

Review Article

The Legacy of Internal Migration in Our Environment: Understanding Its Footprint and Fingerprint

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Abstract

Internal migration is a process of relocation within a country by a person primarily to find a better prospect, education, or in response to natural calamities. Researching internal migration must be given attention to comprehend demographic movements and how they affect places where migration takes place and where it is received. This study sheds light on the very complicated relationship between internal migration and environmental effects. This paper lays out the systematic literature reviews by descriptively analyzing the causes of internal migration: economic opportunity, social bonds, and the environment. This paper explores the effect of internal migration on the environment, including the positive aspects (e.g. knowledge transfer, investment in green technology) and the negative ones (urban sprawl, increased consumption). The study of footprints and fingerprints and their effects on environmentalism is complex and at the same time contradictory. This study also focuses on policy responses and mitigation options, stating that there is a need for a holistic strategy that will meet the special demands of internal migrants and help them to be integrated into society. It will also promote sustainable development. The study makes valuable recommendations for drawing up sustainable development strategies that consider the link between internal migration and environmental well-being.

Keywords

Internal Migration, Environmental Sustainability, Policy and Mitigation, Migration Drivers, Environmental Impacts

1. Introduction

Migration is the act of moving from one place in a country to another, either short-term or long-term, to improve living conditions. The fact that the interest of scholars in the study of migration and distance can be linked to Ravenstein's [1] discovery that most migrants do not travel a long distance has been there. Internal migration is defined by Ravenstein's rule, which states that most people move within their own country's borders to other towns for various reasons, including better economic opportunities and quality of life [2, 3]. Intra-migration is a complex and intricate process that occurs

when people move from one region of a country to another and settle down in a different place. The other part of the argument is environmental sustainability, one of the basic notions of modern society that emphasizes the necessity to use the resources of the planet wisely without consuming the opportunities of future generations [4].

Environmental sustainability and internal migration are two issues that are largely regarded as important problems of the present. This interconnection is critical for academics, global citizens, and politicians alike. A lack of environmental sus-

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tainability, which exacerbates urbanization and is mostly caused by internal migration, increasing energy consumption, and pollution [5, 6], is a widespread occurrence. Similarly, it threatens biodiversity and ecosystem services by causing habitat loss and deforestation [7]. It should be emphasized that this link is bidirectional, and intra-urban migration may promote urban growth. The three key factors of environmental sustainability through internal migration are the government's role, the social economy, and ecological aspects [8]. As a result, it is worth noting that the process of building long-lasting and just communities for the present and future generations takes into account this complex dynamic.

Although research on global migration usually focuses on international migration, the volume of internal migration (which is usually larger than international flows) requires the environmental outcomes' intricate linkage to be studied in depth. This study brings efforts to the forefront by exposing this critical yet underexplored subject, which focuses on the complicated relationship between migration patterns, footprints, fingerprints, and their motivations. This study begins by describing the context in which the migration phenomenon occurs, emphasizing that individuals move internally in significant numbers for a variety of reasons, including rural poverty, resource scarcity, and sociopolitical instability [9]. This establishes the context for the issue statement: knowledge gaps on how internal migrations occur and the impacts that migrants have on sustainability. The lack of connection between these two realms is a major reason why this research is vital, as it allows one to see the deep interconnectedness between the two regions. This assessment will assist in identifying the overall environmental implications of internal migration, as well as evidence-based policy interventions that reduce the negative effects and use migration's potential to promote environmental sustainability. Finally, this

study aims to leave a permanent "fingerprint" on our understanding of complicated phenomena, pointing us toward a future in which human mobility and environmental health live together.

2. Methodology

A thorough literature search was undertaken using PubMed, Web of Science, Scopus, and Google Scholar for articles published between 2000 and 2024. Some articles published before 2000 were included for theoretical background. Search phrases included "internal migration," "environmental impact," and "sustainability." Titles and abstracts were evaluated for relevance, followed by full-text evaluations of peer-reviewed studies that addressed internal migration's environmental implications. Studies concentrating exclusively on international migration or missing environmental issues were eliminated. The quality of the selected articles was appraised, and essential information was carefully collected.

3. Drivers of Internal Migration

Internal migration is the movement of individuals within a country's boundaries. This phenomenon has a significant influence on countries' internal changes. Economic opportunities, social relationships, and environmental variables all have an impact on the patterns and consequences of human mobility. On a wide scale, economic factors such as industrialization operate as enticing forces, drawing people into cities by providing job opportunities and better living circumstances [10, 11].

Table 1. Migration Driver Taxonomy.

Driver dimensions	Driving factors
Demographic	Population dynamics Family size and structure
Economic	Economic and business conditions Labor markets and employment Urban/rural development and Living standards Poverty and inequality
Environmental	Climate change and environmental conditions Natural disasters and environmental shocks
Human development	Education Services and training opportunities Health services and Situation

Driver dimensions	Driving factors
Individual	Personal resources and migration experience Migrant aspirations and attitudes Public infrastructure, services, and provisions
Politico-institutional	Migration governance and infrastructure Migration policy and other public policies Civil and political rights
Security	Conflict, war, and Violence Political situation, repression, and regime transitions Migrant communities and networks
Sociocultural	Cultural norms and ties Gender relations Globalization and (Post) colonialism
Supranational	Transnational ties International relations and geopolitical transformations

Conventional economic models, such as Lewis [12] and Harris and Todaro [13], highlight the importance of regional wage and opportunity inequalities as the main drivers of migration. Nevertheless, the narrative does not conclude at that point. When we examine things on a very small scale, we see a diverse range of individual impulses that influence people in various ways. Career, education, and family decisions are influential factors in the lives of women in Bangladesh, with marriage being a significant aspect [14, 15]. Age can impact your priorities. Young people tend to prioritize jobs and education [16], but older individuals may prioritize housing and being close to family [17]. Traditional mobility theories suggest that housing and neighborhood considerations have a greater impact on shorter-distance relocations, while long-distance migrations are usually motivated by economic opportunities [18, 19]. Environmental considerations contribute an additional level of intricacy. Natural calamities like cyclones and floods can function as potent impelling pressures, causing the displacement of individuals from their residences and means of sustenance [20]. Climate change is projected to have a growing impact on internal migration in the future. In general, the pursuit of a better life is the main factor weaving all the aspects of these complicated threads together. The need for self-improvement, driven by economic aspirations, educational motives, and the necessity to secure one's life, discourages people from staying in their usual surroundings to look for better opportunities, regardless of the difficulties they may face [21]. When individuals and families contemplate migration, they engage in intricate decision-making processes that involve weighing the pros and cons of both economic and non-economic factors [22]. While

all of these factors can be classified into the five main categories identified by Green [23]—demographics, macroeconomics, technology, and societal issues—a more comprehensive breakdown of migration drivers can be found in Table 1 [24]. Internal migration has repercussions. Urbanization can alter the physical layout of cities, put pressure on existing infrastructure and resources, and exhaust rural populations. However, it has the potential to generate economic growth, initiate societal revolutions, and promote personal empowerment. Policymakers and communities must gain a thorough knowledge of the complex network of forces influencing internal migration. This knowledge helps them to develop effective tactics that reduce the negative consequences while maximizing the positive results of this powerful force of change.

4. The Impacts of Internal Migration on the Environment

4.1. Footprints

Internal migration poses significant environmental challenges, mainly due to urban expansion, increased resource usage, and associated traffic congestion. The influx of migrants into cities causes urban regions to grow, resulting in the loss of rural land, farms, and open spaces. This exacerbates the loss of natural habitats, produces significant traffic congestion, and adds to environmental degradation [25, 26]. Urban centers have issues fulfilling the growing demand for water, electricity, and housing, which may lead to shortages

and environmental stress [27]. Heavy traffic in cities not only affects efficiency but also contributes to air pollution and greenhouse gas emissions due to increased fuel consumption [28, 29]. As people grow in density, so does the amount of rubbish created, putting pressure on waste management systems and potentially causing environmental harm if not managed effectively [30]. Internal migration within Sub-Saharan Africa, notably in Tanzania, has serious environmental implications, including deforestation, overgrazing, and violence [31]. This process occurs as people move from rural to urban regions, altering patterns of land use and coverage [32]. Deforestation and land degradation occur as a result of infrastructure development and increased housing demand [33]. According to Jahan [34], the scarcity of housing in Dhaka is an important concern due to the city's rapid population growth. As a result, slums and squatter colonies have emerged across Dhaka. There are 4966 slums in Dhaka alone, which house about 3.4 million people. Urbanization has increased the burden on natural resources and infrastructure, thereby compromising biodiversity and agricultural productivity. Furthermore, moving to locations prone to natural disasters may exacerbate environmental dangers and increase vulnerability to climate change's consequences. Furthermore, the process of integrating and resettling displaced humans and eco-migrants may present issues, putting additional strain on the environment and resources in host communities [33]. Internal migration has a detrimental environmental impact that goes beyond deforestation and land degradation. Urbanization, which is strongly tied to migration, can result in high traffic volumes, insufficient utility services, and garbage accumulation, all of which can be detrimental to the environment [35]. The increased demand for water in cities may lead to overexploitation of local water resources such as rivers and aquifers [36]. Zhang and Li [37] demonstrate that population shifts and land-use changes lead to soil erosion. Even though cities only account for a small fraction of the planet, urbanization increases per capita demand, which has a significant impact on the environment. This is mostly due to urban growth caused by internal migration [38]. The environmental effects discussed are complex and depend on a variety of factors, including economics, politics, society, and demography [39]. Research has shown that there are unfavorable links between internal migration and environmental circumstances. For example, air quality in China has declined [40], as have specific pollutants such as CO₂ [41]. Gaining a complete understanding of the varied and nuanced implications is critical for developing effective policies and strategies to address the environmental concerns associated with internal migration.

4.2. Fingerprints

While internal migration is typically considered in terms of its negative effects on destination areas, certain positive features may benefit origin locales, mostly owing to a shift in

attitudes toward destination cities. Increased investment in green technologies is one reason. Expanding cities frequently prioritize renewable energy sources and energy-efficient structures, as shown in China, where environmental legislation, green financing, and investment in green technology have all advanced significantly [42]. Seeing concerns and solutions in urban areas may motivate environmental participation and a desire to make similar improvements at home [43]. Returning migrants to their villages allows them to apply the information and skills they learned in cities, encouraging innovation and supporting the adoption of more environmentally friendly approaches in rural areas [44]. Urban lifestyles typically emphasize smaller living spaces, public transportation, and energy efficiency; when migrants return to their home communities, they may adopt these sustainable practices, influencing local norms and behaviors and contributing to a gradual cultural shift towards a more environmentally conscious way of life [45]. Migration can also increase rural communities' representation in government and decision-making processes, giving rural voices a stronger platform to advocate for environmental protection policies and ensure that their concerns are addressed in urban development plans [46]. The inclusion of environmental factors into urban design and administration is crucial to meeting migrants' demands while also achieving sustainable development [47, 45]. Furthermore, rural-to-urban migration may help conserve biodiversity by concentrating human populations in cities and minimizing encroachment and habitat loss in fragile ecosystems such as mountainous areas [48]. Transitioning to sustainable lifestyles is another potential benefit, as developed cities frequently promote public transportation, smaller living spaces, and energy-efficient infrastructure, all of which can be adopted by those returning to their hometowns, fostering a more environmentally conscious approach [49]. Furthermore, migrants choose environmentally friendly places with lower pollution, more urban green space, and a pleasant climate, all of which contribute to a healthier and more sustainable urban environment [50]. Reduced deforestation is another potential benefit of people relocating for alternative livelihoods and housing, reducing pressure on rural forests for resources and improving overall environmental well-being [51]. Finally, internal migration usually results in urbanization, which, with proper planning, may promote long-term growth. Compact towns with efficient land use and transportation networks limit sprawl and its negative environmental consequences; nonetheless, air pollution and heat island effects must be addressed [49]. Furthermore, focusing on resource conservation through measures such as UNESCO's historic Urban Landscape Recommendation can contribute to the country's sustainable urbanization. Internal migration can improve access to healthcare, education, and public transportation in rural areas by concentrating resources in cities, which may be more effective and efficient in providing these services than smaller, dispersed populations [52]. In conclusion, the impacts of

internal migration on origin areas are not entirely negative. Rethinking attitudes toward destination cities can have positive environmental, social, and economic consequences for places experiencing population exodus.

5. Interaction of Footprints and Fingerprints for Environmental Sustainability

The intricate and diverse relationship between internal migration and environmental sustainability (Figure 1) necessitates a more detailed investigation. Internal migration, which includes both in-migration and out-migration within a country, has a significant impact on the natural environment. The risk varies depending on a variety of factors, including the quantity and direction of migration, the characteristics of the migrants, and the environmental conditions in the impacted areas [53]. Balcar and Šulák [54] suggest that out-migration from rural regions can benefit the environment. Climate change, for example, can reduce pressure on natural resources and ecosystems in rural areas, which are frequently overexploited due to high population density and limited economic opportunities [51], as well as reduce strain on local resources, pollution levels, and deforestation, all of which contribute to the larger goal of environmental sustainability [55]. Out-migration can also help to reduce greenhouse gas emissions because urban areas have more efficient public transportation systems and lower per capita energy consumption than rural areas [56, 47], as well as opportunities for environmental restoration and natural habitat preservation, which reduce fragmentation and promote conservation. However, the environmental advantages of outmigration are balanced by a variety of drawbacks. This includes reduced agricultural activity [57], which can have an impact on food production and rural economies; decreased overall economic activity in rural areas [58]; social disruption within communities left behind [59]; diminished cultural heritage as traditions is impacted; and property and land neglect, resulting in declining functionality in these regions [60]. In contrast, in-migration, or when people move to cities, has its own set of environmental consequences. This can lead to urban regeneration, greater demand for eco-friendly behaviors, and investment in sustainable infrastructure and green technologies, all of which contribute to a move toward more environmentally sustainable lifestyles [61, 62]. The advent of new residents can start a revolution in metropolitan areas, driving a change toward environmentally conscious activities and sustainable living habits. Nonetheless, in-migration raises a number of issues, including urban sprawl, increased pollution and waste generation, traffic congestion, increased resource consumption, deforestation, land degradation, biodiversity loss, water scarcity, and decreased agricultural land availability [63]. These negative consequences can stress the ecosystem and stymie efforts toward sustainability. A diverse

strategy is required to manage and reduce these negative repercussions while maximizing favorable outcomes. Regulatory measures are critical for controlling land use, development, and resource management in order to manage shifts in land resource usage and ensure the land market's civilized operation [64]. Economic incentives can help firms and individuals adopt environmentally friendly practices. Environmental incentives have a positive relationship with green responsiveness and environmental performance, and green responsiveness serves as a mediator [65]. Community participation is critical for promoting collaboration and raising public awareness. Urban and rural development planning must strike a sustainable balance between expansion and environmental protection. Furthermore, education and awareness activities help to promote environmentally responsible attitudes and practices among the general population.

The history of the Belo Monte Dam in the Brazilian Amazon exemplifies the intricate interplay of internal migration, major infrastructure development, and environmental sustainability. The dam, one of the world's major hydroelectric dams, was meant to make a significant contribution to Brazil's energy expansion strategy. It had an installed capacity of approximately 11,233 megawatts [66]. Nonetheless, the project produced a variety of outcomes, including a complex mix of benefits and drawbacks. Floods forced indigenous and local communities to leave their ancestral lands, resulting in internal movement patterns [67]. Concurrently, there was a considerable rise in economic migration as individuals from various locations traveled to pursue work connected to the dam's construction and operation [68]. Dams can boost economic development and electricity generation. However, they can cause deforestation, human dislocation, and environmental damage. These negative impacts raise questions about the region's long-term environmental sustainability [69]. The Amazon's capacity to operate as a carbon sink was reduced due to ecological effects such as the depletion of rainforest regions, changes to adjoining ecosystems, and increasing levels of CO₂ in the atmosphere [70]. Forced migration causes urbanization, which strains infrastructure and essential services, worsening environmental issues [71]. Although the Brazilian government and dam builders have attempted to alleviate the situation, there are ongoing debates over the efficacy of actions implemented to address the complex socio-environmental consequences [72].

Gaining a thorough knowledge of the complicated link between internal migration and environmental sustainability is critical for creating a more ecologically responsible future. Implementing appropriate rules and boosting public awareness can help to ensure that the favorable and adverse impacts of both emigration and immigration on the environment balance out. This is critical for the long-term health and sustainability of our environment.

6. Policy Responses and Mitigation Strategies

Internal migration may negatively influence a country's demographic balance; hence, it is vital to establish policies that support sustainable growth while allowing individuals to remain in their existing areas [73].

Furthermore, policy responses and mitigation measures must account for variables such as resource depletion and climatic catastrophes when addressing the demands and problems of internal migrants [74]. To address the root causes of migration, it is vital to employ sustainable development techniques such as improved land management, early warning systems, and renewable energy sources. It is feasible to boost community flexibility and reduce migration pressure by providing them with access to cash, education, and skills training. Furthermore, to guarantee safe and systematic migration, it is critical to establish clear legal mechanisms, promote social integration in host communities, and use remittances to fund development projects in the countries of origin. Zambia's National Migration Policy aims to facilitate and monitor internal migration, with a focus on migration data management [75].

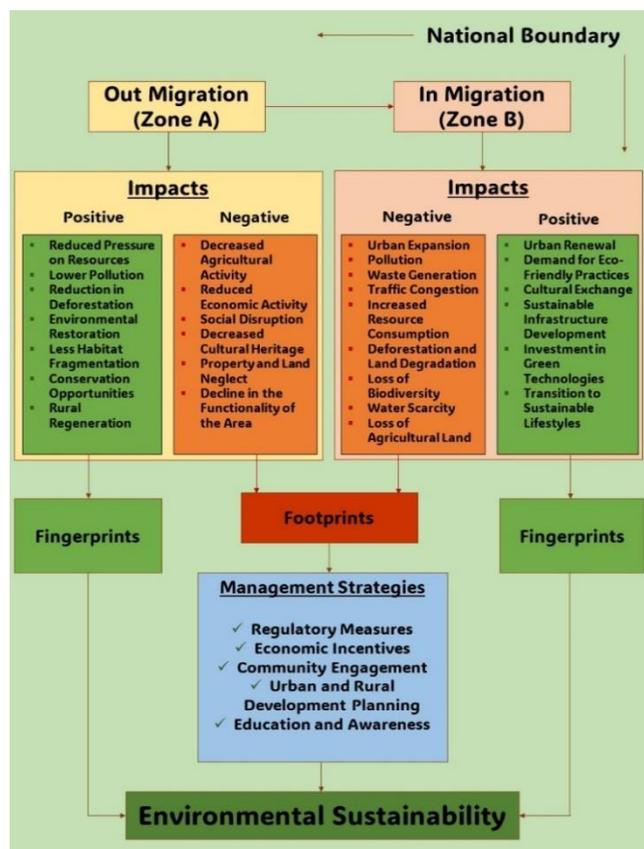


Figure 1. Conceptual framework for understanding the relationship between internal migration impacts and environmental sustainability.

Examining internal migration in isolation from international migration frequently results in a dearth of correlation between the two domains of policy formulation and scholarly inquiry [74]. The exclusion of marginalized communities, including internal labor migrants in India, from social and development policies underscores the necessity for a more comprehensive approach to policy formulation [76]. Preventing, regulating, managing, and attending to the healthcare requirements of migrants are aspects of displacement that ought to be anticipated and addressed by policies in response to climate change [33]. Incorporating internal migration into the government's development framework and guaranteeing equitable preparation and adaptation to the surge in migration in Bangladesh necessitates the use of a rights-based approach [77].

Internal migration dynamics in Bangladesh are characterized by certain cities experiencing high rates of inbound migration and districts in the north and south experiencing high rates of outbound migration; net migration is influenced by activity rate, municipal cooperation, and poverty rate. Migrant destinations are predominantly urbanized and developed areas, which necessitates careful consideration in policy formulation. In certain communities, comprehensive urban planning and the decentralization of institutions are required to prevent excessive population growth. It is advisable to prioritize development and concentration in rural regions while also ensuring that migrants have access to employment, education, and training opportunities in their countries of origin [14]. Bangladesh's current policies do not include migration as a climate change adaptation option, and internal migration is seen negatively. Martin et al. [78] recommend a policy reorientation toward decreasing the need for migration wherever possible and assisting individuals in participating in the larger labor market, which may require movement.

According to Sethi and Kundu [79], to recognize internal migrants' economic contributions, the Indian government should provide them with a minimum income, adequate housing, healthcare, and education, as well as protection from exploitation and harassment. It is critical to promote an integrated, rights-based strategy that acknowledges the interconnectedness of development and internal migration. In general, policy responses and mitigation methods should aim to address the unique needs and challenges those internal migrants face, promote inclusivity, and ensure long-term development. The development of green infrastructure, such as environmentally friendly transportation and climate-resilient housing, creates economic opportunities in both the source and destination regions. The reciprocal link between migration and environmental sustainability fosters a virtuous loop.

7. Conclusion

A wide range of factors, including environmental forces, economic opportunities, and social relationships, drive the

complex and ever-changing process of internal migration. A diverse set of incentives at both the macro and local levels have a considerable influence on migration trends. Economic pressures, such as industrialization, as well as human considerations like job choices and household duties, all play a role in developing these patterns. Policymakers need to understand the complex dynamics to develop effective policies that mitigate the negative repercussions and capitalize on the positive possibilities of internal migration. Internal migration, on the other hand, has serious environmental consequences, such as traffic congestion, environmental deterioration, and urbanization. The complicated relationship between fingerprints and imprints in terms of environmental sustainability underscores the importance of taking a comprehensive approach to policy design. Although deliberate policies and techniques are used to regulate internal migration, it has the potential to provide good environmental consequences, despite the burden it may put on ecosystems and rural populations. The Belo Monte Dam, located in the Brazilian Amazon, offers a dramatic example of the complications and challenges that result from the simultaneous processes of significant infrastructure construction and internal migration. To strike a balance between beneficial and negative effects, sustainable urban and rural development planning, economic incentives, regulatory measures, and community participation are necessary. Understanding the complicated interplay between internal migration and environmental sustainability allows policymakers to direct the process of transitioning to a future marked by increased ecological responsibility.

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Md. Anik Hossain is the sole author. The author read and approved the final manuscript.

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Data Availability Statement

All data used in this study are fully available within the manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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