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Education for climate justice and sustainability in underserved communities.

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Abstract

Underserved communities face disproportionate climate risks while simultaneously having fewer resources and less access to high-quality climate and sustainability education. This article synthesizes recent literature (2018–2025) on climate-justice-centered education for marginalized populations, identifies effective principles and program models, and proposes a practical, research-informed framework for educators, community organizations, and policymakers. Key findings show that community-based participatory approaches, place-based curricula, culturally responsive pedagogy, and integration of workforce pathways (green jobs) increase relevance, engagement, and resilience among youth and adults in underserved areas. We conclude with concrete recommendations for design, implementation, evaluation, and policy to scale equitable climate education.

Climate change disproportionately impacts underserved communities, yet these populations often face systemic barriers to education and resources needed to respond effectively. This paper explores the role of education as a catalyst for climate justice and sustainability in marginalized contexts. Drawing on interdisciplinary perspectives, it highlights how culturally relevant curricula, community-based learning, and participatory approaches can empower learners to engage with environmental challenges while advancing social equity. The study emphasizes the importance of integrating local knowledge systems, addressing structural inequalities, and fostering youth leadership to ensure that climate education does not reproduce existing disparities but instead drives inclusive resilience and transformation. By reframing education as both a right and a tool for justice, this work argues that sustainable futures must be co-created with communities most affected by climate change, ensuring that solutions are equitable, context-specific, and rooted in solidarity.

Keywords

Climate justice; sustainability education; underserved communities; community-based learning; participatory approaches; culturally responsive pedagogy; green jobs; equity in education; resilience; policy frameworks.

Introduction

Climate change and environmental hazards (heat, flooding, poor air and water quality) disproportionately affect low-income, Indigenous, Black, Brown, and immigrant communities; these are often the same communities underserved by formal education systems and workforce pipelines. Without targeted educational efforts that center justice, communities risk maladaptation and missed opportunities to build local resilience, agency, and green-economy access. Recent policy and research emphasize the need for justice-centered climate education that links

knowledge, community priorities, and action. The accelerating climate crisis is not only an environmental challenge but also a profound social justice issue. Its impacts are unevenly distributed, with underserved and marginalized communities bearing a disproportionate share of the risks—ranging from heightened exposure to extreme weather events and pollution, to economic precarity and health vulnerabilities. Yet, paradoxically, these same communities often have the least access to high-quality education, resources, and decision-making power that could enable them to respond effectively to climate threats. This dual burden underscores the urgency of rethinking education as both a right and a tool for advancing climate justice and sustainability.

Education is widely recognized as a driver of social transformation, equipping individuals and communities with the knowledge, skills, and agency needed to navigate complex global challenges. However, dominant models of climate and sustainability education often remain disconnected from the lived realities of marginalized populations. Too frequently, they prioritize technical or global perspectives over local knowledge systems, overlook systemic inequalities, and fail to address the socio-political dimensions of climate vulnerability. As a result, underserved communities may remain excluded from shaping or benefiting from climate solutions, reinforcing cycles of inequity.

In response, scholars, educators, and practitioners are increasingly calling for climate-justice-centered education that explicitly links sustainability to equity, empowerment, and community resilience. Emerging research and practice point to promising approaches, including community-based participatory learning, place-based and culturally responsive curricula, and pathways to green jobs that align education with livelihood opportunities. Such approaches not only make climate education more relevant and accessible but also help foster collective capacity to envision and build just, sustainable futures.

This article synthesizes recent literature (2018–2025) on climate-justice-oriented education in underserved communities and identifies effective principles and program models. It also proposes a practical, research-informed framework to guide educators, community organizations, and policymakers in designing and scaling equitable climate education initiatives. By centering justice, solidarity, and the agency of those most affected, this work argues that education can play a pivotal role in transforming climate vulnerability into resilience and in advancing inclusive sustainability.

This paper asks: **What approaches to education best promote climate justice and sustainability outcomes in underserved communities?** We synthesize empirical and practitioner literature and offer an actionable framework for research and program design.

Objectives

1. **To analyze** recent literature (2018–2025) on climate-justice-centered education and its implications for underserved and marginalized communities.
2. **To identify** effective principles, models, and pedagogical strategies—such as community-based participatory learning, place-based curricula, culturally responsive pedagogy, and green workforce pathways—that enhance climate education outcomes.
3. **To develop** a practical, research-informed framework that educators, community organizations, and policymakers can apply to scale equitable and justice-centered climate education.
4. **To evaluate** how integrating local knowledge systems, cultural contexts, and structural equity considerations can strengthen resilience and empowerment in underserved populations.
5. **To provide** actionable recommendations for the design, implementation, and policy integration of climate justice education initiatives.

Hypothesis

Climate-justice-centered education that incorporates **community participation, cultural relevance, local knowledge, and green workforce pathways** will be more effective in increasing engagement, empowerment, and resilience among underserved communities than conventional climate and sustainability education models that focus primarily on technical or global perspectives.

Methods: Scope and Approach

This study employs a qualitative, integrative literature review approach to examine how climate justice and sustainability education has been conceptualized and implemented in underserved communities. The scope covers peer-reviewed articles, policy reports, and program evaluations published between **2018 and 2025**, reflecting the period of rapid growth in climate-justice-oriented education research and practice. Sources were identified through systematic searches in academic databases (e.g., Scopus, Web of Science, ERIC, Google Scholar) and supplemented with gray literature from international organizations, NGOs, and community-based initiatives.

The review focused on materials that explicitly addressed:

- **Target populations**: Underserved or marginalized groups, including low-income communities, Indigenous peoples, racial/ethnic minorities, and climate-vulnerable regions.
- **Educational contexts**: Formal (K–12 and higher education), nonformal (community programs, NGO initiatives), and informal (youth movements, grassroots efforts).
- **Pedagogical approaches**: Community-based participatory methods, place-based curricula, culturally responsive pedagogy, integration of local/Indigenous knowledge, and workforce pathways (green jobs).
- **Outcomes of interest**: Equity, inclusion, empowerment, resilience, knowledge gains, community engagement, and sustainability impacts.

Analysis proceeded in three stages:

1. **Mapping and categorization** – Studies and initiatives were mapped by region, population, educational setting, and pedagogical approach.
2. **Thematic synthesis** – Key themes and patterns were extracted to identify effective principles, models, and barriers.
3. **Framework development** – Insights were synthesized into a research-informed framework to guide the design, implementation, and evaluation of climate-justice-centered education initiatives.

This approach emphasizes both breadth (capturing global and cross-sectoral insights) and depth (highlighting community-driven and context-specific strategies). The aim is not only to document effective practices but also to bridge scholarship, policy, and practice in order to advance equitable, justice-centered climate and sustainability education.

Literature Review

1. Climate Justice and Unequal Vulnerabilities

The literature consistently highlights that climate change disproportionately impacts underserved communities, including low-income populations, Indigenous peoples, and racial/ethnic minorities (Bullard & Wright, 2019; Schlosberg & Collins, 2021). These groups are often situated in areas more exposed to climate hazards (e.g., flood

zones, urban heat islands) while lacking the adaptive capacity and resources to respond effectively. This intersection of environmental vulnerability and social inequality underpins the emerging field of *climate justice education*, which seeks to frame climate learning not only as scientific knowledge acquisition but also as an avenue for equity and empowerment (Kagawa & Selby, 2020).

2. Education as a Catalyst for Sustainability and Justice

Education has long been recognized as a driver of sustainable development, as reflected in UNESCO's Education for Sustainable Development (ESD) framework. However, critiques of mainstream ESD argue that it often privileges technical knowledge and global perspectives, while neglecting power, justice, and local realities (Stevenson et al., 2017). Scholars argue that climate justice education must go beyond environmental awareness to interrogate systemic inequities, connect with learners' lived experiences, and foster civic engagement (Bali & Alvarez, 2022).

3. Community-Based and Participatory Approaches

A growing body of evidence supports **community-based participatory education** as a strategy for aligning learning with local needs and knowledge systems. Case studies demonstrate that when communities co-design curricula and programs, education becomes more relevant, accessible, and impactful (Martinez & Brown, 2020; Misiaszek, 2021). Participatory approaches also build collective agency and ensure that climate education does not reproduce top-down dynamics of exclusion.

4. Place-Based and Culturally Responsive Pedagogy

Research underscores the value of **place-based learning**, which situates climate and sustainability education within local ecologies, histories, and cultural practices (Gruenewald & Smith, 2014). This method helps learners understand both global and local dimensions of climate change, while cultivating stewardship of their immediate environments. Similarly, **culturally responsive pedagogy** acknowledges and integrates the cultural identities of learners, making education more inclusive and resonant (Gay, 2018; Ladson-Billings, 2021). In underserved communities, such approaches are particularly powerful for bridging climate knowledge with social identity and justice.

5. Pathways to Green Jobs and Livelihoods

Recent literature highlights the integration of **workforce pathways**—particularly in renewable energy, sustainable agriculture, and green infrastructure—into climate justice education (ILO, 2019; Evans, 2023). Such linkages not only enhance youth engagement but also connect education to tangible economic opportunities, addressing the structural inequities that often trap marginalized populations in climate-vulnerable livelihoods. Programs that align sustainability learning with job readiness have shown promise in building resilience at both individual and community levels.

6. Barriers and Gaps in Current Practice

Despite growing innovation, several barriers persist. These include limited funding for underserved schools, lack of teacher training in justice-centered approaches, policy frameworks that prioritize standardized curricula over contextual relevance, and insufficient evaluation of community-based programs (Anderson et al., 2020). Moreover, much of the literature remains concentrated in the Global North, with less documentation of climate justice education in the Global South—where vulnerabilities are often greatest.

7. Emerging Trends and Contributions of This Study

The literature points toward a paradigm shift: from technocratic, one-size-fits-all sustainability education to **justice-oriented, community-rooted, and transformative climate education**. This paper contributes to the field by synthesizing recent research (2018–2025), identifying core principles of effective practice, and offering a framework for scaling climate justice education that integrates pedagogy, policy, and community action.

Synthesis: Core Principles for Climate-Justice Education in Underserved Communities

The review of recent scholarship and practice (2018–2025) reveals a set of interrelated principles that underpin effective climate-justice-centered education for underserved populations. These principles emphasize both pedagogical innovation and structural transformation, ensuring that climate education contributes to equity, empowerment, and resilience.

1. Community-Based and Participatory Engagement

Programs that are co-designed with local communities enhance relevance, trust, and ownership. Community-based participatory approaches position learners not only as recipients of knowledge but as co-creators, ensuring that educational initiatives reflect lived realities and build collective agency.

2. Place-Based and Context-Specific Learning

Grounding curricula in the ecological, cultural, and socio-political realities of a given community strengthens the connection between global climate issues and local experiences. Place-based education fosters stewardship by linking sustainability practices to the immediate environment and daily lives of learners.

3. Culturally Responsive and Inclusive Pedagogy

Integrating diverse cultural identities, traditions, and knowledge systems increases inclusivity and engagement. Culturally responsive pedagogy ensures that underserved groups—particularly Indigenous peoples and racial/ethnic minorities—see their identities reflected and valued in climate education, making learning both meaningful and empowering.

4. Integration of Local and Indigenous Knowledge

Acknowledging and valuing community expertise disrupts dominant, technocratic narratives that often marginalize grassroots perspectives. Incorporating local and Indigenous knowledge enriches curricula, provides practical adaptation strategies, and affirms learners' cultural heritage as central to sustainability.

5. Linkages to Green Workforce Pathways

Climate-justice education is most impactful when it connects learning with livelihood opportunities. Embedding pathways to green jobs—such as renewable energy, sustainable agriculture, and conservation—supports both economic resilience and environmental sustainability, particularly in communities where economic precarity amplifies climate vulnerability.

6. Youth Leadership and Intergenerational Collaboration

Youth-led initiatives and intergenerational partnerships are central to building long-term resilience. Programs that cultivate leadership skills among young people while drawing on the wisdom of elders create stronger networks of advocacy, innovation, and action.

7. Equity, Access, and Structural Change

True climate justice education requires addressing systemic barriers—such as underfunded schools, lack of teacher training, and inequitable policies—that limit access to quality education. Equitable resourcing, inclusive policies, and capacity-building for educators are necessary to scale and sustain transformative models.

8. Action-Oriented and Transformative Learning

Finally, climate justice education must move beyond awareness-raising toward collective action and systemic change. Action-oriented pedagogy empowers learners to engage in advocacy, policy-making, and community projects, shifting education from individual knowledge acquisition to collective transformation.

These principles emphasize that climate-justice-centered education in underserved communities must be **participatory, place-based, culturally responsive, and structurally equitable**, while simultaneously linking learning to **economic opportunity, youth empowerment, and collective action**. Together, they provide a foundation for designing and scaling education initiatives that advance both sustainability and social justice.

Program overview — "Community-Rooted Climate & Justice Academy" (CR-CJA)

A 3-year phased model suitable for school-community partnerships in underserved neighborhoods.

Year 1 — Co-design & capacity building

Establish a steering committee (community reps, teachers, local NGOs, municipal resilience staff).

Conduct community hazard mapping and needs assessment (participatory workshops).

Teacher professional development in climate justice pedagogy and place-based inquiry. PMC+1

Year 2 — Curriculum delivery & community projects

Implement a scaffolded curriculum (grades 6–12) combining science, social studies, and civic engagement.

Student-led projects: air/heat monitoring, neighborhood cooling strategies, advocacy campaigns, or green-business prototypes.

Partner with local employers/community colleges for skill-building modules. celfeducation.org+1

Year 3 — Evaluation, refinement & scaling

Participatory evaluation measuring learning, civic engagement, adaptive capacity, and pathways into work.

Create policy briefs and toolkits to support replication in other neighborhoods. PMC

Evaluation approach (mixed methods + participatory metrics)

Quantitative: pre/post surveys of climate literacy, civic self-efficacy, and employability skills; attendance and progression into training.

Qualitative: focus groups with students, parents, and community partners on perceived relevance and empowerment.

Participatory indicators: locally defined measures (e.g., number of community cooling interventions implemented, meetings with city officials).

Use participatory implementation science frameworks to adapt and sustain interventions. PMC

Illustrative case examples (selected)

School air-quality inquiry (CELF model): Ninth graders conducting air-quality investigations leading to neighborhood advocacy. Demonstrates inquiry-to-action and civic engagement.

Youth GIS & remote sensing projects: Nonprofits training BIPOC youth in geospatial skills to map local vulnerabilities and influence planning. Connects technical skills to advocacy and jobs.

Boatbuilding and environmental science projects: Place-based EE programs engaging youth in underserved coastal communities, building skills and identity.

Policy implications and recommendations

1. **Fund multi-year, place-based programs** — short grants undercut sustainability. Municipal and philanthropic funders should prioritize 3–5 year investments.
2. **Support teacher preparation** — integrate climate justice modules into teacher education and provide stipended PD.
3. **Bridge education with workforce systems** — create certification stacks, apprenticeships, and employer partnerships targeting local green-economy jobs.
4. **Embed participatory evaluation in funding requirements** — require community-defined outcomes and CBPR principles.
5. **Policy alignment** — align district curricula and municipal resilience plans so education directly contributes to local adaptation strategies.

While this study provides a synthesis of recent scholarship and practice in climate-justice-centered education, several limitations should be acknowledged.

Scope of Literature

The review was limited to materials published between 2018 and 2025 and primarily in English. This scope may exclude earlier foundational work and non-English sources, particularly from the Global South, where critical innovations in community-based climate education may be underrepresented in international databases.

Geographic Representation

Much of the accessible literature is concentrated in the Global North, while fewer peer-reviewed studies document experiences in regions most vulnerable to climate change, such as Sub-Saharan Africa, small island states, and parts of South Asia. This creates an imbalance in perspectives, with a risk of overemphasizing models from wealthier contexts.

Reliance on Secondary Sources

The analysis is based on existing studies and program evaluations rather than primary data collection. As a result, the findings are constrained by the methodological rigor and scope of the reviewed sources, many of which lack standardized outcome measures for educational impact and resilience.

Variability in Definitions and Frameworks

Across the literature, terms such as *climate justice education*, *sustainability education*, and *environmental justice learning* are used inconsistently. This conceptual variability makes direct comparisons difficult and may obscure subtle distinctions in approaches.

Limited Evidence on Long-Term Outcomes

While many studies report short-term gains in knowledge, engagement, and empowerment, there is limited longitudinal research on how climate-justice education translates into sustained behavioral change, community resilience, or systemic transformation.

Policy and Implementation Gaps

Although several promising principles and models were identified, there remains a lack of large-scale policy integration and institutional support for climate-justice education. This gap limits the generalizability of findings and raises questions about scalability in underserved communities facing structural inequities.

Discussion

The findings of this study underscore the multifaceted role of education in advancing climate justice and sustainability in underserved communities. Climate-justice-centered education emerges not simply as a tool for knowledge acquisition, but as a vehicle for empowerment, resilience, and structural transformation. Key discussion points include:

1. **Participatory and Community-Rooted Learning**

Programs that actively engage communities in co-design and implementation are more likely to achieve relevance and sustained impact. Participatory approaches, such as the CR-CJA model, position learners and community members as co-creators of knowledge, strengthening social cohesion and collective agency. These approaches also address historical inequities by centering the voices of those most affected.

2. **Place-Based and Culturally Responsive Pedagogy**

Integrating local ecologies, cultural identities, and Indigenous knowledge into curricula enhances engagement and fosters a sense of ownership. Place-based and culturally responsive strategies make climate education meaningful for learners, connecting abstract global issues with tangible local experiences.

3. **Linking Education to Economic and Civic Pathways**

Education that integrates workforce pathways, such as green jobs, apprenticeship programs, and environmental stewardship initiatives, addresses structural inequities while creating tangible opportunities for community members. This dual focus on civic and economic outcomes ensures that climate education contributes to both sustainability and social mobility.

4. **Youth Leadership and Intergenerational Collaboration**

Empowering youth as agents of change and incorporating intergenerational knowledge strengthens community adaptive capacity. Youth-led projects, such as local air-quality monitoring and advocacy campaigns, exemplify how education can cultivate leadership while driving concrete environmental improvements.

5. **Barriers and Structural Challenges**

Despite promising models, systemic barriers—limited funding, lack of teacher training, inconsistent policy support, and insufficient longitudinal evaluation—continue to hinder the scalability and sustainability of climate-justice education. Addressing these gaps is critical for embedding equity and resilience into educational systems.

Findings

From the literature review, case studies, and synthesis, several key findings emerge:

1. **Effectiveness of Participatory Approaches** – Community co-design increases relevance, engagement, and long-term sustainability of programs.
2. **Importance of Place-Based and Culturally Responsive Learning** – Curricula grounded in local context and cultural knowledge enhance learner connection, identity affirmation, and civic participation.
3. **Integration with Green Workforce Pathways** – Linking education to skill development and job opportunities strengthens economic resilience and motivation to participate.
4. **Youth Empowerment Drives Action** – Engaging youth in leadership and decision-making fosters social cohesion, advocacy skills, and tangible community interventions.
5. **Persistent Gaps in Policy and Institutional Support** – Lack of systemic support, standardized evaluation metrics, and multi-year funding limits program scaling and replicability.

Future Projections

Looking forward, several trends and potential developments are projected in the field of climate-justice education for underserved communities:

1. **Expansion of Community-Rooted Programs** – Models like CR-CJA are expected to proliferate, with greater adoption in both urban and rural underserved contexts globally.
2. **Integration with Technology and Data Skills** – GIS mapping, remote sensing, and citizen science platforms will increasingly complement participatory and place-based learning, linking climate literacy to technical competencies.
3. **Policy and Funding Alignment** – Anticipated growth in multi-year, government-supported programs and philanthropy focused on justice-centered climate education. This will include embedding climate education into formal curricula and municipal resilience strategies.
4. **Interdisciplinary and Cross-Sector Collaboration** – Partnerships between schools, NGOs, local governments, and private sector green initiatives will expand, creating holistic educational ecosystems.
5. **Longitudinal and Impact-Focused Research** – Future studies are likely to emphasize long-term outcomes, including resilience, behavioral change, and community adaptation, with standardized participatory evaluation frameworks.
6. **Global South Representation** – Greater documentation and adaptation of justice-centered education models in regions most vulnerable to climate impacts, ensuring culturally relevant and context-specific solutions.

Implications

These projections suggest that the future of climate-justice education lies at the intersection of **community participation, policy integration, and systemic support**. Programs that combine participatory pedagogy, place-

based learning, workforce development, and youth leadership will likely drive the most significant impact. Moreover, integrating evaluation frameworks and sustained funding will be essential to scale interventions while maintaining equity and relevance.

Conclusion

Education for climate justice in underserved communities must be more than climate science lessons: it needs to be co-designed, place-based, action-oriented, and linked to civic and economic pathways. Participatory implementation science and CBPR provide robust frameworks to design, adapt, and evaluate such programs. Scaling successful models requires sustained funding, teacher capacity building, and policy alignment that centers the voices and priorities of those most affected. The proposed CR-CJA model offers an actionable blueprint that communities and partners can adapt to local contexts.

Underserved communities face the compounded challenge of disproportionate climate risks and systemic barriers to quality education. This review highlights that climate-justice-centered education can play a transformative role in addressing these inequities when it is grounded in community participation, cultural responsiveness, local knowledge, and pathways to green livelihoods. By synthesizing recent literature (2018–2025), the study identifies core principles and models that not only make climate education more relevant and accessible but also enhance resilience, empowerment, and equity.

The findings underscore that effective climate-justice education must extend beyond knowledge transmission to actively challenge structural inequalities, foster youth leadership, and build collective agency for sustainable futures. Education, reframed as both a fundamental right and a tool for justice, has the potential to bridge global sustainability goals with the lived realities of marginalized populations.

For policymakers, educators, and community organizations, the implication is clear: climate education cannot be separated from questions of justice, equity, and inclusion. Scaling effective models will require long-term investment, institutional support, and cross-sector collaboration that centers the voices of those most affected by climate change.

Ultimately, sustainable futures will not emerge from technical solutions alone but from educational practices that empower underserved communities to co-create just, resilient, and context-specific pathways forward. Climate-justice education, therefore, is not merely an academic or policy agenda—it is a moral imperative and a cornerstone of equitable sustainability.

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