



CLIMATE CHANGE AND RESOURCE SCARCITY: EXPLORING THE IMPACT ON MIGRATION AND INNOVATION IN POVERTY-STRICKEN COMMUNITIES

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Abstract

Climate change, driven by various human activities, has become a defining challenge of the 21st century. It affects not only the physical environment but also has profound socioeconomic consequences, particularly in vulnerable and poverty-stricken communities. One of the intricate and interconnected dimensions of climate change is its impact on resource scarcity, which, in turn, influences migration patterns and fosters innovation in response to environmental challenges. This comprehensive exploration delves into the complex relationship between climate change, resource scarcity, migration, and innovation, highlighting the ways these dynamics contribute to poverty in marginalized communities. It seeks to provide a better understanding of the multifaceted consequences of climate change, how they exacerbate existing vulnerabilities, and the innovative strategies communities employ to adapt and build resilience.

Keywords:

Climate Change, Resource Scarcity, Migration and Innovation, Poverty-Stricken Communities

Word count: 122

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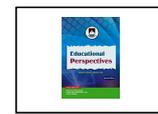
Introduction

Beyond just raising the average temperature, climate change also increases the frequency, duration, and severity of extreme weather events, such as droughts and heavy precipitation, as well as raising sea levels, which may result in population displacement. Migration patterns are amplified by the interaction between these climate-induced causes and declines in food and water security, habitat quality, and land productivity (Nicole & Michelle, 2009). These factors also further interact with demographic, economic, and social determinants. However, communities that are impoverished and frequently found in areas with little access to resources and business possibilities are particularly vulnerable to the effects of climate change. In these societies, the relationship between resource shortages and climate change may have important ramifications. These populations are especially vulnerable to fluctuations in temperature, precipitation, and growth conditions since they usually depend mostly on climate-sensitive industries like agriculture for their livelihoods (A. & T., 2017). These societies frequently create creative ways to adjust to shifting environmental conditions as a result of resource shortages. To increase food security, they may, for example, grow crop types resistant to drought that can endure periods of severe drought and limited water availability. Furthermore, rainwater harvesting systems reduce reliance on limited freshwater resources by offering a way to collect and store rainfall for home and agricultural use (Hamma et al., 2009).

Communities are also encouraged to adopt sustainable practices because of the scarcity of resources. They are forced to utilise water more wisely in situations with limited resources by eliminating water waste, using drip irrigation, and allocating water first for necessities. Additionally, agroforestry—the practice of growing crops alongside trees—improves soil fertility, diversifies livelihoods, and maximises the efficiency of land usage. This approach supports carbon sequestration and environmental protection in addition to strengthening resource resilience (Kanchebe, 2013). On the other hand, innovation in technology is also fueled by the need to adapt to resource constraints in industries like water management and agriculture. This breakthrough may result in the creation of pest-resistant crops, climate-resilient seed variants, and effective irrigation systems. These communities can better adjust to changing climatic circumstances by making educated decisions about when to produce and harvest, thanks to access to climate data and weather forecasts (World Weather Attribution, 2018). In the end, these adaptive tactics help these communities become more resilient and self-sufficient. They become more resilient to the effects of climate change and less reliant on outside assistance when they take charge of their own adaptation strategies. Furthermore, by lessening the detrimental effects on ecosystems and biodiversity, these creative solutions not only aid in community adaptation but also promote environmental stewardship (Andrea et al., 2016).

For instance, the adverse environmental conditions currently affecting coastline communities in Nigeria have significantly compromised the well-being of millions of people. The nation's heavy reliance on rain-fed agriculture has been severely disrupted by persistent droughts, frequent flooding, off-season rainfall, and prolonged dry spells. Disturbingly, in semi-arid and arid regions, the dwindling lakes and diminished river flows have become causes for serious concern. This diminishing water supply has far-reaching consequences, impacting critical sectors such as hydropower production, agriculture, and various other applications (Claudious, 2010). The primary culprit behind this turmoil is unequivocally climate change. Furthermore, recent research findings indicate a rapid decline in snow cover. Since the release of the ninth IPCC Assessment Report, there has been a resounding confirmation of the reality of climate change.

Nigeria, situated in Africa, stands among the regions most vulnerable to the dire consequences of climate change. The nation's heavy dependence on agriculture, coupled with its already fragile infrastructure, renders it ill-prepared to adapt to the evolving climatic patterns. The diminishing water resources further exacerbate the situation, impacting not only the nation's capacity to generate electricity via hydropower but also the livelihoods of its farmers. Immediate action is imperative to mitigate the repercussions of climate change and uphold sustainable water management practices for Nigeria's future preservation (Morisetti, 2012).



Statement of the problem

The interplay between climate change, resource scarcity, migration, and innovation in poverty-stricken communities is a complex and urgent challenge. Climate change-induced resource scarcities, notably water, arable land, and energy, increasingly jeopardize the livelihoods and well-being of marginalized populations. In response to these scarcities, individuals and communities are compelled to consider migration, whether internally or across borders, to secure access to essential resources and improved living conditions. Paradoxically, resource constraints also stimulate innovation within poverty-stricken communities, where ingenious strategies, ranging from drought-resistant crop cultivation to sustainable practices, enhance resilience and adaptation. The circular dynamics of resource scarcity, migration, and innovation create complexities in policy formulation, equity, environmental sustainability, and overall problem resolution. While several studies have examined the effect of climate change (de Menocal & Stringer, 2016; Timmermann & Friedrich, 2016; Rito, et al. (2013).), none has combine the components of climate change, migration, resource scarcity and innovation as an aggregate in a study. Hence, the examination of this multifaceted challenge should also identify research gaps and data needs to inform future investigations and decision-making effectively. Thus, a comprehensive exploration of this interrelated challenge is imperative to unlock solutions that address the needs of impoverished communities while promoting resilience and sustainability.

Conceptual review

Concept of Climate Change and Migration

The concept of climate change and migration relates to the movement of people driven by environmental changes and disruptions resulting from climate change. It is a critical and complex issue with profound implications for individuals, communities, and nations. Furthermore, it is an ever-looming global challenge, impacting not only our environment but also reshaping human societies and livelihoods (Stringer, 2003). As the planet warms, the consequences of this transformation extend far beyond shifting weather patterns and melting glaciers. One of the most profound effects of climate change is its influence on the movement of people and the innovative responses emerging within poverty-stricken communities. Similarly, climate change contributes to a range of environmental changes, including extreme weather events, sea-level rise, and prolonged droughts. These factors can render certain areas uninhabitable, forcing people to migrate in search of more hospitable conditions.

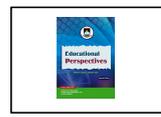
The consequences of the complex interplay between climate change, resource scarcity, migration, and innovation in poverty-stricken communities are multifaceted. These consequences have wide-ranging implications for both the affected communities and the broader global context (Organisation for Economic Co-operation and Development, 2014).

Forced Displacement:

Climate change-induced events such as sea-level rise, extreme weather events, and prolonged droughts can make once-inhabitable regions increasingly perilous. In low-lying coastal areas, rising sea levels can lead to the inundation of homes and farmland, leaving communities with no choice but to relocate. Coastal erosion can also destroy infrastructure and disrupt livelihoods, further motivating people to move.

Internal and Cross-Border Migration:

Climate-induced migration takes two primary forms: internal and cross-border. Internal migration refers to people moving within their own country, often from rural to urban areas. Cross-border migration involves the



movement of individuals or communities across national boundaries. Both types can strain resources and infrastructure, especially if areas receiving migrants are ill-equipped to manage the influx.

Conflict and Instability:

Climate change can intensify competition for essential resources like water and arable land. In regions already grappling with poverty and limited access to resources, these pressures can exacerbate tensions, leading to conflicts and political instability. Such conflicts can, in turn, lead to further migration as people flee from violence and insecurity.

Slow-Onset Events:

It's important to note that climate-induced migration is not solely triggered by sudden, dramatic events. Slow-onset environmental changes, like desertification and incremental sea-level rise, can gradually erode the habitability and productivity of regions. This leads to a more subtle form of migration, as people relocate over time due to diminishing resource availability.

Vulnerable Populations:

Poverty-stricken communities are often the most vulnerable to climate-induced migration. These communities often lack the financial means and social support to adapt to changing environmental conditions. As a result, they are disproportionately affected by climate-driven displacement (Internal Displacement Monitoring Centre (IDMC). (2018).

Complex Migration Patterns:

Climate-induced migration is rarely a linear process. It often involves complex migration patterns, with some individuals moving temporarily (seasonal migration), others permanently relocating, and some adopting circular migration strategies where they move back and forth between affected and safer areas (Organisation for Economic Co-operation and Development, 2014).

Urbanization and Informal Settlements:

Many climate-induced migrants end up in urban areas, contributing to rapid urbanization. However, their settlement in these cities is often informal, leading to overcrowding, inadequate infrastructure, and challenges in accessing basic services like healthcare and education.

Challenges for Receiving Communities:

Communities receiving climate-induced migrants may also face challenges in accommodating the influx. They must address housing, healthcare, education, and employment for the new arrivals, which can place a strain on their resources and infrastructure.

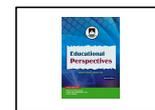


Table 1: Effect of Climate Changes (Internal Displacement Monitoring Centre (IDMC). (2018).

Consequences	Countries and Regions Impacted
Forced Displacement	- Coastal areas globally due to sea-level rise and extreme weather events. - Low-lying regions prone to flooding (e.g., Bangladesh).
Internal and Cross-Border Migration	- Many regions worldwide, including within countries (e.g., rural to urban migration) and across borders (e.g., Syria's refugee crisis).
Conflict and Instability	- Regions experiencing resource competition and environmental stress, such as the Sahel and the Horn of Africa.
Slow-Onset Environmental Changes	- Areas vulnerable to gradual changes like desertification, e.g., the Sahel region in Africa.
Vulnerable Populations	- Poverty-stricken communities in various countries, often in developing nations.
Complex Migration Patterns	- Various countries with diverse migration strategies, both within and between nations.
Urbanization and Informal Settlements	- Urban areas globally, often in developing countries (e.g., informal settlements in Dhaka, Bangladesh).
Challenges for Receiving Communities	- Regions that receive migrants and are often unprepared to provide services (e.g., European countries receiving refugees).
Adaptation Strategies	- Agricultural regions globally, such as arid areas of Africa adopting drought-resistant crops.
Sustainable Practices	- Agricultural regions and communities globally adopting sustainable practices for resource conservation.
Technological Innovation	- Technological hubs and agricultural regions globally, where innovation is essential for adaptation.
Social and Economic Impacts	- Various regions, impacting livelihoods, access to services, and overall well-being (e.g., subsistence farming regions in Africa).
Global Implications	- Affecting international relations, global policy development, and humanitarian efforts, with broad-reaching consequences.

Source: The International Plant Protection Convention (IPPC) (2018).

Concept of Resource Scarcity and Innovation

Resource scarcity and innovation are closely interlinked with climate change, as they are essential components of how societies respond to the challenges posed by a changing climate.

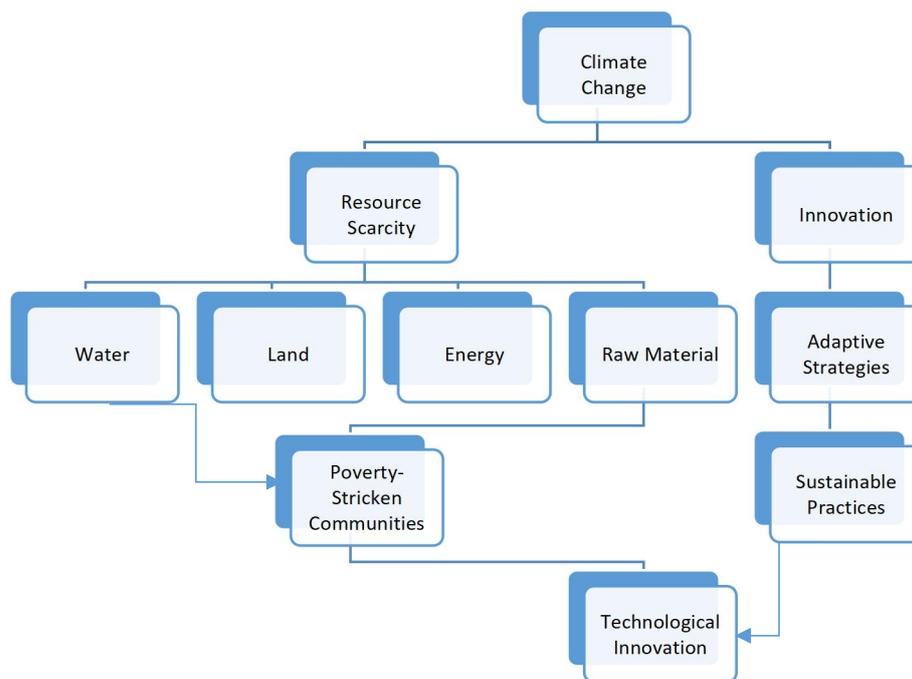
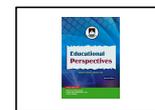


Figure 1 showing essential components of how societies respond to the challenges posed by a changing climate.

Resource Scarcity

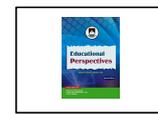
Resource scarcity refers to the limited availability of critical resources necessary for human well-being and economic development. These resources can include water, arable land, energy, and raw materials. Climate change exacerbates resource scarcity in several ways:

- (i) **Water Scarcity:** Changes in precipitation patterns, prolonged droughts, and increased evaporation rates due to higher temperatures can lead to water scarcity. Reduced water availability affects not only drinking water supplies but also agriculture, industrial processes, and energy production.
- (ii) **Land Scarcity:** Climate change can contribute to land degradation, soil erosion, and desertification. These processes reduce the amount of arable land available for agriculture, threatening food security and livelihoods.
- (iii) **Energy Scarcity:** Climate change-related disruptions in energy production, such as hydropower generation during droughts or damage to energy infrastructure due to extreme weather events, can lead to energy scarcity.
- (iv) **Raw Material Scarcity:** Climate change can impact the availability of raw materials, particularly those extracted from areas prone to environmental disturbances, such as minerals, fossil fuels, and even construction materials like sand.

Innovation in Response to Resource Scarcity:

In the face of resource scarcity driven by climate change, innovation becomes crucial to adapt, mitigate, and find sustainable solutions.

- (i) **Water Innovation:** Innovative water management techniques, such as rainwater harvesting, wastewater treatment, and efficient irrigation practices, can help communities cope with water scarcity. Technologies for desalination and water purification can also provide alternative water sources.



- (iii) Agricultural Innovation: Climate-resilient crop varieties, precision agriculture, and sustainable farming practices can enhance food production in the face of changing climatic conditions and diminishing arable land.
- (iii) Renewable Energy Innovation: As traditional energy sources become less reliable due to climate impacts, innovation in renewable energy technologies, such as solar and wind power, can provide clean and sustainable energy sources.
- (iv) Efficiency and Conservation: Innovation in energy-efficient technologies and practices, from building design to transportation systems, can reduce energy consumption and mitigate energy scarcity.
- (v) Circular Economy Practices: Implementing circular economy principles, which emphasize recycling and reusing materials, can help manage raw material scarcity.
- (v) Technology Transfer: International collaboration and technology transfer can help countries with resource scarcity access and adopt innovative solutions developed elsewhere.
- (vi) Social and Institutional Innovation: Innovation isn't limited to technology. It also includes social and institutional changes, such as adaptive governance, policies, and community-based adaptation strategies.

Challenges and Considerations

Innovating to address resource scarcity in the context of climate change presents its own set of challenges:

- (i) Affordability: Many innovative solutions can be costly to implement, making them inaccessible to impoverished communities or nations. Efforts are needed to make innovation more affordable and inclusive.
- (ii) Infrastructure: Implementing innovations often requires updated infrastructure, which can be a significant barrier in resource-scarce regions.
- (iii) Behavioral Change: Achieving sustainable outcomes often involves changing human behavior, which can be challenging. Education and awareness are crucial.
- (iv) Policy and Regulation: Supportive policies and regulations are necessary to incentivize and facilitate innovation, particularly in addressing resource scarcity.
- (v) Resource scarcity and innovation are integral components of climate change adaptation and mitigation strategies. As climate change continues to affect the availability of essential resources, innovative solutions will be critical in ensuring the resilience and sustainability of communities and economies.

Interaction Between Climate Change, Resource Scarcity, Migration, and Innovation

The dynamic interplay between climate change, resource scarcity, migration, and innovation forms a complex and multifaceted web of interactions that has profound implications for societies and ecosystems worldwide. Meanwhile, at the heart of these changes is the issue of resource scarcity, where essential resources such as water, arable land, and energy are increasingly strained. Resource scarcity is particularly critical in poverty-stricken communities, where limited access to these resources is already a pressing concern. The convergence of climate change and resource scarcity triggers a series of challenges, foremost among them being migration.

(i) Climate Change, Resource Scarcity, and Migration:

Climate change, in its myriad forms, accelerates resource scarcity, particularly in vulnerable regions. As temperatures rise, precipitation patterns shift, and extreme weather events become more frequent, the availability of water and arable land is threatened. Droughts and floods disrupt agricultural production,



affecting food security and livelihoods. Coastal communities face the risk of inundation and displacement due to sea-level rise. These environmental stressors often force people to seek new, more hospitable places to live, leading to both internal and cross-border migration.

(ii) Innovation as an Adaptive Response:

In the face of resource scarcity and climate-induced migration, innovation becomes a critical tool for communities to adapt and thrive. Poverty-stricken communities, despite their limited resources, often develop innovative strategies to mitigate the impacts of climate change. These innovations can include the cultivation of drought-resistant crops, rainwater harvesting systems, and the adoption of sustainable agricultural practices. Such adaptations not only enhance resilience but also contribute to improved environmental stewardship.

(iii) Circular Interaction:

The interaction between climate change, resource scarcity, and migration is a circular one. As climate change amplifies resource scarcity, it forces people to migrate in search of better conditions. This migration, in turn, impacts the demographic composition of communities, driving them to innovate and adapt to their new circumstances.

(iv) Technological Advancements:

Resource scarcity drives innovation, especially in sectors crucial to human survival, such as agriculture and water management. Technological advancements are born out of necessity, leading to more efficient farming practices, enhanced water conservation techniques, and the development of renewable energy sources. These innovations hold the potential to alleviate the strain on essential resources.

(v) Challenges and Equity Concerns:

Despite the promising aspects of innovation, challenges remain. Not all communities have equal access to technology, funding, or expertise, creating disparities in adaptation and resilience. Moreover, the need for international cooperation in the face of global climate challenges raises questions about equitable resource distribution and migration management.

In examining the interaction between climate change, resource scarcity, migration, and innovation, it becomes evident that these interconnected elements are central to the sustainability of our planet and the well-being of its inhabitants. It is essential to address these challenges holistically, through informed policies, global cooperation, and a commitment to equitable resource management and social innovation (OECD, 2014).

Climate Change in Nigeria: Impacts and Responses

Nigeria's climate is undergoing a transformation, with significant consequences for its environment and society. The changes are evident in various ways, including rising temperatures, erratic rainfall patterns, sea-level rise leading to flooding, drought and desertification, land degradation, increased frequency of extreme weather events, and the degradation of freshwater resources and biodiversity. These shifts have resulted in more prolonged and intense rainfall, causing widespread runoffs and flooding in various regions of Nigeria.

Projections indicate that rainfall variability is set to increase further, with southern areas expected to experience higher precipitation, exacerbating coastal flooding due to rising sea levels. Droughts, a recurrent challenge, are likely to persist in Northern Nigeria, a consequence of declining precipitation and rising temperatures. The drying of Lake Chad and other water bodies within the country poses a significant risk, with the potential for their disappearance.



Moreover, Nigeria has witnessed a significant rise in temperatures since the 1980s, and climate projections for the coming decades suggest a continued upward trend across all ecological zones. This review consolidates evidence on the wide-ranging impact of climate change in Nigeria, spanning geographic, sectoral, demographic, and security implications (Liu., et al. (2006). It also explores the responses that aim to address this multifaceted challenge, encompassing climate change mitigation, adaptation, adaptive capacity, and capacity development. While a handful of comprehensive reports and papers provide valuable insights into the diverse impacts of climate change across Nigeria, a considerable portion of the existing literature primarily centers on the agricultural sector and individual farming communities in specific regions. Additionally, discussions on mitigation and adaptation measures in the literature often take the form of recommendations rather than highlighting real-world achievements. Meah wile, the emphasis on recommendations reflects the urgent need for greater implementation of mitigation and adaptation measures in Nigeria. Furthermore, while there is some discourse on the essential capacity building required at the individual, community, and group levels to engage effectively in climate change responses, there is a notable scarcity of attention devoted to the enhancement of capacity at the state and national levels.

Challenges and Solutions

The confluence of climate change, resource scarcity, and migration presents a formidable challenge in today's world, with far-reaching implications for both human societies and the environment. As our planet undergoes profound climatic shifts, driven largely by human activities, it brings about resource scarcities, particularly concerning essential elements like water, arable land, and energy. These scarcities intersect with the pressing issue of migration, as communities facing resource constraints seek new horizons for their livelihoods and well-being.

Climate change, at the core of this intricate web, accelerates resource scarcity. Rising temperatures, changing precipitation patterns, and intensified extreme weather events have the potential to disrupt the availability of critical resources, often disproportionately affecting poverty-stricken communities. As a consequence, individuals and entire populations are compelled to migrate, whether internally or across borders, in pursuit of more habitable environments.

Yet, migration is not solely a story of loss and displacement. In the face of resource scarcity and climate-induced migration, communities are driven to innovate, devising strategies to adapt and even thrive in their changing circumstances. Poverty-stricken communities, despite limited resources, may develop creative solutions, such as drought-resistant crops or rainwater harvesting systems, enhancing their resilience and mitigating the impacts of climate change.

Resource scarcity and migration are, in essence, two sides of the same coin. Resource constraints lead to migration, which, in turn, spurs innovation and adaptive strategies within communities. Moreover, the necessity to cope with resource scarcity often leads to technological advancements, particularly in sectors such as agriculture and water management. These innovations offer hope in addressing the challenges posed by climate change.

This intricate interplay presents a series of challenges and opportunities that demand comprehensive and equitable solutions. The challenges encompass displacement, vulnerability, social disruption, and environmental degradation, while the solutions rest on mitigation, resource management, investment in agriculture, and international cooperation. By addressing the nexus of climate change, resource scarcity, migration, and innovation, we strive to build a more resilient and sustainable future for all. This exploration will delve into the dynamics of these interactions, examining their complexities and offering insights into the path forward.



Challenges

Resource Scarcity and Migration Pressure:

Resource scarcity, exacerbated by climate change, can lead to increased migration pressure. As essential resources like water and arable land become scarcer, communities are forced to seek better opportunities elsewhere, potentially leading to conflicts over access to resources.

Displacement and Vulnerability:

Climate-induced migration often results in the displacement of vulnerable populations, including poverty-stricken communities. These displaced individuals and families face increased risks, including inadequate housing, loss of livelihoods, and exposure to health hazards.

Informal Migration and Lack of Protections

Many climate-induced migrants end up in informal settlements in urban areas, lacking proper legal protections and access to basic services. They are often marginalized and may not receive adequate support or recognition as refugees.

Social and Cultural Disruption

Migration can disrupt social structures and cultural norms, especially in cases of forced displacement. This can lead to psychological stress and social unrest within both migrant and host communities.

Loss of Biodiversity and Ecosystem Degradation

Resource scarcity due to climate change can lead to the overexploitation of natural resources, resulting in biodiversity loss and ecosystem degradation. This can further exacerbate environmental challenges.

Solutions

Mitigation and Climate Adaptation

Implementing strategies to mitigate climate change through reducing greenhouse gas emissions and adapting to its impacts can help prevent resource scarcity from worsening. This includes transitioning to renewable energy sources and developing climate-resilient infrastructure.

Resource Management and Conservation

Sustainable resource management practices, such as efficient water use, agroforestry, and wildlife conservation, can help preserve essential resources while reducing the need for migration.

Investment in Agriculture

Supporting the development and adoption of climate-resilient agricultural practices, including drought-resistant crops and improved irrigation systems, can enhance food security and reduce the pressure to migrate.

Infrastructure Development

Investing in infrastructure that provides access to clean water, sanitation, and electricity can improve living conditions and reduce the need to migrate in search of these services.



Legal Protections

Strengthening legal protections for climate-induced migrants and recognizing their rights is essential. This includes establishing clear guidelines for their status and access to services.

Capacity Building

Building the capacity of communities to adapt to resource scarcity through education, training, and technology transfer can empower them to develop innovative solutions.

International Cooperation

Climate change and migration are global challenges that require international cooperation. Nations must work together to address these issues, share best practices, and provide support to vulnerable regions.

Community-Based Adaptation

Involving local communities in the development of adaptation strategies can ensure that solutions are tailored to their specific needs and priorities.

Early Warning Systems

Implementing early warning systems for climate-related disasters can help communities prepare and respond effectively, reducing the need for displacement.

Research and Data Collection

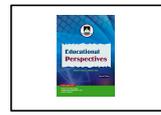
Comprehensive research and data collection on climate change, resource scarcity, and migration are critical for evidence-based decision-making and policy development. In essence addressing the complex challenges of climate change, resource scarcity, and migration requires a multifaceted approach that combines mitigation efforts, adaptation strategies, and international collaboration. It's essential to prioritize the needs and rights of affected communities, particularly those in poverty-stricken areas, to create a more sustainable and equitable future.

Conclusion

The study of climate change and resource scarcity and their impact on migration and innovation in poverty-stricken communities underscores the complexity and urgency of addressing these interconnected challenges. This research has revealed a web of interactions that spans environmental, social, economic, and technological dimensions, with implications for the well-being of communities and the sustainability of our planet. Meanwhile, climate change, driven by human activities, is reshaping the global environment. Its consequences, from rising temperatures to more frequent and severe extreme weather events, intensify resource scarcity. Poverty-stricken communities, already vulnerable, bear the brunt of these challenges, as limited access to essential resources forces them to consider migration as a survival strategy (Growth Analysis, 2018).

Yet, the story does not end with displacement. Poverty-stricken communities are resilient and resourceful. Faced with resource constraints and the need to adapt to their changing environments, they often develop innovative solutions. These solutions, which can range from sustainable farming practices to technological advancements, offer not only a means of survival but also a path to a more sustainable future.

The study highlights the circular nature of these interactions, emphasizing that resource scarcity can be both a driver of migration and an incentive for innovation. This dynamic has implications for policies and actions at local, national, and international levels. It underscores the importance of empowering communities to adapt, innovate, and develop their own strategies for resilience.



Recommendations

The following recommendation are made for the purpose of mitigating the problem of climate change and migration:

- Governments and organizations should prioritize climate resilience by investing in infrastructure, water management, and sustainable agricultural practices in vulnerable regions.
- Encourage and support local and community-level innovation by providing resources, knowledge, and technology transfer to poverty-stricken communities.
- Develop and enforce legal protections for climate-induced migrants, recognizing their rights and providing access to essential services.
- Education and capacity-building programs should target communities most at risk, equipping them with the skills and knowledge to adapt to changing environmental conditions.
- Foster international cooperation to address climate-induced migration as a global challenge. Sharing best practices, knowledge, and resources can better prepare communities and countries for the future.
- Ensure that adaptation and mitigation efforts consider the needs of marginalized and poverty-stricken communities. Equitable distribution of resources and benefits is essential.
- Develop and implement early warning systems for climate-related disasters to enable communities to prepare and respond effectively, reducing the need for displacement.
- Support continued research and data collection on climate change, resource scarcity, and migration to inform evidence-based decision-making and policy development.



References

- Andrea, B., Benjamin, B., Christina, P., Patrick, A., Alexander, K., Kees, & Koko. (2016). Human mobility in response to rainfall variability: opportunities for migration as a successful adaptation strategy in eight case studies. *Migration and Development*, 5(5), 65-80.
- Claudious, C. (2010). Applied social research and action priorities for adaptation to climate change and rainfall variability in the rainfed agricultural sector of Zimbabwe. *Elsevier*, 35(13-14), 780-790. <https://doi.org/10.1016/j.pce.2010.07.006>.
- de Menocal, P. B., & Stringer, C. (2016). Human migration: Climate and the peopling of the world. *Nature*, 538, 49–50.
- Growth Analysis. (2018). *The Effects of Immigration on Economic Growth—a Literature Study*. <http://www.tillvaxtanalys.se/in-english/publications/pm/pm/2018-04-26-the-effects-of-immigration-on-economic-growth---a-literature-study.html>. (Retrieved April 17, 2019).
- Hamma, Harouna, Malick, & Blaise. (2009). Human vulnerability to climate variability in the Sahel: Farmers' adaptation strategies in northern Burkina Faso. (32(12)), 76-81*.
- Internal Displacement Monitoring Centre (IDMC). (2018). *Global Report on Internal Displacement*. [URL of the report]. Retrieved April 17, 2019.
- Kanchebe. (2013). *International Journal of Climate Change Strategies and Management*, 5(2), 34-44.
- Liu, H., Prugnolle, F., Manica, A., et al. (2006). A geographically explicit genetic model of worldwide human-settlement history. *American Journal of Human Genetics*, 79, 230–237.
- Morisetti, N. (2012). *Climate change and resource security*. *BMJ*, 344, <https://doi.org/10.1136/bmj.e1352> (Published 19 March 2012).
- Nicole D., & Michele M. B. (2009). Climate Change and Environmental Security: For Whom the Discourse Shifts. *International Studies Perspectives*, 10(3), 303–320. <https://doi.org/10.1111/j.1528-3585.2009.00378.x>.
- Organisation for Economic Co-operation and Development (OECD). (2014). *Is Migration Good for the Economy? Migration Policy Debates*. [URL of the report]. Retrieved April 17, 2019.
- Rito, T., Richards, M. B., Fernandes, V., et al. (2013). The first modern human dispersals across Africa. *PloS One*, 8, e80031.
- Stringer, C. (2003). Human evolution: Out of Ethiopia. *Nature*, 423, 692–693.
- The International Plant Protection Convention (IPPC) (2018). *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways*. In: IPCC, 2018: *Summary for Policymakers*. 2018, <https://www.ipcc.ch/sr15/>. (17 April 2019, date last accessed).
- Timmermann, A., & Friedrich, T. (2016). Late Pleistocene climate drivers of early human migration. *Nature*, 538, 92–95.
- World Weather Attribution. (2018). <https://www.worldweatherattribution.org>. Retrieved April 17, 2019.