

BEYOND SHELTER: DISPLACEMENT AT THE THRESHOLD OF ECOLOGICAL CHANGE

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Abstract

Mass displacement and the establishment of large-scale refugee settlements generate consequences that extend well beyond humanitarian concerns, profoundly reshaping local environments. This occurs as the concentration of populations often exceeds the ecological carrying capacity of the surroundings, generating acute pressures on land, water and biodiversity. This paper does not seek to criticize the establishment of refugee settlements, which provide vital support to vulnerable populations that are at risk. Instead, its primary objective is to highlight the challenges that emerge from the often ad hoc development of these settlements, which frequently lack proper planning and inadequate infrastructure for waste management, sanitation and energy provision; such factors contribute both to ecological degradation and to increased risks to public health.

To address the research objectives, two case studies, one in Asia and one in Africa, were selected to examine how refugee settlements of varying dynamics impact local environments in differing ecological and socio-political contexts. The first case study examines the Kutupalong Camp in Cox's Bazar, Bangladesh, that now accommodates over a million Rohingya refugees in approximately 30,000 hectares, one fourth of which derived from deforestation, leading to the disruption of local flora and fauna, and increased vulnerability to floods and wildfires. Comparable challenges are evident in the Minawao Camp in Mayo Tsanaga Division, Cameroon, which hosts roughly 76,000 refugees displaced from Nigeria; in this case, land degradation and overexploitation of natural resources has also been observed.

The results highlight the urgent need to integrate sustainable management strategies into humanitarian assistance. Only then displaced populations as well as the urban and environmental systems entwined with their survival may be safeguarded and sustained in resilience. To conclude, the contribution of this paper lies in highlighting the compatibility between refugee settlements and environmental protection, emphasizing the imperative of implementing integrated strategies.

Key words: *refugee settlements, environmental impacts, sustainable management, socio-ecological systems, humanitarian assistance, ecological resilience.*

1. INTRODUCTION

Human mobility represents one of the most pressing challenges of the twenty-first century. Millions are displaced, at a global level (Eleftheriou, Kyriakidis & Potsiou, 2023), not only in pursuit of better living conditions and improved economic opportunities (Rondos, Nagopoulos & Panagos, 2017), but also as a result of armed conflicts (Anderson, 2020), environmental disasters, and climate variability (UN Development Program, 2015 in Wennersten & Rubbins, 2020). According to the United Nations High Commissioner for Refugees (UNHCR, 2023), the overall scale of forced displacement has more than doubled over the past decade. Refugees constitute a significant proportion of these mobile populations, with their number estimated at approximately 42.5 million people by the end of 2025 (UNHCR, 2025). As a result, substantial population concentrations have emerged within refugee settlements worldwide. This demographic concentration poses multifaceted social, economic, and environmental challenges, significantly impacting infrastructure, local ecosystems, and overall ecological resilience (Sakamoto, Ullah & Tani, 2024; Shen, 2024; Sarkar, Saroar & Chakraborty, 2023; Geoffrey & Tumwine, 2023; Tafere, 2018), while prolonged displacement further intensifying these pressures by accelerating the degradation of natural resources (Black, 1994).

Within this context, academic literature has expanded considerably, in recent years. Early analyses, often influenced by neo-Malthusian -or environmental Malthusian- perspectives (see more in Istalince, 2023; Merchant, 2022), tended to interpret increased refugee presence as a primary driver of environmental degradation. However, more recent research challenges this linear causality (Hunter, Luna & Norton, 2015). Contemporary studies argue that environmental deterioration in host regions is rarely attributable solely to refugee influxes; rather, it is embedded in pre-existing structural vulnerabilities, institutional shortcomings, and unequal systems of natural resource governance (Dano, et al., 2025; Bose, 2024; Jacobsen, 1997). The field of political ecology has been particularly influential in advancing this reconceptualization, emphasizing power relations, land administration structures, and differential access to resources as decisive factors shaping environmental outcomes in displacement contexts. The shift reframes refugee settlements not merely as sites of ecological strain, but as complex socio-political urban systems (Al-Homoud & Samarah, 2025) where environmental change is negotiated and mediated through governance systems.

Contemporary research increasingly prioritizes the identification of sustainable and integrative policy solutions. Guided by the framework of the United Nations Sustainable Development Goals (SDGs), policymakers and scholars seek to integrate economic development, environmental resilience, and social inclusion, which is considered as the main pillar for the success of such a strategy (Eleftheriou, Kyriakidis & Potsiou, 2023).

Positioned within this evolving scholarly approach, this paper explores the complex relationship between forced migration and environmental impact, not to critique the essential humanitarian assistance provided, but to illuminate the complex challenges that emerge when settlements are established with limited planning and infrastructure. Rather than approaching refugee camps solely as temporary humanitarian spaces -as tended to be considered mainly in the past (Al-Homoud & Samarah, 2025)-, this study conceptualizes them as evolving socio-ecological systems, embedded within and interacting with broader environmental processes. Understanding these dynamics requires an examination of diverse contexts, as the effects of displacement are mediated by ecological, climatic, and socio-political factors. Accordingly, the main research question guiding this study is: *To what extent do governance structures and planning approaches determine whether large-scale refugee settlements function as drivers of environmental degradation or as potential catalysts for sustainable environmental adaptation?* To this end, two refugee settlement contexts are examined as comparative case studies

(Section 2). The findings derived from the analysis of secondary data are subsequently synthesized to draw broader analytical conclusions (Section 3). These conclusions are intended to inform and provide a conceptual foundation for future research focusing on the European context.

2. CASE STUDIES

KutupalongRefugee Camp

The Kutupalong Refugee Camp in Cox’s Bazar, Bangladesh has emerged as the largest refugee settlement globally in response to the mass displacement of the Rohingya people, an Indo-Aryan, predominantly Muslim group (Alam & Uddin, 2025) who fled systematic persecution and statelessness in Myanmar (Bashar & Bernell, 2025), following violent military campaigns beginning in August 2017. The unprecedented influx, that expanded the existing camp, has placed extraordinary pressure on local ecosystems and has driven significant changes in land use patterns that have clear environmental and social consequences (Loncar & Cabral, 2021; Quader, et al., 2021; Benz, et al., 2019; Braun, Fakhri & Horchschild, 2019).



Figure 1. The Kutupalong Refugee Camp in Cox’s Bazar, Bangladesh, before and after the 2017 Rohingya crisis. Source: Wikipedia (2025)

Satellite-based studies combining multi-temporal Landsat imagery (Bappa, et al., 2022) with radar data from Sentinel-1 and ALOS-2 (Braun, Fakhri & Horchschild, 2019) have documented how the rapid establishment and expansion of the camp have altered the physical landscape. According to their results, forested areas were progressively converted into built-up land as the camp expanded roughly ten-fold between 2015 and 2021. An estimated 1,500 hectares of vegetation were lost, partly for camp infrastructure and partly due to wider deforestation trends in the surrounding landscape (Braun, Fakhri & Horchschild, 2019). These changes have disrupted local ecosystems and altered land surface temperature patterns, signaling environmental stress beyond the immediate settlement footprint.

These landscape alterations have had profound implications on biodiversity. Habitat fragmentation and the loss of vegetation compromise ecosystem services such as carbon sequestration (Li, et al., 2022) and water regulation, due to the fact that vegetation plays a crucial role in the hydrological cycle (Wang, et al., 2018). Wildlife, including threatened species like Asian elephant (*Elephas maximus*), face increased conflict as traditional migration corridors (Rahman, 2019) and feeding grounds are occupied by the expanding

settlement areas. These anthropogenic pressures extend beyond the camp boundaries, intensifying stress on flora and fauna and accelerating ecosystem degradation.

The removal of vegetation, unstable soils, and steep slopes, combined with intense monsoonal rainfall, has markedly increased landslide and flooding risks, as Kamal, et al. (2022) support in their research focused on the Kutupalong Camp. In this research (Kamal, et al., 2022), advanced geospatial hazard assessments applied indicate that slope failures and flash floods are becoming more frequent, threatening both human settlements and adjacent ecosystems. This interplay between deforestation and extreme weather illustrates how rapid settlement expansion not only alters the landscape but also magnifies geophysical vulnerabilities, compounding environmental and socio-ecological risks.

Although most academic studies focus on remote sensing and hazard assessment, as focused above, there is a growing acknowledgment that environmental change in contexts like Kutupalong must be understood in conjunction with social and governance factors that shape resource use patterns. The findings from the above literature consistently indicate that rapid, unplanned settlement expansion can produce significant environmental consequences in host regions, particularly when local planning mechanisms, institutional capacities and environmental safeguards are limited or absent. In the case of the Kutupalong camp, limited access to clean energy, low adaptive capacity, unstable incomes, and lack of alternative livelihoods drive fuelwood dependence and reinforce a social conflict-deforestation cycle, intensifying pressure on forests and host communities (Ulah, et al., 2025).

In response to the environmental degradation, **participatory and sustainable-focused interventions** have been implemented at Kutupalong. UNHCR and partners have engaged refugees in **reforestation** (Chowdhury *et al.*, 2025) **and ecosystem restoration**, with thousands trained to manage nurseries and plant indigenous trees, stabilising slopes and enhancing vegetation cover (replanted on over 600 ha) (De La Portilla, 2021). **Complementing these ecosystem restoration efforts, solid waste management initiatives led by UNDP in partnership with Bangladesh Rehabilitation Assistance Committee (BRAC) have addressed another critical dimension of environmental risk within the camps.** Through the establishment and expansion of sanitary landfill facilities at Camp 20 Extension, embedded within an integrated waste management system, the programme has reduced public health and environmental hazards associated with unmanaged waste. At the same time, structured “Cash for Work” schemes have created livelihood opportunities for Rohingya refugees, demonstrating how governance-supported planning can align environmental sustainability objectives with camp management and socio-economic inclusion (UNDP Bangladesh, 2025a; 2025b).

Minawao Camp

In the south-eastern region of Cameroon, the Minawao refugee camp exemplifies the complex interplay between governance, planning and environmental outcomes in large-scale settlements. Originally constructed in 2013 to accommodate 10,000 persons fleeing Boko Haram insurgency in neighbouring Nigeria, Minawao now shelters roughly 76,000 people in a highly climate-stressed dryland environment (Magne & Aholou, 2024). This dramatic increase has exerted acute pressure on already vulnerable ecosystems, accelerating tree removal for firewood and daily cooking, exacerbating local desertification and provoking resource competition with indigenous pastoralists (Magne & Aholou, 2024; Kodji & Adamou, 2021). Field observations and remote sensing analyses indicate that the expansion of informal settlements and the associated activities have resulted in patchy vegetation loss, increased erosion rates, and microclimatic changes within the surrounding savannah and woodland landscapes (Magne & Aholou, 2024). In the absence of integrated environmental planning

and effective governance coordination, the camp's expansion has shifted from humanitarian relief towards an inadvertent ecological stressor.



Figure 2. Minawao Refugee Camp, then and now. Source: Good News Network (2021).

By contrast, continental initiatives such as the African Union's Great Green Wall (GGW) show how governance frameworks and multi-level planning can transform environmental degradation into opportunities for adaptation. Launched in 2007, the GGW brought together 18 African states (11 core countries along with 7 additional countries linked to the initiative) (Deng, Hao & Qu, 2024) and international partners with goals to restore 100 million hectares of degraded land (Mirzabaev, et al., 2022), sequester carbon, and create green employment by 2030 (UNCCD, 2020). Since the beginning of the Initiative more than 360,000 seed plants were planted in more than 100 hectares (area of around 26 football fields) (Bourgois, 2021). These trees provided shade for other plants, while fallen leaves acted as natural fertilizers, improving soil fertility. The emerging forest attracted rainfall and enhanced water retention, contributing to local ecological resilience. The initiative provides an illustrative model for cross-border collaboration, integrating local knowledge, scientific research, and policy mechanisms to enhance resilience as well as ecological restoration in terms of landscape (Goffner, et al., 2019). In Nigeria, for example, coordinated institutional support facilitated the establishment of contiguous windbreak corridors and reforestation activities, yielding measurable ecological benefits including 2,801 hectares of reforested land and enhanced local food and energy security through community gardens (UNCCD, 2020). To address ongoing firewood demand, alternative energy programs were introduced: camp residents process waste into "ecologic" coal at plants staffed by trained refugees, generating both sustainable energy and a steady income.

The contrasting trajectories of Minawao and the GGW initiative highlight the centrality of governance in shaping environmental outcomes. Refugee settlements often emerge rapidly with limited capacity for environmental planning, forcing refugees to rely on local biomass without sustainable alternatives. This can deepen degradation when governance structures fail to integrate environmental safeguards into site design, resource distribution and livelihood programmes. Conversely, initiatives with clear governance mandates and participatory planning generate enabling conditions for ecological restoration and socio-economic adaptation, notably when local communities are co-designed into decision-making and benefit-sharing processes. Effective planning must therefore span humanitarian and environmental domains. This requires institutional frameworks that anticipate ecological limits, allocate sustainable energy alternatives, and embed monitoring systems capable of assessing landscape changes over time.

3. CONCLUSIONS

The analysis of Kutupalong and Minawao refugee settlements underscores the intricate relationship between forced displacement, environmental sustainability and governance frameworks. Refugee camps are not isolated humanitarian spaces; rather, they operate as dynamic socio-ecological systems embedded within larger environmental and urban contexts. Rapid, unplanned settlement expansion, as observed in Kutupalong, can amplify environmental pressures, triggering deforestation, habitat fragmentation, soil instability, and heightened vulnerability to hydrological hazards. These pressures extend beyond camp boundaries, threatening both biodiversity and the ecological services upon which local communities depend. Crucially, such outcomes are rarely attributable solely to refugee presence; they are amplified by pre-existing structural vulnerabilities, limited institutional capacity, and inadequate planning mechanisms.

By contrast, the Minawao case and complementary continental initiatives like the GGW initiative demonstrate that proactive governance, integrated planning and participatory approaches can transform environmental risks into adaptive opportunities. When refugee settlements are incorporated into broader ecological restoration frameworks, environmental degradation can be mitigated and socio-economic resilience simultaneously enhanced. For example, structured reforestation, sustainable energy programmes and waste management initiatives not only stabilise landscapes but also provide livelihoods, improve resource security and integrate displaced populations. These interventions illustrate that environmental protection and humanitarian assistance are not mutually exclusive but can be mutually reinforcing when strategically aligned.

The comparative analysis highlights that governance quality, policy integration and institutional foresight are decisive in determining environmental outcomes in displacement contexts. Effective planning must anticipate ecological thresholds, allocate alternative energy resources and embed monitoring systems capable of capturing both ecological and social dynamics. Furthermore, the inclusion of host communities in planning processes is essential, as it fosters equitable resource distribution, reduces potential conflicts and ensures that restoration efforts yield tangible benefits for all stakeholders.

Ultimately, the study emphasises that refugee settlements can either exacerbate environmental degradation or serve as catalysts for sustainability, depending on the governance and planning approaches applied. Integrating environmental objectives with humanitarian priorities is no longer optional; it is essential for safeguarding ecosystems, enhancing resilience and securing the long-term well-being of displaced populations. Future interventions must therefore move beyond temporary relief perspectives and embrace comprehensive, adaptive strategies that embed ecological stewardship into the core of humanitarian operations. In doing so, refugee settlements can become spaces of coexistence with the environment, demonstrating that human mobility and ecological protection can be mutually compatible rather than inherently contradictory.

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