarly and policy discourse remains inconsistent. Martello (2008) argues that the Arctic Indigenous Peoples have become both symbols and spokespersons in the global climate change arena. These representations grant the Indigenous Peoples visibility and credibility in global forums but also risk essentializing their identities within narrowly defined categories that serve broader scientific narratives (Tormos-Aponte, 2021).

Similarly, Wilson et al. (2022) emphasize that while the Indigenous Peoples have governed their territories for millennia, mainstream climate governance literature often fails to reflect this. Scoping reviews consistently reveal that only a minority of climate governance studies fully incorporate Indigenous concepts such as self-determination, legal orders, and nation-to-nation relationships (Wilson et al., 2022; Zurba and Papadopoulos, 2023). Indigenous voices are frequently marginalized, and Indigenous knowledge systems are tokenistically included even though their recognition is growing (Carmona et al., 2024). This gap is attributed to framing Indigenous actors as stakeholders rather than rights holders or sovereign entities. There needs to be a shift from viewing Indigenous Knowledge as supplemental to recognizing its foundational governance value. Together, these studies underscore the critical importance of recognizing Indigenous governance not merely as a cultural or knowledge contribution, but as a legitimate and sovereign system that must be respected and integrated into environmental decision-making at all levels (Wilkens and Datchoua-Tirvaudey, 2022).

3. Methods

This study employed a two-part methodology to examine the integration of intersectional factors in Arctic climate adaptation using a defined, deductive, codebook-based thematic analysis framework. To address Research Question 1, a systematic literature review of peer-reviewed academic publications on Arctic climate adaptation was conducted through targeted database searches to examine how intersectional considerations, including Indigenous rights, gender, and socioeconomic disparities, had been represented and incorporated in the literature. A systematic review methodology was selected

because it enabled a transparent, replicable, and unbiased approach to synthesizing diverse bodies of evidence (Petticrew & Roberts, 2006). Key themes and trends were identified to assess the extent and nature of intersectional engagement, providing a foundational understanding of the conceptual and analytical approaches that had shaped Arctic adaptation research over time. To address Research Question 2, the same thematic analysis framework was applied to examine how intersectional considerations were incorporated into Alaska's climate adaptation plans. The analysis was conducted for 23 community climate adaptation plans across Alaska (based on publicly accessible documents from the reference list in Kelly & Holen (2024)) with an in-depth examination of Anchorage and Fairbanks' plans. These cities were chosen as case studies because they are Alaska's largest urban centers and can provide valuable insights. The content analysis was based on the presence of relevant keywords, thematic depth, inclusion of specific strategies, and the extent to which the plans operationalized these themes. This method enabled the identification, analysis, and interpretation of patterns within qualitative data while providing the methodological flexibility required to examine complex and context-dependent issues such as intersectionality in Arctic adaptation discourse (Morgan, 2022). In addition, by comparing findings from the literature review with those from policy documents, the study evaluated the alignment between academic discourse and adaptation planning practice, providing a comprehensive assessment of how well current adaptation plans addressed intersectional vulnerabilities.

3.1 Systematic Literature Review

The study utilized the Google Scholar database as our primary data source. Given the rapid evolution of intersectionality concepts in the last decade, we focused on most recent sources (2012–2025). We searched for articles in the English language that addressed climate adaptation in the Arctic to examine how intersectional factors have or have not been incorporated. The selection process of this systematic review was based on predefined eligibility criteria. The inclusion criteria targeted published peer-reviewed studies on Arctic climate adaptation strategies and research addressing intersectional factors such as Indigenous rights, gender, age, disability, environmental justice, and socio-economic aspects. The search terms used were “Arctic climate adaptation” OR “Arctic climate plans” AND “Indigenous rights” OR “Indigenous governance”, “Climate adaptation” AND “Arctic communities” AND “Gender” OR “Women”, “Arctic adaptation” AND “Socio-economic Disparities” AND “Equity” OR “Justice”, “Arctic climate adaptation plans” AND “Intersectionality”, “Arctic adaptation policies” AND “Intersectionality” AND “Policies”, “Arctic Climate Adaptation Policies” AND “Gender”. The total number of articles meeting all criteria was 15.

3.2 Coding Framework for Thematic Analysis

To systematically assess how intersectional considerations are represented in both the reviewed literature (Research Question 1) and the community climate adaptation plans in Alaska (Research Question 2), a structured analytical framework was developed in the form of a coding table, as shown in Table 1. This table included nine predefined themes grounded in existing literature on intersectionality,

climate justice, and Indigenous governance. The table served as a guiding codebook for identifying patterns, gaps, and thematic emphasis in the selected peer-reviewed articles and climate adaptation plans. By applying the same intersectional framework across both datasets, the study ensured comparability and analytical coherence between the systematic literature review and the climate adaptation plans analysis.

Table 1
Thematic analysis framework

Theme	Definition	Indicators (examples)
Recognition of Intersectionality	Explicit inclusion of intersectional frameworks or overlapping vulnerabilities.	Mentions of intersectionality, overlapping identities, or compounded vulnerability.
Indigenous Rights and Knowledge	Incorporation of Indigenous Knowledge, rights, or governance in climate adaptation. Keywords: Traditional knowledge, Indigenous, Native, Tribal, Traditional	Use of Traditional Ecological Knowledge, Indigenous consultation or self-governance.
Gender Equity	Attention to gender-specific vulnerabilities and inclusion of women in planning. Keywords: Gender equity, Gender, Women, Men, LGBTQ+	Gender analysis, participation metrics, reference to gender-based issues or programs.
Socioeconomic Disparities	Recognition of economic inequalities and targeted support for low-income populations. Keywords: Low-income, Poverty, Housing, Job opportunities, Economic	Reference to income level, housing insecurity, or job inequality.
Disability and Age Inclusion	Inclusion of needs of people with disabilities or the elderly. Keywords: Elderly, Disability, Age	Accessible infrastructure, age-related planning, inclusion of disability support.
Community Participation and Governance	Community engagement and participatory processes in climate adaptation planning. Keywords: Community, Stakeholder	Public consultations, community workshops, co-production of plans.
Equity in Resource Distribution	Fair allocation of adaptation resources across different social and geographic groups. Keywords: Food security, Subsistence	Equitable resource allocation, geographic spread of funding or assistance.
Environmental Justice	Identification of disproportionate environmental impacts on marginalized groups. Keywords: Health, Environmental impact, Racism	Pollution impact disparity, mining or extraction concerns in vulnerable communities.

Theme	Definition	Indicators (examples)
Language and Framing	Use of justice-oriented language and framing of communities as agents of change.	Mentions of justice, empowerment, equity, or rights-based approaches.

3.3 Evaluation Criteria

To evaluate the extent to which each climate adaptation plan incorporated nine intersectional themes, a four-level color-coded rating system was applied as shown in Table 2. Themes were assessed based on the presence of relevant keywords, the depth of discussion, the inclusion of concrete examples or strategies, and the extent to which the theme was operationalized throughout the adaptation plan rather than mentioned only in passing.

Table 2
Color-coded evaluation criteria

Red – Not at all	**• The theme is absent from the adaptation plan.** **• No relevant keywords, concepts, strategies, or actions are identified.** **• There is no evidence that the issue was considered in planning or implementation.**
Light Red – Superficial Engagement	• The theme is briefly acknowledged but receives limited attention. • References are largely descriptive or symbolic, with little explanation or supporting evidence. • Few or no concrete actions, implementation mechanisms, or measurable commitments are provided.
Yellow – Moderate Engagement	• The theme is discussed beyond simple acknowledgment. • The plan includes several relevant examples, strategies, or policy actions. • However, discussion lacks comprehensive integration, detailed implementation measures, or consistent consideration throughout the document.
Green – Engaged with Detail	• The theme is comprehensively integrated throughout the adaptation plan. • The plan provides detailed discussion supported by specific strategies, implementation mechanisms, measurable actions, or governance structures. • The theme is operationalized rather than simply acknowledged and is clearly reflected in policy objectives and implementation.

3.4 Researchers' positionality

As a researcher from India conducting graduate research in the United States, the lead author's positionality brings a transnational perspective to this study. Her background informs a sensitivity to issues of environmental injustice, systemic exclusion, and the need for equity-oriented approaches in

climate governance. While she is not a member of the communities analyzed in this study, her approach to this work is with a commitment to respectful engagement, cultural humility, and scholarly accountability. A field visit to Fairbanks, Alaska, supported by URSA MAJOR Young Scientists' School, and conversations with local stakeholders enriched her understanding of the local context, though she recognizes the limitations of interpreting plans without deep community participation. The second author is a settler senior researcher with broad international experience and background who spent many years working in and with Arctic communities in North America and Eurasia. Both authors would like to recognize that this research concerns lands, waters and community well-being of the Arctic Indigenous People, and Alaska Natives specifically. We respect the sovereignty and honor the culture, traditions, resilience and wisdom of the Indigenous Peoples as stewards of Alaska.

4. Findings

4.1 Climate adaptation literature analysis

The first research question focuses on how Arctic climate adaptation literature has historically incorporated intersectional factors such as Indigenous rights, gender, and socioeconomic disparities. The systematic review of 15 articles reveals an uneven treatment of intersectional themes in Arctic climate adaptation literature, marked by both progress and persistent gaps in justice, equity, and inclusion, as shown in Table 3. The most consistently addressed themes are Indigenous Rights and Knowledge and Community Participation and Governance. Most articles recognize the importance of Indigenous worldviews in shaping adaptation strategies, reflecting a growing appreciation of Indigenous communities as both knowledge holders and leaders. However, this engagement is often symbolic, lacking concrete frameworks for Indigenous governance, self-determination, or power sharing. Community participation is closely linked to the development of locally tailored solutions that reflect the unique needs of Arctic communities, challenging one-size-fits-all approaches (e.g., Pearce et al., 2012; Desjardins et al., 2020; Pfirman et al., 2023). Socioeconomic disparities also emerge as a commonly discussed dimension of vulnerability. Many articles consider how income inequality, housing insecurity, and infrastructure gaps exacerbate climate risks, especially in Arctic communities already facing economic marginalization.

Table 3: Intersectionality themes in the literature

Articles	Recognition of Intersectionality	Indigenous Rights and Knowledge	Gender Equity	Socioeconomic Disparities	Disability and Age Inclusion	Community Participation and Governance	Equity in Resource Distribution	Environmental Justice	Language and Framing
Pearce et al., 2012	✓	✓	X	✓	X	✓	✓	✓	✓
Ford et al., 2014	X	✓	X	✓	X	✓	X	✓	✓
Ford et al., 2015	✓	✓	X	✓	✓	✓	✓	✓	✓
Bunce et al., 2016	✓	✓	✓	✓	X	✓	✓	X	✓
Prior & Heinämäki, 2017	✓	✓	✓	✓	X	✓	✓	✓	✓
Hoogensen Gjørv, 2017	✓	✓	✓	✓	X	✓	✓	✓	✓
Gunnarsson & Svensson, 2017	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mattar et al., 2020	✓	✓	X	✓	X	✓	✓	✓	✓
Romero-Nieva Santos et al., 2020	✓	✓	✓	✓	X	✓	✓	✓	✓
Desjardins et al., 2020	X	✓	X	✓	X	✓	X	✓	✓
Vogel & Bullock, 2021	✓	✓	X	✓	X	✓	✓	✓	✓
Rautio et al., 2021	✓	X	✓	✓	X	✓	✓	✓	✓
Pfirman et al., 2023	X	✓	✓	✓	X	✓	X	✓	✓
Malik & Ford, 2025a	✓	✓	✓	✓	X	✓	✓	✓	✓
Malik & Ford, 2025b	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Presence of a theme marked as ✓ , absence is marked as X

While many articles mention multiple forms of vulnerability, few approach them through an explicitly intersectional lens. Instead, vulnerability factors are often treated as isolated or additive rather than interacting and compounding. This fragmented framing limits the ability of adaptation strategies to fully grasp and respond to the lived experiences of those facing multiple, intersecting disadvantages, such as Indigenous women with disabilities or low-income LGBTQ+ youth. Gender equity is another critically neglected area. Despite growing global recognition of the gendered impacts of climate change, very few articles in the review engage with how climate risks or adaptation resources are experienced differently by women, men, and gender diverse individuals (Bunce et al., 2016; Gunnarsson & Svensson, 2017; Rautio et al., 2021; Romero-Nieva Santos et al., 2020). Most papers lack gender disaggregated data or any analysis of gender roles, responsibilities, or agency in adaptation contexts. The absence of references to LGBTQ+ populations further highlights a systemic neglect of gender diversity in Arctic adaptation literature. This finding aligns with critiques from scholars who argue that Indigenous women remain marginalized in both feminist and Indigenous climate discourses (e.g., Prior and Heinämäki, 2017; Friedrich, 2023).

Disability and age inclusion are also the least represented themes in the review. The needs and vulnerabilities of elderly individuals, people with disabilities, or those requiring caregiving support are seldom discussed. This omission is troubling given the increasing climate risks facing these populations, including during emergencies such as wildfires, heatwaves, and infrastructure failures. Moreover, the failure to include their perspectives in planning and research processes perpetuates ableism and ageism in climate governance.

Environmental justice and equity in resource distribution are addressed in approximately half the articles. Discussions of environmental justice tend to focus on the disproportionate health and ecological burdens faced by marginalized groups, such as pollution exposure or inadequate emergency response systems. However, only a few articles extend their analysis to the historical and structural drivers of these injustices, such as colonial land policies, extractive industries, or systemic racism. Similarly, while several articles emphasize the importance of equitable access to adaptation resources (e.g., food, energy, infrastructure), few offer concrete mechanisms for how these resources should be distributed or governed. Finally, justice-oriented language and framing are present in much of the literature, with frequent references to “resilience,” “equity,” and “just transition.” However, this rhetorical commitment does not always translate into substantive engagement with intersectional justice or structural reform. In many cases, the language appears aspirational rather than operational.

Taken together, these findings reveal that while Arctic climate adaptation literature is evolving to incorporate some dimensions of justice, especially Indigenous Knowledge, economic disparity, and community participation, it remains thematically fragmented and methodologically underdeveloped in its treatment of intersectionality. The limited attention to gender, disability, and compounding vulnerability undermines the transformative potential of climate adaptation efforts. The analysis in most studies relies on single-variable approaches, where factors like gender, race, or income are examined in isolation. This limits the application of an intersectional lens, which is essential for understanding how overlapping identities compound climate vulnerabilities in adaptation planning.

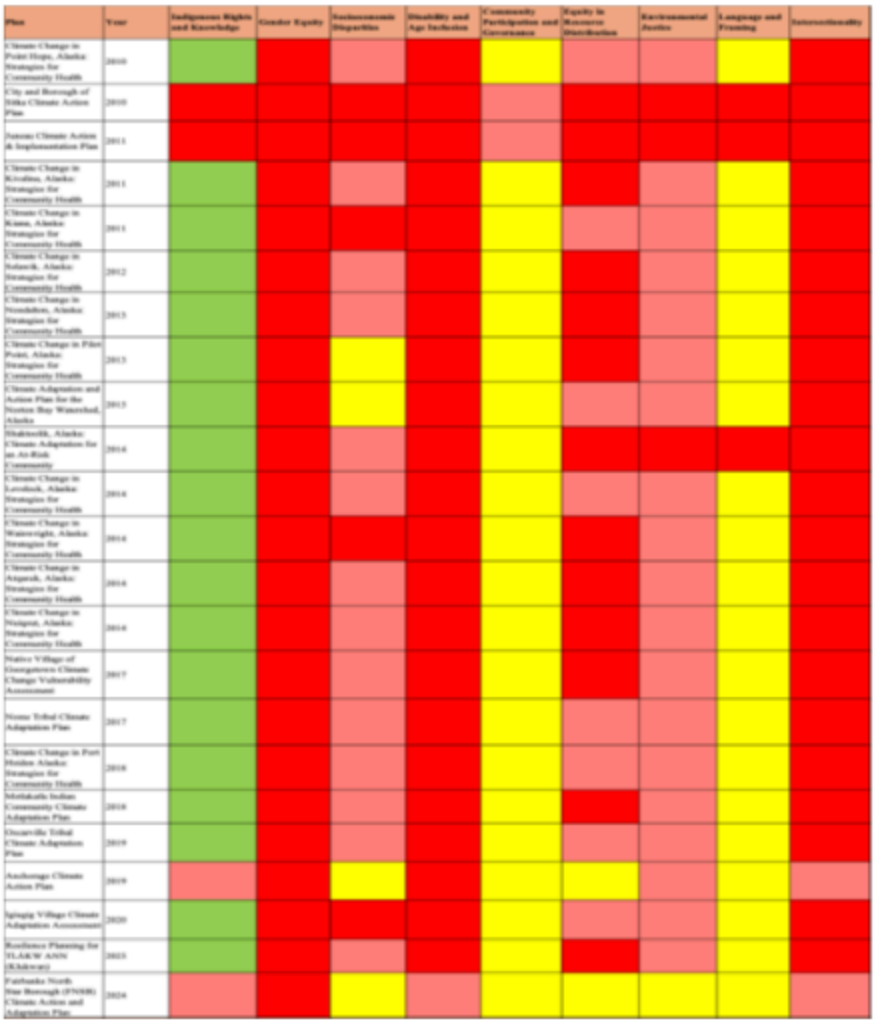
4.2 Climate adaptation plans of Alaska

The second research question focuses on how community climate adaptation plans in Alaska incorporate intersectionality to address the needs of marginalized communities, including Indigenous people, low-income populations, people with disabilities, and gender-diverse groups. Using thematic analysis and the same coding framework, 23 climate adaptation plans from various communities across Alaska were analyzed, with two local plans (for Anchorage and Fairbanks) examined in greater depth as representative case studies, as shown in Table 4. The analysis of these plans mirrors many of the findings observed in the systematic literature review. A key strength across most of the plans is their emphasis on Indigenous Rights and Knowledge, as well as robust Community Participation and Governance. Many plans recognize the value of Traditional Ecological Knowledge (TEK) and include Indigenous perspectives in shaping climate strategies. They often portray Indigenous communities not as passive recipients of aid but as proactive agents of change. In several instances, the plans acknowledge the historical and ongoing effects of colonization, highlighting how these legacies have compounded current climate vulnerabilities.

However, while community engagement is a consistent feature, it remains unclear who within the community is actually represented in decision-making processes. The plans often lack clarity about whether women, elders, people with disabilities, or gender-diverse individuals are meaningfully included in consultation or governance. Moreover, most plans approach vulnerability using single-variable analysis, examining factors like income or gender in isolation. This mirrors literature’s broader gap in

applying a truly intersectional lens. As a result, the plans rarely account for how overlapping identities, such as being an Indigenous woman, an elder, or a person with disabilities, may shape distinct climate risks and adaptation needs.

Table 4: Intersectionality themes in Alaska community climate adaptation plans



Note: A color code indicates the degree to which each theme is integrated in the adaptation plan: Red: Not at all, Light Red: Superficial engagement, Yellow: Moderate engagement, Green: Engaged with detail

Notably, gender, age, and disability are among the least addressed dimensions. Few plans explore how climate change uniquely impacts women, elderly individuals, or disabled persons, nor do they propose targeted adaptation strategies for these groups. This gap suggests that while many plans demonstrate a commitment to Indigenous leadership and community resilience, they fall short in ensuring that adaptation planning is inclusive of the full diversity of community members. The subsequent case studies echo the patterns identified in the systematic literature review.

4.3 Case studies

The two in-depth case studies chosen for this analysis are the Fairbanks North Star Borough Climate Action & Adaptation Plan (CAAP), adopted in 2024, and the Anchorage Climate Action Plan, adopted in 2019. Both plans discuss strategies for reducing greenhouse gas emissions, strengthening community

resilience, and adapting to the impacts of climate change. Table 5 provides a comparative overview of both plans, which are examined in detail in this paper.

Table 5
Comparative overview of the Fairbanks North Star Borough Climate Action & Adaptation Plan and the Anchorage Climate Action Plan

Theme	Fairbanks North Star Borough Climate Action & Adaptation Plan	Anchorage Climate Action Plan
Recognition of Intersectionality	Superficial engagement	Superficial engagement
Indigenous Rights and Knowledge	Superficial engagement	Superficial engagement
Gender Equity	None present	None present
Socioeconomic Disparities	Moderate engagement	Moderate engagement
Disability and Age Inclusion	Superficial engagement	None present
Community Participation and Governance	Moderate engagement	Moderate engagement
Equity in Resource Distribution	Moderate engagement	Moderate engagement
Environmental Justice	Moderate engagement	Superficial engagement

4.3.1 Case study 1: Fairbanks North Star Borough Climate Action & Adaptation Plan (CAAP). While the CAAP thoroughly acknowledges various vulnerability axes like income, age, race, housing, and geography, it treats them as additive rather than intersectional. There is no discussion of how these identities might interact to create compounded risk (e.g., elderly disabled residents, or Indigenous single mothers). The CDC's Social Vulnerability Index (SVI) is used to assess susceptibility to harm from climate-related hazards based on factors like poverty, disability, and housing conditions. The plan uses social vulnerability indices effectively but misses an opportunity to frame responses around lived experiences of overlapping marginalization, which is at the core of intersectional climate justice.

Indigenous Rights and Knowledge: The plan includes a land acknowledgment and recognizes Indigenous Knowledge systems as valuable for ecosystem resilience. However, the engagement is largely symbolic and referential as there are no explicit frameworks for decision-making authority, consent-based collaboration, or self-governance mechanisms. This limits Indigenous engagement to a consultative role, rather than embedding Indigenous sovereignty and leadership in climate governance. For example, the following excerpts from the plan demonstrate how Indigenous Rights and Knowledge are incorporated throughout the document: "We recognize that we live and work throughout the unceded territories of the Indigenous Peoples of Alaska… traditional territories of the lower Tanana Dena' Athabascan Peoples" (p.

2); and “The CAAP encourages Indigenous partnerships to facilitate the incorporation of this knowledge, which can support healthy ecosystems and a resilient community” (p. 35).

Gender Equity

Gender is entirely absent from the CAAP. There are no references to women, LGBTQ+ individuals, gender-based vulnerability, or gender equity in planning or implementation. This is a significant gap, especially given that climate impacts and access to adaptation resources often differ along gender lines. The lack of gendered analysis or any sex-disaggregated data suggests that gender is not yet integrated into the borough's climate framework. However, it analyzes socially vulnerable demographic groups, including low-income households, older adults, children, people with disabilities, racial and ethnic minorities, and residents with housing, transportation, or language-related vulnerabilities, to assess their susceptibility to extreme events.

Socioeconomic Disparities: The plan explicitly acknowledges socioeconomic disparities and includes multiple targeted actions: energy assistance for low-income households, support for food pantries, and use of vulnerability indices to identify geographic disparity. These strategies are integrated into both the goals and metrics of climate adaptation. Notably, it includes cost-tiered strategies and emphasizes reducing the tax burden on vulnerable residents, showing a clear attempt to embed equity in resource allocation. Several passages from the plan demonstrate how socioeconomic disparities have been recognized: “Identify ways to support tax, grant, and other assistance to low-income residents for energy conservation upgrades.” (p. 49); and “Ensure that climate-action strategies benefit all community members and sufficiently protect residents who are most threatened.” (p. 37).

Disability and Age Inclusion: The plan recognizes disability and aging as critical vulnerabilities in the context of heat, wildfire, and evacuation planning. Accessibility in public transportation and emergency shelters is addressed. However, it lacks specific strategies tailored to the daily lived realities of disabled or elderly populations (e.g., home retrofits, caregiving support). The absence of disabled residents’ voices in planning processes also limits how robustly inclusion is integrated. For example, the following excerpts from the plan show how disability and age inclusion have been acknowledged here: “Identify and prioritize the protection of vulnerable (e.g., children, elderly, low-income, and disabled) residents from climate-related risks…” (p. 61); and “Ensure that sidewalks and public transportation facilities are safe for users of all abilities year-round” (p. 52).

Community Participation and Governance: Community engagement is one of the plan’s strongest areas. It is described as “community-driven”, with evidence of surveys, engagement events, and inclusion of local organizations. The creation of the Assembly Climate Action Committee, composed of community members, is a governance highlight. The following excerpts show the importance of community participation and governance in CAAP : “Vision and goals are strongly guided by community input gathered through the community survey and CAAP public engagement events” (p. 42). However, while participatory methods are emphasized, the plan could go further by embedding co-production or power-sharing structures in future implementation steps.

Equity in Resource Distribution

There is an effort to ensure fair geographic distribution of resources, especially energy upgrades, food systems, and transit access. Mapping tools and social indices are used to identify resource deserts, and several strategies support equitable land use, food access, and clean energy adoption. The plan integrates equity into operational decisions, not just as an aspirational value, making this a well-developed area. For example, the document indicates that “In its Sustainability Plan, the FNSB identified food security as an issue and is attempting to increase local food production, storage, and distribution” (p. 20).

Environmental Justice: The plan identifies environmental burdens, especially wildfire smoke and air pollution, and their disproportionate impact on marginalized groups. However, framing remains impact-based rather than justice-oriented. While risks are mapped and mitigated, a transformative environmental justice approach would require addressing root causes and offering restitution-oriented policies. For example, the following quotes illustrate how environmental justice has been acknowledged: “Research has shown that groups traditionally underrepresented in planning processes—such as lower income, differently abled, immigrant, limited-English speaking, elderly, and black and brown communities—are also more susceptible to the negative impacts of climate change. This is due to a number of intersecting socioeconomic, geographic, and cultural factors such as systemic racism, classism, and discrimination” (p. 173); and “Poor air quality and wildfire smoke disproportionately affect those with preexisting and chronic health conditions such as asthma, and vulnerable populations such as low-income residents, the elderly, and the unhoused” (p. 60).

Language and Framing

The document uses some justice-oriented language, with framing that centers inclusion, resilience, co-benefits, and public health. Words like “equity,” “inclusive,” and “just transition” are present across sections. While some deeper structural critiques are missing (e.g., settler colonialism, racial capitalism), the linguistic framing shows clear intent to align with values of climate justice and community empowerment.

4.3.2 Case Study 2: Anchorage Climate Action Plan. The Plan was developed through a partnership between municipal government, a local university, and the broader community (Hahn, et al., 2020). Similar to CCAP, it acknowledges various vulnerabilities based on socioeconomic status, immigrant background, race, ethnicity, gender and Indigenous identity. It demonstrates commitment to community engagement and inclusive governance of the climate adaptation process. Still, the Plan largely misses intersectionality as a key to understanding complex and variable impacts of climate change and perpetuates superficial treatment of important components of equitable climate planning, such as Indigenous Knowledge.

Recognition of Intersectionality

The plan addresses overlapping and compounded vulnerabilities to some extent. It recognizes how limited English proficiency and structural isolation increase climate risk. The plan's equity framing acknowledges how race, income, and language intersect with climate vulnerability. However, it does not analyze how race, gender, class, and ability may interact in complex ways.

Indigenous Rights and Knowledge: The plan's incorporation of Indigenous Knowledge remains largely symbolic and introductory. Although it is indicated that "[t]his Climate Action Plan is built on the recognition that Indigenous values and knowledge are foundational..." (p. 3), the document lacks detailed mechanisms for integrating Indigenous Knowledge into sector-specific adaptation strategies or decision-making frameworks. There is little evidence of sustained power-sharing or co-management with Tribal or Indigenous organizations governments beyond acknowledgment. Additionally, the absence of measurable goals, funding commitments, or dedicated roles for Indigenous leadership raises concerns about the depth and continuity of engagement. *Gender Equity*: The plan does not address gender as a category of vulnerability or identity. There is no mention of gender-disaggregated impacts, representation of women in planning, or policies aimed at gender inclusion. There are no references to LGBTQ+ communities or gender-diverse populations.

Socioeconomic Disparities: Economic inequality is addressed in multiple sections: low-income communities are acknowledged as more vulnerable to emergencies and high utility costs. The plan emphasizes financial savings for households, job creation through clean energy, and community-based food access. For example, the plan aims to "[c]onsider racial and ethnic communities, limited English proficient individuals, low-income populations, older adults, people with disabilities, and minority, women, and emerging small businesses" (p. 92).

Disability and Age Inclusion

While there is some accessibility framing (e.g., language access, outreach to isolated communities), there is no direct mention of the needs of elderly or disabled individuals.

Community Participation and Governance: The Plan embeds structures for ongoing participation and oversight, most notably through the establishment of a Climate Action and Equity Council composed of representatives from municipal government, the university, tribal communities, utilities, state agencies, businesses, and nonprofits. This external body meets at least annually to review annual reports, advise on implementation, and contribute to five-year plan updates, helping ensure equity and accountability remain front and center. Overall, the plan demonstrates commitment to community participation: "Throughout, a community engagement strategy was used that provided multiple opportunities for residents to engage in the planning process" (p. 91).

Equity in Resource Distribution

The plan promotes equitable access to food, clean energy, and health services, with a focus on affordability and local production. It acknowledges disparities in income and health, particularly among

low-income and limited English proficiency communities, and promotes actions like expanding access to local foods, increasing energy efficiency to lower utility costs, and improving emergency preparedness across all neighborhoods. For example, the document proposes to “[d]evelop education strategies for teaching Anchorage residents about growing, harvesting, cooking, and processing local agricultural goods and subsistence resources in neighborhoods most at risk of food insecurity (supports Health and Emergency Preparedness Action 16C)” (p.72).

Environmental Justice: The plan discusses health impacts like wildfire smoke, vector-borne disease, and food insecurity, but does not consistently link these to race, income, or historical marginalization. Legacies of environmental racism are not addressed. For example, the following excerpts from the plan illustrate how environmental justice has been acknowledged here: “Educate the public about the health risks of higher temperatures, develop strategies to check on individuals at greatest risk, and make options for cooling widely accessible” (p. 62).

Language and Framing

Justice-oriented language is somewhat embedded in the narrative. The plan frames communities as active agents of change, not just victims of climate impact. Words like “empower,” “inclusive,” “climate equity,” and “resilient” reflect a commitment to equity-driven framing.

5. Discussion

5.1 Key insights

This study aimed to explore the extent to which intersectional considerations are incorporated into Arctic climate adaptation plans by conducting a systematic review of existing academic literature and community-level climate adaptation plans from Alaska, using a predefined thematic analysis framework. The findings reveal a landscape characterized by both progress and significant limitations. While many plans and articles recognize key elements of social vulnerability, such as economic inequality, Indigenous Knowledge, and community participation, there remains a notable gap in how these factors are understood in relation to one another. Most efforts continue to approach vulnerability through a single variable lens, treating race, gender, age, disability, and income as isolated categories rather than as interconnected systems of disadvantage (Mikulewicz et al., 2023; Tschakert et al., 2025). As a result, the analysis shows that climate adaptation strategies often fail to reflect the lived realities of those who occupy multiple marginalized identities, such as Indigenous women, elderly individuals with disabilities, or low-income LGBTQ+ community members (Mikulewicz et al., 2023; Chapola et al., 2025).

While many climate adaptation plans acknowledge Indigenous stewardship, they often fall short of establishing meaningful power-sharing mechanisms or Indigenous governance structures, a limitation that is especially evident in the case studies compared to the more locally grounded village climate adaptation plans in Alaska. This reflects a broader tendency within policy and academic literature to valorize Indigenous Knowledge rhetorically without addressing the underlying colonial structures that

continue to shape climate governance in the Arctic (Mattar et al., 2020; Malik & Ford, 2025b). They also fail to address the power dynamics that come into play.

Community participation is another area that demonstrates promise, with many adaptation plans incorporating public meetings, surveys, and advisory committees. While these efforts suggest an intention to foster inclusivity and local ownership, they frequently lack specificity regarding who was engaged and how their input informed policy outcomes. The absence of demographic breakdowns or explicit strategies for involving marginalized populations raises questions about whether participation was genuinely equitable or simply procedural. Moreover, without intentional design, participatory processes risk reproducing existing social hierarchies by privileging voices with access to decision-making spaces.

Critically, the study reveals that themes such as gender equity, disability inclusion, and intersectionality are among the most underrepresented across both the literature and the adaptation plans. Few documents address the unique ways in which climate impacts are gendered, nor do they consider the specific needs and strengths of LGBTQ+ individuals or people with disabilities (Bunce et al., 2016; Gunnarsson & Svensson, 2017; Rautio et al., 2021; Romero-Nieva Santos et al., 2020; Oddsdóttir et al., 2021). This omission is especially concerning given the growing global recognition of the gendered dimensions of climate vulnerability and the documented exclusion of these groups from adaptation policy and funding. The findings underscore that climate adaptation may unintentionally reinforce existing inequalities or lead to maladaptive outcomes without deliberate efforts to center intersectional identities and dismantle structural barriers (Johnson et al., 2021).

In the case studies, the climate adaptation plans of Fairbanks and Anchorage express a commitment to equity and the inclusion of vulnerable populations most affected by climate change. These plans emphasize the importance of hearing diverse voices, identifying who is being included or excluded from decision-making, and ensuring representation of minority communities. They also advocate for community-led and collaborative approaches to climate solutions. However, despite this stated intent, the documents fall short of applying intersectional lens in practice. The plans offer minimal engagement with the ways in which intersecting identities such as race, gender, age, disability, and socioeconomic status shape individuals' experiences of climate risk. Consequently, they are not able to adequately articulate how adaptation strategies will respond to the compounded vulnerabilities faced by marginalized groups. This reveals a disconnect between inclusive intentions and the practical integration of equity in climate planning.

Ristroph (2018) reveals multiple systemic issues that lead to the exclusion of communities in the climate adaptation planning process. Planning is predominantly led by external contractors and agencies who often follow rigid federal templates, resulting in plans that are generic, disconnected from local realities, and largely inaccessible to community members. Many residents are unaware that such plans even exist, reflecting a lack of meaningful community involvement. Contractors typically rely on teleconferences or newsletters rather than culturally grounded engagement methods, and often

introduce pre-conceived, one-size-fits-all solutions that overlook ground-level issues like subsistence impacts and permafrost melt. The final plans are lengthy and overly technical, making them difficult for local residents to engage with or implement. Consequently, these plans often go unused, as their action items are either too vague or insufficiently prioritized, contributing to a cycle of excessive planning without meaningful implementation. This externally driven, uncoordinated strategy reinforces a loop where communities are consulted superficially, but not empowered in meaningful decision-making (Ristroph, 2018). Such limitations in addressing intersectionality within Alaska's adaptation efforts reflect similar patterns at the federal level, where the application of equity frameworks in climate governance remains uneven and fragmented (Basu, 2025).

Overall, this discussion reflects the urgent need for climate adaptation efforts in the Arctic, and Alaska specifically, to move beyond additive models of vulnerability and adopt comprehensive, intersectional approaches. Such approaches must recognize the complex ways social, cultural, political, and economic factors interact to shape climate risk and adaptive capacity. Incorporating intersectionality is not simply an academic exercise; it is a necessary condition for creating climate adaptation plans that are equitable, effective, and grounded in justice.

5.2 Global context and implications

Broadening the scope beyond Alaska's climate adaptation plans to a global perspective reveals recurring patterns in how intersectionality is (or is not) addressed across national and regional contexts. Across countries, climate adaptation efforts tend to overlook the diverse ways in which individuals experience and respond to climate hazards based on intersecting identities such as gender, race, class, and indigeneity (Bunce & Ford, 2015; Singleton et al., 2022). This oversight often results in a homogenized approach to vulnerability and adaptation, even within communities, where internal differences are rarely acknowledged or addressed. As previously discussed, Alaska's climate adaptation planning exemplifies this pattern of exclusion. A global examination reinforces this tendency, highlighting a widespread neglect of intersectional considerations in climate adaptation planning (Recalde Martínez et al., 2025). These findings underscore the growing importance of integrating intersectionality into climate adaptation frameworks and the urgent need to move beyond one-size-fits-all approaches to ensure equitable and effective responses to climate change.

In the European context, intersectionality is gaining traction but remains largely under-integrated into policy implementation (Singleton et al., 2022). A study of three Swedish government agencies, the Environmental Protection Agency, the Energy Agency, and the Transport Administration, found that while social differences such as gender or age are acknowledged, they are often framed in broad, generic terms. This superficial inclusion risks obscuring the differentiated impacts of climate change and the unequal effects of climate action, thereby perpetuating environmental injustice (Singleton et al., 2021). Despite Sweden's international reputation for progressive climate policy, these agencies focus predominantly on technological solutions and market-based incentives, with limited attention to how climate vulnerabilities and participation in policymaking vary across different social groups.

Countries in the Global South, such as Bangladesh, offer a compelling example of how intersectional vulnerabilities are both widespread and insufficiently addressed within climate adaptation governance. Despite Bangladesh's well-developed policy frameworks like the National Adaptation Programme of Action (NAPA), in the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), and the National Adaptation Plan (NAP) intersectionality is largely absent from practical implementation. Although climate risks such as cyclones, floods, and droughts disproportionately affect coastal populations, these plans often fail to recognize how intersecting identities such as gender, disability, age, ethnicity, and geography compound vulnerability (Islam et al., 2025). For instance, widowed, pregnant, and elderly women face challenges accessing cyclone shelters due to the lack of gender segregated facilities and privacy provisions, while disabled individuals are excluded due to inadequate infrastructure like ramps. Indigenous women in hill districts walk longer distances to fetch water because of deforestation-induced springshed degradation, yet they remain excluded from local water governance. Similarly, slum dwelling elderly and disabled individuals are left behind by digital early warning systems, and female garment workers face heat-related stress, economic insecurity, and water shortages without adequate adaptation responses (Islam et al., 2025). These examples highlight the critical need to ground adaptation strategies in real-world, identity-based experiences.

In Africa, intersectionality reveals the multidimensional nature of vulnerability. Research from Durban, South Africa, illustrates how Black African women are disproportionately affected by floods due to compounded disadvantages stemming from gender, race, and poverty. These women face challenges such as inadequate infrastructure, exclusion from formal decision-making, and limited access to adaptation resources. Yet they are not passive victims; they actively employ adaptation strategies informed by situated knowledge, community networks, and indigenous practices (Udo and Naidu, 2024; Udo et al., 2025). The eThekwini Municipality's lack of an intentionally gendered adaptation governance approach further exacerbates these challenges, emphasizing the need for bottom-up, feminist political ecology frameworks that prioritize local women's agency and lived experience.

Australia presents a different yet equally instructive case. In rural and drought-affected regions of Southwest Queensland, women, particularly Aboriginal women, experience what scholars call "slow violence," or the gradual, often invisible effects of prolonged environmental stressors such as drought (Casey et al., 2025). These experiences are frequently overlooked due to policy biases that prioritize urban centers and sudden climate disasters like floods and wildfires. Aboriginal and settler women, who are often marginalized in dominant narratives, possess critical knowledge about land, resilience, and adaptation. Their stories challenge mainstream representations of rural life and highlight the importance of recognizing slow, cumulative harms in climate policy. Integrating Indigenous Knowledge and addressing gendered power relations are key to just and sustainable adaptation in these rural contexts.

In the Global North, climate hazards such as wildfires, floods, and droughts are intensifying preexisting social inequalities in rural and Indigenous communities, yet these groups are often treated as homogeneous in both research and policy (Walker et al., 2019). Despite growing recognition of intersectionality in climate research, its empirical application, particularly in the Global North, remains

limited (Cohen, 2017; Walker et al., 2019). Greater integration of intersectional perspectives is therefore needed to understand how interacting social identities and power relations shape climate vulnerability and to prevent adaptation policies and practices from reproducing existing inequalities (Kaijser & Kronsell, 2014; Djoudi et al., 2016; Walker et al., 2019). In Latin America, intersectionality reveals stark inequalities in adaptation outcomes, even within marginalized communities. A study across four districts in Peru's Caylloma Province found that individuals' ability to adapt to social ecological changes such as glacier retreat and water scarcity was shaped by intersecting factors including gender, age, class, land ownership, and language. Public adaptation spaces like irrigation commissions favored Spanish-speaking, land-owning men, effectively excluding Quechua-speaking women and migrants from decision-making and resource access (Erwin et al., 2021). These dynamics show that adaptation is not just about responding to environmental change but also about navigating entrenched social hierarchies and structural barriers.

This global perspective not only reinforces the findings from Alaska but also highlights their wider relevance: the absence of intersectionality is a structural challenge rather than a localized mistake. By positioning Alaska’s adaptation efforts within this broader Arctic and global contexts, the paper emphasizes the urgent need for climate governance frameworks, at both local and international levels, that prioritize intersectional justice. Such an approach ensures that climate adaptation strategies are not only technically robust but also grounded in equity and capable of recognizing and driving meaningful social change.

6. Conclusion

This study illustrates that despite the growing urgency of climate change in the Arctic and the rising discourse around equity and inclusion, the practical integration of intersectional considerations into climate adaptation planning remains limited. Through a systematic review of academic literature and an in-depth thematic analysis of Alaska’s community-level climate adaptation plans, this research reveals both areas of progress and significant gaps. Indigenous Knowledge and community participation are increasingly acknowledged in both literature and adaptation plans. However, they are often incorporated in symbolic or superficial ways that fail to challenge underlying power imbalances or colonial legacies. Meanwhile, gender equity, disability inclusion, and compounded social vulnerabilities remain critically underrepresented, both conceptually and operationally. The adaptation plans refer to community participation, yet they often fail to specify which members of the community are involved in decision-making roles. Additionally, urban climate adaptation plans largely exclude the Indigenous Peoples from the planning process, with minimal recognition of their knowledge and governance systems.

The findings emphasize that the prevailing approach to vulnerability in Arctic adaptation planning is additive rather than intersectional. This means that identities such as race, gender, income, and ability are often treated in isolation, missing how these factors interact to shape climate risk and adaptive capacity in complex, compounding ways. As a result, the most marginalized, including Indigenous women, LGBTQ+ individuals, the elderly, and disabled persons, remain at the periphery of climate

governance despite being among the most impacted. This fragmentation undermines the transformative potential of climate adaptation, risking strategies that are technically sound but socially blind.

The study also highlights how planning processes in Alaska frequently rely on external experts who produce documents based on generic templates with limited community engagement (Ristroph, 2018). These plans are often inaccessible to the very communities they are intended to serve. They are technically dense, disconnected from local realities, and lack culturally grounded outreach. Consequently, action items remain vague, poorly prioritized, and seldom implemented. Such a planning model not only marginalizes Indigenous and low-income voices but also perpetuates cycles of overplanning and underdelivery. As field insights from Fairbanks show, even when efforts are made to include Indigenous perspectives during implementation, the lack of initial co-production creates gaps that are difficult to bridge retrospectively.

Therefore, adopting an intersectional approach is not just a theoretical aspiration. It is an ethical and practical imperative. Intersectionality offers the tools to design climate policies that are more inclusive, more just, and eventually more effective in addressing the needs of all community members. This means moving beyond rhetorical commitments to equity and toward embedding intersectionality into every stage of climate adaptation, from stakeholder engagement and plan development to implementation and evaluation. It also requires investing in community-led research, decolonizing planning processes, and centering the voices of those historically excluded from environmental decision-making.

Ultimately, this study calls for a reimagining of climate adaptation in the Arctic, one that sees communities not as passive recipients of top-down plans but as active agents of change with unique knowledge, needs, and capacities. As climate threats accelerate, the path forward must be grounded in justice, co-creation, and an unwavering commitment to those most at risk. While the climate adaptation plans generally succeed in promoting community participation, their effectiveness as agents of transformative change would be significantly enhanced by integrating intersectional factors and grounding them in lived community experiences.

6.1 Limitations

Google Scholar was used as the primary database for the systematic literature review, as it provided access to a wide range of interdisciplinary scholarship relevant to Arctic climate adaptation. While other databases such as JSTOR and Web of Science were explored during the initial scoping phase, they yielded limited results directly relevant to the research focus. This study also relies solely on the analysis of publicly available climate adaptation plans from Alaska. While the thematic analysis framework offers a structured approach to examine how intersectional factors are addressed, the method is inherently interpretive. Some degree of subjectivity remains in identifying and categorizing themes across diverse documents. Moreover, the study does not include interviews or participatory input from affected communities, practitioners, or local stakeholders. This limits the ability to validate how these adaptation plans are understood, received, or implemented at the community level.

6.2 Future directions

Future research should build on this study by incorporating interviews with individuals from Alaskan communities and other adaptation planning process participants to better understand the on-the-ground realities of climate adaptation planning and implementation. Such qualitative insights would help assess how these plans are experienced locally, including the extent to which they benefit residents. This would strengthen the case for integrating intersectional identity considerations into climate adaptation efforts and reinforce their critical importance in addressing climate vulnerability effectively.

Declarations

Author Contribution

Authors' contributions Conceptualization: [Sneha Basu] and [Andrey Petrov]; Methodology: [Sneha Basu] and [Andrey Petrov]; Formal analysis and investigation: [Sneha Basu]; Writing - original draft preparation: [Sneha Basu]; Writing - review and editing: [Sneha Basu] and [Andrey Petrov]; Funding acquisition: [Andrey Petrov]; Resources:[Andrey Petrov]; Supervision: [Andrey Petrov].

Acknowledgement

Acknowledgements We would like to thank URSA MAJOR Young Scientists' School for giving the lead author the opportunity to interact with community members in Fairbanks, Alaska, whose insights provided me with valuable perspectives on the region's climate adaptation plans.

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