Achieving climate justice: addressing disparities and enhancing equity in global climate policies

Lacour M. Ayompe*

Department of Earth System Science, University of California, Irvine, Irvine, CA, United States

This paper interrogates the nexus between climate justice and policy-driven equity, placing a spotlight on the disproportionate vulnerabilities faced by marginalized groups, including women, Indigenous peoples, and low-income communities, in the global climate arena. It argues for incorporating diverse perspectives in decision-making processes and shows how historical injustices, particularly those rooted in colonial legacies, continue to shape current climate governance structures. Using illustrative examples, the manuscript demonstrates how local initiatives that prioritize community engagement and empowerment can effectively tailor climate strategies to address the specific needs of impacted populations. Moreover, it emphasizes the critical role of interdisciplinary collaboration, spanning public health, urban planning, and environmental protection, in crafting climate policies that mitigate environmental impacts while promoting social justice. Ultimately, this study offers practical insights and strategies for policymakers, researchers, and advocates committed to building resilient and inclusive climate policies, underscoring that embedding equity in global climate action is essential for achieving a sustainable and just future for all communities.

KEYWORDS

climate justice, social equity, global climate policy, marginalized communities, inclusive governance, community engagement

Highlights

- Explores colonial legacies shaping modern climate governance.
- Stresses community-led approaches for inclusive climate policymaking.
- Presents examples of localized, adaptive climate strategies.
- Advocates cross-sector collaboration for equitable climate solutions.
- Calls for equity to uplift marginalized communities and enhance resilience.

1 Introduction

Global climate policy increasingly embraces climate justice as a framework for achieving fairness and equity when addressing the diverse impacts of climate change. This perspective recognizes that while vulnerable communities often contribute little to global emissions, they disproportionately bear the adverse consequences of climate change (Diezmartínez and Gianotti, 2022; Perkiss, 2024). Viewing climate change as fundamentally a social and ethical challenge, rather than solely an environmental issue,

compels a critical examination of entrenched disparities and power imbalances within existing governance structures (Han and Ahn, 2020; Round and Visseren-Hamakers, 2022).

Historically, climate policies have frequently marginalized socio-economically disadvantaged groups, deepening environmental injustices in regions, especially developing nations, with limited capacity for adaptation (Gallagher and Holloway, 2022). The local impacts of climate change, such as the degradation of agricultural lands and resources, underscore the need for a nuanced understanding of justice that accounts for varied vulnerabilities (Iglesias et al., 2011; Schlosberg and Collins, 2014). Although international frameworks are gradually acknowledging climate justice, prevailing policy approaches have tended to prioritize economic efficiency and technological solutions, often sidelining the participation and needs of those most affected (Tutak et al., 2021; Bulkeley and Betsill, 2013; Munenzon, 2024). This shortfall underscores the importance of transformative, participatory governance that incorporates local knowledge and community-based strategies (Khanal et al., 2024a; Dobai and Riemer, 2023).
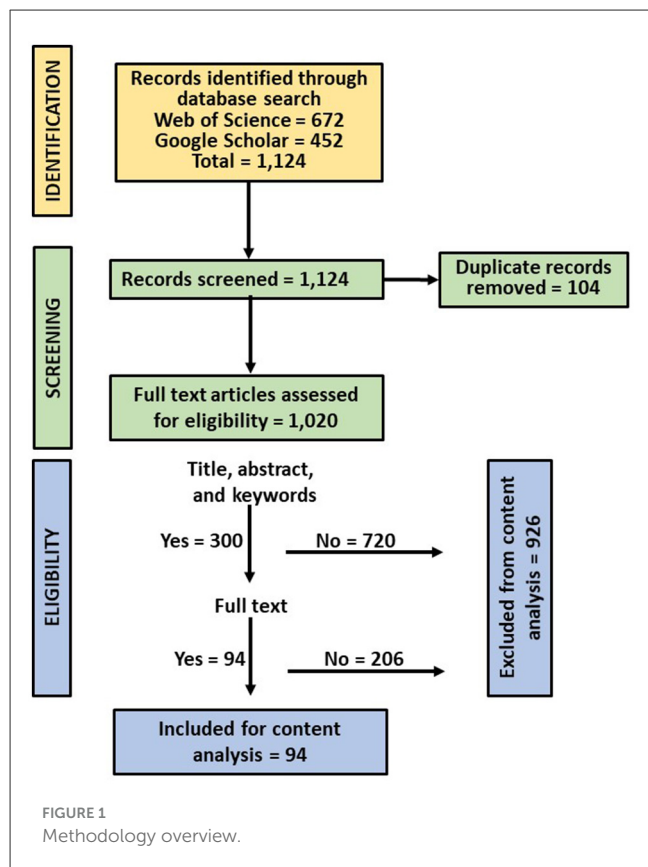
Climate justice integrates environmental sustainability, human rights, and social equity by illustrating that climate change is not solely an environmental issue but also a social justice challenge, as marginalized communities, including racial and ethnic minorities, low-income groups, and Indigenous populations suffer disproportionately despite their minimal contribution to its causes (Shonkoff et al., 2011; Hayes et al., 2018). Studies show these groups face greater exposure to extreme weather, pollution, and systemic inequities in healthcare and economic opportunities (Joseph and Doon, 2023; Berberian et al., 2022), underscoring the need for policies that extend beyond greenhouse gas mitigation to ensure equitable resource distribution and community participation (Wild et al., 2025). Furthermore, by revealing that those least responsible for emissions bear the greatest burdens (Sasser, 2023; Bulkeley et al., 2013) and highlighting local disparities observed in contexts such as Nigeria (Oramah and Olsen, 2021) alongside the heightened vulnerabilities of Indigenous peoples, racial minorities, women, and impoverished communities (Sasser, 2023; Arifin et al., 2023), a climate justice framework offers a path to redress historical injustices while building resilient, inclusive societies.

Achieving effective climate justice also demands comprehensive systemic reforms that consider the intersectionality of social, economic, and environmental challenges. For example, the convergence of gender-based inequalities, which limit women's access to resources and decision-making opportunities (Khanal et al., 2023), with the threats faced by indigenous communities regarding their traditional lands (Mattar et al., 2021) necessitates policy responses that foster both climate mitigation and social equity (Zavala et al., 2024; Upadhyay and Bastola, 2024). Moreover, integrating underexplored dimensions such as mental health, reproductive justice, and health vulnerabilities (Sasser, 2023; Dunk et al., 2016; Polonik et al., 2023), alongside addressing global power imbalances and the links between biodiversity conservation and ecosystem resilience (Meshkani, 2024; Vasiliev, 2022; Malherbe and Oladejo, 2024), is essential for crafting policies that are both just and effective.

In light of these challenges, this paper critically examines gaps in the climate justice discourse by exploring how systemic disparities, rooted in historical injustices and socio-economic imbalances, can be remedied within policy frameworks. While existing literature calls for equity, it rarely analyzes the interplay of distributive, procedural, and recognition-based justice (Perkiss, 2024; Pollex, 2024; Haque, 2024) or robustly integrates the voices of marginalized communities. In the realm of climate justice, the concepts of equity, distributive justice, procedural justice, and recognition-based justice are pivotal for addressing disparities in global climate policies, as they provide the ethical foundation and frameworks for equitable environmental governance. Equity entails the fair allocation of resources and responsibilities among diverse populations, ensuring that marginalized communities disproportionately affected by climate change have equal access to the benefits of climate actions (Arifin et al., 2023; Oramah and Olsen, 2021). Distributive justice focuses on the equitable sharing of the benefits and burdens of climate change mitigation and adaptation, redressing historical injustices, particularly in low-income communities (Nguyễn, 2023; Babatunde, 2020). Procedural justice emphasizes the need for inclusive decision-making processes that actively involve affected communities through transparent and participatory approaches (Barkai and Winkler, 2024; Chen et al., 2024), while recognition-based justice demands the acknowledgment and respect of diverse identities and experiences, integrating indigenous rights and local knowledge systems into global strategies (Imam and Tijjani, 2024; Sengupta, 2023). Incorporating these four dimensions into climate policy frameworks is essential for advancing a just transition that addresses the uneven impacts of climate change and promotes fairness, inclusivity, and respect across all communities (Pratt, 2022, 2023).

Accordingly, this study aims to address pressing disparities in global climate policies by advancing equity and achieving climate justice through active engagement with historically marginalized groups. Specifically, the research objectives are: (1) to explore the multifaceted dimensions of climate justice and identify key disparities within current policy frameworks by examining the gap between political rhetoric and the lived realities of diverse communities; (2) to propose targeted, inclusive policy modifications that redress historical injustices and ensure effective, just climate governance; and (3) to analyze successful illustrations of community-led initiatives, offering practical, evidence-based frameworks for bottom-up systemic change.

Following this introduction, the paper proceeds through six interconnected sections. Section 2, "Methodology," describes the systematic review protocol adopted from Haldar et al. (2023), detailing the search strategy in Web of Science and Google Scholar (Section 2.1), the screening and eligibility process that narrowed 1,124 records to 94 studies (Section 2.2), and the manual, hybrid deductive-inductive data extraction and thematic synthesis conducted in Microsoft Excel (Section 2.3). Section 3, "Dimensions of climate justice," synthesizes how distributive, procedural, and recognition-based justice are articulated in the literature and bridges theory and practice through illustrative case examples. Section 4, "Climate policy

FIGURE 1
Methodology overview.

2.1 Search strategy

Informed by the systematic review protocol of Haldar et al. (2023), comprehensive searches were conducted in Web of Science and Google Scholar to capture peer-reviewed literature examining how distributive, procedural, and recognition justice have been integrated into global climate policy. The search string combined core justice terms, "climate justice," "social equity," and "global climate polic*" with equity-related concepts such as "colonial legacies," "participatory governance," and "community engagement." To focus on high-quality evidence, the query was limited to articles and reviews published in English between 2000 and 2024 and confined the subject areas to Social Sciences, Environmental Studies, and Political Science. The full search expression was: (TITLE-ABS-KEY("climate justice" OR "social equity" OR "global climate polic*")) AND (TITLE-ABS-KEY("colonial legacies" OR "participatory governance" OR "community engagement")) AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "re")) AND (LIMIT-TO(LANGUAGE, "English")) AND (PUBYEAR > 1999 AND PUBYEAR < 2025). This strategy yielded 672 records from Web of Science and 452 records from Google Scholar, for a total of 1,124 titles and abstracts that formed the initial corpus for screening (see Figure 1 for an overview of the review workflow).

2.2 Screening and eligibility

Following the four-phase screening protocol of Haldar et al. (2023), the 1,124 records were first deduplicated, removing 104 repeats to yield 1,020 unique entries. A title, abstract, and keyword screening was then conducted to identify studies explicitly engaging with distributive, procedural, or recognition justice in global climate policy. This step excluded 720 articles that did not meet the focus criteria, leaving 300 for in-depth review. During the full text eligibility assessment, each of the 300 articles was evaluated for empirical or theoretical treatment of at least one justice dimension. Of these, 206 lacked a clear justice framing and were excluded, resulting in 94 studies that satisfied all inclusion criteria. Figure 1 provides a visual overview of this entire screening and eligibility workflow.

2.3 Data extraction and thematic synthesis

Following full-text screening, the final sample of 94 studies was subjected to detailed data extraction. I pilot-tested the extraction template on 10 randomly selected articles to refine variable definitions and ensure clarity before processing the entire dataset. Extraction was managed in Microsoft Excel and captured the following information from each study:

- Bibliographic details (author, year, journal).
- Justice dimension(s) addressed (distributive, procedural, recognition).

inequities," critically evaluates empirical evidence on how global frameworks and local policies perpetuate or mitigate inequities, exposing gaps in resource allocation, decision-making, and recognition of marginalized communities. Section 5, "Challenges and strategic pathways," identifies systemic barriers such as colonial legacies and sectoral silos and offers actionable recommendations for inclusive policy design, community engagement, and interdisciplinary collaboration. Finally, Section 6, "Conclusion," synthesizes the key findings, reflects on the gap between political rhetoric and lived experiences, and charts a clear roadmap for future research and policy innovation toward resilient, sustainable, and equitable climate governance.

2 Methodology

This section details the systematic literature review approach adopted, drawing on the protocol of Haldar et al. (2023) to investigate how distributive, procedural, and recognition-based justice principles have been integrated into global climate policies. The sub-sections are organized as follows: Section 2.1 describes the search strategy; Section 2.2 outlines the screening and eligibility process; Section 2.3 presents data extraction and thematic synthesis. Figure 1 illustrates the full review process.

- Policy instrument or mechanism (e.g., carbon markets, adaptation finance, local CAPs, UNFCCC protocols).
- Geographic scope (global, regional, national, local case study).
- Stakeholder groups (governments, NGOs, Indigenous peoples, women's groups, private sector).
- Equity outcomes or indicators (resource allocation, participation rates, benefit-sharing, health impacts).
- Conceptual framing (decolonial, rights-based, capabilities, etc.).
- Methodological approach (case study, modeling, discourse analysis, normative review).

A hybrid deductive-inductive thematic synthesis was manually conducted in Microsoft Excel. Deductive codes for the three justice pillars were defined a priori based on the conceptual framework in Figure 2. Inductive sub-themes emerged through a line-by-line review of extracted text passages.

The synthesis proceeded in six iterative steps:

1. Imported the extraction sheet into Excel and applied deductive justice-pillar codes to relevant entries.
2. Reviewed each article's text excerpts to identify emergent themes.
3. Assigned inductive codes to these passages and recorded definitions alongside deductive codes.
4. Grouped fine-grained codes into descriptive themes (e.g., "funding equity," "participatory governance," "Indigenous knowledge integration," "colonial barriers," "sectoral silos").
5. Refined descriptive themes into higher-order analytical themes (e.g., "from tokenism to co-decision," "finance as power redistribution," "integrated health-equity governance").
6. Mapped the final analytical themes back onto distributive, procedural, and recognition justice to verify alignment with the framework illustrated in Figure 2.

This iterative process generated the thematic structure presented in Section 3 and underpinned the analyses of policy inequities in Section 4 and the strategic pathways in Section 5.

3 Dimensions of climate justice

Drawing on the triumvirate of justice tenets originally articulated in the energy justice literature by McCauley et al. (2013), this section explores the three key dimensions of climate justice: distributive, procedural, and recognition-based justice, to illuminate how equitable climate policy can be achieved. Distributive justice focuses on the fair allocation of benefits and burdens across society, ensuring that no group disproportionately bears the costs of mitigation or adaptation. Procedural justice underscores the necessity of inclusive and transparent decision-making processes, giving all stakeholders a voice in designing and implementing climate policies. Recognition-based justice calls for the acknowledgment and respect of marginalized communities, affirming their cultural identities and historical experiences within policy frameworks. The framework depicted in Figure 2 builds on McCauley et al. (2013) triumvirate model by mapping these three justice dimensions onto both local and national governance

structures. This structured approach guides policymakers and stakeholders in bridging the gap between theoretical principles and concrete, actionable strategies. Applying this model helps ensure that climate governance is both effective and inclusively designed to meet the needs of all communities.

3.1 Distributive justice

Distributive justice is a core principle in climate justice, concerned with the equitable allocation of both the benefits and burdens associated with climate change and related policies (Furlan and Mariano, 2023). This concept recognizes that communities experience different levels of exposure to climate hazards, necessitating a resource-allocation framework that accounts for these disparities (Schapper, 2018). Fundamental questions arise regarding who is entitled to protection from climate impacts, who should bear the responsibility for mitigation, and how the rights to emit greenhouse gases should be allocated (Feng, 2024). The literature further warns that an overemphasis on economic efficiency in climate policies can risk marginalizing vulnerable populations, thereby perpetuating existing inequalities (Okereke and Coventry, 2016; Michael et al., 2018).

Building on this foundation, several studies have underscored that the equitable distribution of climate resources must consider the varying exposure of different communities to climate risks. Scholars such as Swanson (2021) and Khanal et al. (2024b) emphasize the need to account for these differences, while Sušanj et al. (2019) raise key issues regarding the responsibilities for climate protection and mitigation. Moreover, research by Lioubimtseva (2022) and Salle et al. (2021) indicates that prioritizing resource allocation based solely on economic performance can exacerbate vulnerabilities and limit resilience among already marginalized groups. Consequently, there is a growing consensus that climate adaptation strategies should be guided by principles of equity, ensuring that funding and resources are allocated based on vulnerability rather than merely on economic efficiency measurements (Wells et al., 2021).

The climate finance landscape further illustrates significant gaps in the distribution of adaptation resources. Initiatives like REDD+ (Reducing Emissions from Deforestation and Forest Degradation) have prompted concerns over the inequitable allocation of funds, particularly between developed and developing nations (Skutsch et al., 2014; Gakou-Kakeu et al., 2024). Research suggests that without specific attention to distributive equity, benefits may disproportionately favor affluent entities, often sidelining the local communities crucial for effective implementation (Isyaku et al., 2017). For instance, Palomo et al. (2019) have shown that adaptation measures such as infrastructure enhancements are frequently concentrated in wealthier urban areas, leaving rural or low-income communities underfunded, a pattern that can intensify existing vulnerabilities (Barrett, 2014). Thus, experts argue that climate adaptation strategies must rigorously incorporate equity principles to ensure resources are allocated based on vulnerability, a point further emphasized by Wong (2016). Table 1 provides an overview of these key aspects and concerns related to distributive justice in climate policy.
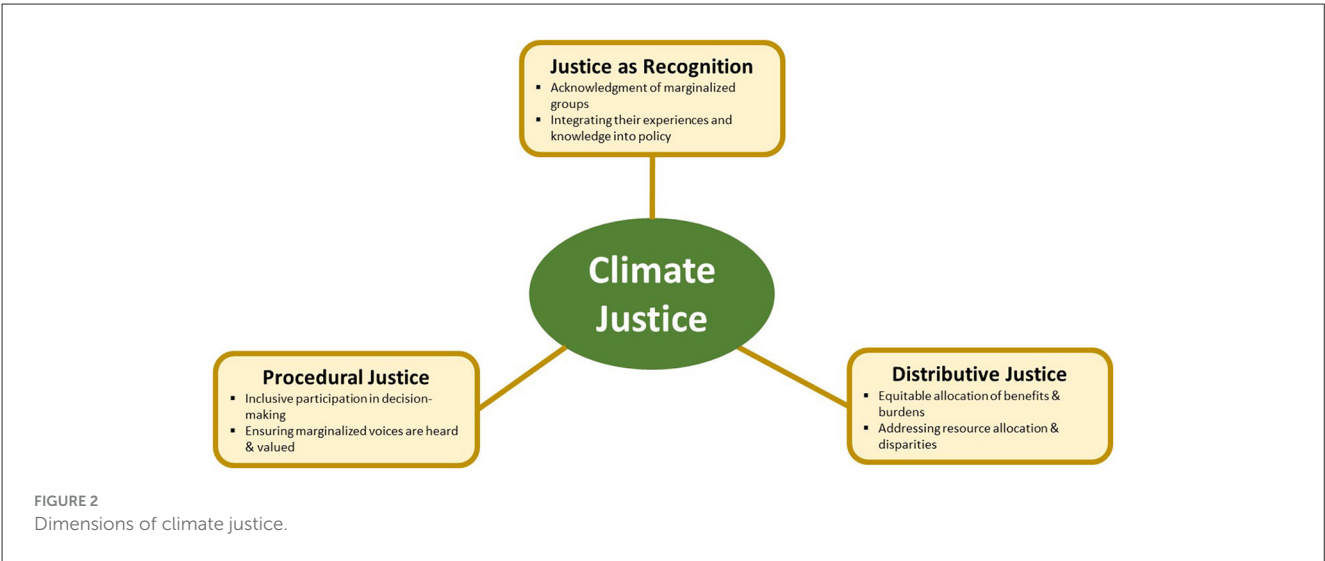
FIGURE 2
Dimensions of climate justice.

TABLE 1 Key aspects of distributive justice in climate policy.

Aspect	Description	Reference
Core principle	Advocates for the fair distribution of both the benefits and burdens associated with climate change policies.	Furlan and Mariano, 2023
Exposure disparities	Recognizes that different communities experience varying levels of exposure to climate hazards.	Schapper, 2018
Resource and responsibility allocation	Stresses that the allocation of resources and responsibilities must account for these disparities.	Feng, 2024
Key policy questions	Raises critical questions about protection entitlements, the responsibilities for mitigation, and how rights to emit greenhouse gases should be allocated.	Feng, 2024
Economic efficiency vs. equity	Highlights that prioritizing economic efficiency in resource allocation may marginalize vulnerable populations.	Okereke and Coventry, 2016
Existing inequalities	Emphasizes that a sole focus on efficiency can perpetuate societal inequalities, thus necessitating a rethinking of current policy frameworks.	Michael et al., 2018
Climate finance discrepancies	Points out the significant discrepancies in the distribution of adaptation resources globally.	Skutsch et al., 2014
REDD+ Concerns	Underlines issues in the equitable allocation of funds under initiatives like REDD+, especially between developed and developing nations.	Gakou-Kakeu et al., 2024
Urban vs. rural funding	Observes that investments in infrastructure improvements tend to focus on wealthier urban areas, often leaving rural areas underfunded.	Palomo et al., 2019
Equity integration	Advocates for incorporating equity principles into climate adaptation strategies so that resources are allocated based on vulnerability rather than returns.	Wells et al., 2021

3.2 Procedural justice

Procedural justice is critical for advancing climate justice, as it emphasizes that the fairness of decision-making processes is as important as the outcomes themselves (Brandstedt and Brülde, 2019; Brabec and Chilton, 2015). Inclusive participation in these processes ensures that the voices of all stakeholders, particularly marginalized and vulnerable communities, are heard and valued (Ahmad et al., 2022). Research has demonstrated that when community members actively engage in decision-making, they foster a sense of ownership and responsibility, thereby enhancing the effectiveness of climate policies. Moreover, the inclusion of local knowledge during the planning and execution stages enriches climate interventions and leads to outcomes that are both contextually relevant and operationally effective (Restrepo-Mieth et al., 2023; Bailey and Darkal, 2017).

In addition to promoting inclusivity, procedural justice fundamentally influences how resources are allocated for climate adaptation. Studies indicate that decision-making processes lacking broad stakeholder input often result in resource allocations that favor economically viable or strategically important areas, leaving high-risk communities underserved (Scandrett, 2016; Hughes, 2015). For example, infrastructure improvements and technological implementations are frequently concentrated in wealthier urban contexts, while rural or impoverished regions receive insufficient support (Diezmartínez and Gianotti, 2022). This uneven distribution exacerbates existing vulnerabilities among marginalized populations (Radonic and Zúñiga-Terán, 2023). As

such, ensuring that decision-making processes incorporate diverse perspectives is crucial for realigning resource flows based on vulnerability rather than purely on efficiency metrics, a shift essential for achieving just climate adaptations (Hughes, 2013; Stamenkovic et al., 2018).

Furthermore, embedding procedural justice in climate governance is instrumental in addressing systemic inequalities that historically leave marginalized groups underserved. Actively including these communities in policy-making processes allows for the incorporation of localized, context-specific knowledge that can transform urban climate strategies into more equitable frameworks (Hügel and Davies, 2020). Community-based participatory approaches have proven particularly effective in areas where socioeconomic disadvantages intensify climate risks, ensuring that local concerns and priorities shape the final policy outcomes (Restrepo-Mieth et al., 2023; Schapper, 2018). Ultimately, by foregrounding procedural justice within climate governance, policymakers can foster long-lasting resilience built on collective action (Vaghri, 2018). Table 2 highlights key aspects and concerns related to procedural justice in climate policy.

3.3 Justice as recognition

Justice as recognition is a critical concept in advancing climate justice by emphasizing the need to acknowledge and respect marginalized and oppressed groups within climate strategies (Nursey-Bray and Palmer, 2018). This recognition is essential for ensuring that the experiences, rights, and needs of vulnerable populations, such as Indigenous peoples, racial minorities, and low-income groups, are considered during the formulation of climate policies. Historically, these communities have been systematically excluded from decision-making processes surrounding climate change (Kinay et al., 2023), leading to policies that often overlook their unique vulnerabilities and fail to incorporate their traditional knowledge and practices. For example, Indigenous knowledge provides valuable insights into sustainable practices developed over generations (Bodmer et al., 2018). By fostering an environment where marginalized groups are recognized and their rights are upheld, more inclusive and effective climate policies can be devised that address the multifaceted impacts of climate change (Schramm et al., 2020), while also enhancing accountability and reflecting the realities and aspirations of these communities (Benjaminsen et al., 2021).

Acknowledgment of marginalized voices enhances the legitimacy of climate policies and contributes to the development of more equitable and sustainable outcomes. Research indicates that recognizing the interests and rights of vulnerable communities fosters collaboration, builds resilience, and empowers individuals to advocate for their own needs (Jodoin et al., 2020; Schlosberg and Collins, 2014). A notable example is the REDD+ (Reducing Emissions from Deforestation and Forest Degradation) program in Tanzania, which underscores the importance of recognizing local communities' land rights and livelihoods in creating effective climate interventions (Parsons, 2018). By incorporating the perspectives of marginalized populations into decision-making processes, policymakers can better align climate actions with social justice principles to ensure that interventions benefit those most

affected by climate change (Tilahun et al., 2017). This inclusive approach leads to solutions that are effective and culturally relevant and enjoy the support of those directly impacted (Parsons, 2018).

The concept of intersectionality further enriches the discussion of justice as recognition by examining how overlapping social identities such as race, gender, socioeconomic status, and geography contribute to unique vulnerabilities in the context of climate change (Brandão et al., 2019). For instance, women in marginalized communities often face heightened risks due to cultural norms that limit their access to resources, decision-making power, and essential information (Cottrell, 2024), while individuals from lower socioeconomic backgrounds may encounter limited access to adaptive resources, increasing their susceptibility to climate impacts (Razgour et al., 2019). Understanding these intersecting factors is crucial for developing comprehensive and tailored climate strategies (Nadeau and Urban, 2019). Ultimately, recognizing and integrating the diverse experiences of marginalized groups into climate policymaking is vital for dismantling systemic inequalities and advancing justice as recognition (Galway and Beery, 2022). Such an approach sets the stage for a more just and equitable future, where all communities are empowered to effectively respond to the challenges posed by climate change (Kantos et al., 2023). Table 3 highlights the key aspects and concerns related to justice as recognition in climate policy.

3.4 Bridging climate justice theory and practice

Understanding the multifaceted impacts of climate change on marginalized communities requires a critical analysis of real-world examples through the lens of the three main dimensions of climate justice, distributive, procedural, and recognition-based justice, as outlined in Figure 2. Each dimension reveals distinct aspects of inequity and resilience in climate governance, emphasizing how theory can be translated into actionable strategies.

For instance, community-based participatory climate action in disadvantaged regions, as detailed by Hutton and Menne (2014), powerfully demonstrates recognition-based justice. By leveraging local and Indigenous knowledge, these initiatives transform communities from passive recipients of policy to active architects of their resilience. Similarly, the REDD+ program in Tanzania (Limaye et al., 2019) addresses recognition-based concerns by acknowledging local land rights and integrates procedural justice through its inclusive, transparent decision-making processes. This dual focus ensures that climate interventions are both context-sensitive and systematically fair.

In stark contrast, studies from the United States reveal significant shortcomings in distributive justice. Analyses by Bezgrebelna et al. (2021) indicate that climate-sensitive events impose multi-billion-dollar burdens on the health sector, disproportionately affecting low-income and marginalized groups, a disparity further underscored by Fox et al. (2019) and systematic reviews by Chua et al. (2019). These findings suggest that the uneven distribution of economic and health impacts is a critical failure of climate policy. Additionally, investigations into the influence of cultural norms and resource accessibility (Yang et al.,

TABLE 2 Key elements of procedural justice in climate policy.

Aspect	Description	Reference
Core principle	Central emphasis on ensuring that all voices are included in climate-related decision-making as an essential component of procedural justice.	Brandstedt and Brülde, 2019
Decision-making processes	The fairness of the decision-making process itself is regarded as equally important as the resulting policy outcomes.	Brabec and Chilton, 2015
Inclusive participation	Guarantees that every stakeholder, especially those from marginalized groups, has a meaningful opportunity to contribute.	Ahmad et al., 2022
Community engagement	Encourages active involvement to foster a sense of ownership and accountability among community members.	Restrepo-Mieth et al., 2023
Local knowledge contribution	Integrates community insights to enhance the relevance and success of climate adaptation and mitigation initiatives.	Bailey and Darkal, 2017
Ethical and efficacy alignment	Prioritizing procedural fairness fulfills ethical imperatives and strengthens the overall effectiveness of climate strategies.	Brandstedt and Brülde, 2019
Resource allocation priorities	Evaluates the distribution of resources with an emphasis on supporting the most vulnerable regions as opposed to areas considered economically advantageous.	Scandrett, 2016
Equity in resource distribution	Ensures that funds and resources are provided based on genuine need rather than potential returns, promoting equitable outcomes.	Hughes, 2013
Addressing systemic inequalities	Actively involves marginalized groups in the policymaking process to help rectify long-standing systemic injustices.	Hügel and Davies, 2020
Community-based participatory action	Highlights the importance of using community-driven approaches and local insights to address adaptation challenges in high-risk areas.	Restrepo-Mieth et al., 2023
Achieving climate resilience	Fosters collective action and inclusive participation as fundamental strategies for building sustained and effective climate resilience.	Vaghri, 2018

TABLE 3 Key components of justice as recognition in climate policy.

Aspect	Description	Reference(s)
Core principle	Emphasizes the need to acknowledge and respect marginalized and oppressed groups within climate strategies. It ensures that the experiences, rights, and needs of vulnerable populations, including Indigenous peoples, racial minorities, and low-income groups, are fully integrated into climate policy formulation.	Nursey-Bray and Palmer, 2018
systemic exclusion	Highlights the historical exclusion of marginalized communities from decision-making processes, which often leads to policies that fail to address their unique vulnerabilities and do not incorporate traditional knowledge and practices.	Kinay et al., 2023; Vogel et al., 2022
Indigenous knowledge	Underscores the critical role of Indigenous knowledge in climate governance by offering sustainable practices developed over generations.	Bodmer et al., 2018
Inclusive policies	Demonstrates that recognizing marginalized voices enhances the legitimacy of climate policies. Inclusive participation in decision-making fosters collaboration, builds resilience, and empowers affected communities to influence interventions that reflect their realities and aspirations.	Schramm et al., 2020; Benjaminsen et al., 2021; Parsons, 2018; Tilahun et al., 2017
Intersectionality	Examines how overlapping social identities, such as race, gender, socioeconomic status, and geography, shape unique vulnerabilities to climate change.	Brandão et al., 2019; Cottrell, 2024; Razgour et al., 2019; Nadeau and Urban, 2019; Galway and Beery, 2022; Kantos et al., 2023

2018) further emphasize the necessity for recognition-based justice by illustrating how local contexts shape adaptive responses.

Procedural justice, which is concerned with fairness in how decisions are made and whose voices are included, is vividly illustrated across multiple scales. For example, Caggiano et al. (2023) demonstrate how U.S. cities have revamped their Climate Action Plans (CAPs) by engaging diverse communities, including local environmental justice groups, to ensure that policies address the real needs of all residents. Globally, the negotiation processes at the 2015 Paris Climate Summit serve as an exemplar of procedural fairness, where inclusive dialogue and balanced power

dynamics (Walker, 2018; Schapper, 2018) legitimized the collective decision-making process. Local adaptation strategies in Nigeria (Oramah and Olsen, 2021) and the design of carbon market projects (Mathur et al., 2013) further illustrate how embedding community perspectives into decision-making can operationalize procedural justice.

Critically comparing these examples within the overarching climate justice framework reveals that no single strategy can address the complexities of climate injustice on its own. Instead, a comprehensive approach is required, one that ensures equitable outcomes (distributive justice), supports inclusive and transparent

decision-making (procedural justice), and celebrates the unique cultural and local contributions to adaptation (recognition-based justice). Table 4 below consolidates these illustrative examples, explicitly linking each case to its corresponding climate justice dimension(s) to highlight the multidimensional nature of vulnerability and resilience.

4 Climate policy inequities

This section critically examines how climate change disproportionately impacts marginalized communities while revealing systemic shortcomings in current policy frameworks. Drawing on the theoretical constructs from Section 3, this study investigates empirical evidence and real-world examples to expose the intricate interplay between historical injustices, socioeconomic vulnerabilities, and policy effectiveness. In doing so, it highlights how both local and global climate policies have often failed to address the unique challenges faced by women, Indigenous peoples, low-income groups, and other vulnerable populations, thereby neglecting to reflect the lived experiences of those most affected by climate change.

4.1 Disparities in climate vulnerability

Climate change exacerbates preexisting social, economic, and environmental inequities, resulting in pronounced disparities in vulnerability and health outcomes among marginalized groups. This subsection examines these disparities through two complementary lenses. First, it explores how entrenched structural inequalities heighten risks for specific demographics, such as women in developing regions, who often depend on natural resources for their livelihoods and therefore bear a disproportionate burden during severe climate events (Brika et al., 2024; Chersich and Wright, 2019). Similarly, people of color, low-income individuals, and Indigenous communities are frequently located in areas particularly prone to hazards like flooding, heatwaves, and food insecurity (Haigh et al., 2023). In support of these observations, Table 5 collates diverse risk factors across different regions, emphasizing the need for policies that address the unique environmental and socioeconomic challenges these populations face.

Beyond direct physical risks, climate change further compromises community wellbeing by eroding the fundamental determinants of health. Vulnerable populations increasingly suffer from reduced access to clean air, potable water, nutritious food, and secure housing, conditions that drive up the prevalence of respiratory and heat-related illnesses (Arimi et al., 2020; Liu et al., 2020). Disruptions in healthcare services during extreme weather events intensify these challenges, while the psychological stresses linked to displacement and economic instability contribute to significant mental health burdens (Blane and Basu, 2022; White et al., 2023). An intersectional perspective further reveals that individuals facing compounding disadvantages, for example, those with low-income status combined with minority identity, are subjected to layered vulnerabilities, calling for tailored adaptation and mitigation strategies. Table 5 synthesizes research on the compounded risks faced by specific demographics, demonstrating how multiple social, economic, and environmental factors interact to intensify climate vulnerability.

4.2 Policy frameworks for achieving climate justice

Achieving climate justice necessitates the development of comprehensive, equitable policy frameworks that address the diverse needs and vulnerabilities of affected communities. Such frameworks must be underpinned by the principles of fairness, inclusivity, and accountability to ensure that support reaches those most at risk. This subsection reviews key global instruments and local-to-national initiatives, highlighting their strengths and limitations in addressing climate inequities.

4.2.1 Global policy instruments

Since its establishment in 1992, the United Nations Framework Convention on Climate Change (UNFCCC) has served as a critical platform for international collaboration aimed at mitigating greenhouse gas emissions and bolstering adaptive capacity among vulnerable groups (Okereke and Coventry, 2016). With its foundation in the principle of common but differentiated responsibilities (CBDR), the UNFCCC underscores the greater historical accountability of developed nations, mandating more substantial corrective measures (Mele et al., 2021). Annual Conference of the Parties (COP) meetings complement the convention by functioning as dynamic forums for negotiating global climate agreements and mobilizing equity-focused actions (Obergassel et al., 2022).

Subsequent frameworks have sought to build on this foundation. The Kyoto Protocol (1997) mandated legally binding emission reduction targets for industrialized countries; however, its limited scope due to non-participation by major emitters and its lack of obligations for developing nations restricted its overall impact (Magnúsdóttir and Kronsell, 2024; Frenova, 2021). In contrast, the Paris Agreement of 2015 represents a decisive shift toward inclusivity by encouraging all nations to submit nationally determined contributions (NDCs) tailored to their specific circumstances and capabilities (Charlery and Trærup, 2018). By committing to limit global warming to well below 2 °C and ideally under 1.5 °C, the Paris framework prioritizes both adaptive capacity and support mechanisms, such as technology transfer and capacity building, that are vital for safeguarding vulnerable populations (Ogle et al., 2015; Debie et al., 2022). Supplementary Table S1 encapsulates the key features and equity contributions of these international policy instruments.

4.2.2 Local and national climate plans

Embedding social equity into every level of climate action is essential for achieving lasting climate justice. A comprehensive framework illustrated in Figure 3 integrates core equity principles with environmental sustainability to address the needs of marginalized and vulnerable communities. This

TABLE 4 Illustrative examples of climate vulnerability and resilience aligned with the climate justice framework.

Example	Climate Justice Dimension(s)	Description	Reference
Community-based participatory climate action	Recognition-based justice	Leverages local and Indigenous knowledge to empower marginalized communities, transforming them into active architects of adaptive strategies.	Hutton and Menne, 2014
REDD+ program in Tanzania	Recognition and procedural justice	Prioritizes local land rights and includes community voices in decision-making, integrating both recognition and procedural fairness in climate interventions.	Limaye et al., 2019
Health-related costs of climate-sensitive events	Distributive justice	Documents the substantial economic impacts on the health sector from climate events, disproportionately affecting marginalized and low-income populations.	Bezgrebelna et al., 2021
Connection between climate hazards and health risks	Distributive justice	Highlights the higher health risks experienced by marginalized communities in low-income areas, underlining inequities in the burden of climate impacts.	Fox et al., 2019
Systematic reviews on climate change health impacts	Distributive justice	Demonstrates that extreme events, such as flooding, exacerbate adverse health outcomes among vulnerable groups, reflecting an uneven distribution of climate risks.	Chua et al., 2019
Influence of cultural norms and local knowledge	Recognition-based justice	Reveals how local cultural factors and resource accessibility significantly shape community responses, reinforcing the need for socially just adaptation strategies.	Yang et al., 2018
Equity integration in U.S. climate action plans	Procedural justice	Shows how U.S. cities involve diverse stakeholders, including local environmental justice groups, to ensure that climate policies are responsive to community needs.	Caggiano et al., 2023
International climate negotiations at the Paris summit	Procedural justice	Exemplifies inclusive negotiation processes where diverse stakeholder input and balanced power sharing lent legitimacy to global climate policy outcomes.	Walker, 2018; Schapper, 2018
Local adaptation strategies in Nigeria	Procedural justice	Focuses on embedding community perspectives within adaptation processes, ensuring that local voices shape climate interventions in vulnerable regions.	Oramah and Olsen, 2021
Carbon market projects	Procedural justice	Illustrates how fair, transparent decision-making processes in carbon market initiatives can enhance local communities' engagement and benefit-sharing.	Mathur et al., 2013

model emphasizes distributive justice (the fair allocation of resources and responsibilities), procedural justice (transparent and participatory decision-making processes), and recognition justice (acknowledging the unique experiences of historically marginalized groups). Together, these interlocking principles ensure that both the benefits and burdens of climate action are shared equitably across society.

In practice, this framework offers strategic guidance for municipalities and governments in translating equity into actionable policies. It advocates for participatory governance through public consultations, stakeholder workshops, and community planning sessions that actively involve women, Indigenous peoples, and low-income groups. Despite challenges such as limited resources, fragmented policy execution, and systemic barriers (including colonial legacies and entrenched sectoral silos), strategies like adaptive management and strategic planning present viable pathways forward.

At the local level in North America, for instance, municipalities are increasingly incorporating these equity considerations into their Climate Action Plans (CAPs). Lioubimtseva et al. (2024) document a growing institutional commitment in Michigan to operationalizing equity theories, although research by Davoudi et al. (2013) reveals persistent challenges associated with resource constraints and execution. MacKinnon and Derickson (2012) stress the importance of amplifying marginalized voices, and studies by Pratt (2022), Tausch et al. (2011), and Cheng (2016) underscore how robust community engagement enhances both the effectiveness and public support for these initiatives. Equity-focused urban planning, as noted by Bulkeley et al. (2013), not only builds urban resilience but also advances social justice for at-risk communities. Supplementary Table S2 synthesizes the various approaches, illustrative examples, and implementation challenges documented in the literature for integrating social equity into local and national climate plans.

On a national and regional scale, climate plans across Asia, Africa, and Europe are increasingly designed to align adaptation strategies with broader social justice and developmental goals. Tompkins et al. (2018) illustrate how these plans effectively allocate resources while ensuring comprehensive policy coordination, and Lecoutere et al. (2023) emphasize the critical role of gender and other equity considerations in national policies, particularly in sectors such as agriculture. Systematic reviews by Ford et al. (2014) uniformly suggest that inclusive governance strategies are paramount for ensuring that marginalized communities receive the essential support they need during climate disruptions.

TABLE 5 Vulnerability of specific demographics to climate change.

Aspect	Description	Reference
Disproportionate impacts on women	Women in developing nations suffer more severe climate disasters due to entrenched social inequalities.	Brika et al., 2024
Dependency on natural resources	Women's heavy reliance on natural resources for their livelihoods, combined with limited access to adaptation resources, increases their vulnerability.	Chersich and Wright, 2019
Marginalized communities	People of color, low-income individuals, and indigenous groups are often located in high-risk areas, heightening their exposure to climate hazards.	Haigh et al., 2023
Health inequities	Vulnerable groups experience elevated rates of respiratory issues, heat-related illnesses, and mental health challenges due to climate impacts.	Liu et al., 2020
Impact on social determinants of health	Climate change disrupts access to essential resources such as clean air, water, food security, and safe housing, further undermining community wellbeing.	Arimi et al., 2020
Disruption of healthcare services	Extreme weather events frequently interrupt healthcare delivery, compounding access issues for marginalized populations.	Blane and Basu, 2022
Mental health impacts	Displacement, loss of livelihood, and trauma from climate events contribute to increased stress and mental health issues among vulnerable populations.	White et al., 2023
Intersectionality of social identity factors	Individuals facing overlapping disadvantages (e.g., low-income combined with minority status) encounter compounded challenges that heighten climate vulnerability.	Brika et al., 2024

FIGURE 3
Framework for integrating social equity into climate plans.
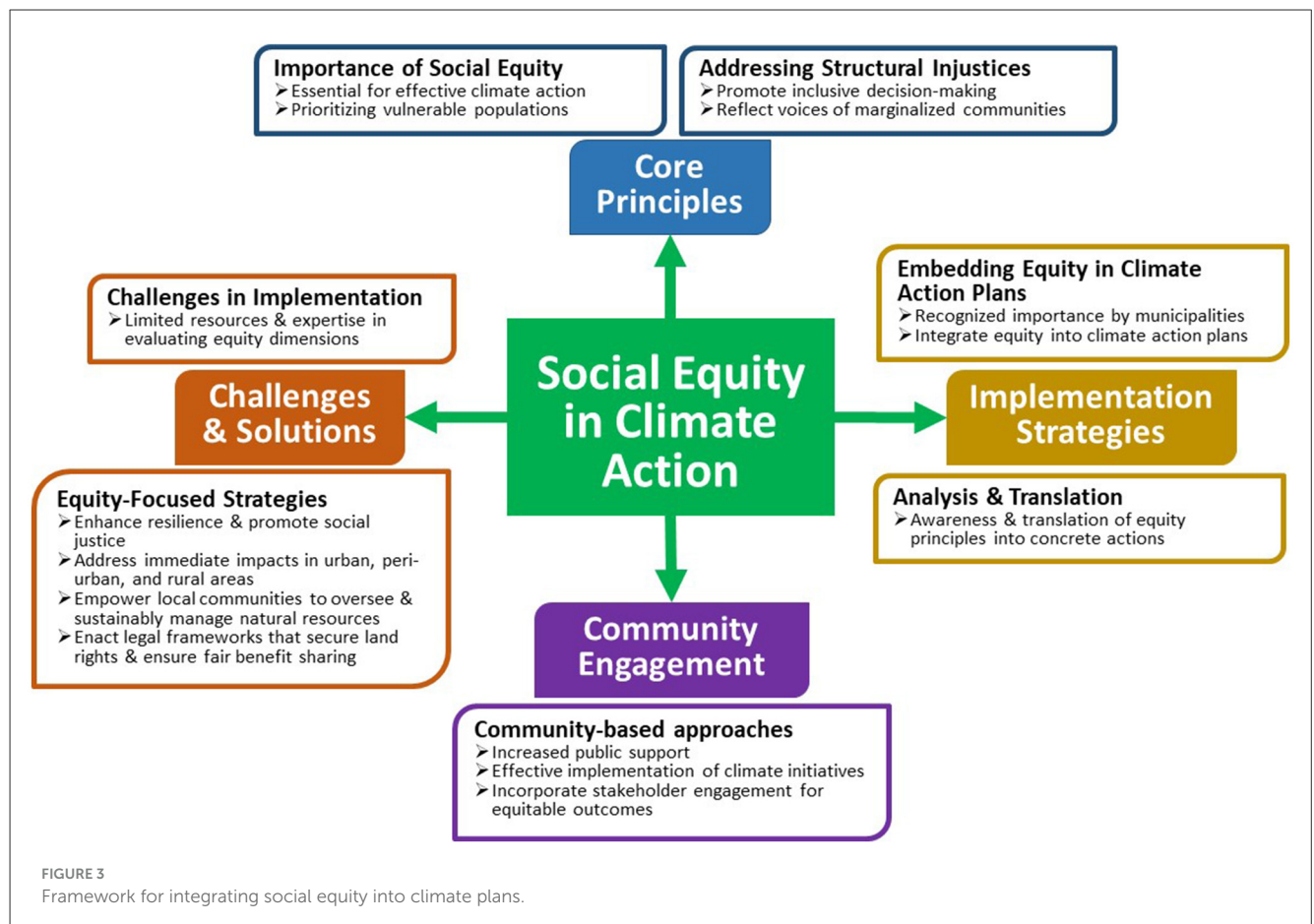
5 Challenges and strategic pathways

Section 4 delves into the complex challenges that impair the realization of climate justice and outlines strategic pathways to overcome these obstacles. Building on the insights from the previous sections, this part identifies systemic barriers, including entrenched power imbalances, fragmented governance, and inadequate resource allocation, that limit the effectiveness of current climate policies in addressing the needs of vulnerable communities. It also highlights the pressing need for more inclusive, adaptive, and interdisciplinary approaches that can bridge the gap between political rhetoric and lived experiences.

By proposing actionable strategies and recommendations, this section aims to chart a clear roadmap for future research and policy development, ultimately fostering resilient and equitable climate governance.

5.1 Challenges and barriers to climate justice

Achieving climate justice requires confronting a range of obstacles embedded in existing governance structures. This section highlights key issues that hinder equitable climate action, most notably, the enduring colonial legacy in climate governance and the fragmented, siloed nature of sector-specific approaches that limit interdisciplinary collaboration. By critically examining these challenges, the study charts the steps needed to develop more inclusive and effective climate policies that address the complex impacts of climate change on vulnerable communities. Subsequent subsections explore the implications of colonial practices and sector silos, emphasizing the importance of collaboration to advance both social and environmental justice.

5.1.1 Colonial legacy in climate governance

The lingering impact of colonialism continues to shape contemporary climate governance by reinforcing persistent inequalities and establishing systemic barriers to effective climate action. Historical injustices, such as the dispossession of land and the exploitation of Indigenous peoples, have molded governance structures that frequently sideline the rights and knowledge of marginalized communities. This systemic exclusion from decision-making processes not only perpetuates existing vulnerabilities but also limits the capacity of these groups to influence policies affecting their lives (Baniya and Aryal, 2022). Moreover, the divergence between historical and current climate policies often mirrors a continuation of colonial practices, wherein affluent nations impose mitigation strategies on developing countries without considering local contexts or needs (Wagner et al., 2021).

To address these deep-rooted grievances, integrating justice principles into climate governance is essential. Contemporary policy frameworks tend to favor economic efficiency and industrial interests over social equity, resulting in measures that benefit well-resourced regions at the expense of marginalized populations. This imbalance underscores the urgent need to re-evaluate and redesign governance mechanisms to establish inclusive frameworks, ones that acknowledge historical injustices and promote equitable resource distribution (Adelle and Russel, 2013).

Ensuring a more equitable system also requires the meaningful incorporation of Indigenous knowledge and community perspectives into policy design and implementation. Engaging local communities enhances the legitimacy of climate strategies and enriches the decision-making process with diverse, context-specific insights, leading to more effective solutions. Ultimately, by prioritizing inclusion and recognizing the rights and experiences of historically marginalized groups, climate governance can evolve into a system that is more responsive and representative. Overcoming the colonial legacies in climate governance will thus depend on collaborative efforts among local communities,

Indigenous groups, policymakers, and scientists all working together to build resilience against the impacts of climate change (Wohlgezogen et al., 2020).

5.1.2 Sector silos

The persistence of sector silos in climate governance significantly undermines efforts to achieve health equity. Fragmented, compartmentalized approaches often result in public health considerations being sidelined in climate initiatives. Structural and cultural barriers hinder the effective integration of health equity into climate action, which in turn narrows municipal planning to a limited focus on mitigation while neglecting crucial links between environmental policies and health outcomes (McPherson et al., 2016; Zimmermann et al., 2023). This disjointed approach leads to an uneven spread of resources, further perpetuating disparities among vulnerable populations.

Interdisciplinary cooperation is essential to breaking down these silos. Effective climate action requires coordinated efforts across sectors such as public health, urban planning, environmental protection, and social services (Aziz and Anjum, 2024). Intersectoral strategies can address the social determinants of health, thereby mitigating the adverse impacts of climate change (Ndumbe-Eyoh and Moffatt, 2013; Nair et al., 2023). However, current framework deficiencies often result in fragmented policy responses, leaving issues like heat-related illnesses and poor air quality inadequately addressed (Qamar, 2023). Advocacy coalitions play a critical role in bridging these gaps by fostering interdisciplinary partnerships that recognize the interconnectedness of climate, health, and social justice (Diezmartínez and Gianotti, 2022; Thorndike et al., 2023). Such collaborative frameworks are imperative for developing comprehensive climate action plans that effectively support marginalized communities and promote health equity.

5.2 Strategies for enhancing equity in climate policies

Achieving climate justice demands a comprehensive approach that embeds equity into every facet of policy development and implementation. This section outlines key strategies for advancing equity in climate policies, focusing on inclusive policy design, robust community engagement, and outlining future directions for research and policymaking. By prioritizing these strategies, the approach ensures that the response to climate change effectively addresses the needs of marginalized populations while promoting fairness and inclusivity across all levels of governance.

5.2.1 Recommendations for inclusive policy design

Embedding diverse voices in policy-making is essential for developing climate policies that truly address community needs. Actively engaging historically marginalized groups such as women, Indigenous peoples, and low-income communities ensures that their unique experiences shape climate initiatives. Fox et al. (2019) found that such meaningful participation enhances the

relevance of policies, while Lâm et al. (2024) demonstrated that aligning strategies with real-world challenges increases overall policy effectiveness. Integrating gender perspectives is equally important; Lesnikowski et al. (2020) highlight the crucial role women play in managing natural resources and building resilience, even though their contributions are often overlooked in formal policy frameworks. Incorporating local knowledge into decision-making further ensures that policies are context-sensitive and culturally appropriate, ultimately strengthening adaptation efforts and promoting social equity.

The integration of participatory governance frameworks in climate policy design is essential for fostering inclusivity and responsiveness to the needs of marginalized populations. Rilling and Tosun (2021) support this idea by emphasizing that open dialogue and shared decision-making empower communities to shape their climate futures more actively (Faber, 2025). This sentiment is echoed by Heijden (2021), who argues that robust community engagement fosters trust among stakeholders, enhancing the responsiveness of climate policies to local needs (Vihma and Hukkinen, 2024). Moreover, the findings of Cintron-Rodriguez et al. (2021) affirm that equitable and empowering participatory policy design strategies are critical to accelerating just climate action, underscoring the importance of active community involvement in decision-making processes (Ganesh and Smith, 2018). Together, these strategies serve as a roadmap for enhancing equity in climate policy through inclusion, the integration of diverse expertise, and genuine participatory processes.

5.2.2 Leveraging community engagement

Local empowerment is essential for building resilient, equitable climate action. Involving historically marginalized groups such as women, Indigenous peoples, and low-income communities in policymaking ensures that their unique experiences and local knowledge are incorporated into climate strategies (Rhodes et al., 2021). Meaningful participation has been shown to foster a sense of ownership among these communities (Selvey et al., 2022). Furthermore, community-based participatory approaches enable affected individuals to clearly articulate their specific needs and develop tailored solutions (Heijden, 2021).

Organizations also play a pivotal role in bridging gaps between communities and policymakers. Non-governmental organizations and grassroots groups can facilitate engagement, resource sharing, and advocacy, thereby amplifying the voices of marginalized populations (Ganesh and Smith, 2018). Participatory governance frameworks that adopt co-design principles help policymakers work directly with community members to develop culturally appropriate and context-sensitive strategies (Entradas et al., 2019). Collaborative planning efforts driven by such frameworks have been found to build public trust and create more effective adaptive strategies (Awuor et al., 2023). Finally, interdisciplinary collaboration among scientists, policymakers, and local partners contributes to enhanced resilience and

sustainable climate action (James et al., 2021; Tiwana et al., 2024).

5.2.3 Future directions for research and policy

Looking ahead, there is an urgent need to adopt multidisciplinary approaches that bring together insights from fields such as public health, sociology, environmental science, and economics to advance climate justice. Holz et al. (2023) emphasize that this integration is essential for capturing the full complexity of climate challenges, especially those that affect marginalized communities. In addition, Holz et al. (2023) show that embedding equity considerations into Nationally Determined Contributions (NDCs) leads to more just climate responses. Policymakers must therefore foster cross-sector collaboration to improve outcomes for vulnerable populations. It is also critical to understand the generational aspects of resource allocation and burdens, a point highlighted by Ly and Cope (2023), to promote social sustainability.

Future research should focus on evaluating and learning from successful models of participatory governance and community engagement within climate policy frameworks. Clark and Miles (2021) argue that such evidence-based assessments can guide other regions in replicating effective practices. Kaida et al. (2023) stress that ongoing evaluation of global frameworks, like the Paris Agreement, is necessary to ensure equity remains at the heart of climate action. Continuous reflection on policy outcomes advised by Arries (2023), ensures that strategies adapt to serve diverse communities better, while Coley et al. (2022) call for transformative changes to achieve just outcomes. Policymakers should also regularly assess the effectiveness of climate agreements in addressing equity, as noted by Sasser (2023), and explore innovative mechanisms to overcome barriers, such as providing financial support for vulnerable groups and establishing robust accountability measures (Kashwan, 2021). Table 6 summarizes these key future directions, underscoring the importance of collaboration, rigorous evaluation, and ongoing adaptation for achieving equitable climate outcomes.

6 Conclusion

This study investigated the multifaceted dimensions of climate justice, highlighting the critical gap between political rhetoric and the lived experiences of marginalized communities, such as women, Indigenous peoples, and low-income groups, that disproportionately bear the impacts of climate change despite their minimal contribution to its causes. By synthesizing a rich body of literature on distributive, procedural, and recognition-based justice, this review advances our understanding of how historical injustices and entrenched socio-economic imbalances continue to shape policy frameworks. Notably, the study reveals that conventional policy approaches often fail to capture the nuanced realities of vulnerable populations, underscoring the need for more robust evaluative criteria that can guide the development of inclusive, equitable climate policies.

TABLE 6 Future directions for research and policy in climate justice.

Aspect	Description	Reference
Multidisciplinary approaches	Leverage insights from public health, sociology, environmental science, and economics to enrich the study and practice of climate justice.	Holz et al., 2023
Equity in NDCs	Integrate equity considerations into Nationally Determined Contributions to secure a more just response to climate change.	
Collaborative efforts	Prioritize cross-sector collaboration to improve outcomes for vulnerable populations in climate policy.	
Generational aspects	Investigate how resource allocation and climate burdens impact different generations, fostering long-term social sustainability.	Ly and Cope, 2023
Participatory governance	Assess and refine models of participatory governance and community engagement to design climate policies that are both effective and inclusive.	Clark and Miles, 2021
Evaluation of global frameworks	Continuously evaluate international agreements like the Paris Agreement to ensure equity remains a fundamental component of global climate action.	Kaida et al., 2023
Feedback from marginalized groups	Employ feedback from marginalized communities to adapt policies and achieve outcomes that reflect their specific needs.	Arries, 2023
Addressing barriers	Identify obstacles to the equitable implementation of climate policies and explore innovative strategies to surmount these challenges.	Kashwan, 2021
Continuous adaptation	Regularly review and adjust strategies to better serve diverse populations and enhance community resilience over time.	Coley et al., 2022
Commitment to equity	Reinforce a strong commitment to ensuring that the transition to a sustainable, low-carbon future leaves no community behind.	Sasser, 2023

The analysis makes several significant contributions to the literature. First, it bridges the gap between theoretical constructs of justice and real-world policy outcomes, demonstrating that meaningful change requires adaptive policy designs and active community participation. The empirical review of community-led initiatives serves as a compelling illustration of how bottom-up approaches can effectively redress systemic inequities and catalyze transformative change. Moreover, this study articulates the interplay of political rhetoric and actual governance practices, providing concrete evidence that symbolic commitments without tangible action only exacerbate existing disparities. In doing so, the paper enriches the discourse by offering a more integrated, evidence-based framework for assessing and enhancing climate justice within global and local policy contexts.

Looking forward, the findings of this review underscore that achieving climate justice demands a continuous and adaptive integration of social equity into policymaking. Policymakers must embrace interdisciplinary collaboration and develop innovative strategies that incorporate marginalized voices not merely as beneficiaries, but as active partners in decision-making. By offering targeted, inclusive policy modifications and highlighting successful models of community empowerment, this study lays a solid foundation for future research and policy development. Ultimately, the added knowledge from this review illuminates the shortcomings of current strategies and charts a clear pathway toward resilient, sustainable, and equitable climate governance.

Author contributions

LA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing.

Funding

Acknowledgments

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of

their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsuep.2025.1592249/full#supplementary-material

References

Adelle, C., and Russel, D. (2013). Climate policy integration: a case of déjà vu? *Environ. Policy Gov.* 23, 1–12. doi: 10.1002/eet.1601

Ahmad, S., Islam, M., Zada, M., Khattak, A., Ullah, R., Han, H., et al. (2022). The influence of decision making on social inclusion of persons with disabilities: a case study of Khyber Pakhtunkhwa. *Int. J. Environ. Res. Public Health* 19:858. doi: 10.3390/ijerph19020858

Arifin, R., Rodiyah, R., and Wulansarie, R. (2023). "Climate justice in Indonesian environmental protection: past, present and future challenges," in *IOP Conference Series: Earth and Environmental Science, Vol. 1248, ICE-BEES Conference on Re-thinking the Dynamization between Environmental Issues and Adaptive Technology for Inclusive Growth* (Semarang). doi: 10.1088/1755-1315/1248/1/012037

Arimi, K., Kolayemi, M., Fatufe, O., and Joshua, A. (2020). Cowpea farmers' vulnerability and adaptation to climate change in Iddo local government area of Oyo State, Nigeria. *Yüzüncü Yıl Üniversitesi Tarim Bilimleri Dergisi* 30, 601–610. doi: 10.29133/yyutbd.687100

Arries, E. (2023). Ethics, care and climate change mitigation: a reflection on what care professionals can do. *Nurs. Ethics* 30, 479–481. doi: 10.1177/09697330231179034

Awuor, L., Meldrum, R., and Liberda, E. (2023). Institutional engagement practices as barriers to public health capacity in climate change policy discourse: lessons from the Canadian province of Ontario. *Int. J. Environ. Res. Public Health* 17:6338. doi: 10.32920/22782716

Aziz, M., and Anjum, G. (2024). Transformative strategies for enhancing women's resilience to climate change: a policy perspective for low- and middle-income countries. *Women's Health* 20:17455057241302032. doi: 10.1177/17455057241302032

Babatunde, E. (2020). Distributive justice in the age of climate change. *Can. J. Law Jurisprud.* 33, 263–292. doi: 10.1017/cjlj.2020.13

Bailey, I., and Darkal, H. (2017). (Not) talking about justice: justice self-recognition and the integration of energy and environmental-social justice into renewable energy siting. *Local Environ.* 23, 335–351. doi: 10.1080/13549839.2017.1418848

Baniya, B., and Aryal, P. (2022). Can the framing of climate mitigation actions into government policies lead to delivering them? – Insights from Nepal's experience. *Environ. Manage.* 70, 179–200. doi: 10.1007/s00267-022-01643-6

Barkai, K., and Winkler, H. (2024). Developing a framework for assessing equity in national contributions to the global goal on adaptation. *Int. Environm. Agreem. Politics, Law Econ.* 25, 79–106. doi: 10.1007/s10784-024-09660-y

Barrett, S. (2014). Subnational climate justice? adaptation finance distribution and climate vulnerability. *World Dev.* 58, 130–142. doi: 10.1016/j.worlddev.2014.01.014

Benjaminsen, T., Svarstad, H., and Tordarroch, I. (2021). *Recognising Recognition in Climate Justice.* Brighton: Institute of Development Studies.

Berberian, A., Gonzalez, D., and Cushing, L. (2022). Racial disparities in climate change-related health effects in the United States. *Curr. Environ. Health Rep.* 9, 451–464. doi: 10.1007/s40572-022-00360-w

Bezgrebelna, M., McKenzie, K., Wells, S., Ravindran, A., Kral, M., Christensen, J., et al. (2021). Climate change, weather, housing precarity, and homelessness: a systematic review of reviews. *Int. J. Environ. Res. Public Health* 18:5812. doi: 10.3390/ijerph18115812

Blane, D., and Basu, N. (2022). Tackling climate change and health inequalities in primary care. *Fam. Pract.* 40, 498–501. doi: 10.1093/fampra/cmac146

Bodmer, R., Mayor, P., Antúnez, M., Chota, K., Fang, T., Puertas, P., et al. (2018). Major shifts in amazon wildlife populations from recent intensification of floods and drought. *Conservat. Biol.* 32, 333–344. doi: 10.1111/cobi.12993

Brabec, E., and Chilton, E. (2015). Toward an ecology of cultural heritage. *Change Over Time* 5, 266–285. doi: 10.1353/cot.2015.0021

Brandão, M., Kirschbaum, M., Cowie, A., and Hjuler, S. (2019). Quantifying the climate change effects of bioenergy systems: comparison of 15 impact assessment methods. *GCB Bioenergy* 11, 727–743. doi: 10.1111/gcbb.12593

Brandstedt, E., and Brülde, B. (2019). Towards a theory of pure procedural climate justice. *J. Appl. Philos.* 36, 785–799. doi: 10.1111/japp.12357

Brika, S., Abderzag, F., Ghandri, M., and Lamari, I. (2024). Climate change and human psychology: a comprehensive analysis of thoughts and emotions. *J. Ecohumanism* 3:4955. doi: 10.62754/joe.v3i8.4955

Bulkeley, H., and Betsill, M. M. (2013). Revisiting the urban politics of climate change. *Env. Polit.* 22, 136–154. doi: 10.1080/09644016.2013.755797

Bulkeley, H., Carmin, J., Broto, V., Edwards, G., and Fuller, S. (2013). Climate justice and global cities: mapping the emerging discourses. *Global Environ. Change* 23, 914–925. doi: 10.1016/j.gloenvcha.2013.05.010

Caggiano, H., Kocakuşak, D., Kumar, P., and Tier, M. (2023). U.S. cities' integration and evaluation of equity considerations into climate action plans. *NPJ Urban Sustainab.* 3:1. doi: 10.1177/09562478211021710

Charlery, L., and Trærup, S. (2018). The nexus between nationally determined contributions and technology needs assessments: a global analysis. *Clim. Policy* 19, 189–205. doi: 10.1080/14693062.2018.1479957

Chen, M., Wang, Y., and Xu, Z. (2024). A framework for assessing the blue equity of social-ocean systems in marine governance transformation. *Front. Mar. Sci.* 11:1403194. doi: 10.3389/fmars.2024.1403194

Cheng, C. (2016). Spatial climate justice and green infrastructure assessment: a case study for the Huron river watershed, Michigan, USA. *GI_Forum* 4, 176–190. doi: 10.1553/giscience2016_01_s176

Chersich, M., and Wright, C. (2019). Climate change adaptation in south Africa: a case study on the role of the health sector. *Global. Health* 15:1. doi: 10.1186/s12992-019-0466-x

Chua, P., Dorotan, M., Sigua, J., Estanislao, R., Hashizume, M., and Salazar, M. (2019). Scoping review of climate change and health research in the Philippines: a complementary tool in research agenda-setting. *Int. J. Environ. Res. Public Health* 16: 2624. doi: 10.3390/ijerph16142624

Cintron-Rodriguez, I., Crim, H., Morrison, D., Niepold, F., Kretser, J., Spitzer, W., et al. (2021). Equitable and empowering participatory policy design strategies to accelerate just climate action. *J. Sci. Policy Gov.* 18. doi: 10.38126/JSPG180203

Clark, S., and Miles, M. (2021). Assessing the integration of environmental justice and sustainability in practice: a review of the literature. *Sustainability* 13:11238. doi: 10.3390/su132011238

Coley, R., Duan, K., Hoopes, A., Lapham, G., Liljenquist, K., Marcotte, L., et al. (2022). A call to integrate health equity into learning health system research training. *Learn. Health Syst.* 6:e10330. doi: 10.1002/lrh2.10330

Cottrell, C. (2024). The effect government recognition of indigenous communities has on climate adaptation funding in the united states. *Environ. Managem. Sustain. Dev.* 14:1. doi: 10.5296/emsd.v14i1.22267

Davoudi, S., Brooks, E., and Mehmood, A. (2013). Evolutionary resilience and strategies for climate adaptation. *Plan. Pract. Res.* 28, 307–322. doi: 10.1080/02697459.2013.787695

Debie, A., Khatri, R., and Assefa, Y. (2022). Successes and challenges of health systems governance towards universal health coverage and global health security: a narrative review and synthesis of the literature. *Health Res. Policy Syst.* 20:50. doi: 10.1186/s12961-022-00858-7

Diezmartínez, C., and Gianotti, A. (2022). US cities increasingly integrate justice into climate planning and create policy tools for climate justice. *Nat. Commun.* 13:5763. doi: 10.1038/s41467-022-33392-9

Dobai, A., and Riemer, K. (2023). Rethinking structures of governance: the role of community-based strategies. *Int. J. Soc. Gov.* 15, 145–162.

Dunk, R., Satyal, P., and Bonaventura, M. (2016). "A novel impact assessment methodology for evaluating distributional impacts in Scottish climate change adaptation policy," in *Implementing Climate Change Adaptation in Cities and Communities. Climate Change Management*, eds. W. Leal Filho, K. Adamson, R. Dunk, U. Azeiteiro, S. Illingworth, and F. Alves (Cham: Springer). doi: 10.1007/978-3-319-28591-7_5

Entradas, M., Marcelino, J., Bauer, M., and Lewenstein, B. (2019). Public communication by climate scientists: what, with whom and why? *Clim. Change* 154, 69–85. doi: 10.1007/s10584-019-02414-9

Faber, R. (2025). Meaningful participatory climate governance: lessons from EU multilevel climate and energy dialogues. *Rev. Eur. Comp. Int. Environ. Law.* 34, 394–408. doi: 10.1111/reel.12618

Feng, J. (2024). Framing queer climate justice. *Polit. Sci. Polit.* 57, 529–539. doi: 10.1017/S1049096524000350

Ford, J., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., and Pearce, T. (2014). The status of climate change adaptation in africa and asia. *Region. Environ. Change* 15, 801–814. doi: 10.1007/s10113-014-0648-2

Fox, M., Zuidema, C., Bauman, B., Burke, T., and Sheehan, M. (2019). Integrating public health into climate change policy and planning: state of practice update. *Int. J. Environ. Res. Public Health* 16:3232. doi: 10.3390/ijerph16183232

Frenova, S. (2021). Orchestrating the participation of women organisations in the UNFCC led climate finance decision making. *Climate* 9:135. doi: 10.3390/cli9090135

Furlan, M., and Mariano, E. (2023). Effects of democracy, social inequality and economic growth on climate justice: an analysis with structural equation modelling. *Nat. Resour. Forum* 48, 435–467. doi: 10.1111/1477-8947.12320

Gakou-Kakeu, J., Gregorio, M., Paavola, J., and Sonwa, D. (2024). REDD+ organisational arrangements and potential for sectoral integration: evidence from Cameroon. *Environ. Policy Governance* 34, 740–753. doi: 10.1002/eet.2120

Gallagher, C., and Holloway, T. (2022). U.S. decarbonization impacts on air quality and environmental justice. *Environ. Res. Letters* 17:114018. doi: 10.1088/1748-9326/ac99ef

Galway, L., and Beery, T. (2022). Exploring climate emotions in Canada's provincial north. *Front. Psychol.* 13:920313. doi: 10.3389/fpsyg.2022.920313

Ganesh, C., and Smith, J. (2018). Climate change, public health, and policy: a California case study. *Am. J. Public Health* 108, S114–S119. doi: 10.2105/AJPH.2017.304047

Haigh, F., Crimeen, A., Green, L., Moeller, H., Conaty, S., Prior, J., et al. (2023). Developing a climate change inequality health impact assessment for health services. *Public Health Res. Pract.* 33:e3342336. doi: 10.17061/phrp3342336

Haldar, S., Peddibhotla, A., and Bazaz, A. (2023). Analysing intersections of justice with energy transitions in India—A systematic literature review. *Energy Res. Soc. Sci.* 98:103010. doi: 10.1016/j.erss.2023.103010

Han, H., and Ahn, S. (2020). Youth mobilization to stop global climate change: narratives and impact. *Sustainability* 12:4127. doi: 10.3390/su12104127

Haque, M. (2024). Conceptualizing climate justice. *J. Climate Policy* 3, 13–31. doi: 10.47941/jcp.1678

Hayes, K., Blashki, G., Wiseman, J., Burke, S., and Reifels, L. (2018). Climate change and mental health: risks, impacts and priority actions. *Int. J. Ment. Health Syst.* 12:1. doi: 10.1186/s13033-018-0210-6

Heijden, J. (2021). When opportunity backfires: exploring the implementation of urban climate governance alternatives in three major US cities. *Policy Soc.* 40, 116–135. doi: 10.1080/14494035.2021.1934984

Holz, C., Cunliffe, G., Mbeva, K., Pauw, P., and Winkler, H. (2023). Tempering and enabling ambition: how equity is considered in domestic processes preparing NDCS. *Int. Environ. Agreem. Polit. Law Econ.* 23, 271–292. doi: 10.1007/s10784-023-09599-6

Hügel, S., and Davies, A. (2020). Public participation, engagement, and climate change adaptation: a review of the research literature. *Wiley Interdiscip. Rev. Clim. Change* 11:e645. doi: 10.1002/wcc.645

Hughes, S. (2013). Justice in urban climate change adaptation: criteria and application to Delhi. *Ecol. Soc.* 18:48. doi: 10.5751/ES-05929-180448

Hughes, S. (2015). A meta-analysis of urban climate change adaptation planning in the U.S. *Urban Climate* 14, 17–29. doi: 10.1016/j.uclim.2015.06.003

Hutton, G., and Menne, B. (2014). Economic evidence on the health impacts of climate change in Europe. *Environ. Health Insights* 8, EHI.S16486. doi: 10.4137/EHI.S16486

Iglesias, A., Quiroga, S., Moneo, M., and Garrote, L. (2011). From climate change impacts to the development of adaptation strategies: challenges for agriculture in Europe. *Clim. Change* 112, 143–168. doi: 10.1007/s10584-011-0344-x

Imam, M., and Tijjani, C. (2024). Dismantling green colonialism: Energy and climate justice in the Arab region. *J. Global Econ. Busin.* 5, 43–47. doi: 10.58934/jgeb.v5i17.257

Isyaku, U., Arhin, A., and Asiyanbi, A. (2017). Framing justice in REDD+ governance: centring transparency, equity and legitimacy in readiness implementation in west Africa. *Environ. Conserv.* 44, 212–220. doi: 10.1017/S0376892916000588

James, R., Gibbs, B., Whitford, L., Leisher, C., Konia, R., and Butt, N. (2021). Conservation and natural resource management: where are all the women? *Oryx* 55, 860–867. doi: 10.1017/S0030605320001349

Jodoin, S., Snow, S., and Corobow, A. (2020). Realizing the right to be cold? Framing processes and outcomes associated with the inuit petition on human rights and global warming. *Law Soc. Rev.* 54, 168–200. doi: 10.1111/lasr.12458

Joseph, D. D., and Doon, R. A. (2023). The impact of climate change on maternal and child health in the Caribbean. Eds. Joseph, D. and Doon, R. The impact of climate change on vulnerable people. *Basel: MDPI* 25–46. doi: 10.3390/books978-3-0365-5503-4-2

Kaida, A., Anderson, J., Barnard, C., Bartram, L., Bert, D., Carpendale, S., et al. (2023). Realizing the promise of disaggregated data and analytics for social justice through community engagement and intersectoral research partnerships. *Engaged Scholar J.* 8, 57–71. doi: 10.15402/esj.v8i4.70792

Kantos, Z., Özdemir, B., and Taşdan, M. (2023). Investigating the relationship between teachers' organizational identity perceptions and accountability levels in school climate and school development dimensions. *Shanlax Int. J. Educ.* 11, 201–214. doi: 10.34293/education.v11iS1-Oct.6741

Kashwan, P. (2021). Climate justice in the global north. *Case Stud. Environ.* 5:1125003. doi: 10.1525/cse.2021.1125003

Khanal, S., Bolte, G., and Boeckmann, M. (2024a). Sector silos in climate action- a missed opportunity to prioritize health equity. *PLoS Climate* 3:e0000349. doi: 10.1371/journal.pclm.0000349

Khanal, S., Ramadani, L., and Boeckmann, M. (2023). Health equity in climate change and health policies: a systematic review. *Sustainability* 15:10653. doi: 10.3390/su151310653

Khanal, S., Shrestha, R., and Boeckmann, M. (2024b). Examining health equity in Nepal's climate change and health policies through the lens of environmental justice: insights from a content analysis. *Glob. Health Action* 17:1. doi: 10.1080/16549716.2024.2432069

Kinay, P., Wang, X., Augustine, P., and Augustine, M. (2023). Reporting evidence on the environmental and health impacts of climate change on indigenous peoples of Atlantic Canada: a systematic review. *Environm. Res. Climate* 2:022003. doi: 10.1088/2752-5295/accb01

Lâm, S., Nović, G., Skinner, K., and Nguyen-Viet, H. (2024). Greener through gender: what climate mainstreaming can learn from gender mainstreaming. *Wiley Interdiscipl. Rev. Clim. Change* 15:e887. doi: 10.1002/wcc.887

Lecoutere, E., Mishra, A., Singaraju, N., Koo, J., Azzarri, C., Chanana, N., et al. (2023). Where women in agri-food systems are at highest climate risk: a methodology for mapping climate–agriculture–gender inequality hotspots. *Front. Sustain. Food Syst.* 7:1197809. doi: 10.3389/fsufs.2023.1197809

Lesnikowski, A., Biesbroek, R., Ford, J., and Berrang-Ford, L. (2020). Policy implementation styles and local governments: the case of climate change adaptation. *Env. Polit.* 30, 753–790. doi: 10.1080/09644016.2020.1814045

Limaye, V., Max, W., Constible, J., and Knowlton, K. (2019). Estimating the health-related costs of 10 climate-sensitive U.S. events during 2012. *Geohealth* 3, 245–265. doi: 10.1029/2019GH000202

Lioubimtseva, E. (2022). The role of inclusion in climate vulnerability assessment and equitable adaptation goals in small American municipalities. *Discover Sustainab.* 3:3. doi: 10.1007/s43621-022-00071-0

Lioubimtseva, E., Zylman, H., Carron, K., Poynter, K., and Rashrash, B. (2024). *Equity and Inclusion in Climate Action and Adaptation Plans of Michigan Cities.*

Liu, J., Potter, T., and Zahner, S. (2020). Policy brief on climate change and mental health/well-being. *Nurs. Outlook* 68, 517–522. doi: 10.1016/j.outlook.2020.06.003

Ly, A., and Cope, M. (2023). New conceptual model of social sustainability: review from past concepts and ideas. *Int. J. Environ. Res. Public Health* 20:5350. doi: 10.3390/ijerph20075350

MacKinnon, D., and Derickson, K. (2012). From resilience to resourcefulness. *Prog. Hum. Geogr.* 37, 253–270. doi: 10.1177/0309132512454775

Magnúsdóttir, G., and Kronsell, A. (2024). Climate institutions matter: the challenges of making gender-sensitive and inclusive climate policies. *Coop. Confl.* 59, 361–378. doi: 10.1177/00108367241230011

Malherbe, N., and Oladejo, A. (2024). Against climate aid colonialism: the case for climate reparations and south-south solidarity. *Afr. Spectrum* 60, 84–105. doi: 10.1177/00020397241285040

Mathur, V., Afionis, S., Paavola, J., Dougill, A., and Stringer, L. (2013). Experiences of host communities with carbon market projects: towards multi-level climate justice. *Clim. Policy* 14, 42–62. doi: 10.1080/14693062.2013.861728

Mattar, S., Jafry, T., Schröder, P., and Ahmad, Z. (2021). Climate justice: priorities for equitable recovery from the pandemic. *Clim. Policy* 21, 1307–1317. doi: 10.1080/14693062.2021.1976095

McCauley, D. A., Heffron, R. J., Stephan, H., and Jenkins, K. (2013). Advancing energy justice: the triumvirate of tenets. *Int. Energy Law Rev.* 32, 107–110. Available online at: https://hdl.handle.net/10023/6078

McPherson, C., Ndumbe-Eyoh, S., Betker, C., Oickle, D., and Peroff-Johnston, N. (2016). Swimming against the tide: a Canadian qualitative study examining the implementation of a province-wide public health initiative to address health equity. *Int. J. Equity Health* 15:129. doi: 10.1186/s12939-016-0419-4

Mele, A., Paglialunga, E., and Sforna, G. (2021). Climate cooperation from Kyoto to Paris: what can be learnt from the CDM experience? *Socioecon. Plann. Sci.* 75:100942. doi: 10.1016/j.seps.2020.100942

Meshkani, T. (2024). Climate change and flooding: governmental responses to displacement and relocation in Jakarta's informal neighborhoods. *Int. J. Disast. Resilience Built Environ.* 15, 551–570. doi: 10.1108/IJDRBE-02-2023-0037

Michael, K., Deshpande, T., and Ziervogel, G. (2018). Examining vulnerability in a dynamic urban setting: the case of Bangalore's interstate migrant waste pickers. *Clim. Dev.* 11, 667–678. doi: 10.1080/17565529.2018.1531745

Munenzon, D. (2024). Co-production for equitable governance in community climate adaptation: neighborhood resilience in Houston, Texas. *Urban Planning* 9:7338. doi: 10.17645/up.7338

Nadeau, C., and Urban, M. (2019). Eco-evolution on the edge during climate change. *Ecography* 42, 1280–1297. doi: 10.1111/ecog.04404

Nair, J., Sathyan, A., Jena, A., and Reddy, M. (2023). Unveiling climate resilience of peri-urban agriculture: a farming system-based assessment of coastal plains of Kerala, India. *Asian J. Agricult. Extens. Econ. Sociol.* 41, 871–877. doi: 10.9734/ajaees/2023/v41i102238

Ndumbe-Eyoh, S., and Moffatt, H. (2013). Intersectoral action for health equity: a rapid systematic review. *BMC Public Health* 13:1056. doi: 10.1186/1471-2458-13-1056

Nguyễn, H. (2023). Climate justice in Vietnam's green transformation: A three-dimensional analysis of the green growth and climate change mitigation sectors. *Minist. Sci. Technol. Vietnam* 65, 90–99. doi: 10.31276/VMOSTJOSSH.65(1).90-99

Nursey-Bray, M., and Palmer, R. (2018). Country, climate change adaptation and colonisation: insights from an indigenous adaptation planning process, Australia. *Heliyon* 4:e00565. doi: 10.1016/j.heliyon.2018.e00565

Obergassel, W., Bauer, S., Hermwille, L., Aykut, S., Boran, I., Chan, S., et al. (2022). From regime-building to implementation: harnessing the un climate conferences to drive climate action. *Wiley Interdiscipl. Rev. Clim. Change* 13:e797. doi: 10.1002/wcc.797

Ogle, S., Davis, K., Lauvaux, T., Schuh, A., Cooley, D., West, T., et al. (2015). An approach for verifying biogenic greenhouse gas emissions inventories with atmospheric co2concentration data. *Environ. Res. Letters* 10:034012. doi: 10.1088/1748-9326/10/3/034012

Okereke, C., and Coventry, P. (2016). Climate justice and the international regime: before, during, and after Paris. *Wiley Interdiscipl. Rev. Clim. Change* 7, 834–851. doi: 10.1002/wcc.419

Oramah, C., and Olsen, O. (2021). "Equity and justice in climate change adaptation: policy and practical implication in Nigeria," in *African Handbook of Climate Change Adaptation*, eds. W. Leal Filho, N. Oguge, D. Ayal, L. Adeleke, and I. da Silva (Cham: Springer). doi: 10.1007/978-3-030-42091-8_45-1

Palomo, I., Dujardin, Y., Midler, E., Robin, M., Sanz, M., and Pascual, U. (2019). Modeling trade-offs across carbon sequestration, biodiversity conservation, and equity in the distribution of global REDD+ funds. *Proc. Nat. Acad. Sci.* 116, 22645–22650. doi: 10.1073/pnas.1908683116

Parsons, L. (2018). Structuring the emotional landscape of climate change migration: towards climate mobilities in geography. *Prog. Hum. Geogr.* 43, 670–690. doi: 10.1177/0309132518781011

Perkiss, S. (2024). Climate apartheid: the failures of accountability and climate justice. *Account. Audit. Accountab. J.* 37, 1761–1794. doi: 10.1108/AAAJ-02-2024-6903

Pollex, J. (2024). Climate justice and policy analysis: still a reserved relationship. *NPJ Clim. Action* 3:1. doi: 10.1038/s44168-024-00146-w

Polonik, P., Ricke, K., Reese, S., and Burney, J. (2023). Air quality equity in us climate policy. *Proc. Nat. Acad. Sci.* 120:26. doi: 10.1073/pnas.2217124120

Pratt, B. (2022). Equitable urban planning for climate change. *J. Plan. Literat.* 38, 59–69. doi: 10.1177/08854122221138125

Pratt, B. (2023). How should urban climate change planning advance social justice? *Kennedy Inst. Ethics J.* 33, 55–89. doi: 10.1353/ken.2023.a899459

Qamar, A. H. (2023). Social dimensions of resilience and climate change: a rapid review of theoretical approaches. *Pres. Environ. Sustain. Dev.* 17, 139–153. doi: 10.47743/pesd2023171010

Radonic, L., and Zúñiga-Terán, A. (2023). When governing urban waters differently: five tenets for socio-environmental justice in urban climate adaptation interventions. *Sustainability* 15:1598. doi: 10.3390/su15021598

Razgour, O., Forester, B., Taggart, J., Bekaert, M., Juste, J., Ibáñez, C., et al. (2019). Considering adaptive genetic variation in climate change vulnerability assessment reduces species range loss projections. *Proc. Nat. Acad. Sci.* 116, 10418–10423. doi: 10.1073/pnas.1820663116

Restrepo-Mieth, A., Perry, J., Garnick, J., and Weisberg, M. (2023). Community-based participatory climate action. *Global Sustainab.* 6:e14. doi: 10.1017/sus.2023.12

Rhodes, E., Krawchenko, T., Pearce, K., and Shaw, K. (2021). Scaling up local climate action: a survey of climate policy priorities in the Vancouver island and coastal communities region. *Can. Plan. Policy* 2021, 36–69. doi: 10.24908/cpp-apc.v2021i01.14469

Rilling, B., and Tosun, J. (2021). Policy and political consequences of mandatory climate impact assessments: an explorative study of German cities and municipalities. *Policy Soc.* 40, 99–115. doi: 10.1080/14494035.2021.1907901

Round, C., and Visseren-Hamakers, I. (2022). Blocked chains of governance: using blockchain technology for carbon offset markets? *Front. Blockchain* 5:957316. doi: 10.3389/fbloc.2022.957316

Salle, T., Rocha-Neves, J., Jimerson, S., Sano, S., Martinsone, B., Albertová, S., et al. (2021). A multinational study exploring adolescent perception of school climate and mental health. *School Psychol.* 36, 155–166. doi: 10.1037/spq0000430

Sasser, J. (2023). At the intersection of climate justice and reproductive justice. *Wiley Interdiscipl. Rev. Clim. Change* 15, e860. doi: 10.1002/wcc.860

Scandrett, E. (2016). Climate justice: contested discourse and social transformation. *Int. J. Clim. Change Strateg. Managem.* 8, 477–487. doi: 10.1108/IJCCSM-05-2015-0060

Schapper, A. (2018). Climate justice and human rights. *Int. Relat.* 32, 275–295. doi: 10.1177/0047117818782595

Schlosberg, D., and Collins, L. (2014). From environmental to climate justice: climate change and the discourse of environmental justice. *Wiley Interdiscipl. Rev. Clim. Change* 5, 359–374. doi: 10.1002/wcc.275

Schramm, P., Ahmed, M., Siegel, H., Donatuto, J., Campbell, L., Raab, K., et al. (2020). Climate change and health: local solutions to local challenges. *Curr. Environ. Health Reports* 7, 363–370. doi: 10.1007/s40572-020-00294-1

Selvey, L., Carpenter, M., Lazarou, M., and Cullerton, K. (2022). Communicating about energy policy in a resource-rich jurisdiction during the climate crisis: lessons from the people of Brisbane, Queensland, Australia. *Int. J. Environ. Res. Public Health* 19, 4635. doi: 10.3390/ijerph19084635

Sengupta, S. (2023). Climate change, international justice and global order. *Int. Aff.* 99, 121–140. doi: 10.1093/ia/iiac264

Shonkoff, S., Morello-Frosch, R., Pastor, M., and Sadd, J. (2011). The climate gap: environmental health and equity implications of climate change and mitigation policies in California—a review of the literature. *Clim. Change* 109, 485–503. doi: 10.1007/s10584-011-0310-7

Skutsch, M., Turnhout, E., Vijge, M., Herold, M., Wits, T., Besten, J., et al. (2014). Options for a national framework for benefit distribution and their relation to community-based and national REDD+ monitoring. *Forests* 5, 1596–1617. doi: 10.3390/f5071596

Stamenkovic, S., Njegovan, B., and Vukadinović, M. (2018). Intra-national diversity. *Cross Cult. Strat. Managem.* 25, 425–442. doi: 10.1108/CCSM-05-2017-0061

Sušanj, Z., Jakopec, A., and Radoš, A. (2019). Interactive effects of multi-foci justice climates on teams' psychological empowerment. *Suvremena Psihologija* 22, 27–37. doi: 10.21465/2019-SP-221-02

Swanson, K. (2021). Equity in urban climate change adaptation planning: a review of research. *Urban Plan.* 6, 287–297. doi: 10.17645/up.v6i4.4399

Tausch, N., Becker, J., Spears, R., Christ, O., Saab, R., Singh, P., et al. (2011). Explaining radical group behavior: developing emotion and efficacy routes to normative and nonnormative collective action. *J. Pers. Soc. Psychol.* 101, 129–148. doi: 10.1037/a0022728

Thorndike, A., Peterson, L., Spitzer, S., Patel, S., Smithey, A., Moore, J., et al. (2023). Advancing health equity through partnerships of state Medicaid Agencies, Medicaid managed care organizations, and health care delivery organizations. *Front. Public Health* 11:1104843. doi: 10.3389/fpubh.2023.1104843

Tilahun, M., Angassa, A., and Abebe, A. (2017). Community-based knowledge towards rangeland condition, climate change, and adaptation strategies: the case of afar pastoralists. *Ecol. Proc.* 6:29. doi: 10.1186/s13717-017-0094-4

Tiwana, M., Smith, J., Kirby, M., and Purewal, S. (2024). Equity lens on Canada's covid-19 response: review of the literature. *Int. J. Health Policy Managem.* 13, 1–9. doi: 10.34172/ijhpm.2024.8132

Tompkins, E., Vincent, K., Nicholls, R., and Suckall, N. (2018). Documenting the state of adaptation for the global stocktake of the paris agreement. *Wiley Interdiscipl. Rev. Clim. Change* 9:5. doi: 10.1002/wcc.545

Tutak, M., Brodny, J., and Bindzár, P. (2021). Assessing the level of energy and climate sustainability in the European Union countries in the context of the European green deal strategy and agenda 2030. *Energies* 14:1767. doi: 10.3390/en14061767

Upadhyay, B., and Bastola, A. (2024). Breaking the silence: the complex nexus of gender and climate change in Nepal. *Environ. Res.: Climate* 3:025004. doi: 10.1088/2752-5295/ad2eb1

Vaghri, Z. (2018). Climate change, an unwelcome legacy: the need to support children's rights to participate in global conversations. *Child. Youth Environ.* 28, 104–114. doi: 10.1353/cye.2018.0025

Vasiliev, D. (2022). "Climate justice and biodiversity," in *IOP Conference Series Earth and Environmental Science, 1072(1), 012008. IOP Conference Series: Earth and Environmental Science, Volume 1072, 9th International Conference on Coastal and Ocean Engineering (ICCOE 2022).* doi: 10.1088/1755-1315/1072/1/012008

Vihma, P., and Hukkinen, J. (2024). Bracing urban governance against climate crises: how to integrate high reliability into strategic decision-making? *Environ. Policy Govern.* 35, 103–113. doi: 10.1002/eet.2129

Vogel, B., Yumagulova, L., McBean, G., and Norris, K. (2022). Indigenous-led nature-based solutions for the climate crisis: insights from Canada. *Sustainability* 14:6725. doi: 10.3390/su14116725

Wagner, P., Torney, D., and Ylä-Anttila, T. (2021). Governing a multilevel and cross-sectoral climate policy implementation network. *Environ. Policy Govern.* 31, 417–431. doi: 10.1002/eet.1942

Walker, H. (2018). *Mutual recognition in global negotiations: the case of the 2015 Paris climate summit.* GLOBUS Research Paper 8/2018. doi: 10.2139/ssrn.3198061

Wells, H., Kirobi, E., Chen, C., Winowiecki, L., Vågen, T., Ahmad, M., et al. (2021). Equity in ecosystem restoration. *Restorat. Ecol.* 29, e13385. doi: 10.1111/rec.13385

White, B., Breakey, S., Brown, M., Smith, J., Tarbet, A., Nicholas, P., et al. (2023). Mental health impacts of climate change among vulnerable populations globally: an integrative review. *Ann. Global Health* 89:66. doi: 10.5334/aogh.4105

Wild, K., Rasanathan, K., Singh, S., and Woodward, A. (2025). Balancing short-term and long-term climate-health equity strategies: a framework for supporting faster, fairer joint action on climate change and health equity. *BMJ Global Health* 9:e016094. doi: 10.1136/bmjgh-2024-016094

Wohlgezogen, F., McCabe, A., Osegowitsch, T., and Mol, J. (2020). The wicked problem of climate change and interdisciplinary research: tracking management scholarship's contribution. *J. Managem. Organiz.* 26, 1048–1072. doi: 10.1017/jmo.2020.14

Wong, S. (2016). Can climate finance contribute to gender equity in developing countries? *J. Int. Dev.* 28, 428–444. doi: 10.1002/jid.3212

Yang, L., Liao, W., Liu, G., Zhang, N., Zhong, S., and Huang, C. (2018). Associations between knowledge of the causes and perceived impacts of climate change: a cross-sectional survey of medical, public health and nursing students in universities in china. *Int. J. Environ. Res. Public Health* 15:2650. doi: 10.3390/ijerph15122650

Zavala, M. D., Cejas, C., Rubinstein, F., and López, A. (2024). Gender inequities in the impact of climate change on health: a scoping review. *Int. J. Environ. Res. Public Health* 21:1093. doi: 10.3390/ijerph21081093

Zimmermann, K., Haen, L., Desloge, A., and Handler, A. (2023). The role of a local health department in advancing health equity: universal postpartum home visiting in a large urban setting. *Health Equity* 7, 703–712. doi: 10.1089/heq.2023. 0104