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Investigating the Multifaceted Link Between Climate-Induced Resource Scarcity, Conflict, and Insecurity in Humanitarian Situations Involving Refugees and IDPs

Michael Munyaradzi Makova (PhD)

2375 Bluffhill Westgate, Zimbabwe

Abstract:
Climate change has significant and far-reaching impacts on displaced population such as refugees and internally displaced persons (IDPs). Climate change is intricately linked to resource scarcity, conflicts, and insecurity in refugee and IDP humanitarian situations with varying impacts. Climate change exacerbates resource scarcity by altering weather patterns, leading to extreme events such as droughts, floods, and storms. The changes have significantly reduced the availability of essential resources like water, food, and arable land in some regions creating competition. Resource scarcity driven by climate change has acted as a catalyst for conflicts between some communities creating an environment of insecurity. Humanitarian contexts in conflict and fragile post conflict situations, climate change has exacerbated existing insecurity for refugees and IDPs. Refugees and IDPs are particularly vulnerable to the impacts of climate change because of their inherent difficult situations and vulnerabilities in foreign lands and far away from home. Recognizing the complex interconnections between climate change, resource scarcity, conflict, and insecurity, this paper investigates the multifaceted and interdependent dimensions of these relationships in refugee and IDP humanitarian situations. By examining existing literature and case studies, the paper aims to provide a comprehensive understanding of how climate-induced resource scarcity exacerbates conflicts and insecurity, impacting on the well-being of refugee and IDPs. The key considerations will inform strategies to enhance resilience and security for refugees and IDPs in face of climate change, offering valuable insights for humanitarian organizations and policymakers.

Key words: Climate change, Conflict, Insecurity and Resource Scarcity.

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1. Introduction

The complex interplay and multifaceted interlinkages between climate change, resource scarcity, conflict and insecurity create significant challenges across all facets of life in refugee and IDP humanitarian situations. Climate change has had a significant impact on resource scarcity in regions already facing humanitarian crises involving refugees and internally displaced persons, leading to localized conflicts and increasing insecurity[1,2]. Numerous refugee and IDP communities are in camps and settlements located in areas identified as climate change hotspots. Some of the locations are isolated and highly susceptible to the detrimental impacts of climate change and natural disasters such as, droughts, flooding, landslides, wildfires, extreme heat, and extreme cold. Examples of refugees and IDPs communities in areas considered climate hotspot include Cox's Bazar, Bangladesh; Upper

Nile, South Sudan; Chad basin, involving multiple countries; Tongogara, Zimbabwe and Mozambique IDP camps[1,2]. Refugees and IDPs are particularly vulnerable to the negative effects and impacts of climate change because of their inherent vulnerabilities and difficult situations in foreign lands and for IDPs far away from home[3]. This vulnerability compromises their safety and security and increases their risks to diverse security threats and risks, some associated with secondary displacements, particularly in conflict and fragile post conflict environments[3]. In some areas affected by conflict or instability, whether political, economic, or social, climate change has worsened the already precarious conditions for refugees and IDPs leading to increased insecurity.

Climate change has increasingly caused severe weather events, such as droughts, floods, and storms, disrupt livelihoods and force people to flee their homes[4]. This displacement often leads to overcrowded refugee and IDP camps, where resources are already limited[5]. Climate change has exacerbated scarcity of essential resources like water and arable land[6]. This scarcity has often led to competition and conflict among displaced populations like refugees or IDPs and host communities[7]. Further, resource scarcity and displacement fuel tensions and conflicts, making it difficult for humanitarian organizations to operate safely and effectively[8]. In conflict zones, access to affected populations is often restricted, and aid workers face significant security risks[9,10]. The combination of climate induced displacement, resource scarcity, and conflict creates an environment of insecurity[11]. Insecurity in refugee and IDP humanitarian contexts refers to the diverse security threats and risks faced by refugees and IDPs individually and or collectively. Insecurity also refers to the threats and risks that hinder the delivery of humanitarian assistance to them. Insecurity prevents the delivery of humanitarian aid from accessing the neediest and increases security risks [10,12,13]. Insecurity also exposes refugees and IDPs to other harmful events such as violence and torture, arbitrary detention and arrests, human trafficking, gender-based violence, religious and ethnic violence [10,13].

Climate change is a contemporary pressing challenge. Its effects and impacts are widespread and multifaceted, affecting various aspects of the environment, health, economic, ecosystems and society. Climate change has significant implications on refugees and IDPs access to humanitarian assistance and their safety and security in their vulnerable situations from both primary and secondary displacements. The intricate relationship between climate change, resource scarcity, conflict, and insecurity in refugee and IDP humanitarian contexts has been subject of several studies, diverse debates and discussions at various fora, be it local, national, regional and international. There appears to be significant contemporary recognition of the complex and interconnected relationship between climate change, resource scarcity, conflict, and insecurity, especially in humanitarian and development contexts involving refugees and IDPs[3,7]. Climate change is increasingly recognized as a threat multiplier, driver of displacement and exacerbates existing vulnerabilities particularly for refugees and IDPs[3,7,8]. Several reputable and authoritative reports suggest that by 2040, the number of countries facing extreme climate-related hazards is expected to rise significantly, many of which already host displaced populations, such as refugees and IDPs [3, 7].

This research paper explored the complex interplay between climate change, resource scarcity, conflict, and insecurity in humanitarian contexts involving refugees and IDPs. The research investigates how climate-induced resource scarcity exacerbates conflict leading to insecurity in humanitarian settings, highlighting its impact on refugees and IDPs. Addressing the complex interplay between climate-induced resource scarcity, conflict, and insecurity in refugee and IDP humanitarian settings, policy and practice should focus on integrated approaches that combine humanitarian assistance with climate adaptation, conflict sensitivity, safety and security and long-term development planning. The research guides the development of strategies to bolster refugee and IDPs resilience and security, providing crucial insights for policymakers and humanitarian organizations.

2. What is Climate change?

Climate change involves long-term alterations in global temperatures and weather patterns on earth primarily driven by human activities. The Intergovernmental Panel on Climate Change (IPCC) defines Climate change as "any change in climate over time, whether due to natural variability or as a result of human activity"[14, 15, 16, 17]. The Framework Convention on Climate Change (FCCC) defines climate change as "a change of climate that is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, and that is in addition to natural climate variability over comparable time periods"[14]. There is a clear distinction between climate change caused by human activities and natural climate variability. Climate Change caused by human activities include greenhouse emissions and industrial processes. This is persistent and potentially irreversible, leading to long-term shifts in climate patterns and more extreme weather events[18,19,20]. Natural climate variability refers to natural processes such as volcanic eruptions, solar radiation variations, ocean currents, and natural greenhouse gas fluctuations. This is often cyclical and reversible, affecting climate on a short-term basis without altering long-term averages significantly[20, 21,22].

Climate change is primarily driven by human activities, such as burning fossil fuels, deforestation, and industrial processes, which increase the concentration of greenhouse gases in the atmosphere. These gases trap heat, leading to global warming and altering weather patterns. Climate change is directly linked to rising and shifts in global temperatures, more frequent droughts and floods, and extreme weather events such as storms, cyclones, typhoons, hurricanes, and wildfires[23,24,25,26]. Climate change impacts on agricultural productivity, leading to reduced yields and the extinction of certain tree and plant species due to altered rainfall patterns. Natural wildlife habitats are also significantly affected, causing declines in the populations of various wildlife species[23,24,25,26].

Climate change has increasingly caused severe weather events, such as droughts, floods, and storms, disrupting livelihoods and forcing people to flee their homes[14, 15, 16]. This displacement often leads to overcrowded refugee and IDP camps, where resources are already limited[15,16]. Climate change has exacerbated scarcity of essential resources like water and arable land[16,17]. This scarcity has often led to competition and conflict among displaced populations like refugees or IDPs and host communities[17, 18]. Further, resource scarcity and displacement fuel tensions and conflicts, making it difficult for humanitarian organizations to operate safely and effectively[18, 19, 20]. In conflict zones, access to affected populations is often restricted, and aid workers face significant security risks[27,28]. The combination of climate-induced displacement, resource scarcity, and conflict creates an environment of insecurity[29]. Insecurity hampers the delivery of aid and increases security risks to vulnerable populations such as refugees and IDPs[30]. Insecurity also exposes refugees and IDPs to other harmful events such as violence and torture, detention and arrets, human trafficking, gender-based violence, religious and ethnic violence[10,27,28]. Addressing climate change involves reducing greenhouse gas emissions, transitioning to renewable energy sources, and implementing policies to mitigate its impacts[25,26].

3. What are the effects of climate change?

Climate change is a significant global threat and stands as one of the most urgent and pressing challenges of this era. Its effects are extensive and complex, influencing all facets of the environment, human health, economies, ecosystems, and society. The following climate change effects are well documented.

1. Environment: Climate change significantly affects the environment in a variety of interconnected ways. Rising temperatures have caused global temperatures to increase significantly, leading to more frequent and intense heatwaves, droughts and wildfires [31,32]. This has severe effects on human health, agriculture, and natural ecosystems. Rising sea levels caused by melting glaciers and ice sheets have contributed to coastal erosion, increasing flooding, and displacement of communities[31,32]. Climate change induced ocean acidification has been associated with increased Carbon dioxide (CO_2) absorption by oceans, leading to harmful

effects on marine life[31,32]. Climate change is also linked to an increase in the frequency and severity of extreme weather events such as hurricanes, droughts, floods, storms, cyclones and heavy rainfall that devastate communities[31,32]. These events have caused significant damage to infrastructure, disrupted food and water supplies, and led to loss of life [33, 34, 35, 36].

Refugee and IDP camps and settlements are often located in areas prone to extreme weather events such as floods, droughts, cyclones, and heatwaves. These events have damaged shelters, reduced access to clean water, caused droughts and increased the spread of diseases[33, 35, 36]. Examples include Democratic Republic of the Congo (DRC), Somalia, Sudan, Yemen and Syria[31,32,33]. In Democratic Republic of the Congo (DRC), in addition to the ongoing conflict, severe flooding, and disease outbreaks in IDP and refugee camps have been worsened by climate change. Somalia continues experiencing conflicts and extreme droughts that have destroyed livelihoods and forced IDPs to flee multiple times. Sudan is affected by both conflict and climate-related disasters like floods and droughts affecting millions of IDPs and refugees. In Syria, climate stressors compound the ongoing humanitarian crisis. Yemen which has been experiencing many years of conflict, the population continue suffering from water scarcity and food insecurity, intensified by climate change[31,32,33].

Extreme weather events such as floods, droughts, cyclones, and heatwaves have exacerbated insecurity in refugees and IDPs humanitarian situations. Threats and risks have increased, taking advantage of refugee and IDPs vulnerabilities and their inherent difficult situations in foreign lands or far away from home. Examples include Rohingya refugee camps in Cox's Bazar, Bangladesh, which have about one million refugees. The refugee camps have experienced severe flooding and landslides due to heavy rains negatively impacting on refugees and local communities. Climate induced resource scarcity has been a source of conflict between the refugees and local communities. This has exacerbated insecurity for refugees, with new security threats evolving [37].

2. Human Health: The health effects of climate change on refugees and internally displaced persons (IDPs) are profound and multifaceted. Climate has exacerbated health issues by increasing the prevalence of heat-related illnesses, vector-borne diseases, and respiratory problems due to poor air quality[31,32]. According to the UNHCR, climate change has exacerbated health issues among refugees and IDPs by increasing the prevalence of diseases, malnutrition, malnutrition, waterborne diseases, heat-related illnesses and mental health problems[31,32,33]. This further strains humanitarian resources and complicates efforts to provide adequate care[31,32,33]. Higher temperatures have led to heat-related illnesses and deaths, particularly affecting vulnerable populations like the elderly and children[33,34,35]. Climate change has worsened air quality, leading to respiratory issues and other health problems[33,34,35]. Changes in climate also alter the distribution of diseases, potentially increasing the spread of vector-borne diseases like malaria and dengue fever among others[33,34,35]. Refugees and internally displaced persons (IDPs) often face significant health challenges due to their living conditions and limited access to healthcare services[38, 39]. Refugees and migrants generally face worse health outcomes in countries of transit and destination due to barriers including language and cultural differences, institutional discrimination and restricted use of health and other services[32,34,35]. Examples of health delivery systems challenged in refuge and IDP camps exacerbated by climate change include, Bangladesh, Democratic Republic of the Congo (DRC), Somalia, Sudan, Yemen and Syria [32, 33, 34, 37].

3. Economic: The economic effects of climate change are substantial and far reaching, affecting industries such as agriculture, fisheries, and tourism. The cost of disaster response and recovery also places a significant burden on economies[40,41]. Changes in temperature and precipitation patterns have affected crop yields, leading to food insecurity and economic losses for farmers in many regions of the world[34,35,39]. Extreme weather events have also caused significant damage to infrastructure, leading to costly repairs and economic disruptions[34,35,39]. Increased frequency of natural disasters drive up insurance costs and reduce the affordability of coverage[34, 35, 39]. Many refugees and IDPs rely on agriculture or natural resources for their income. Climate-related disasters like droughts, floods, and storms can destroy crops, livestock, and fishing opportunities, leaving them without a source of income wherever they are. Competition over scarce resources like water, arable land, and energy can lead to tensions between displaced populations and host communities,

further hindering economic stability. Displaced populations are often forced to live in areas highly exposed to climate hazards, making them more vulnerable to repeated displacement and economic instability[31,32, 33]. Competition over scarce resources like water, arable land, and energy often lead to tensions between displaced populations and host communities, further hindering economic stability. Refugees and IDPs rely heavily on humanitarian aid for survival. The increasing frequency and intensity of climate-related disasters has strained aid resources, making it difficult to meet the growing needs [3,36,42]. The economic effects of climate change have been witnessed in refugee and IDP camps in Bangladesh, Democratic Republic of the Congo (DRC), Somalia, Sudan, Yemen and Syria among many other countries [32, 33, 34, 37].

4. **Ecosystem and Biodiversity**: Climate change significantly affects ecosystems and biodiversity in multiple interconnected ways. Rising temperatures, changing rainfall patterns, and extreme weather events alter natural habitats and threaten species with extinction[31,32, 33]. Many species are struggling to adapt to changing climates, leading to shifts in geographic ranges and potential extinctions[31,32, 33]. Increased CO2 levels are causing oceans to become more acidic, affecting marine life and ecosystems[32, 33,34]. Ecosystems provide services like clean water, pollination, and climate regulation. Their degradation affects human well-being and food security. Refugees and IDPs rely on local ecosystems for food, water, and shelter. Climate change-induced degradation, such as deforestation or desertification, reduces the availability of these resources. In areas hosting large numbers of refugees and IDPs, ecosystems become overexploited. For example, forests are cleared for firewood or agriculture, leading to soil erosion and loss of biodiversity.

Large refugee population in Cox' Bazar, Bangladesh and Bidibidi in Uganda has led to deforestation as trees are cut for shelter and firewood. This degraded local ecosystems, reduced biodiversity, and increased vulnerability to landslides and soil erosion [33,34,37,42]. Refugees and IDPs are often settled in environmentally fragile areas, such as floodplains or arid regions. Climate change exacerbates the risks in these areas, making them more prone to disasters like floods or droughts. Limited natural resources, such as water or arable land, can lead to tensions between displaced populations and host communities, further straining ecosystems[31,32, 33, 34]. The ecosystem and biodiversity have been significantly affected in refugee and IDP camps in Bangladesh, Democratic Republic of the Congo (DRC), Uganda, Ethiopia, South Sudan, Kenya, Chad and Syria among many other countries [33, 34, 37, 42, 43].

4. Impacts of Climate Change

Climate change has wide-ranging and profound impacts that cut across the environment, human societies, and economies.

1. **Resource Scarcity**: Climate change exacerbates resource scarcity, particularly water and arable land[43,44,45]. This scarcity leads to increased competition among communities, often resulting in conflicts. For example, in regions where water resources are shared, upstream withdrawals create tensions and even violent disputes[44,45]. Climate change-induced events like droughts, floods, and storms deplete essential resources such as water and arable land. This leads to increased competition between displaced populations, such as refugees and IDPs, and host communities. Refugees and IDPs often settle in areas that are already environmentally fragile. The additional pressure on local ecosystems can lead to overexploitation of resources, further degrading the environment[44,45]. Climate change negatively impacts on agricultural productivity, making it harder for refugees and IDPs to grow food to sustain themselves. This can lead to food insecurity and malnutrition[44, 45]. Scarcity of resources often lead to conflicts between refugees and or IDPs with host communities, as both groups compete for limited resources. Refugees and IDPs as aid beneficiaries are also exposed to a host of other security threats and risks associated with their vulnerable situations [13,27,28].

2. **Conflict**: Climate change and conflict are deeply intertwined, especially in the context of refugees and internally displaced persons (IDPs). Climate change exacerbates resource scarcity, such as water and arable land, leading to competition and conflict between displaced populations and host communities[46, 47].This is particularly so in regions already experiencing political instability or economic hardship[46,47]. Displaced

populations such as refugees and internally displaced persons (IDPs) often settle in areas prone to climate-related hazards, such as floods and droughts. These hazards can further displace people and create conflicts over limited resources [48]. Climate change make it difficult for refugees and IDPs to return to their homes. Environmental degradation and resource scarcity can render their original homes uninhabitable[46, 47]. In some situations, the homes are already occupied by other community members, a flashy point of conflict[46, 47]. The combination of climate change and conflict places a significant strain on humanitarian efforts. Climate change intensify existing conflicts by exacerbating underlying issues like poverty and resource scarcity. This leads to increased displacement as people flee conflict zone[46,47,48].

3. **Displacement and Migration**: Extreme weather events, such as droughts, floods, and hurricanes lead to more frequent and severe displacements and migrations [47,49, 50]. The displacement can be temporary or permanent, depending on the severity of the event and the availability of resources. This increases the number of refugees and IDPs, straining already limited resources and infrastructure[47, 49, 50]. Refugee and IDP camps are often located in climate-vulnerable areas, making them susceptible to secondary displacements caused by climate-related disasters, such as flooding[47,49, 50]. Refugees and IDPs also face insecure living conditions, lack of access to basic services, and heightened vulnerability to exploitation and violence due to displacements and migrations[47,49,50]. Displacement and migration also expose refugees and IDPs to diverse security threats peculiar to their situations. This adds to the instability and insecurity of already vulnerable populations[10, 13,27].

4. **Economic Instability**: Climate change significantly contributes to economic instability in refugee and IDP situations. Climate-induced economic shocks, such as reduced agricultural productivity, can destabilize local economies[47, 48, 51, 52]. This economic instability increase social tensions and contribute to conflict, particularly in regions heavily dependent on agriculture[48, 51, 52]. Displaced persons such as refugees and IDPs rely on agriculture, fishing, or natural resources for their livelihood income. Climate-related disasters like droughts, floods, and storms destroy these livelihoods, leaving them without a source of income[48, 51, 52]. Hosting countries or regions often bear the financial burden of accommodating refugee and IDPs straining already overstretched national capacities. This includes providing shelter, food, healthcare, and other essential services, which strain local economies. Refugees and IDPs often face barriers to employment, due to several reasons which include prohibitive government policies, lack of documentation, discrimination, or limited access to markets. Climate change exacerbates these challenges by reducing the availability of jobs in affected areas. Competition over scarce resources like water, arable land, and energy also leads to tensions between displaced populations and host communities, further hindering economic stability. Refugees and IDPs are often forced to live in areas highly exposed to climate hazards, making them more vulnerable to repeated displacement and economic instability [48, 51, 52].

5. **Humanitarian Challenges**: Climate change poses several humanitarian challenges for refugees and internally displaced persons (IDPs). These populations are often among the most vulnerable to environmental disruptions. Climate change significantly impacts humanitarian operations creating new challenges and intensifying existing ones. More frequent and intense climate-related disasters (floods, droughts, cyclones) lead to larger and more complex displacement crises. This adds to the already high numbers of refugees and IDPs[53, 54, 55]. The influx of refugees and IDPs strain local resources and infrastructure, making it challenging for host communities to provide adequate support[53,54,55]. Humanitarian organizations often struggle to meet the needs of displaced populations, especially in protracted crises where resources are limited[53,54,55].

6. **Security Risks**: The impact of climate change on security risks in refugee and internally displaced persons (IDP) situations is complex and multifaceted. Climate change significantly hampers the delivery of humanitarian aid and increases security risks for vulnerable displaced populations like refugees and internally displaced persons (IDPs) [56,57,58]. Refugees and internally displaced persons (IDPs) are generally products of armed conflict and other socio-economic problems. They often face significant security threats and risks due to their unique circumstances. Climate change has exacerbated their exposure to some of the security threats and risks leading to significant insecurity in some refugee and IDP humanitarian situations. Insecurity in refugee and IDP humanitarian contexts refers to the diverse security threats and risks faced by refugees and IDPs individually

and or collectively. Insecurity also refers to the threats and risks that hinder the delivery of aid and assistance to them [56, 57, 58]. Insecurity hampers the delivery of aid and increases security risks to vulnerable displaced populations, such as refugees and IDPs[56,57,58]. Armed groups may exploit these vulnerabilities to recruit or control populations, increasing regional instability. Insecurity exposes refugees and IDPs to other harmful events such as violence and torture, detention and arrets, human trafficking, gender-based violence, religious and ethnic violence[10,13,27]. Climate change induced resource scarcity can increase exposure to some of these harmful events. Insecurity in refugee and IDP humanitarian situations is often exacerbated by weakness of some state institutions and infrastructure resulting in the inability of some governments to effectively enforce law and order in their territories. In such countries or regions already experiencing weak governance or conflict, climate stress can undermine peacebuilding efforts.

5. Climate Change and Resource Scarcity

Climate change and resource scarcity are critical and contemporary global challenges that are interconnected. Climate change significantly exacerbates resource scarcity[59]. Resource scarcity occurs when the demand for natural resources exceeds their availability. This can be due to overuse, environmental degradation, or unequal distribution[59]. Key natural resources which are affected by climate change include water and arable land [60,61]. Many regions of the world now face water scarcity due to over-extraction, pollution, and climate-induced changes in precipitation patterns[61, 62]. Examples of countries affected and hosting refugees and IDPs include, Chad, Jordan, South Sudan, Mozambique, Bangladesh, Lebanon, among many others[63,64,65]. Agricultural productivity is also threatened by climate change, leading to food shortages and increased prices[60,65,66]. Examples include, Somalia, South Sudan, Nicaragua, India, Mexico, South Africa, Ghana, Ivory Coast among many other countries[66, 67].Resource scarcity also leads to increased competition among communities, often resulting in conflicts. For example, in regions where water resources are shared, upstream withdrawals create tensions and even violent disputes[68,69]. In countries such as Nigeria, Mali, and Burkina Faso, competition over dwindling water and grazing resources led to violent clashes between farmers and herders[68,69]. Climate change exacerbated these conflicts by causing desertification and reducing the availability of arable land[68,69]. The shrinking of Lake Chad, which borders Nigeria, Niger, Chad, and Cameroon, has intensified competition for water and arable land, contributing to conflicts among local communities[68,69]. Non- state armed groups such as Boko Haram have duly taken advantage of these resource-based conflicts and instability to further their agenda and disrupting local economies [70].

Resource scarcity brings with it complex relationship dynamics in refugee and internally displaced persons (IDP) humanitarian situations where the competition with local communities may be intense and acrimonious. The following are some of the key resources impacted by climate change and their impacts on refugees and IDPs.

1. **Water Shortages**: Water shortages have profound impacts on refugee and internally displaced person (IDP). Changing precipitation patterns and increased frequency of droughts have led to severe water scarcity in some regions. This is particularly challenging for refugees and IDPs who may already have limited access to clean water. As temperatures rise and weather patterns become more erratic, water sources dry up, making it harder for refugees and IDPs to access clean, safe water. This can lead to dehydration, spread of waterborne diseases, and increased competition for remaining water resources. Scarcity of water often lead to conflicts between refugees and host communities over limited resources. This tension can further destabilize already vulnerable regions hosting refugees and IDPs [65,68,71].
2. **Agricultural Productivity**: Climate change has negatively impacted agricultural productivity through extreme weather events and changing climate conditions, making it harder for displaced persons, such as refugees and IDPs, to grow food and sustain themselves. This leads to food shortages, malnutrition and increased insecurity. Climate change affects crop yields, livestock health, and fishing stocks, contributing to food shortages. In refugee and IDP camps and settlements, limited access to food results in malnutrition, especially among children and other vulnerable groups such as elderly and disabled [61]. Limited access to natural resources

hinders economic opportunities for refugees and IDPs, making it difficult for them to support themselves and their families. This leads to increased dependency on aid and limited prospects for self-reliance. [61,72,73,74,75].

3. **Degraded Natural Resources**: Refugees and IDPs often rely on local ecosystems for their basic needs. Climate change-induced events like deforestation, desertification, and soil erosion reduce the availability of these resources. Climate change has disrupted energy production, particularly in regions reliant on hydropower. Reduced water flow due to droughts decrease the efficiency of hydroelectric plants, leading to energy shortages. Climate change-induced scarcity leads to increased competition for essential resources like water and arable land between refugees/IDPs and host communities, which often results in conflicts and tensions. As resources become scarcer, competition for them intensify. In the Sahel region and Chad basin climate change has exacerbated competition over scarce resources like water and arable land, leading to conflicts and migration. Host communities already struggling with resource scarcity, the influx of refugees and IDPs put additional strain on these resources, exacerbating the situation further[72, 76, 77,78].

4. **Health**: Climate change strain healthcare systems, making it difficult to provide adequate medical care and supplies. Access to safe drinking water is often compromised due to droughts, floods, and contamination, leading to waterborne diseases. Extreme weather events damage sanitation infrastructure, increasing the risk of infectious diseases. Resource scarcity leads to poor living conditions, which in turn can result in health risks such as waterborne diseases and malnutrition. The changing climate can lead to the spread of diseases, particularly vector-borne diseases such as malaria and dengue fever[37, 61,79].

5. **Shelter and Infrastructure:** Extreme weather events like floods, hurricanes, and droughts destroy shelters and essential infrastructure in refugee and IDP camps compounding the vulnerability of already at-risk populations. When shelters are destroyed, families are often forced to move again, leading to cycles of displacement and loss of stability. Camps built on unstable or deforested land are prone to landslides and erosion, damaging buildings and roads. Many camps lack proper drainage systems, making them highly vulnerable to flooding and waterborne diseases during heavy rains. Rebuilding after such events is often slow and resource-intensive.[47,48, 80].

Examples of key resources impacted by climate change with significant impact on refugees and IDPs include countries such as Bangladesh, Syria, South Sudan, Lake Chad Basin, Mozambique, Somalia, Zimbabwe and Pacific Islands among many other countries [66,67,68,70,81]. The following specific examples highlight how climate change has exacerbated resource scarcity in refugee and IDP situations:

1. Bangladesh - Rohingya Refugees: Cox's Bazar refugee camps in Bangladesh is home to about a million Rohingya refugees who continue facing multiple challenges some exacerbated by climate change. The refugee camps are located in areas prone to monsoon flooding and landslides, putting refugees at constant risk[37,79]. Monsoon rains and cyclones frequently flood and damage shelters, contaminate water sources, and disrupt food supplies. For example, in July 2021, heavy monsoon rains triggered flash floods and landslides, affecting more than 12,000 refugees and damaging or destroying approximately 2,500 shelters[82]. In September 2024, monsoon rains from September 12 to 14 caused significant flooding and landslides in the refugee camps , displacing 7,404 Rohingya refugees and damaging 1,177 shelters. A total of 379 major and minor landslides were reported across 33 camps [83]. The large influx of Rohingya refugees from Myanmar in 2017 also strained local resources, including water and food supplies[79,84]. Overcrowded conditions and poor sanitation increased the risk of disease outbreaks[79,84]. Efforts to provide safe drinking water and sanitation are hindered by the increasingly erratic weather patterns in that region, leading to waterborne diseases and resource scarcity[79,84].

2. Syria - Internally Displaced Persons: Conflict remain the main driver of displacements in Syria. However, prolonged droughts in Syria have led to water and food shortages, forcing many people to flee their homes. In IDP camps, the scarcity of water is a perennial issue, and the changing climate has made agriculture even more difficult, exacerbating food insecurity. For example, droughts in northern Syria during periods 2014 to 2016 and 2021- 2023, IDPs in camps such as Atmeh and Al-Hol, faced harsh conditions affecting the availability of water and agricultural productivity causing food shortages[85]. Al-Hol and Atmeh camps also faced extreme weather conditions, with harsh winters and hot summers making living conditions extremely difficult[79,85]. The camps

also struggled with limited access to clean water and food, affecting the health and well-being of its residents[86, 87]. Frequent conflicts in Syria and climate-related disasters have damaged infrastructure, making it hard to deliver aid. For example, Rukban camp located in a remote desert area at the tri-border point between Syria, Jordan, and Iraq, has endured severe weather conditions and extreme deprivation for years, with the situation reportedly worsening between 2021 and 2024[88]. Severe weather conditions, combined with no permanent shelters, exposed residents to heatstroke, dehydration, and cold-related illnesses The camp's infrastructure damaged by frequent conflicts and climate-related disasters, made it hard to deliver aid to the camp[87]. Once home to 80,000 people, the camp now shelters around 8,000, as many have left due to the unbearable conditions and limited access to basic necessities [88].

3. **South Sudan - Refugees and IDPs:** South Sudan has been severely affected by climate change, with recurring floods and droughts impacting the country's agricultural output. For example, South Sudan experienced significant flooding in late 2021 and early 2022, affecting over 900,000 people. The floods led to outbreaks of cholera and malaria, highlighting the country's vulnerability to climate-induced health crises [89]. The compounded effects of climate change and conflict in South Sudan, have had devastating consequences for refugees and IDPs. For example, in 2023, more than 7.8 million people in South Sudan were projected to face high levels of food insecurity, a significant increase from the previous year. Particularly affected were refugees and IDPs because of their specific vulnerabilities to any shocks [89]. Upper Nile and Unity state regions which host both refugees and IDPs, have been particularly impacted by flooding sometimes leading to further displacement of communities and creating challenges in delivering humanitarian aid. For example, refugee camps in Maban and IDP camps in Bentui have faced recurrent flooding for successive years , exacerbating the already difficult living conditions for refugees and IDPs[90]. Access to food and clean water became limited, and extreme weather events further strained these resources, making survival even more challenging[90, 91]. Further, local communities in these regions(Upper Nile and Unity) have been displaced multiple times due to both conflict and climate-induced disasters. For example, since 2018, the Greater Upper Nile region has seen diffuse, opportunistic violence, accounting for 43% of communal violence . This violence has repeatedly displaced local communities [92].

4. **Drought in the Lake Chad Basin:** The Lake Chad Basin in Africa, encompassing parts of Nigeria, Niger, Chad, and Cameroon, has experienced severe weather conditions leading to droughts, increased desertification and erratic rainfall patterns. Lake Chad has reportedly lost about 90% of its surface area since the 1960s [93,94]. This has exacerbated competition between farming, fishing, and herding communities. This reduction in water availability has led to violent clashes over fertile land and resources. Droughts have drastically reduced water levels in Lake Chad, affecting millions of people who depend on it for drinking water and agriculture[95]. The scarcity of water and arable land has forced many to leave their homes, resulting in large numbers of IDPs as they search for arable land and water sources [95]. The scarcity of resources has also heightened tensions between migrating communities and host populations, leading to conflicts over access to limited resources. For example, in 2015, conflicts over water and land resources intensified due to the shrinking of Lake Chad[95]. The reduced water levels led to competition among farmers, herders, and fishermen from Nigeria, Niger, Chad, and Cameroon who share lake Chad exacerbating tensions and leading to violent clashes[95]. In May 2021, climate-driven scarcity triggered tensions between fishing, farming, and herding communities, leading to violent clashes. This resulted in approximately 60,000 Cameroonians seeking refuge in neighbouring Chad[96].

5. **Cyclone Idai in Mozambique, Malawi, Zimbabwe, and Madagascar.** In March 2019, cyclone Idai devastated parts of Mozambique, Malawi, Zimbabwe, and Madagascar displacing thousands of people[60]. Refugees and IDPs faced severe challenges. Many homes were destroyed, forcing people to seek shelter in overcrowded camps[60]. The cyclone destroyed crops and disrupted food supplies, leading to severe food shortages[60]. Flooding and poor sanitation in IDP camps increased the risk of waterborne diseases[60]. For example, in Mozambique the cyclone's impact was particularly devastating in Inhambane, Manica, Sofala, Tete, and Zambezia provinces. In Zambezia and Tete provinces, more than 140,000 people were displaced[97]. In Zimbabwe, Tongogara refugee camp was affected by cyclone Idai causing extensive damage. Approximately 1,200 refugee homes were damaged or destroyed due to excessive rain weakening their structures and 618 latrines

collapsed. 5300 refugees were affected needing immediate assistance in form of food and non-food items such as blankets, kitchen sets, jerry cans, mosquito nets, solar lamps, sanitary pads, and soap[98].

6. Climate Change, Resource Scarcity and Conflict

Resource scarcity significantly impact on conflict and insecurity, in humanitarian contexts with refugees and internally displaced persons (IDPs). Scarcity of essential resources such as water, food, and shelter due to climate change heighten tensions and often lead to conflicts within and between displaced communities, e.g., refugees or IDPs and host populations[3,6,32,60]. Scarcity of resources intensify competition , potentially leading to local tensions or sparking new conflicts between and within communities, especially in regions already facing instability due to a variety of reasons but primarily armed conflict[3,6,32,60]. Many refugees or IDPs live in areas heavily impacted by both climate change and armed conflict, such as Ethiopia, DRC, Somalia, Syria, Yemen, South Sudan and Sudan. Refugees and internally displaced persons (IDPs) in these regions face multiple, overlapping crises. These include reduced agricultural yields, water shortages and general insecurity, undermining local economies, particularly in regions heavily dependent on agriculture. This economic instability increase refugee and IDPs vulnerability and may contribute to social unrest[3,6,32,60].

Understanding the types and causes of conflicts is critical in developing strategies to mitigate resource-related tensions in refugee and IDP camps. Conflicts arising from resource scarcity in refugee and IDP camps can be categorized as follows, each driven by specific causes:

1. **Interpersonal Conflicts**: Disputes over daily needs in refugee and IDP humanitarian situations sometimes causes conflict**.** Conflicts often arise over access to daily necessities such as water, food, and shelter. For example, in overcrowded refugee and IDP camps, competition for limited water sources, agricultural and grazing land and fishing rights can lead to frequent disputes. This has been observed in refugee camps and settlements in Bangladesh and Uganda[99].
2. **Intergroup Conflicts**: Ethnic, religious and cultural tensions arise because of the diversity of the population in refugee and IDP camps. Different ethnic, religious or cultural groups within camps may clash over resource allocation or access , especially if one group perceives favouritism or inequity. If one group believes another is receiving preferential treatment (e.g., more food, better shelter, or more access to jobs or aid), it can lead to resentment and hostility. Many refugees and IDPs also come from regions with long-standing ethnic or sectarian tensions and old rivalries are easily reignited under the stress of displacement. This has been observed in refugee camps in greater Upper Nile, South Sudan and Kakuma in Kenya where ethnic tensions are exacerbated by resource scarcity and have led to conflicts[100].
3. **Conflicts with Host Communities**: Resource competition has been a source of conflict in many refuges and IDP humanitarian situations especially in resource-scarce environments. Refugees and IDPs often compete with local populations for resources such as arable and grazing land, water, and employment opportunities. The competition over essential resources often leads to tensions and conflict. In Uganda, the influx of refugees led to tensions with host communities over agricultural land[101].

Causes of Conflicts

1. **Degree of Scarcity**: Absolute scarcity breeds competition. When resources are extremely limited and cannot meet the needs of the population, conflicts are more likely. For instance, in some arid regions, water scarcity has led to intense competition and conflict[99, 100].
2. **Supply-Induced Scarcity**: This occurs when the availability of a resource diminishes over time, such as through overexploitation of natural resources, deforestation, climate change(e.g., low rainfall) and poor resource management or inefficient infrastructure[99, 100].
3. **Demand-Induced Scarcity**: An increase in the camp population naturally leads to higher demand for resources, exacerbating scarcity and leading to conflicts. This is common in rapidly growing camps[99]. Further, as the needs of the camp population grow, the demand for resources such as food and water increases, leading to conflicts over limited supplies[100]. These rising consumption Levels have been sources of conflict.

4. **Power Dynamics**: The relative power dynamics of diverse groups in refugee and IDP camps are often a source of conflict. The power dynamics between different groups within the camp can influence conflict. More powerful groups may have better access to resources, leading to resentment and conflict with less powerful groups[100]. Groups or individuals supported or sponsored by armed groups may wield great power which prejudices less powerful communities[100].

5. **Environmental Degradation**: Overuse of resources has been a significant contributor to conflicts in some refugee and IDP humanitarian situations. The concentration of large populations in camps leads to the overuse and depletion of local resources, such as water and firewood, causing conflicts over the remaining resources[101].

6. **Lack of Alternatives**: There is limited access to alternatives in refugee and IDP humanitarian situations. When there are no alternative sources of essential resources, the competition for the available resources intensifies, leading to conflicts. For example, in camps with no alternative water sources, disputes over water access are common[100].

Conflicts over resources in refugee and IDP camps is a significant security challenge, often exacerbated by the scarcity of essential supplies and the pressures of large populations living in close quarters. Climate change-induced resource scarcity has contributed to conflicts in several refugee and IDP humanitarian situations. Examples include:

1. **Lake Chad Basin**: The Lake Chad Basin, encompassing parts of Nigeria, Niger, Chad, and Cameroon, has seen significant conflict due to resource scarcity. The lake has shrunk by about 90% since the 1960s, leading to intense competition for water and fertile land. This has fuelled conflicts among farming, fishing, and herding communities, displacing thousands [93, 94, 96].

2. **South Sudan**: In South Sudan, climate change has led to recurring floods and droughts, severely impacting agricultural output. For instance, the floods in 2021 and 2022 affected over 900,000 people, leading to food insecurity and displacement. The compounded effects of climate change and ongoing conflict left millions of refugees and IDPs in dire conditions in Upper Nile region[89].

3. **Somalia**: Somalia has experienced prolonged droughts, which have devastated livestock and crops, leading to severe food and water shortages. This has exacerbated conflicts over scarce resources, contributing to the displacement of millions of people. For example, by the end of 2022, Somalia recorded 3.8 million IDPs due to natural hazards like drought and flooding combined with widespread insecurity [102]. In 2017, a severe drought displaced over 900,000 people within the country [103].

4. **Bangladesh**: The Rohingya refugee crisis in Bangladesh is an example where climate change-induced resource scarcity has heightened tensions. The influx of refugees from 2017 has put immense pressure on local resources, leading to conflicts between refugees and host communities over access to water, food, and land. A research by Ali, M., & Shahreen, T, on "*Climate-resilient water resource management for Rohingya refugee camps in Cox's Bazar, Bangladesh*" highlighted that severe water resource challenges in the Rohingya refugee camps had been exacerbated by climate change. Over-extraction of groundwater and deteriorating water quality led to periods of acute scarcity and contamination risks, intensifying tensions between refugees and host communities [104]. In August 2018, UNHCR, in collaboration with partners, introduced reusable LPG tanks to Rohingya refugees and members of the host community. This initiative aimed to reduce reliance on firewood, which had led to deforestation and increased tensions over resource scarcity [105].

5. **Kenya.** In Kenya severe droughts and flooding have forced many communities to migrate particularly in the great rift valley area. The competition for dwindling resources has led to conflicts between different ethnic groups and increased the number of internally displaced persons[106]. In Baringo County, the Kiwanja Ndege IDP camp was severely affected by climate change induced drought in 2020. The prolonged drought led to water shortages, causing conflicts between different ethnic groups within the camp over access to water points[106]. Refugees have also been affected in Kenya. For example, Kakuma refugee camp in Turkana County has faced significant challenges due to prolonged droughts. The scarcity of water and pastures led to conflicts between

refugees and the local Turkana community leading to violent clashes.[107].In 2023, the severe drought in Turkana County led to increased competition for scarce resources such as water and grazing land. This resulted in conflicts between the Turkana community and refugees from Kakuma camp further displacing many individuals[106].

7. Climate Change, Resource Scarcity, Conflict and Insecurity

Climate change and resource scarcity are intricately linked with conflict and insecurity, especially in humanitarian contexts involving refugees and internally displaced persons (IDPs) [108, 109, 110]. The interaction and or interplay between climate change and resource scarcity intensifies conflict. Conflict is a significant source of insecurity in diverse refugee and IDP humanitarian operations. Insecurity in humanitarian contexts refers to the diverse security threats and risks faced by refugees and IDPs individually and or collectively[56, 57, 58]. Insecurity exposes refugees and IDPs to harmful events such as crime, violence, torture, exploitation, unlawful detention and arrests, human trafficking, gender-based violence, religious and ethnic violence among many other threats[10, 13, 27]. The presence of armed actors near or within some refugee and IDP camps can worsen the situation, undermining security and protection efforts. This inevitably allows informal or other coercive systems of control to emerge, including gangs or militias. Insecurity also limits humanitarian access, disrupt aid delivery, and increase vulnerability, especially for women, children, and persons with disabilities. Insecurity is a significant challenge in some refugee and IDP humanitarian contexts particularly in high-risk environments[13,27,28]. Refugees and IDPs face a plethora of security threats and risks which must be delicately navigated particularly where government and law enforcement systems lack capacity to effectively provide security to populations in their territories[13, 27, 28].

Security threats and risks refugees and IDPs face in their environments are diverse and vary from context to context. Climate change has exacerbated refugees and IDPs vulnerabilities to some of the security threats and risks. Documented security threats faced by refugees and IDPs impacting on their safety and security, and overall well-being in insecure humanitarian environments can broadly be categorized as follows:

Conflict threats. Armed conflict threats include, direct violence, sexual and gender-based violence (SGBV), forced recruitment, landmines and explosive remnants of war (ERW), looting and property destruction and restricted humanitarian access. Refugees and IDPs camps are often located in conflict zones with a plethora of diverse security threats which vary from context to context. Most forced displacements in the world are a product of armed conflict. Refugee and IDP camps and settlements are often located in conflict zones or areas with high levels of violence exposing them to physical violence and attacks. Armed groups infiltrate refugee and IDP camps and settlements exposing refugees and IDPs to additional security threats. For example, forced recruitments and association of children with armed forces and groups**,** including women and children have been documented in conflict zones. In many conflict-affected areas, humanitarian access is often restricted due to security concerns, political barriers, or logistical challenges. In armed conflict situations, access denial threats such as restrictions on humanitarian activities and movements, preventing aid from reaching those in need including interference with aid operations, partiality and discrimination against some aid beneficiaries are common and have been well documented. This hampers the delivery of aid and protection services to those in need in terms of the humanitarian principles of humanity, impartiality, neutrality, independence[13, 27, 28].

Paradoxically, refugees and IDPs flee from conflict zones, but violence often follow them wherever they go. Refugees and IDPs often face dangerous conditions and continue to be at risk even after fleeing exposing them to conflict-related violence and exploitation even in camps and settlements[6, 47, 48]. This includes attacks from armed groups, local conflicts, and tensions with host communities and within the refugee and IDP community itself [6, 10, 47, 48]. Climate change heightens refugee and IDP vulnerability. In conflict zones national governments may struggle to protect and assist displaced citizens, leaving them vulnerable to violence and exploitation[111].Further, access denial threats such as restrictions on humanitarian activities and movements, preventing aid from reaching those in need including interference with aid operations, partiality and

discrimination against some aid beneficiaries are common and have been well documented in conflict zones[13, 27, 28].

Crime threats: Criminal activities targeting refugees and internally displaced persons (IDPs) are prevalent across all humanitarian settings and tend to escalate in high-risk environments, such as conflict zones and fragile post-conflict areas. Refugees and IDP camps and settlements are especially susceptible to crime due to generally weakened law enforcement and governance structures. Common crime threats include theft, robbery, gang violence, kidnapping, abduction, hostage-taking, extortion, human trafficking, banditry, smuggling, and enforced disappearances[13, 26, 27, 28]. Theft and looting of humanitarian aid further complicate security efforts by depriving vulnerable populations of essential resources. The presence of combatants, former fighters, and other armed groups within or near refugee and IDP camps often leads to instability, as these actors exploit resources and infrastructure. As climate change drives repeated displacement, secondary movements become more frequent, often pushing refugees and IDPs into areas with higher crime rates or greater exposure to criminal networks. Their precarious living conditions heighten their vulnerability, making them easy targets for traffickers, smugglers, and other opportunistic criminals[13, 26, 27, 28].

Terrorism threats: Terrorism threats common in refugee and IDP humanitarian environments include religious and ideological persecution, humanitarian access denial and or restrictions, disruption of supply chains, direct and indirect attacks, targeted improvised explosive devices attack, kidnapping, looting and theft of aid. In humanitarian environments with terrorism, forced recruitments and association of children with armed forces and groups**,** including women and children, psychological and emotional abuse and inflicted distress are common [13, 28, 48]. Refugee and IDP camps have been targeted by terrorist groups, leading to loss of life, injuries, and destruction of property. These attacks create fear and instability, making it difficult for refugees and IDPs to feel safe [79]. Camps are fertile recruitment grounds for terrorist organizations. The desperation and lack of opportunities in these camps make individuals particularly youth more susceptible to radicalization. Terrorist activities disrupt the delivery of humanitarian aid, making it harder for refugees and IDPs to access essential services like food, water, and medical care. The constant threat of terrorism leads to severe psychological stress and trauma among displaced populations, affecting their mental health and overall well-being[28, 48, 79, 112].

Civil unrest threats: Demonstrations, protests, and group disturbances/conflicts over a range of grievances are common in refugees and IDP camps and settlements. Group conflicts, which include rival aid benefiaries groups violence and or criminal gang violence fuel civil unrest. Civil unrest disrupts the delivery of essential services such as food, water, healthcare, and shelter. This disruption exacerbates the already precarious living conditions of refugees and IDP [48, 79, 112]. Refugees and IDPs are often more vulnerable during periods of civil unrest. They face heightened risks of violence, exploitation, and abuse, as security forces and other actors may target them. Civil unrest can force refugees and IDPs to move again, leading to secondary displacement. This constant movement disrupts lives and makes it difficult for . refugees and IDPs to find stability [48,79,112].

Gender Based violence threats: Women and girls in refugee and IDP camps and settlements are highly vulnerable to physical and sexual violence. This includes rape, sexual assault, and intimate partner violence. The lack of security and privacy in these camps often makes it easier for perpetrators to commit such acts. Economic violence involving controlling access to resources, employment, and financial independence disproportionally affect women and children[113, 114, 115]. In refugee and IDP camps, women often face barriers to accessing economic opportunities, which can lead to exploitation and abuse. Women and children also suffer from psychological violence which includes threats, coercion, and emotional abuse. The stress and trauma of displacement, combined with the harsh conditions in camps, can exacerbate psychological violence[113, 114, 115].

Cybersecurity, disinformation and misinformation threats: Aid delivery has become more digital, and aid beneficiaries' data is increasingly vulnerable to cyber-attacks. Refugees and IDPs often have their personal and sensitive data collected by humanitarian organizations. Cyber-attacks targeting these organizations can lead to data breaches, exposing individuals to harassment, exploitation, and discrimination. Personal data can be compromised and used for criminal purposes, aid distribution can be disrupted, interfered with or manipulated. For example, diversion of aid to undeserving beneficiaries undermining humanitarian principles and trust in humanitarian organizations. Disinformation and misinformation threats include false information which can

spread rapidly, leading to confusion, mistrust, and even violence. This can hinder aid efforts and put aid beneficiaries at risk[116, 117].

Health and hazardous threats: Inadequate security in refugee and IDP camps leads to numerous health risks, including the spread of diseases in overcrowded or unsanitary conditions. Continuous exposure to violence and insecurity also causes significant psychological stress and trauma. These issues are further exacerbated by climate change, which introduces additional hazardous threats such as natural disasters (flooding, droughts, cyclones, tsunamis), road traffic accidents, and fire accidents. Overcrowded and unsanitary conditions in refugee and IDP camps can lead to the rapid spread of diseases. For example, heavy rains and flooding can contaminate water supplies, leading to outbreaks of waterborne diseases [39, 118]. Overcrowded camps with poor infrastructure are vulnerable to fire hazards and climate change worsens these conditions. High temperatures and prolonged heatwaves dry out temporary shelters and surrounding vegetation, making fires more likely and harder to control. Further, stronger and more erratic winds can cause fires to spread rapidly through densely packed shelters of refugees and IDPs. These extreme weather events damage and destroy infrastructure and disrupt water and sanitation systems [39,118].

Bureaucratic, **Political and Legal threats.** Negotiating administrative hurdles is complex and time consuming in some humanitarian operations**.** Refugees and IDPs often face bureaucratic threats which include abuse of power, corruption, exploitation, and harassment by diverse state and non-state actors. Refugees and IDPs often lack legal protection and face harassment from various actors. Political and legal threats include operational restrictions, detention, arbitrary arrests, expulsion and refoulement. Impediments and restrictions to access legal documentation, including civil documentation (legal identity) is significant in some refugee operations. Climate change can worsen refugee and IDP situations by increasing their dependency on bureaucratic systems that may be corrupt or inefficient[27, 119].

Climate change heightens refugee and IDPs vulnerability to the above threats in several ways. As climate change leads to shortages of essential resources like food and water, competition for these scarce resources can increase. This competition can worsen insecurity, for example, increased incidents of theft, robbery, violence, gender-based violence and other criminal activities within refugee and IDP camps [79]. Climate change increases the vulnerability of refugees and IDPs by forcing them into precarious living conditions and insecurity due to conflict spillover or lack of law enforcement. Climate induced extreme weather conditions such as flooding have caused overcrowding, destruction of shelter or inadequate shelter, lack of basic services, limited access to clean water and sanitation, food insecurity, diseases, safety and protection concerns, economic hardship, education disruption and lack of legal protection**.** These have exacerbated insecurity, making refugees and IDPs vulnerable to all types of risks, which include health risks, abuse, exploitation, gender-based violence, forced recruitments and radicalization[58, 120].

In conflict zones national governments often struggle to protect their citizens more so refugees and or IDPs, leaving them vulnerable to violence and exploitation[27,28,121]. Refugees and IDPs are already vulnerable due to their displacement. Climate change exacerbates this vulnerability by adding another layer of risk and uncertainty, making it harder for these communities to recover and rebuild their lives[118]. As climate change forces people to move repeatedly, they may end up in areas with higher crime rates or in situations where they are more exposed to criminal activities This vulnerability has been exploited by traffickers, smugglers, and other criminals who prey on those in desperate situations[10, 13, 35]. Climate-induced displacement disrupt social networks and community structures, leading to a breakdown in social cohesion. This disruption has created an environment where crime and violence are more likely to occur. Women, children, and marginalized groups face may face increased risks of exploitation and violence during climate-related displacement [79].

Climate change-induced resource scarcity often creates tension which may lead to conflict exacerbating insecurity in refugee and IDP camps. Cyber threats can exploit these tensions by spreading misinformation about resource availability and access [122]. Cyber-attacks can also manipulate climate data and disrupt climate change mitigation efforts, directly and indirectly affecting refugees and IDPs who are already impacted by climate-related

displacement[123]. Extreme weather conditions increase the spread of diseases. For instance, floods can lead to waterborne diseases, while heatwaves can cause heat-related illnesses. The lack of adequate healthcare facilities in many refugee and IDP camps makes it difficult to manage these health risks[79]. Climate change-induced resource scarcity can fuel terrorism in refugee and IDP camps. Terrorist groups can exploit community tensions by increasing recruitment among the youths and spreading misinformation about resource availability and access [124]. Climate change can also fuel environmental extremism, where terrorist groups or radical interest groups use environmental issues as part of their ideology. Hosting communities can also use environmental issues to marginalize refugees and IDPs. This can lead to targeted attacks on infrastructure and resources critical to refugees and or IDPs[125].

Climate change-induced resource scarcity can exacerbate insecurity within refugee and IDP camps leading to civil unrest. This scarcity can lead to demonstrations and protests over access to essential resources like land, food and water [124]. Climate change can disrupt social structures and community networks. This breakdown can lead to a loss of social cohesion and protection mechanisms, making women and girls more vulnerable to gender-based violence[126]. Climate change can lead to loss of livelihoods and economic instability. This economic stress can increase dependency and coercion, leading to higher rates of domestic violence, abuse and exploitation[127].

As climate change impacts become more severe, refugee and IDP camps may face secondary displacement. For example, if a camp is repeatedly affected by floods or other disasters, residents are forced to move again, leading to further instability and insecurity. Secondary displacement due to climate change, has exacerbated refugee and IDPs vulnerability to security threats in the environment. Displacement and resource scarcity create additional security threats and risks for refugees, IDPs and host communities[6,32,33,34]. In Cox's Bazar, Rohingya refugees have faced secondary displacement due to landslides and flooding during the monsoon season. This not only disrupted their lives but also heightened tensions with host communities and increased the risk of violence[6, 32, 33, 34]. In Somalia, droughts and floods have caused secondary displacement among Somali IDPs, forcing them to move repeatedly. This constant movement made them more vulnerable to attacks by armed groups and limited their access to essential services[3, 33, 34, 35]. In South Sudan , flooding in 2022 led to secondary displacement of IDPs who were already living in precarious conditions increasing their exposure to violence and insecurity as they moved to new areas[128].

Examples of refugee and IDP camps exposed to increased insecurity exacerbated by climate change include camps in Nigeria, Bangladesh, South Sudan, Pakistan, Kenya, Somalia, Yemen, Lebanon [79].

1. **Bakassi IDP Camp, Maiduguri, Nigeria (2019)**: In northeast Nigeria, the Bakassi IDP camp faced significant challenges due to water scarcity and land desertification. A study by Kamta*, et al* (2020) on "*Insecurity, Resource Scarcity, and Migration to camps of internally displaced persons in Northeast Nigeria",* investigates the complex drivers behind internal displacement in northeast Nigeria, particularly focusing on the Bakassi IDP camp in Maiduguri. The region is also severely affected by the Boko Haram insurgency and environmental degradation, including land desertification and water scarcity. The key findings were that internally displaced persons (IDPs) cited insecurity due to Boko Haram as the main reason for fleeing their homes. Secondary drivers were resource scarcity and socioeconomic factors such as access to water and arable land, land ownership and wealth, and livelihood opportunities. Both primary and secondary drivers had exacerbated IDP insecurity, making them more vulnerable to abuse and exploitation, theft, violence, and other criminal activities within IDP camps [129, 130].
2. **Bangladesh Cox's bazar:** The Rohingya refugee crisis in Bangladesh is an example where climate change-induced resource scarcity has heightened tension. The influx of refugees from 2017 put immense pressure on local resources, leading to conflicts between refugees and host communities over access to water, food, and land. Deforestation for firewood and shelter construction led to soil erosion and landslides, especially during monsoon seasons. The environmental impacts exacerbated host community grievances, fuelling conflict

leading to altercations and property damage. Criminal groups from both host communities and refugees took advantage of tension to further exploit already vulnerable refugees through coercion and threats. In August 2018, UNHCR, in collaboration with partners, introduced reusable LPG tanks to Rohingya refugees and members of the host community. This initiative was aimed at reducing reliance on firewood, which had led to deforestation and increased tensions over resource scarcity. A 2023 report by the United States Institute of Peace found that host community members increasingly viewed the Rohingya as a burden and security threat. There had been localized disputes over land use, aid distribution, and environmental degradation. Some host community members reported violent altercations and property damage linked to these tension. The influx of refugees and humanitarian organizations also weakened the ability of communities to manage tensions peacefully [131. 132, 133, 134].

A study by Khaled (2021), *Do No Harm in refugee humanitarian aid: the case of the Rohingya humanitarian response,* found out that humanitarian aid for Rohingya refugees, while essential, inadvertently harmed poorer host communities in Cox's Bazar. Increased competition for jobs and natural resources, increasing prices of basic goods and perceptions of inequality in aid distribution led to tensions and sometimes localised clashes between host communities and refugees. Further, the influx of aid and international actors disrupted local governance and social cohesion, weakening the ability of communities to manage tensions peacefully [131. 132, 133, 134].

3. Forced Recruitment- Somalia, Yemen, Lebanon, Kenya and Pakistan: Armed groups exploited vulnerabilities of refugees to recruit members or control resources, further exacerbating conflict and insecurity[135].Examples of documented forced recruitment in refugee and IDP camps include in Somalia, Yemen, Lebanon, Kenya and Pakistan.

In Somalia, recruitment from IDP camps is believed to be ongoing since 2007. Al-Shabaab reportedly routinely forcibly recruited children and young men from IDP camps, especially in Mogadishu and Lower Shabelle regions. Reports include abductions and coercion. In IDP Camps in Yemen from 2015 to present, both Houthi forces and pro-government militias have been accused of recruiting children from displaced camps, particularly in Sana'a, Hajjah, and Taiz camps. In Lebanon, Palestinian camps, armed factions reportedly historically recruited youth from camps like Ain al-Hilweh and militia presence and influence remain strong. In Dadaab refugee camps, Kenya, Al-Shabaab reportedly recruited youth from Somali refugees during 2010s especially during periods of reduced camp security. Kenyan authorities cited this as a reason for attempted Dadaab camps closures [136, 137, 138].

In Afghanistan the Taliban primarily relied on voluntary recruitment, but there were reports of cases of coercion and pressure, especially through family, clan, or religious networks. The consequences of refusal included threats, bodily harm, or even death. During the spring and summer of 2021**,** the Taliban reportedly mobilized thousands of fighters and supporters from Pakistan camps to bolster their ranks in Afghanistan. Recruitment was part of a broader pattern where refugee camps in Pakistan, particularly in Khyber Pakhtunkhwa and Balochistan, became recruitment grounds for various armed groups, including the Taliban and earlier mujahideen factions[136, 137, 138, 139,140].

- **Kakuma Refugee Camp, Kenya**: The Kakuma Refugee camp in northwestern Kenya has experienced significant conflicts among refugees from different ethnic backgrounds leading to violent clashes. The conflicts have often been fuelled by competition over limited resources such as water, food, and shelter[141]. Climate change exacerbated resource scarcity leading to tensions and violent clashes, particularly during periods of drought when water became even more scarce. The camp's population growth further strained the already limited resources, exacerbating conflicts[141]. A study by "Rithi (2015*), Conflict amongst refugees: The case of Kakuma Refugee Camp, 1992–2014* found out that conflicts were frequent and often triggered by minor incidents. Ethnic and national tensions were deeply rooted and easily reignited. The underlying causes included ethnic rivalries, competition for resources, and lack of effective conflict resolution mechanisms. Refugees brought unresolved conflicts from their home countries into the camp. In June 2024, violent clashes were

recorded between Anuak and Nuer ethnic groups in Kakuma camp. A minor dispute developed into broader ethnic violence leading to thousands of Anuaks fleeing to Nairobi. The underlying causes included resource scarcity. When the Anuaks returned to the camps they found their homes looted and conditions dire lacking clean water, food, and basic sanitation {141, 142, 143, 144, 145].

According to UNHCR, climate change has significantly impacted the Kakuma region, contributing to droughts and floods that degrade the environment. These environmental stresses have intensified competition over scarce resources like water, grazing land and firewood between refugees and host communities. These environmental pressures, combined with limited livelihood opportunities, have contributed to conflict and tension between refugees and the local Turkana host population. Refugees are often blamed for environmental degradation, fuelling xenophobia and inter-group hostility [144, 145 146, 147].

8. Tackling Climate Induced Resource Scarcity, Conflict, and Insecurity: Key Considerations and Recommendations

Addressing the multifaceted link between climate-induced resource scarcity, conflict, and insecurity in humanitarian situations involving refugees and internally displaced persons requires a comprehensive, multi-sectoral, and anticipatory approach. Adopting good evidence-based practices from similar contexts to address resource scarcity, conflict, and insecurity in refugee and internally displaced persons situations is powerful strategy and can be made adaptable to new settings. Key considerations and recommendations to inform policy and decision makers, and humanitarian organizations include:

1. **Climate-Sensitive Risk Assessment and Early Warning:** It is critical for humanitarian organizations working in refugee and IDP contexts to integrate climate risk analysis into humanitarian planning, displacement tracking and responses. The use of proactive early warning systems to anticipate climate shocks (e.g., droughts, floods) and their potential to trigger displacement or conflict must be systematized. This is so especially in contexts where such shocks can lead to displacement, conflict, or worsening insecurity**.** Collaborating with local and international meteorological and environmental agencies for real-time data sharing must be consistent and a continuous process. This approach has been successfully implemented in some refugee contexts. For example, Cox's Bazar refugee camps in Bangladesh host nearly a million Rohingya refugees in a region highly vulnerable to cyclones, floods, and landslides. UN humanitarian organizations such as UNHCR and IOM and their partners are proactively utilizing seasonal climate forecasts and early warning systems to trigger pre disaster interventions. The UN agencies and their partners pre-position emergency supplies, protect critical infrastructure, reinforce shelters and evacuate at-risk population. This is done in collaboration with Bangladesh Meteorological Department which provides forecasts. This systematic use of early warning system integrated climate data, satellite imagery, and local knowledge into humanitarian planning resulted in reduced disaster impact and improved preparedness in Cox's bazar refugee camps [79,152,153].This integration of climate risk analysis into humanitarian planning and displacement tracking can also be replicated in other humanitarian contexts with refugees and IDPs facing climate induced shocks, to mitigate impacts. Organizations like UNHCR, Red Cross Red Crescent Climate Centre and ODI Global advocate for inclusion of displaced people like refugees and IDPs in disaster risk management, strategic camp placement in climate-safe zones and the integration of climate adaptation into humanitarian programming. This progressive approach is the way to go [153, 154, 155].
2. **Resource Management and Environmental Sustainability:** The promotion of sustainable natural resource use in refugee and IDP operations (e.g., water conservation, reforestation, clean energy) requires muti-sectoral approach. The challenges and solutions span across environmental, social, economic, safety and security, and governance dimensions. This can be achieved collaboratively through supporting community-based natural resource management to reduce competition and tension between host and displaced populations such as refugees and IDPs. Linking livelihood support with environmental sustainability must be extensively promoted. The adoption of climate-smart agriculture and diversified livelihoods has helped reduce reliance on limited

natural resources in some humanitarian contexts with refugees. The Promotion of community-based natural resource management is also essential to ensure inclusive and participatory decision-making. Embracing clean energy solutions such as, solar lanterns, solar mini-grids, and improved cookstoves offers a sustainable alternative to firewood, helping to curb deforestation and enhance air quality. Additionally, implementing effective conflict resolution mechanisms is crucial to address disputes over shared resources. Coordinated planning among humanitarian organizations, development partners, and local governments is vital, along with establishing long-term funding strategies that support both emergency response and sustainable development[79, 153, 154, 155, 156]

Examples where sustainable resource management and environmental sustainability have been successfully implemented in internally displaced persons (IDP) camps include several countries in West and Central Africa. A multi country study in West and Central Africa regions by IOM in 2021, focussing " *On the Issues and Opportunities of Solid Waste Management within Internally Displaced Persons (IDPs) settings in West and Central Africa*" highlighted some success stories in waste management. The countries of study were Nigeria, Cameroon, Chad, Central African Republic, Mali, Niger and Burkina Faso[157].The IOM study highlighted successful solid waste management (SWM) practices in several IDP camps across several West and Central Africa countries. For example, in Maiduguri, Nigeria (Borno State), IDP camps in and around Maiduguri were noted for piloting community-based waste collection systems, where displaced persons were trained and employed in waste sorting and collection. This helped improve sanitation and created livelihood opportunities[157]. In Diffa region, Niger, IDPs and host communities collaborated on waste segregation and composting projects, supported by humanitarian actors. These efforts were tailored to local cultural practices and environmental conditions[157]. In Central Africa Republic (CAR) in some IDP sites, waste reuse and recycling initiatives were introduced, particularly focusing on plastic waste. These were linked to vocational training programs for youth and women [157]. IOM study outlines several good practices that can be adapted to improve solid waste management in displacement settings. These include community-based waste management; integrating solid waste management with Livelihoods and circular economy; multi-stakeholder coordination; introduction of appropriate infrastructure and technology; raising awareness and behaviour change; and supporting appropriate policy frameworks[157].

UN agencies such as UNHCR and development partners such as World Bank have played significant roles in promoting sustainable natural resource use in refugee and IDP camps and settlements. UNHCR's Climate Resilience and Environmental Sustainability Strategy (2022–2025) has seen some success stories. This is highlighted in UNHCR 2023 progress report *"On the operational strategy for climate resilience and environmental sustainability 2022–2025"* [158,159]. UNHCR piloted and implemented a comprehensive waste management strategy in some refugee camps, focusing on minimizing CO_2 emissions, through sustainable supply chains. This was achieved through recycling and repurposing relief materials and local waste treatment systems to reduce environmental and health risks. For example, in Bangladesh, Cox's Bazar, Kutupalong refugee camp, UNHCR introduced solar-powered water pumps and treatment plants, reducing reliance on diesel generators and cutting emissions. Waste management systems were improved to include waste sorting, recycling, and composting, helping to reduce landfill use and methane emissions [155,158]. This approach needs further advocacy and fund raising to be replicated in refugee settings in other countries.

In Dzaleka refugee settlement, Malawi, UNHCR partnered with the African Risk Capacity (ARC) to provide parametric drought insurance for the Dzaleka refugee settlement. The African Risk Capacity (ARC) is a specialized agency of the African Union established to help African governments plan, prepare for, and respond to extreme weather events and natural disasters especially those that threaten food security and livelihoods[159]. UNHCR collaborated with ARC and the KfW Development Bank under ARC's Replica Program, which allowed humanitarian agencies to purchase insurance on behalf of vulnerable populations. Payouts were triggered automatically based on measurable indicators (e.g., rainfall deficits), enabling rapid response. This

innovative approach ensured faster and more efficient responses to climate shocks enhancing protection and resilience for both refugees and host communities [158, 159]. In Burkina Faso, UNHCR supported training for displaced and local communities to build eco-friendly homes using locally available, sustainable materials. This reduced reliance on imported construction materials and promoted community resilience and environmental sustainability [158,159].

UNHCR has supported the Intergovernmental Authority on Development (IGAD) a regional organization in East and Horn of Africa, in developing a Climate Adaptation Strategy (2023–2030). This was the first regional strategy to include displaced and stateless people in climate adaptation planning. The strategy addressed the intersection of climate change, displacement, and human security in the Horn of Africa [159]. The key focus areas of the strategy were inclusion of displaced and stateless populations, promotion of climate-resilient Livelihoods (sustainable and adaptive livelihoods, climate -smart agriculture) and strengthening of early warning systems and disaster preparedness to reduce the impact of climate-induced displacement. The strategy also focussed on environmental protection and ecosystem restoration, regional cooperation and policy harmonization which aligned with global frameworks like the Paris Agreement and the Global Compact on refugees. The strategy promoted evidence-based policymaking through climate risk assessments, displacement tracking, innovation and supporting the development of climate adaptation technologies and knowledge-sharing platforms [159]. The IGAD Climate Adaptation Strategy (2023–2030), is a model for regional cooperation and represents a significant milestone in regional climate governance for the East and Horn of Africa [159]. The strategy can also be adopted in other regions to guide investments, mobilize climate finance and coordinate humanitarian development peace effort.

Another example of sustainable resource management and environmental sustainability was implemented by World Bank in Sudan. In 2021, in Eastern Sudan, Kassala state, World Bank supported a project that introduced climate-smart agriculture to improve food security for IDPs and host community. The project promoted drought resistant crops and improved seed varieties and supported conservation agriculture techniques like minimum tillage and crop rotation. It encouraged agroforestry and integrated farming systems to diversify income and improve soil health. The project also promoted livelihood diversification to reduce pressure on natural resources. Community-based natural resource management to ease tensions between host and IDPs was core to the project. The region was selected due to its high concentration of IDPs and vulnerable host communities, chronic poverty and limited livelihood opportunities and environmental challenges such as arid conditions and resource scarcity [160].

3. Conflict Sensitivity and Peacebuilding: Refugee and IDP humanitarian settings often have complex dynamics with diverse communities. Conflict over a diverse range of issues is never far away. It is critically important for humanitarian organizations to conduct conflict sensitivity analyses to understand how humanitarian interventions might exacerbate or mitigate tensions. Mainstreaming climate and conflict sensitivity into humanitarian, development, and peacebuilding programs for refugees and IDPs is an imperative for humanitarian organizations. It is equally important to facilitate dialogue and mediation between refugees/IDPs and host communities over shared resources. Particularly important is the participation of women, youth, and other marginalized groups in decision-making. It is also important to invest in data collection and research on the climate-conflict-displacement nexus to develop evidence-based advocacy to influence national and international climate and displacement policies [161,162,163].

Critical is the support to local governance structures to manage disputes and promote social cohesion. Support must include community-led assessments ensuring local perspectives inform programming. In this regard, building capacity of local authorities to mediate disputes and manage shared resources must be enhanced. For example, in South Sudan, Maban and Jamjang refugee camps, UNHCR and its partners conducted conflict sensitivity analyses to understand tensions between refugees and host communities. These analyses informed community-based interventions that promoted peaceful coexistence, such as shared infrastructure

projects and inclusive decision-making forums. Understanding the context was key. IOM developed a conflict sensitivity analysis system (CSAS) used in various fragile and conflict-affected settings to anticipate how humanitarian interventions might impact local tensions. This has been main streamed in countries such as South Sudan, Nigeria, DRC, CAR. IOM uses the conflict sensitivity analysis system to understand local conflict dynamics, anticipate how humanitarian interventions might exacerbate or mitigate tensions and adapt programming to avoid reinforcing existing grievances or inequalities. IOM South Sudan institutionalized conflict sensitivity through a dedicated Conflict Analysis Unit, which worked closely with the Displacement Tracking Matrix (DTM)[161,162,163,164, 165].

The Lake Chad Basin covering parts of Nigeria, Niger, Cameroon, and Chad has experienced significant reduction in water levels due to climate change, which has fuelled conflict over land and water. This has led to displacements, conflict and insecurity in the region[93, 94, 96]. Interventions included peacebuilding programs that integrate environmental restoration, cross-border cooperation to manage shared water resources and livelihood support for displaced populations to reduce reliance on shrinking natural resources[166]. The International Organization for Migration (IOM) Lake Chad Basin Crisis Response Plan (2021) implemented a multi-sectoral response in Cameroon, Chad, Niger, and Nigeria. Key components included community stabilization and peacebuilding, environmental rehabilitation in return areas, support for water, sanitation, and hygiene (WASH) infrastructure, and support for sustainable livelihoods to reduce pressure on natural resources[166]. This plan aligns with the UN and regional governments supported Lake Chad Basin Commission's Regional strategy that emphasizes the humanitarian development peace nexus (HDN)[166]. HDN promotes collaboration and coherence among humanitarian actors, development actors and peace actors[166]. Natural resource management as a peacebuilding tool, cross-border cooperation on environmental restoration, and the inclusion of displaced populations in ecosystem recovery efforts are key strategies which can be adopted in other IDP contexts in similar situations.

4. Protection and Security Measures: The humanitarian operational environment has become increasingly insecure, especially in conflict-affected and post-conflict regions[10,13]. These environments are often characterized by, active armed conflict, volatile political environment, weak governance and law enforcement, presence of non-state armed groups and targeting of humanitarian workers and infrastructure [10,13,27,28]. Climate change induced resource scarcity and conflict has exacerbated insecurity in refugee and IDP operations by further exploiting existing vulnerabilities. To enhance protection and security in refugee and IDP humanitarian settings, it is essential to integrate conflict analysis into all stages of humanitarian and development planning to avoid actions that may unintentionally escalate tensions[95,96,161,162]. Climate conflict risk assessments have to be systematized by conducting integrated climate and conflict sensitivity analyses and identifying potential triggers of violence or displacement[95,96,161,162].Supporting community-led protection initiatives such as neighbourhood watch groups, early warning systems, and local mediation structures can strengthen grassroots resilience. Significantly, empowering refugees and IDPs to actively participate in their own protection through community policing further reinforces resilience [10, 13, 28].

In conflict situations there is always humanitarian space and access concerns. Where direct access is limited, remote management and partnerships with humanitarian local actors and the communities affected ensures continuity of operations. Negotiating safe access with all parties to conflict and maintaining civil-military coordination are also critical to upholding humanitarian principles of humanity, neutrality, impartiality and independence. In parallel, sustained advocacy for the protection of civilians and the preservation of humanitarian space in refugee and IDP situations must remain a priority. Long-term stability requires investment in durable solutions for refugees and IDPs, including safe, voluntary, and dignified return, local integration, or resettlement. Addressing the root causes of displacement, such as conflicts, land disputes, lack of justice, and limited livelihood opportunities, is key to fostering lasting peace and reducing future vulnerabilities. This is a 21st century challenge [10,13, 27, 28].

Humanitarian agencies continue playing an active role in ensuring the safety and security of refugees and IDPs by supporting governments to maintain law and order refugee and IDP camps and settlements. It becomes more imperative as climate change induced resource scarcity becomes a source of additional insecurity, where existing vulnerabilities of refugees and IDPs are exploited further. For example, UN humanitarian agencies such as UNHCR, WFP, IOM among many others, have policies, processes, procedures and practices that specifically address the security of their aid beneficiaries who include refugees and IDPs[27,28]. For UNHCR, ensuring the safety and security of persons under its mandate is a strategic responsibility and challenge, and it is at the core of the UNHCR protection mandate[13,27]. UNHCR actively supports governments in the maintenance of law and order in refugee settings. Examples of the support include building police stations, providing vehicles and motor-cycles, training law and order Police officers and others in refugee and international law, capacity building and community policing initiatives among other support[10,13, 27, 28]

Examples of UNHCR and other UN agencies supporting governments to enhance security of refugees is found in refugee camps and settlements in Kenya, Bangladesh, South Sudan and Uganda among many other refugee operations[10,13, 27, 28]. For example, in Kenya, the Security Partnership Project Memorandum of Understanding (SPP MoU) signed between the Government of Kenya and UNHCR in 2011 and still operational was funded by various donors to improve security in Dadaab and Kakuma refugee camps in Kenya. The SPP supported both hardware infrastructure (police stations, accommodation, new vehicles and their maintenance) and software infrastructure (training, risk analysis, incentives). The MoU led to significant improvement in security in Dadaab and Kakuma refugee camps, enabling humanitarian operations to proceed with reduced interruptions [10,13, 27, 28]. This approach can be adopted in other refugee humanitarian settings.

5. Integrated Humanitarian Development Climate Programming: An integrated approach must align humanitarian responses with long-term development and climate adaptation goals. This can be done through working with development actors to build resilient infrastructure (e.g., water systems, shelters) in refugee and IDP settings. There is need for sustained advocacy for climate finance to support displaced populations and host communities. There are several documented examples where humanitarian responses have been aligned with long-term development and climate adaptation goals in refugee and internally displaced persons (IDP) operations. Examples include **multi**-country initiatives by International Committee of the Red Cross(ICRC) and ODI Global (formerly Overseas Development Institute). A 2024 briefing by ICRC and ODI highlighted successful climate adaptation efforts in fragile and conflict-affected settings with IDPs and refugees such as, Burundi, Ethiopia, Niger, Somalia, and Yemen. The countries implemented tailored interventions that integrated climate resilience into humanitarian responses. This was done through strengthening livelihoods and access to services, building early warning systems and enhancing social safety nets to reduce vulnerability to climate shocks[167].

UNHCR's climate adaptation and resilience programs focus on protecting displaced and stateless populations from the escalating impacts of climate change by enhancing preparedness, promoting sustainable environmental practices, and fostering regional collaboration[159]. UNHCR also supports regional strategies like the IGAD Climate Adaptation Strategy and uses climate hazard data to inform anticipatory action and strategic planning [159]. Further, UNHCR's climate adaptation and resilience programs require UNHCR to actively work towards building climate-resilient shelters and infrastructure in refugee camps. This is done by supporting host governments in integrating refugees and IDPs into national climate adaptation and disaster risk reduction plans[159, 168]. Examples include partnerships for climate risk insurance in Dzaleka camp, Malawi, covering reforestation and clean energy initiatives for refugees [158, 159]. In Cameron, the "Make Minawao Green Again" project, is a climate resilience initiative led by UNHCR in partnership with the Lutheran World Federation and Land Life Company and was officially launched in 2022. It focuses on reversing deforestation around the Minawao refugee camp, which hosts thousands of refugees fleeing violence in Nigeria. Since its launch, the project has reforested over 100 hectares of degraded land and more than 32,000 trees planted. It provides sustainable livelihoods through jobs in tree nurseries, eco-friendly cooking alternatives to reduce wood consumption, and training programs that empower both refugees and host communities[168, 169,170].

UNHCR's climate adaptation and resilience programs in refugee hosting areas in Tanzania and Kenya include major infrastructure and ecosystem restoration efforts. In Tanzania's Kigoma region, a landmark USD 19 million project developed with United Nations Environment Programme (UNEP) and the Green Climate Fund—aims to benefit up to 570,000 people, including refugees in Nduta and Nyarugusu camps. The initiative focuses on climate-resilient land use planning, forestry, agriculture, water security, and flood control, using nature-based solutions to restore over 261,000 hectares of degraded ecosystems[170,171]. In Kenya, similar efforts are underway to strengthen infrastructure and environmental sustainability in refugee-hosting areas, particularly in the Kakuma and Dadaab refugee camps which are located in arid and semi-arid regions. These include solar-powered water systems, reforestation, and sustainable shelter construction, all designed to reduce environmental degradation and improve resilience to climate shocks [170, 171]. ICRC and UNHCR advocate for Inclusion of displaced populations in climate finance mechanisms, such as the Green Climate Fund and policy reforms that ensure refugees and IDPs are not left out of national climate adaptation strategies[166, 170].

Integrated humanitarian programming for climate change in refugee camps is not just a good idea, it's increasingly essential. Refugee camps are often located in climate-vulnerable areas and host populations that are already under immense stress. Integrating climate resilience into humanitarian efforts can significantly improve both immediate well-being and long-term sustainability. It also improves efficiency and resilience of affected people.

6. Partnerships and Coordination: Strengthening coordination between humanitarian, environmental, peacebuilding, and development actors in climate change response initiatives in refugee and internally displaced persons (IDP) contexts is crucial for several interconnected reasons. There are complex interlinked and multi-dimensional challenges to be addressed involving environmental degradation, fragile governance, social tensions, economic instability and insecurity[171, 172]. There is need for holistic solutions as climate change impacts are complex and interconnected. Coordinated efforts ensure that responses address not only immediate humanitarian needs but also long-term environmental sustainability, social cohesion, and economic development. Significantly engaging with local governments, civil society, refugees and IDPs in planning and implementation leverages on their knowledge. Their inputs ensure that climate actions are context-specific, culturally appropriate, and more likely to succeed. Humanitarian and development actors must leverage on regional and global platforms (e.g., UNFCCC, GP20, IGAD) to share best practices and mobilize support[171, 172].

There are several examples where coordination between humanitarian, environmental, peacebuilding, and development actors has been successfully implemented in refugee and IDP operations. These efforts often leverage on platforms like the United Nations Framework Convention on Climate Change(UNFCCC), GP20, and Intergovernmental Authority on Development (IGAD) to share best practices and mobilize support. For example, UNHCR strengthens coordination between humanitarian, environmental, peacebuilding, and development actors in refugee and IDP situations through a variety of strategic mechanisms and partnerships. UNHCR uses the Refugee Coordination Model to lead and support national governments in coordinating refugee responses. In 2023, it coordinated eight regional refugee response plans (RRP) covering 53 countries. Such RRPs included Afghanistan, South Sudan, Sudan, Syria Regional Refugee and Resilience Plan and Ukraine[171, 172].

UNHCR also supports governments led country and regional platforms that align humanitarian efforts with development and peacebuilding goals. For example, IGAD Nairobi Process focuses on durable solutions for Somali refugees and returnees in the Horn of Africa. The IGAD Nairobi Process is a regional initiative launched through the 2017 Nairobi Declaration on Durable Solutions for Somali Refugees and Reintegration of Returnees in Somalia. It aims to address the protracted displacement of Somali refugees across the Horn of Africa by promoting coordinated, long-term solutions[171, 172]. The process is led by IGAD and supported by UNHCR and other partners. In Central America and Mexico, the Comprehensive Regional Protection and Solutions Framework(MIRPS) adopted in 2017 is a regional framework addressing displacement through protection and

development strategies[171,172].In Afghanistan, UNHCR supports the Solutions Strategy for Afghan Refugees (SSAR), a regional framework developed in 2012 by Afghanistan, Iran, and Pakistan with UNHCR's support. The SSAR aims to facilitate voluntary repatriation, promote sustainable reintegration in Afghanistan, and provide assistance to host countries. It emphasizes a comprehensive, regional approach to displacement. The strategy is now implemented through a support platform, launched in 2019, which mobilizes international support and promotes burden and responsibility sharing [171, 172].

7. **Strengthen Coordination and Collaboration Across Actors and Sectors:** Promoting coordination and collaboration between humanitarian, development, environmental and peacebuilding actors is vital to effectively address the complex interconnected impacts of climate change in refugee and IDP contexts. Climate change affects livelihoods, health, security, and ecosystems. Cross-sector collaboration ensures that responses are holistic and address both immediate needs and long-term resilience. Each sector brings unique strengths. For example, humanitarian organizations offer rapid response, development actors provide infrastructure and policy support, environmental experts guide sustainable practices, and peacebuilders help manage conflict risks.

UNHCR's Cross-Sectoral Climate Resilience Strategy, outlined in its *Operational Strategy for Climate Resilience and Environmental Sustainability (2022–2025)*, focuses on enhancing the resilience of displaced and stateless populations by integrating climate action across humanitarian, development, and environmental sectors. The strategy emphasizes four main pillars: (1) strengthening preparedness and anticipatory action to climate-related disasters; (2) preserving and rehabilitating natural ecosystems in displacement settings; (3) mainstreaming environmental sustainability into UNHCR operations; and (4) building strategic partnerships with governments, research institutions, and regional bodies like IGAD. The strategy also promotes the use of climate hazard data, risk insurance mechanisms, and inclusive planning to ensure that displaced populations are not left behind in global climate adaptation efforts [155]. UNHCR's Cross-Sectoral Climate Resilience Strategy has been successfully implemented in several countries, showcasing diverse approaches tailored to local contexts. For example, Malawi in Dzaleka refugee settlement, Cameroon, the "Make Minawao Green Again" project, Kenya in Kalobeyei, Tanzania in the Kigoma region and in IGAD region[173]. The Red Cross Red Crescent Climate Centre has explored anticipatory action in camps, focusing on early warning and preparedness. For example, in Bangladesh, Cox's Bazar, forecast-based financing and early warning systems were used to prepare Rohingya refugees for monsoon floods and cyclones. In Syria (Northwest IDP camps), efforts included pre-positioning supplies and improving drainage systems to reduce flood risks [171, 172, 173, 174, 175].

8. **Integrating Climate Adaptation into Humanitarian Planning:** Integrating climate adaptation into humanitarian planning in refugee and internally displaced persons (IDP) contexts is essential to ensure that vulnerable populations are protected from both current and future climate risks. Localized climate risk assessments are crucial as they help design humanitarian responses that anticipate and respond to climate risks (e.g., floods, droughts). Climate risk assessments will inform site planning and resource allocation. It is an imperative to mainstream climate adaptation into humanitarian programming covering all critical spheres such as shelter, WASH (Water, Sanitation, and Hygiene), Health, Safety and Security and Livelihoods. Examples of how climate adaptation is being integrated into humanitarian planning in refugee and internally displaced persons (IDP) settings include UNHCR's Climate Action which integrates climate risk into camp planning and shelter design. IOM's Environmental Migration Programs support resilience in displacement-prone areas. FAO's Climate-Smart Agriculture promotes food security in refugee-hosting regions[79, 176, 177].

UNHCR has implemented Climate adaptation and resilience initiatives in Kenya, Uganda, Bangladesh, South Sudan, Chad, Lebanon, Jordan among many other refugee operations [174,175,176]. UNHCR works with host governments and partners to help displaced populations prepare for and recover from climate-related shocks. Key actions include Climate-resilient shelter which aims at providing durable shelters that can withstand floods, storms, and extreme temperatures. Non-food item distribution includes supplying blankets, tarpaulins, and hygiene kits tailored to climate conditions. Cash assistance enable displaced people to purchase climate-

appropriate goods. UNHCR advocacy promotes the inclusion of refugees and IDPs in national climate adaptation and disaster risk reduction plans[174,175,176].

In Bangladesh, Cox's Bazar refugee camps, anticipatory action strategies have been piloted to prepare for climate-related disasters like cyclones and landslides by UNHCR, IOM and partners. The strategies included early warning systems tailored to camp settings and the pre-positioning of emergency supplies. Communities were also trained in disaster preparedness and response[177].In Herat, Afghanistan, displaced communities adapted to water scarcity and extreme temperatures through solar-powered cooling and water systems supported by UNICEF and International Medical Corps. Other initiatives included food preservation techniques to reduce spoilage during heatwaves and energy-efficient shelters designed for climate resilience [178].

In Kenya, multiple communities including from Kakuma refugee camp and Turkana County have faced severe climate impacts such as drought and flooding, which have intensified displacement and resource competition. A 2023 Climate Refugees case study in Kenya found that climate change was a major driver of displacement, particularly due to rising lake levels, droughts, and floods. Displaced and host communities responded through grassroots, community-led water management initiatives such as rainwater harvesting, mobile water delivery, and local water-sharing agreements. The efforts, though often informal and underfunded, are vital in addressing water scarcity and sustaining livelihoods. The study also highlighted the inadequacy of traditional humanitarian aid in addressing long-term climate impacts and called for direct climate finance, legal recognition of climate-displaced persons, and greater inclusion of affected communities in adaptation strategies[173, 175, 176].

9. Support Host Communities and Local Governance: In refugee and IDP settings, aid must benefit both displaced and host communities. Ensuring that host communities benefit from aid and infrastructure investments reduce tensions. Significantly, promotion of inclusive governance that involves displaced populations in decision-making must be supported by humanitarian and development actors. In this regard, local governments and civil society must be empowered to lead the planning and implementation of climate change initiatives. There are several good practices which can be adopted. For example, in Uganda, Ethiopia, South Sudan, Bangladesh and Kenya, UNHCR's localized climate resilience approach is implemented closely with host governments and local authorities to strengthen local disaster preparedness and response systems. This included providing climate-resilient infrastructure (e.g., flood-resistant shelters, water systems) that benefits both displaced people and host communities. In 2023, Herat, Afghanistan, International Federation of Red Cross and Red Crescent Societies (IFRC), Afghan Red Crescent Society (ARCS) and Japanese Red Cross Society supported displaced communities to adapt to water scarcity and extreme temperatures. This was implemented through solar-powered cooling and water systems, new food preservation techniques to reduce spoilage during heatwaves and energy efficient shelters designed for climate resilience [178, 179, 180, 181].

10. Expand Access to Climate Finance: It is an imperative that humanitarian and development actors consistently advocate for the inclusion of displaced populations in global climate finance mechanisms such as the Green Climate Fund (GCF), Adaptation Fund, and the Climate Investment Funds. It is critical that climate finance frameworks explicitly recognize displacement as a climate-related vulnerability. In this regard, humanitarian and development actors must develop innovative blended financing models that strategically combine humanitarian aid for immediate relief and protection, development finance for long-term infrastructure, education, and livelihoods, and climate finance for adaptation, mitigation, and resilience-building. Support must also be extended for capacity-building to local actors to access and manage climate finance. Equally important is the creation of a dedicated global displacement and climate finance task force to bring together stakeholders from UN agencies, multilateral development banks, climate funds, civil society, and displaced communities to coordinate advocacy, policy alignment, and funding strategies[182, 183, 184, 185, 186].

There are several promising examples of how displaced populations are being included in climate finance mechanisms, particularly through blended finance models, global climate funds, and local capacity-building initiatives. For example, a report by NORCAP and partners on blended finance in displacement settings outlined

how blended finance was being used to support clean energy access in humanitarian and displacement settings in Rwanda, Kenya, Jordan and Sudan[187]. The key models include Humanitarian Impact Bonds (e.g., ICRC's bond for physical rehabilitation canters), Results-based financing(RBF) to incentivize private sector delivery of solar energy in refugee camps and risk transfer mechanisms to de-risk investments in fragile contexts. Examples include the renewable energy for refugees (RE4R) project, implemented by Practical Action and UNHCR, which combines donor funding with private sector investment to deliver solar mini-grids and clean cooking solutions in Rwanda and Jordan. Results based financing (RBF) has been used to incentivize service delivery, especially in energy access. For example, in South Sudan, RBF has supported the deployment of solar mini-grids in IDP camps. In Kenya, RBF mechanisms have enabled Pay-As-You-Go (PAYG) solar systems for refugees in Kakuma and Kalobeyei. The partners are UNHCR, Practical Action, SNV, and the Global Platform for Action on Sustainable Energy in Displacement Settings (GPA). [182, 183, 184, 185, 186, 187].

Global Climate Funds (GCF) and the Global Environment Facility(GEF) have played significant roles in climate finance mechanisms. While GCF and GEF do not explicitly target displaced populations several projects have indirectly supported refugee-hosting areas or included displaced populations as part of broader vulnerability criteria. For example, UNHCR's Green Financing Facility though not a GCF project itself, is aligned with GCF principles and aims to transition UNHCR offices and operations (often located in refugee-hosting areas) from diesel to solar energy. The Global Environment Facility (GEF) has supported projects that intersect with displacement through its Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) in Chad, Sudan, Uganda and Ethiopia[184, 185, 186, 188].

In some refugee and IDP hosting countries programs are emerging that build the capacity of local NGOs, municipalities, and refugee-led organizations to access and manage climate finance. For example, the Kakuma Kalobeyei Challenge Fund (KKCF) in Kenya supports refugee and host community entrepreneurs with blended finance and technical assistance to scale climate-resilient businesses[182, 183, 184, 185, 186, 188, 189].

UNHCR Climate Resilience Fund while not part of GCF or GEF, is a new mechanism designed to channel climate finance directly to refugee and host communities and could serve as a model for future GCF or GEF aligned initiatives. Significantly, organizations like UNHCR and Refugees International continue advocating for the inclusion of displaced populations in National Adaptation Plans (NAPs) and Green Climate Funding (GCF) proposals. They also advocate for direct access for local actors and governments hosting refugees to apply for GCF funding and provide capacity-building to help local NGOs and municipalities navigate complex climate finance systems. The Center for Financial Inclusion promotes a framework for green inclusive finance, which supports financial services tailored to vulnerable populations, including displaced people. It encourages microfinance institutions and cooperatives to offer climate-resilient loans and insurance emphasizing adaptation and resilience as key outcomes for low-income and mobile populations. [182, 183, 184, 185, 186, 187, 188 189].

11. Harnessing Artificial Intelligence: The evolving role of artificial intelligence (AI) in addressing climate change-induced resource scarcity, conflict, and insecurity in refugee and IDP (Internally Displaced Persons) contexts is becoming increasingly significant. AI powered systems are enhancing early warning mechanisms for climate-related disasters, enabling faster and more targeted humanitarian responses. AI technologies are being used to predict climate-related displacement, optimize humanitarian logistics, and monitor environmental degradation in real time. AI can analyse satellite imagery and climate data to forecast droughts or floods, enabling early interventions that reduce displacement risks. In conflict zones, AI tools can detect patterns of violence or instability through social media and news analysis, helping humanitarian actors anticipate and respond to emerging crises and security threats. These capabilities allow for more proactive, data driven decision making, particularly in fragile refugee and IDP settings[190, 191, 192, 193].

There is still a very long way harnessing AI in refugee and IDP contexts due to a variety of reasons, but the journey has started. AI holds immense promise in refugee and IDP contexts, but the path to fully harnessing its potential is still in its early stages. Some of the few notable promising pilot AI projects that have successfully addressed climate change, resource scarcity, conflict, and insecurity in refugee and IDP humanitarian situations include:

- **Omdena & UNHCR – Somalia Displacement Prediction Project**: This initiative used AI to predict climate change impacts and forced displacement in Somalia. By analysing satellite imagery and environmental data, the project identified areas prone to conflict and natural disasters. Machine learning models achieved high accuracy in forecasting displacement patterns, enabling humanitarian agencies to allocate resources more effectively and respond proactively to crises[190].
- **World Economic Forum – AI for Climate Monitoring**: AI is being used globally to monitor environmental changes, such as tracking iceberg melt rates, predicting extreme weather events, and identifying pollution sources. These tools help scientists and policymakers make faster, data-driven decisions to mitigate climate impacts. For example, AI models can analyse satellite images to detect deforestation or water scarcity trends, supporting sustainable resource management[191].
- **World Bank's AI-Powered Refugee Forecasting Model**: This project uses machine learning to predict refugee movements 4–6 months in advance by analysing over 90 variables, including conflict data, climate indicators, economic trends, and social media language. It has been piloted in Uganda to anticipate inflows from South Sudan and the Democratic Republic of Congo. The model enables early infrastructure investments—like expanding health centres and schools—before refugees arrive, reducing pressure on host communities and improving service delivery[192].
- **Eureka by AI for Good Foundation**: Eureka is a multilingual AI-powered assistant designed to support refugees during their integration journey. It was piloted in multiple European refugee hosting countries. It provides personalized information and guidance on legal rights, healthcare, education, and employment opportunities. By tailoring support to individual needs and language preferences, Eureka helps refugees navigate complex systems and access essential services more effectively[193].

The above projects demonstrate how AI can shift humanitarian responses from reactive to proactive, improving outcomes for refugees, IDPs and host communities. Moving forward, investing in scalable, ethical, and locally relevant AI solutions is essential. This can be achieved by building strong partnerships and collaboration between technologists, humanitarian actors, and displaced communities, while also promoting policies that ensure responsible and inclusive AI use. AI can become a powerful tool for resilience and dignity in refugee and IDP settings with thoughtful innovation and collaboration[190, 191, 192, 193].

9. Conclusion

Climate change is a contemporary pressing challenge affecting every aspect of life from health and food security to water availability, economic stability, safety and security and social cohesion. Climate change intensify underlying issues such as resource scarcity, economic instability, social tensions and insecurity. The impacts are far-reaching rippling through ecosystems, economies, and communities, often amplifying existing vulnerabilities and inequalities. Climate-induced resource scarcity, conflict and insecurity has significantly exacerbated humanitarian challenges in refugee and internally displaced persons (IDP) environments. Climate-induced resource scarcity often fuels conflict both within refugee and IDP communities and between them and host populations. Climate change acts as a risk multiplier**,** not a direct cause of conflict and insecurity, but a factor exacerbating existing vulnerabilities and compounding grievances. Climate change as a risk multiplier creates new or additional security threats. This exposes refugee and IDP to diverse security threats and risks as their vulnerabilities are further exploited.

Addressing the complex interplay of climate-induced resource scarcity, conflict, and insecurity in refugee and IDP humanitarian settings, policy and practice should focus on integrated approaches that combine humanitarian

assistance with climate adaptation, conflict sensitivity, safety and security and long-term development planning. This ensures that refugee and IDPs together with host communities are supported in building sustainable, peaceful coexistence. The challenges of climate-induced resource scarcity, conflict, and insecurity in refugee and IDP settings require a multi-pronged approach that combines immediate relief with long-term resilience-building. Some good practices and success stories in refugee and IDPs situations were noted in several countries. These success stories remain too few but indeed a development in the right direction. The efforts can be replicated in other refugee and IDP operations.

Addressing the complex interplay of climate-induced resource scarcity, conflict, and insecurity in refugee and IDP humanitarian settings necessitates strengthening governance, conflict resolution mechanisms, and inclusive planning. This involves engaging refugees, IDPs and host communities in decision-making processes to ensure equitable access to resources and reduce tensions. Peacebuilding initiatives, such as community dialogue and mediation programs, help to address grievances and prevent violence. Additionally, integrating climate risk assessments into humanitarian planning and early warning systems improve preparedness and response. International cooperation and funding are essential to support these efforts, ensuring that humanitarian responses are not only reactive but also adaptive to the growing impacts of climate change.

While integrated approaches that combine humanitarian aid with climate adaptation, conflict sensitivity, safety, and long-term development have shown promise in refugee and IDP contexts, these successes are still limited in scale and scope. Many interventions remain short-term and reactive, often lacking the coordination and funding needed to address the root causes of vulnerability. There is a pressing need to move beyond siloed responses and adopt holistic strategies that bridge humanitarian assistance with sustainable development, environmental protection, and peacebuilding efforts. This can be achieved through stronger collaboration among governments, humanitarian agencies, development actors, and affected communities. Investing in climate-resilient infrastructure, enhancing local governance and conflict resolution mechanisms, and ensuring that refugees and IDPs are included in planning and decision-making must be institutionalized. Long-term funding commitments, AI utilization, data-driven planning, and inclusive policies are essential to build resilience and reduce the risk of future displacement. Addressing climate-induced resource scarcity, conflict, and insecurity in refugee and internally displaced persons (IDP) situations requires a holistic, multi-sectoral approach to prevent the cycle of crisis and vulnerability continuing. This is a 21st century challenge and imperative.

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INFO

Corresponding Author: Michael Munyaradzi Makova (PhD), 2375 Bluffhill Westgate, Zimbabwe.

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