



Water and Migration: A Global Overview

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EXECUTIVE SUMMARY

Global migration has been increasing since the 1990s. People are forced to leave their homes in search of safety, a better livelihood, or for more economic opportunities. Environmental drivers of migration, such as land degradation, water pollution, or changing climate, are acting as stronger phenomena with time. As millions of people are exposed to multiple water crises, daily needs related to water quality, lack of provisioning, excess or shortage of water become vital for survival as well for livelihood support. In turn, the crisis can transform into conflict and act as a trigger for migration, both voluntary and forced, depending on the conditions. Current interventions related to migration, including funding to manage migration remain focused on response mechanisms, whereas an understanding of drivers or so-called 'push factors' of migration is limited. Accurate and well-documented evidence, as well as quantitative information on these phenomena, are either missing or under-reflected in the literature and policy discourse.

The report aims to start unpacking relationships between water and migration. The data used in this Report are collected from available public sources and reviewed in the context of water and climate. A three-dimensional (3D) framework is outlined for water-related migration assessment. The framework may be useful to aggregate water-related causes and consequences of migration and interpret them in various socioecological, socioeconomic, and sociopolitical settings. A case study approach is adopted to illustrate the various applications of the framework to dynamics of migration in various geographic and hydrological scenarios. The case studies reflect on well-known examples of environmental and water degradation, but with a focus on displacement /migration and socioeconomic challenges that apply. The relevance of proxy measures such as the Global Conflict Risk Index, which helps quantify water and migration interconnections, is discussed in relation to geographic, political, environmental, and economic parameters.

The narratives presented in the Report also point to the existing governance mechanisms on migration, stating that they are fragmented. The report examines global agreements, institutions, and policies on migration to provide an aggregated outlook as to how international and inter-agency cooperation agreements and policies either reflected or are missing on water and climate crises as direct or indirect triggers to migration. Concerning this, the new directives related to migration governance, i.e., the New York Declaration and the Global Compact for Migration, are discussed. The Report recommends an enhanced focus on migration as an adaptation strategy to maximize the interconnectedness with the Sustainable Development Goals (SDGs). It calls for the migration discourse to look beyond from a preventative and problematic approach to a perspective emphasizing migration as a contributor towards achieving sustainable development, particularly SDGs 5, 6, 13, and 16 that aim strengthening capacities related to water, gender, climate, and institutions. Overall, the synthesis offers a global overview of water and migration for researchers and professionals engaged in migration-related work. For international agencies and government organizations and policymakers dealing with the assessment of and response to migration, the report aims to support the work on migration assessment and the implementation of the SDGs. The Report may serve as a public good towards understanding the drivers, impacts, and challenges of migration, for designing long-term solutions and for advancing migration management capabilities through improved knowledge and a pitch for consensus-building.

Key words: *migration, water quantity, water quality, water extremes, climate, conflict, displacement, refugees, gender, sustainable development*

INTRODUCTION

For millennia, people have been migrating and settling in different areas around the world. It is well-established that diverse factors, including economic, political, cultural, and demographic, will synergize with environmental-related events, and thus, individuals will make a choice to migrate or stay (IOM, 2020). The reasons for migration have varied over time. Conventionally, it is explained by ‘push’ and ‘pull’ factors, such as human security, economic opportunity, socio-political stability, or environmental degradation and water-related disasters that act independently or collectively. Facilitated by advancements in transportation, economic disparities, and globalization, migration over the past 100 years, both intra-national and international, have occurred at a rate faster than previously observed. Often, migration can be viewed as an ‘adaptation strategy’ whereby a positive context is assumed; however, the realities faced by migrants are under-represented (IOM, 2020).

Migration is no longer driven just by economics or political conflicts (FAO, 2018; Miletto et al. 2017). Water and climate-driven migration have become a significant global development issue. Several million migrants already state ‘environmental degradation’ and ‘climate change’ as the main drivers for their decision to migrate. Alarming, this number may rise to tens of millions within the next 20 years, and hundreds of millions in the next 50 years (IOM, 2008). Projections by the IOM suggest that by 2050, 200 million additional people labeled as ‘environmental migrants’ will be displaced due to environmental factors, including extreme water events. After 2050, this can reach as high as one billion environmental migrants.

Warner et al. (2010) argue that environmental degradation, water scarcity, water stress, and climate change act as triggers for migration. Furthermore, regions with high population density and limited renewable freshwater resources are witnessing new migration trends and patterns (Warner et al. 2010). Water and climate-related impacts are transitioning from having an indirect to direct impact on people’s decision to migrate. Such transitioning is no longer episodic or localized. In low-resource settings, these impacts are known to weaken the state’s socioeconomic fabric severely. In small island developing states (SIDS), besides

declining tourism, severe challenges including higher insurance costs, food, and water insecurity, and adverse health outcomes are all related to issues of access and availability of freshwater (Gheuens et al. 2019). Globally, socially vulnerable communities with a high dependence on land and water resources for subsistence find it challenging to adapt to changes, and migration often remains the only option (WWAP, 2019).

Simultaneously, the current literature on water-driven migration is heavily focused on humanitarian assessments or the post-migration context. The extent to which the water and climate crises, directly or indirectly, can influence human mobility and impact individuals, families, and the most vulnerable (e.g., children) are not well-documented, except for cases when a situation is classified as a ‘disaster.’ Quantitative studies focusing on water quality driven migration are also limited. Besides, if quantitative data and information are available, which will be in the form of national records on water and climate-driven migration, these mainly focus on internal migration. Migration discourse, at present, appears to be dominated by post-migration ‘response’ contexts (IOM, 2020), whereas drivers receive less focus. A further comprehensive understanding of interlinkages between water and migration is therefore pertinent to ensure that migration-related policy decisions are relevant, and thus, able to make a change in people’s lives.

This report attempts to address this need by analyzing the state of existing knowledge or perceptions of water-migration interlinkages. Furthermore, the analysis aims to unpack the information by contextualizing how ‘water’ is placed in the migration context, both at point of origin to the place of destination. More specifically, the report:

- Provides a simple, “three-dimensional” (3D) framework that connects migration flows to push factors (direct or indirect) of water quantity, quality, and extremes and illustrates water-migration interconnections by several focused case studies from geographically contrasting regions of the world;
- Suggests proxy measures that may help understand and quantify such interconnections;
- Examines how and to what extent, water and climate act as drivers at present in global agreements, institutions, and policies on migration.

The target audience for this report includes: i) researchers and professionals engaged in migration-related studies which may want to expand their scope of synthesis to bridge needs and gaps in the existing migration literature; ii) international agencies focusing on human development; iii) government organizations dealing with the assessment of and response to migration; iv) policymakers that work with the implementation of the SDGs and develop disaster risk reduction (DRR) strategies; v) non-governmental organizations that are active at national, regional, or global scale managing the humanitarian aspects of migration; and vi) general public interested in understanding the drivers, impacts, and challenges of migration.

DEFINITIONS, TRENDS AND ASSESSMENT FRAMEWORK

Global trends and patterns of internal and international migration are driven by a blend of factors, including political conflicts, climate impacts, or social and cultural complexities. Drought and high temperatures, for example, have been linked to the surge in the number of people seeking refugee status in Europe (Missirian and Schlenker, 2017). Similarly, between 2008 and 2014, approximately 102 million, 54 million, and 26 million people were displaced by floods, storms, and earthquakes, respectively (Yonetani et al. 2015). These numbers amount to a total of over 25 million people on average per year displaced by all three disaster types. Yet, there is no nationally

recognized legal definition of, nor an established framework, to capture and explain migration driven by water and/or climate.

The International Organization for Migration (IOM) note that *“environmental migrants are persons or groups of persons who, predominantly for reasons of sudden or progressive change in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes or choose to do so, either temporarily or permanently, and who move either within their country or abroad”* (Ionesco et al. 2017).

This definition provides an initial basis for discussion of water and climate-related migration. Other terms and concepts that apply to migration, in general, and which are useful in the context of water-driven migration are listed in Box 1.

Globally, greater than 60% of migration flows originate in the Global South, but only 34% are from South to North (Figure 1) (UNDESA, 2019). Between 2000 and 2017, Asia has had more international migrants than any other region. The Middle East & North Africa (MENA) region is hosting the most significant number of IDPs from conflict regions (IOM, 2019). The Global South, in general, is observing an increasing trend of out-migration. In Asia, many people opt for migration, for example, from Bangladesh to India, as environmental degradation and climate extremes cause a loss of economic opportunity (Nagabhatla et al. 2015). Water and climate can be direct or indirect drivers

Box 1: Migration-related terms and definitions

International Migrants: people residing in a country that is not their country of birth. As of 2015 there were 244 million international migrants, an increase of 41% since 2000 (IOM, 2015).

Internal Migrants: people who migrate within a country they reside in. This type of migration is usually from rural to urban areas (IOM, 2015). A decade ago, UNDP (2009) estimated ~ 740 million internal migrants

Internally Displaced People (IDPs): people who are displaced, or have fled, from their home to find safety, but remain within their home country's borders (UNHCR, 2017). IDPs might sometimes be referred to as “refugees” since their displacement seen as “forced.” However, these dimensions are not clearly recognized under the 1951 Refugee Convention. UNHCR (2020) currently estimates >40 million IDPs.

Returning Migrants: people who return to their home country after having been an international migrant (short- or long-term international migrant) and intend to stay there for at least a year (OECD, 2001)

Refugees: “... persons who are unable or unwilling to return to their country of origin owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion.” (UNHCR, 2010).

Note: the term “refugees,” as defined in Box 1, while reflects the close connection with human security, it does not capture water or climate-related dimension directly. Hence, the term is used only to a limited extent in this report. UNHCR (2020) estimates >25 million refugees

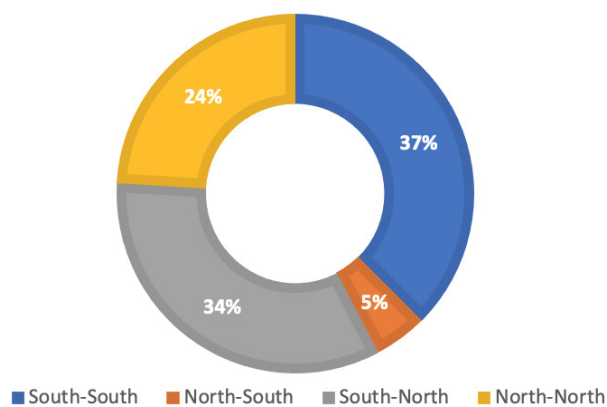


Figure 1. Global migration flows. Adapted from UNDESA (2019)

of migration (voluntary or forced). These drivers can be related to water quality, water quantity, and exposure to extreme events, such as floods or droughts. Migration due to floods and droughts are mostly seasonal or temporary, local or regional, and only occasionally international (Jobbins, 2018). While millions of people worldwide have fled because of floods and other environmental factors (Brown 2008), in some contexts, vulnerable populations with access to limited means cannot

migrate beyond the national boundaries. These vulnerable populations include, amongst others, children, women, and other socio-economically deprived individuals that do not have access to resources or opportunities to move globally.

As water and climate impacts intensify, an increasing number of people are exposed, and new trajectories of migration emerge across the globe. Some sources predict that by 2050, close to 4.8 billion people (>50% global population), and a similar percentage of agricultural production, will be at risk due to increased rainfall variability or due to the variability in droughts (Nelson et al. 2010). This may strengthen the “push factors” of migration. Water is also a significant determining factor of the livelihood and wellbeing (or lack of such) of individuals in post-migration conditions. Internationally, water-related extreme events are impacting millions of individuals both in the Global North and South, as noted in Figure 2. Migrants may be fleeing from a water and/or climate-related challenges, which they continue to encounter in transit and/or at their destination (e.g., in refugee camps lack of clean water is typical (Jobbins, 2018).

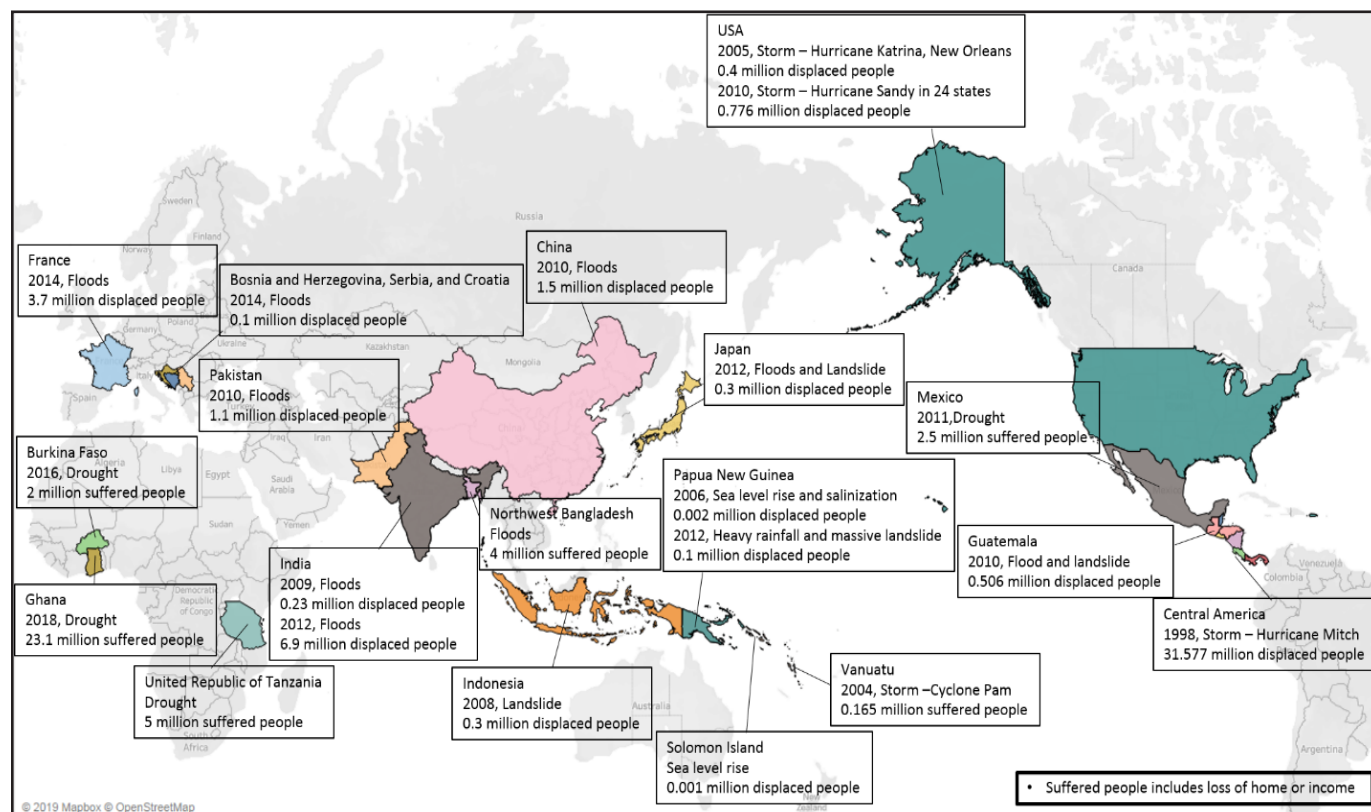


Figure 2. Examples of water-related extreme events and associated numbers of displaced individuals for regions across the globe. Data Source: EM-DAT, 2019.

To assess water and migration interconnections and to place water more explicitly into the scope of environmental migration, it may be useful to consider it in terms of three dimensions (3D) – water quantity, water quality, and water-related extremes (Figure 3). Water quantity can overall progressively increase or decrease in a region, creating more humid or arid conditions, which can either stimulate or attract migrants. Deteriorating water quality may be a migration trigger on its own, as it affects water availability and can thus trigger health outcomes. Increasing frequency and magnitude of water-related extremes, causing threats to human life and property, maybe another migration trigger in certain circumstances. Water extremes can impact the water quantity and quality either directly or indirectly and compound the effects resulting in more migrating. For instance, accessible drinking water sources are contaminated by floodwater, in turn, affecting availability and impacting people's health. As a result, individuals will be forced to

migrate in search of a better livelihood and well-being. Migration triggered by water pollution or shortages, as well as extremes, can be gradual, meaning that there might not be a mass movement of people. Instead, people might leave areas at different periods of time, or temporarily.

Overall, the framework helps integrate various dimensions that apply to water and migration. It is simple, and yet, in principle covers (groups of) all major water-related factors that can trigger migration or affect migrants in the post-migration stage.

It is important to acknowledge that not in all instances, scenarios described in the 3D framework lead to migration. The impact of these factors will also be influenced by the government and society's ability to respond to shifts in water quality/quantity/extremes. Governments and communities with resources will be better prepared and able to

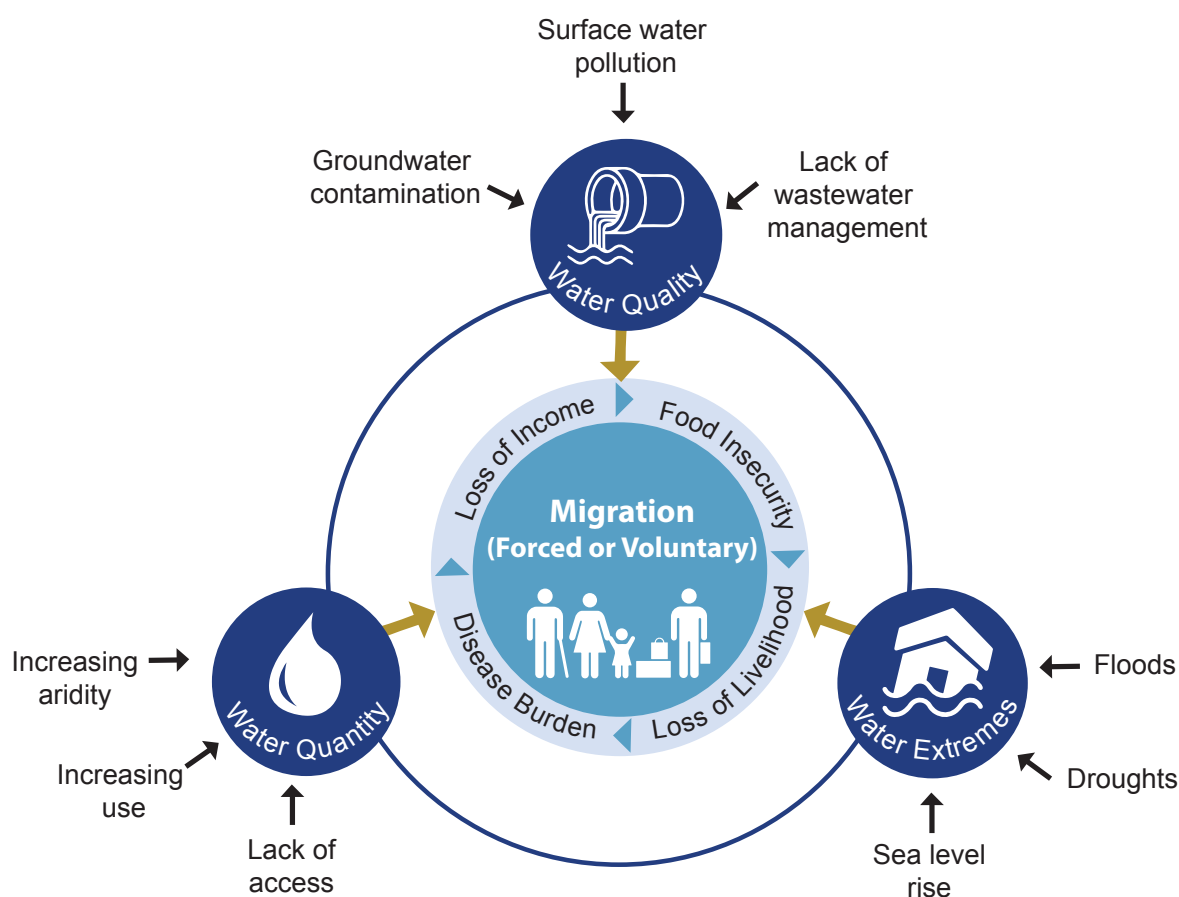


Figure 3. A three-dimensional [3D] framework to assess the water-migration interconnections. Specific push factors (black arrows) affect three key aspects/dimensions of water resources (quantity, quality, and extremes - dark blue circles) that can act individually or collectively and result in specific consequences (e.g., food insecurity, lack of livelihood, etc.). These consequences can, in turn, individually or collectively, trigger migration, which can be either voluntary or forced, depending on conditions.

deal with them in comparison to countries that lack resources. For instance, where social and financial measures and policies are available to improve coping and adaptation, people and communities may decide not to migrate. Subsequent case studies illustrate applications of the 3D framework and specifics of the water-driven migration in various geographical and social contexts.

WATER AND MIGRATION CASE STUDIES

Case Study 1. The Aral Sea: Migration driven by the water crisis and associated adverse health consequences

The Aral Sea is a well-known case of myopic water management whereby the productive aquatic ecosystem has gradually deteriorated due to an extensive withdrawal of irrigation water upstream, with the Aral shrinking from 55,700 to 9,830 km² between the 1970s to 2017 (Figure 4), eradicating associated agriculture, fisheries, and tourism. Overall, more than 100,000 people were displaced due to this environmental crisis (Small et al. 2001). Migration flows within the region are shown in Figure 5. Consequences were due to the severe spillover effects on different aspects of ecosystems, the economy, and socioeconomics (increasing unemployment and migration) (Ataniyazova 2003). Indigenous populations (e.g., Karakalpak) were forced to migrate not only because of a loss of opportunity for income generation but also due to health effects including tuberculosis, diarrhea, and fecal-oral transmission of diseases (MSF, 2003). The health of more than 5 million people throughout

the region was affected (Conant, 2006), and most vulnerable groups, including children, faced an increased risk of death (i.e., double death rate) due to diarrhea (Waehler and Dietrichs, 2017). This case may be seen as an example of how progressive reduction in water availability compounded by associated health impacts leads to or pushes forced migration. The case study emphasizes the water quantity aspect of the 3D framework.

Case Study 2. Central America: Migration due to water extremes and political instability

The Central America region is vulnerable to strong winds, hurricanes, and fluctuating precipitation patterns, on the one hand, and to political instability and associated conflicts and violence – on another. Economic policies favour agricultural exports over domestic food security; associated deforestation and overall extensive degradation of natural resources result in dire impacts on human health and livelihoods. Agreements, such as the Central American Free Trade pact, have driven small farmers out of jobs by putting them into fierce competition against highly subsidized agribusinesses (Wernick, 2018). Limited planning and investment in the agricultural sector have put farmers at risk due to recurring droughts.

It is estimated that in the dry corridor of Central America, an area stretching from 'Southern Mexico to Panama,' six out of every ten households suffer from acute food insecurity. The FAO (2016) has reported that over 30% of the population residing in this corridor is dependent on humanitarian assistance for food and water

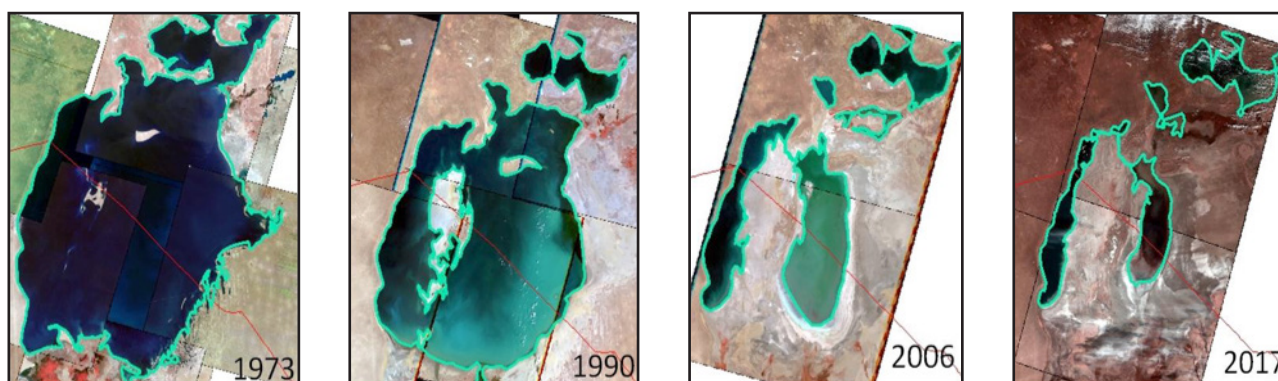


Figure 4. Multi-temporal (1973-2017) trends of surface water area of the Aral Sea derived using remote sensing images. (Data Source: Landsat data mapped by UNU-INWEH).

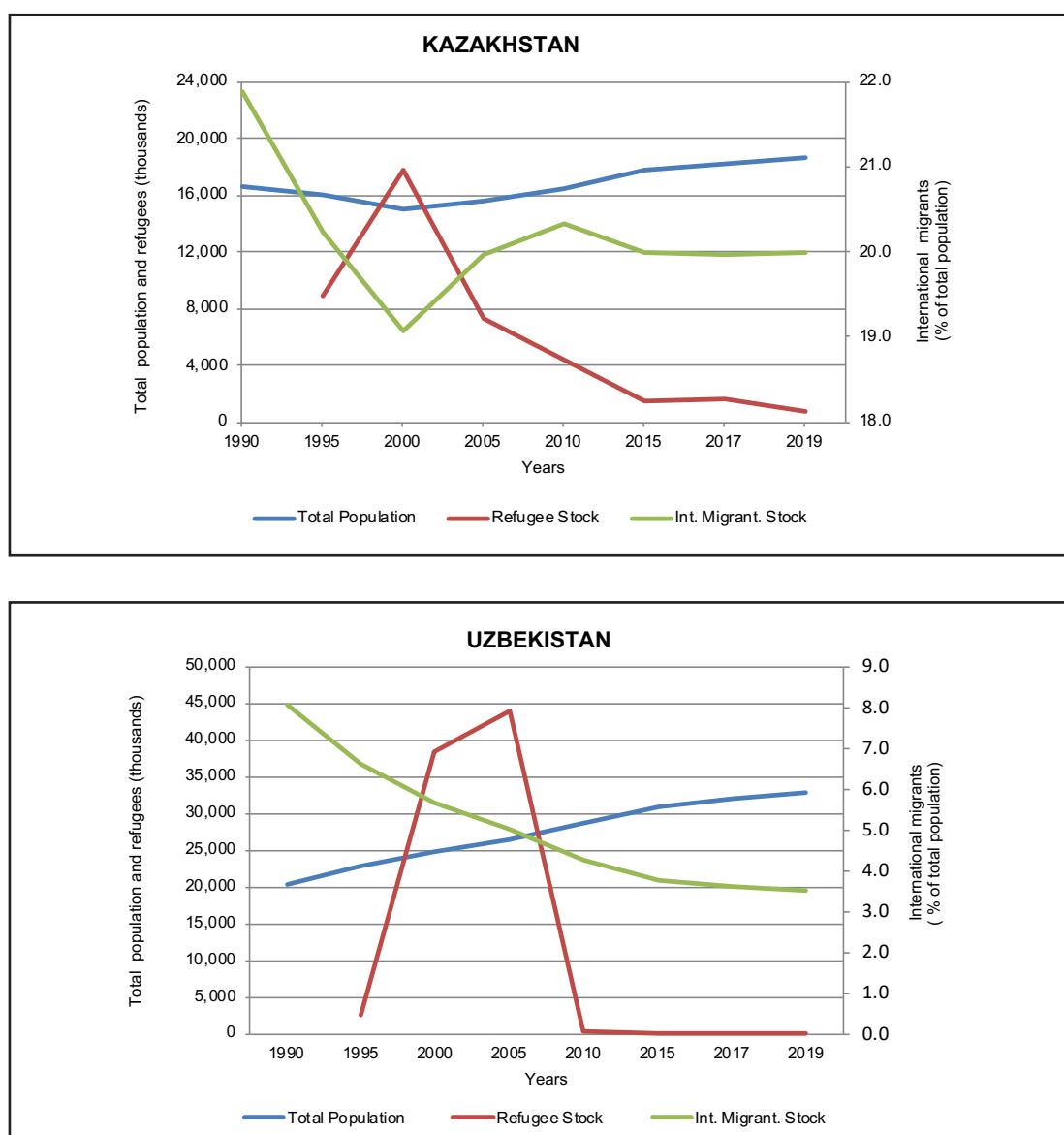


Figure 5. Migration stocks in the Aral Sea Region shown alongside national population trends (1990-2019) for Kazakhstan and Uzbekistan. Refugee Stock includes asylum seekers [Data Source: UNEP, 2017].

supplies. Environmental degradation and violence are pushing populations out of their territories in search of better living conditions, both internally (from rural to urban areas) and internationally. Internationally, increased migration flows from Honduras, El Salvador, Guatemala to the US coincided with extended drought in these three countries (World Bank, 2019). Regionally, the displaced populations, including those displaced due to violence and conflict in Honduras, Nicaragua, and El Salvador, is often forced to find refuge in vulnerable areas, such as steep slopes which are prone to floods (McLeman and Hunter, 2010) which frequent in the region.

Case Study 3. Small Island Developing States (SIDS): Negative net migration rate due to increasing environmental vulnerability

There are 38 UN recognised Small Island Developing States (SIDS)- a group of small island countries (UN-OHRLLS, 2011). They were first recognized as a distinct group of developing countries at the United Nations Conference on Environment and Development in June 1992. Most SIDS have low-resource settings and are highly economically and environmentally vulnerable. Physical remoteness, a lack of economic diversity, as well as infrastructure deficiencies impede adaptation mechanisms in these island states

(Julca & Paddison, 2009). In many instances, water and climate-related factors are mentioned as push factors that trigger migration in all three SIDS clusters, (i) Caribbean; ii) Pacific; and iii) the Atlantic, Indian Ocean, Mediterranean, and the South China Sea (AIMS) (Gheuens et al. 2019). The SIDS are culturally, economically, socially, and linguistically diverse.

Development reports and projections demonstrate that climate change impacts, including increasing intensity gradient and frequency of extreme weather events, bundled with stressed freshwater resource systems and sea level rise, are likely to increase migration, as it will most likely make some islands partly or wholly uninhabitable. Thus, using the 3D framework, push factors to contribute to water extreme events (e.g., increased frequency of floods) and water quantity dimensions (e.g., lack of water availability) to synergize the impacts including a loss of habitat and income, food insecurity whereby people decide to migrate to the SIDS. Notably, >80% of the population in the Pacific islands depend on subsistence agriculture or fishing. There are limited (if any) opportunities to switch to alternative livelihoods in the absence of market-based infrastructure. Food security, as well as contamination of freshwater resources, emerges as a 'chronic concern' (Handmer and Nalau, 2018).

The statistics presented in Figure 6 demonstrate that the island states have negative net migration rates (NMRs), as more people emigrate than immigrate. The Pacific cluster of SIDS has an unusually high out-migration in Micronesia and Tonga, whereby the NMR, as of 2020, is approximately -20 (migrants/1000 population), among the lowest NMR worldwide. In the Caribbean, the NMR ranges between -2 and -6 (migrants/1000 population; CIA, 2020). Some islands note a positive NMR (more immigration), such as Antigua and Barbuda (2.2), Saint Kitts and Nevis (1.2), and Suriname (0.6) (CIA, 2017), but such cases are rare. The positive NMRs of these islands can be partly attributed to the balance in the quality of life, including the availability and accessibility to water provisioning services and vulnerability (extreme water and climate crisis events) when compared to other SIDS (Gheuens et al. 2019).

The migration trends in the Atlantic, Indian Ocean, Mediterranean, and the South China Sea (AIMS)

cluster vary. High outmigration is noted from the Maldives and Sao Tome and Principe, while Seychelles and Singapore report net-in-migration (Figure 6). Maldives, Kiribati, and Tuvalu may require relocating their entire population onto a new territory. In fact, these regions have already begun intensive and elaborate discussions with other countries to host their displaced populations (Gheuens et al. 2019). Kiribati's land purchase from Fiji to relocate its people is a representative case. Although relocation of displaced people and migrants from the SIDS has been discussed in the international arena, no concrete measures are in place that address concerns inclusively and fairly. The response towards the plight facing individuals living in the SIDS due to climate change remains myopic and directed towards economic development rather than building resilience (Bunce et al. 2008). Populations and communities in the SIDS view mobility of human populations as the only coping mechanism. Many countries in reports focused on the SIDS describe water and climate pressures as primary drivers or push factors of migration and have already begun to plan for future mass migrations of their citizens as an adaptive measure to environmental change and degradation (Gheuens et al. 2019).

Case Study 4. The Nile Delta: Sea level rise, water stress, and human displacement

The Nile Delta has a total length of 240 km shoreline and covers approximately 23,851 km² (Hassan & Abd rabo, 2013). The Nile Delta is among one of the most productive areas of Egypt (UNU, 2009). Precipitation and temperature variations intensify in the region due to changing climate, and inundation and saltwater intrusion add to the existing pressure on land and water resources (OECD, 2004). The multitemporal analysis of the selected area in the delta region shows land-use and land-cover change from the 1980s to 2017: notably reduced or shrunken water bodies, depletion of vegetation, and agriculture areas, and increasing habitation (Figure 7).

The Nile Delta region is among the most vulnerable areas to rising sea levels. Rising sea levels are expected to contribute to flooding, and thus cause people to migrate as agriculture is impacted as well as livelihoods (Hereher, 2010). For example, it has been predicted that a rise of 0.5 m in sea level will

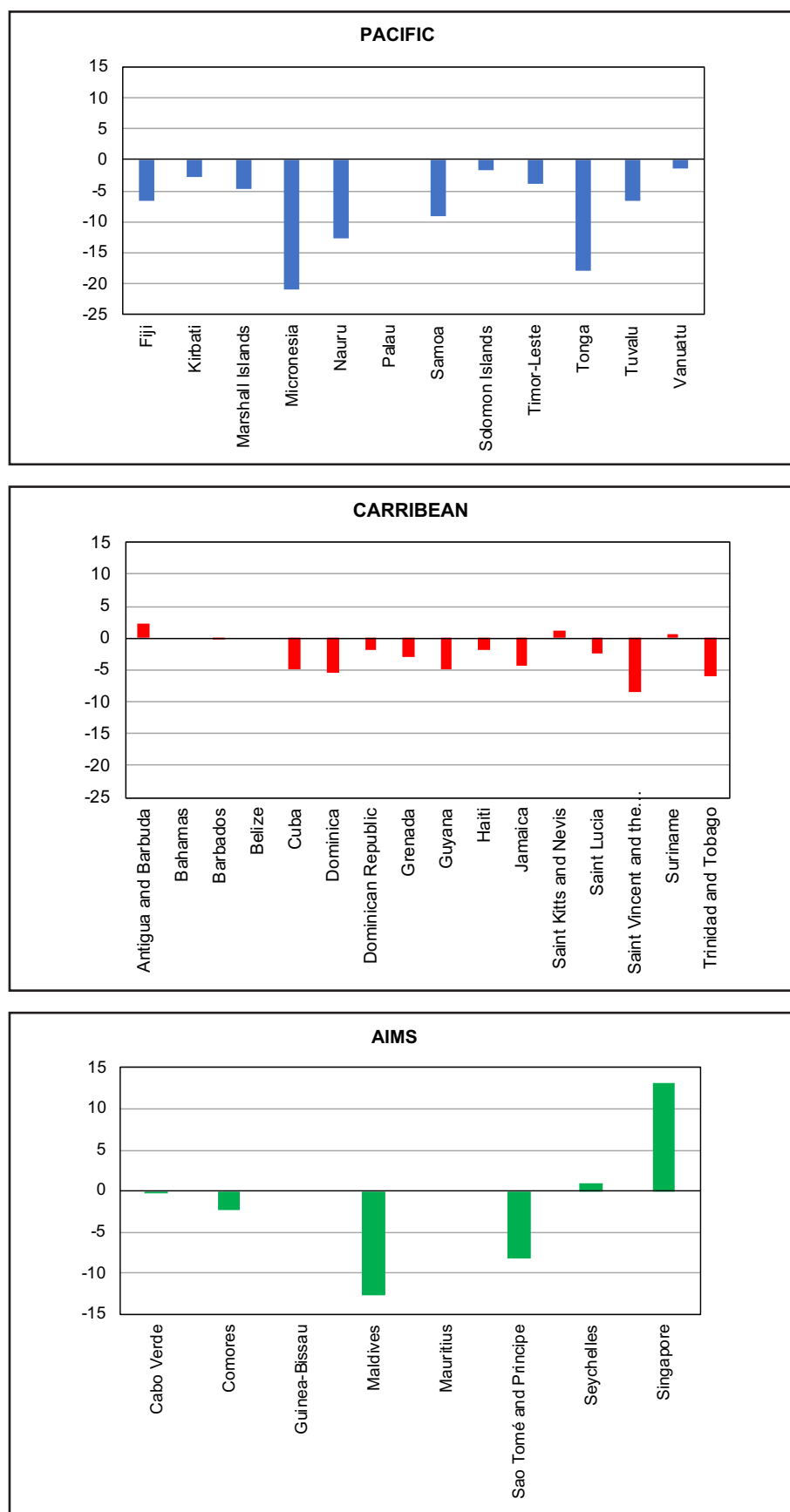


Figure 6. Net Migration Rate of different SIDS clusters (Caribbean; Pacific; and Africa, Indian Ocean, Mediterranean, and South China Sea [AIMS]) [Data Source: IOM, 2017- figures adapted from Gheuens et al., 2019].

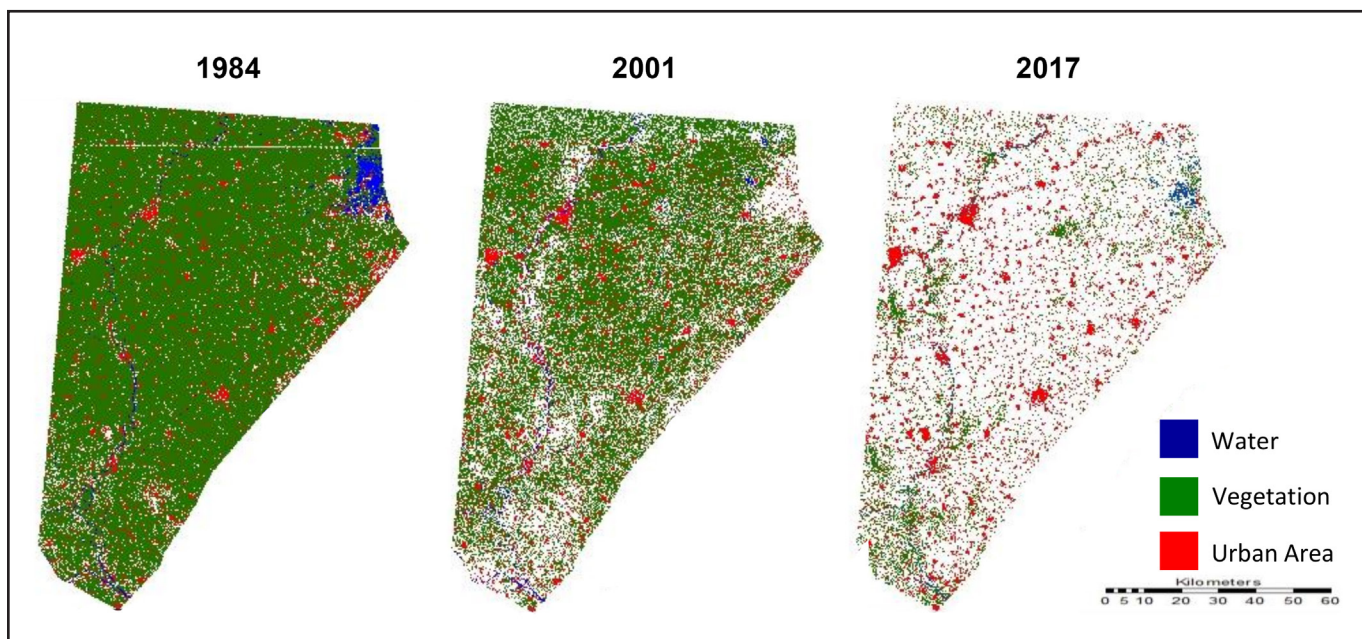


Figure 7. Time series of remote sensing images of part of the Nile Delta region showing changes in water, vegetation, and urban area. Diminishing vegetation (green) and increasing settlements (red) are the key trends observed. Some of these settlements have hosted internally displaced people in the past decades (Fanchette, 1992), and in recent times Syrian refugees (UNHCR - <https://data2.unhcr.org/en/news/12984>). [Data Source: Landsat data mapped by UNU-INWEH].

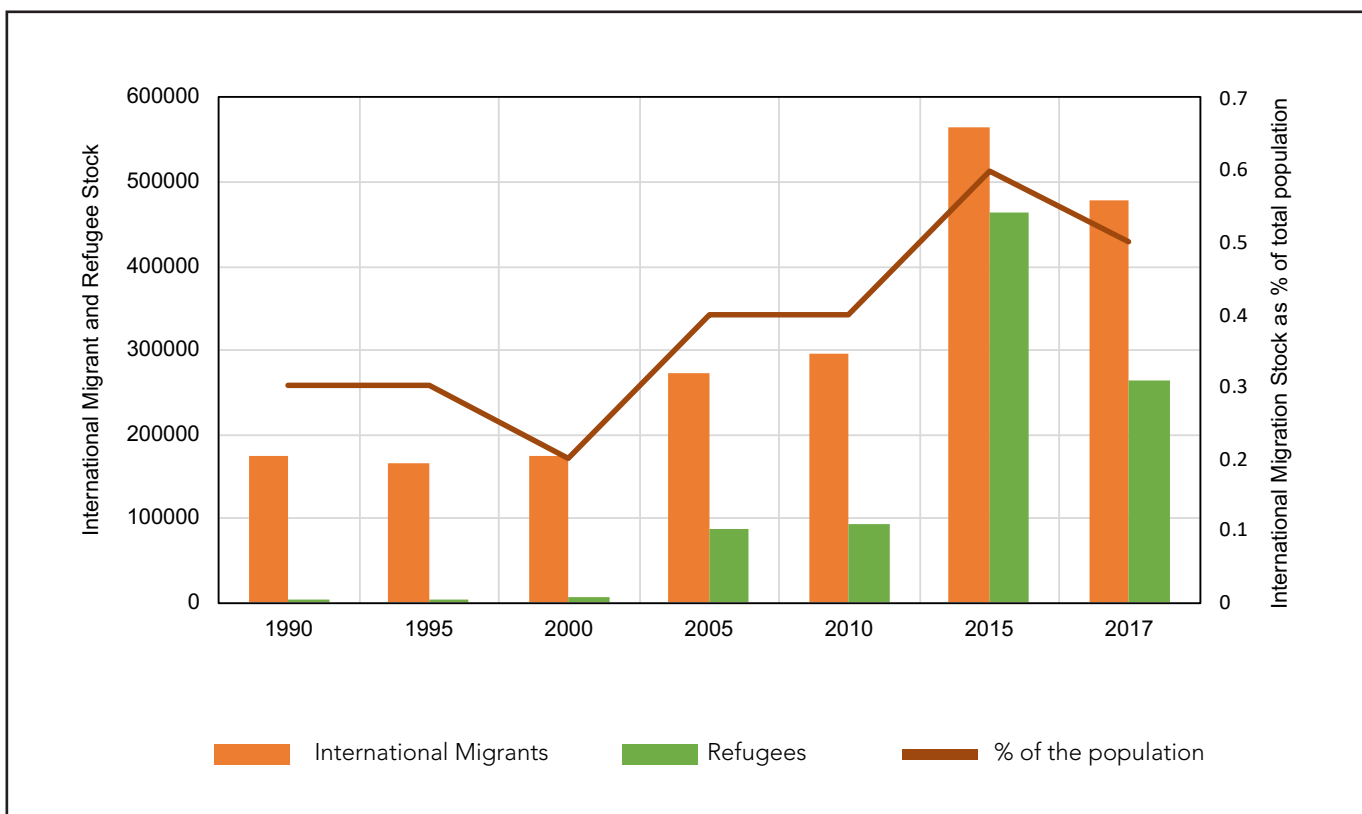


Figure 8. International migrant's and refugees' stock in Egypt from 1990 to 2017, and the international migrant stock as a % of the total population, that is reflective of competing and conflicting use of resources, including water [Data Source: United Nations Migration Database]. In the last 30 years, the country has seen a significant rise in the migrant stock and post 2005 in the refugee's stock.

affect 4 million people. A sea-level rise of 1.5 m will impact an estimated 8 million people and 33% of the total area including Alexandria and other major cities such as Port Said, mostly with catastrophic consequences that include but not limited to a loss of tourism and an increase in the unemployment rate (McGrath, 2014; Elderberky, 2011).

The 3D framework, in this case, connects water quality impacts (e.g., seawater intrusion into groundwater) on people's livelihoods and income that lead to migration as an outcome. In Egypt, overall, there has been a notable increase in migration and refugees' stock in the past 30 years. This trend (as shown in Figure 8) corresponds to the timeline of the Syrian civil war (Kelly et al., 2015 and De Bel-Air, 2016) and with the droughts in the past decades recorded by the Egyptian Meteorological Authority, 2014.

Case Study 5. Lake Chad: Water scarcity and Regional Migration

Lake Chad, once the sixth largest lake in the world, served as a vital source of water to 30 million people in the Sahel who relied on farming, fishing, and pastoral activities for their livelihoods. From the 1960s to 2017, the surface area of Lake Chad shrunk by almost 90% (Figure 9), with the reduction attributed to persistent droughts and an increase in irrigation withdrawals (Gao et al. 2011). The economic dependence of communities from four (Chad, Cameroon, Niger, and Nigeria) countries sharing the lake basin resource for income generation, and hence, their livelihood, was impacted. Displacement and migration in the

region is triggered by various stressors, including limited water availability in the Lake Chad basin and a mixture of socio-economic and sociopolitical factors, including conflicts (IOM, 2019).

The continued shrinking of the lake basin in the early 2000s can be attributed to various reasons, mostly hydroclimatic variability. Out-migration (internal migration and IDPs) increased in both Chad and Nigeria and each of the basin sharing countries, with a maximum trend recorded during the period of 2005-2017 (Figure 10). Chad recorded the highest number of international migrations, followed by the Cameroon, Niger, and Nigeria. Most states in the basin report an increase in internal and international migration flows. In the four countries surrounding the Lake Chad basin, more than 17 million people are living in the conflict affected areas since 2010, and almost 4.5 million persons (IDPs, refugees, asylum seekers and returnees) were displaced (Figure 10; IOM, 2019).

As a significant portion of the open water surface of the Lake Chad has dried up in past decades, most farmers and cattle herders have moved towards greener areas, where they compete for land resources with host communities, and therefore, potentially leading to conflict. Others have gone to Kano, Abuja, Lagos, and other large cities (rural to urban migration), leaving agriculture and fishing based livelihoods to serve as labor in other work sectors. The 3D framework connects increasing water scarcity with negative impacts on the economy and agriculture that lead to various socioeconomic outcomes, including migration.

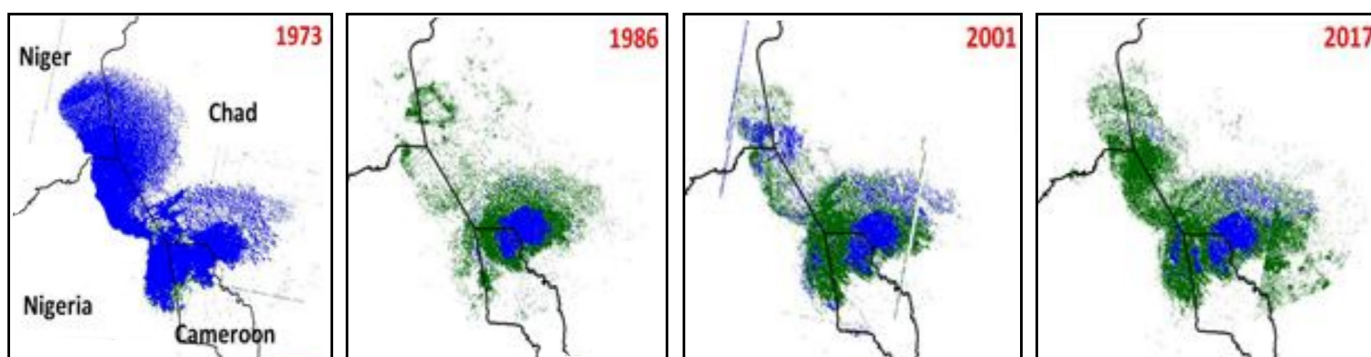


Figure 9. The dynamics of water (blue) and vegetation (green) in and around Lake Chad over the period of 1973-2017. While showing small signs of regeneration after 2001, overall, in the last half a century, the lake surface has remained limited to a fraction of its spread in the early 1970s. [Data Source: Landsat image mapped by UNU-INWEH]

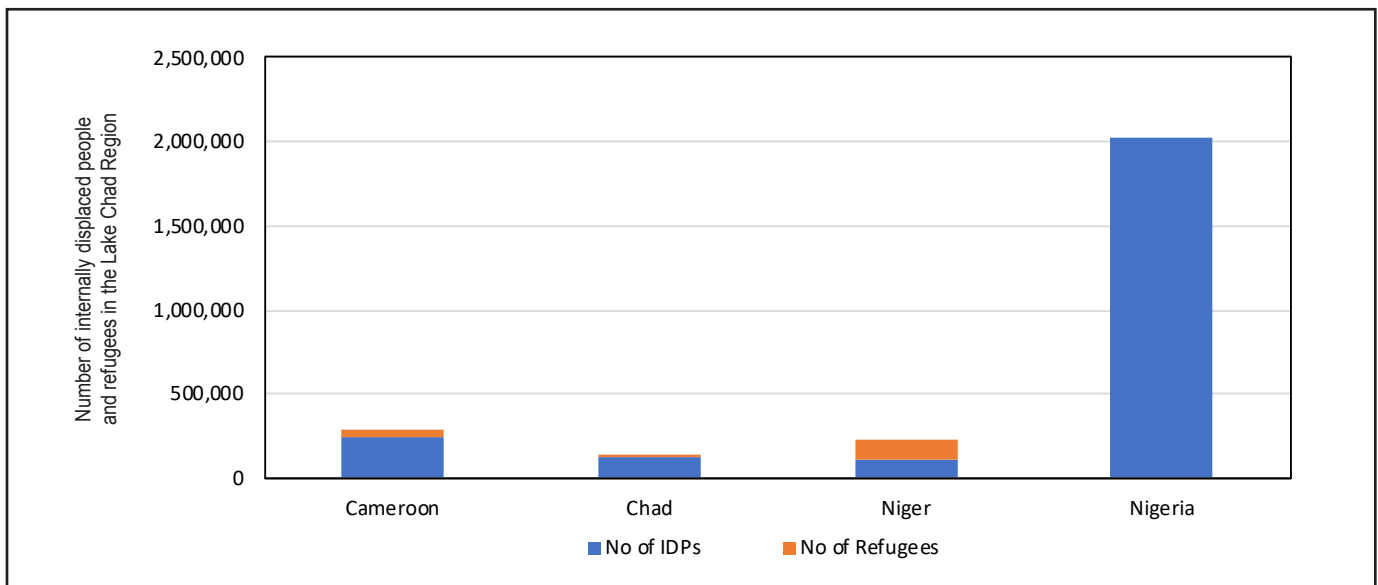


Figure 10. Displaced populations in Lake Chad basin (four countries) between 2016 and 2018. Refugee data for Nigeria are not available for this time period. The total number of displaced people increased by over 20 % of the data before 2016 (IOM, 2019).

The migration trends of the Lake Chad basin constitute both IDPs and refugee flows that were triggered by water scarcity, a lack of economic opportunity, and socio-political conflicts causing >2.5 million people migrating in the past decade and have spread across four countries (Cameroon, Chad, Niger, and Nigeria). Individuals and communities reported a loss of subsistence livelihood, which were generated by land and water resources (agriculture and fishing), and further fueled by the Boko Haram insurgency (political and violent conflict) both added and leveraged from the Lake Chad water crisis.

Case study 6. Global Conflict Risk Index as a proxy tool for water-related migration assessment

The global conflict risk index (GCRI) is an aggregated index of 24 variables and five dimensions - social, economic, security, political, and geographical/environmental (Stamatia et al. 2017). Notably, the information used is found within open source databases. Within the social dimension, which is related to the notion of social cohesion and public health, six variables are included (corruption, ethnic power change, ethnic compilation, transnational ethnic bonds, homicide rate, and infant mortality). The economic dimension also has six variables, including GDP per capita, income inequality, openness, food security, and unemployment. Security, notably, has three variables included

related to conflict (e.g., recent internal conflicts, neighbouring with highly violent conflict, and years since the highly violent conflict). The political dimension considers five variables related to the regime in place (regime type, lack of democracy, government effectiveness, level of repression, and empowerment rights). Finally, geography and environment also include five variables, which include water stress, oil production, structural constraints, population size, and the youth bulge. This index represents the statistical risk that evaluates the probability and intensity of violent conflict using a scale from 0 [no conflict] to 10 (Stamatia et al. 2017).

The GCRI can serve as a proxy indicator to reflect how hotspots of water and climate change-driven migration overlap with conflict zones. The index also accounts for conflicts that arise from shared water supplies, as well as a lack of water security that can trigger hostilities among countries (Link et al. 2016). This index presents a comparative account of the cumulative impact of conflicts, as shown in Figure 11.

WATER, MIGRATION, AND GENDER

Water and climate change have a disproportionate impact on gender, with significant risks emerging from forced and irregular migration (Wrathall et

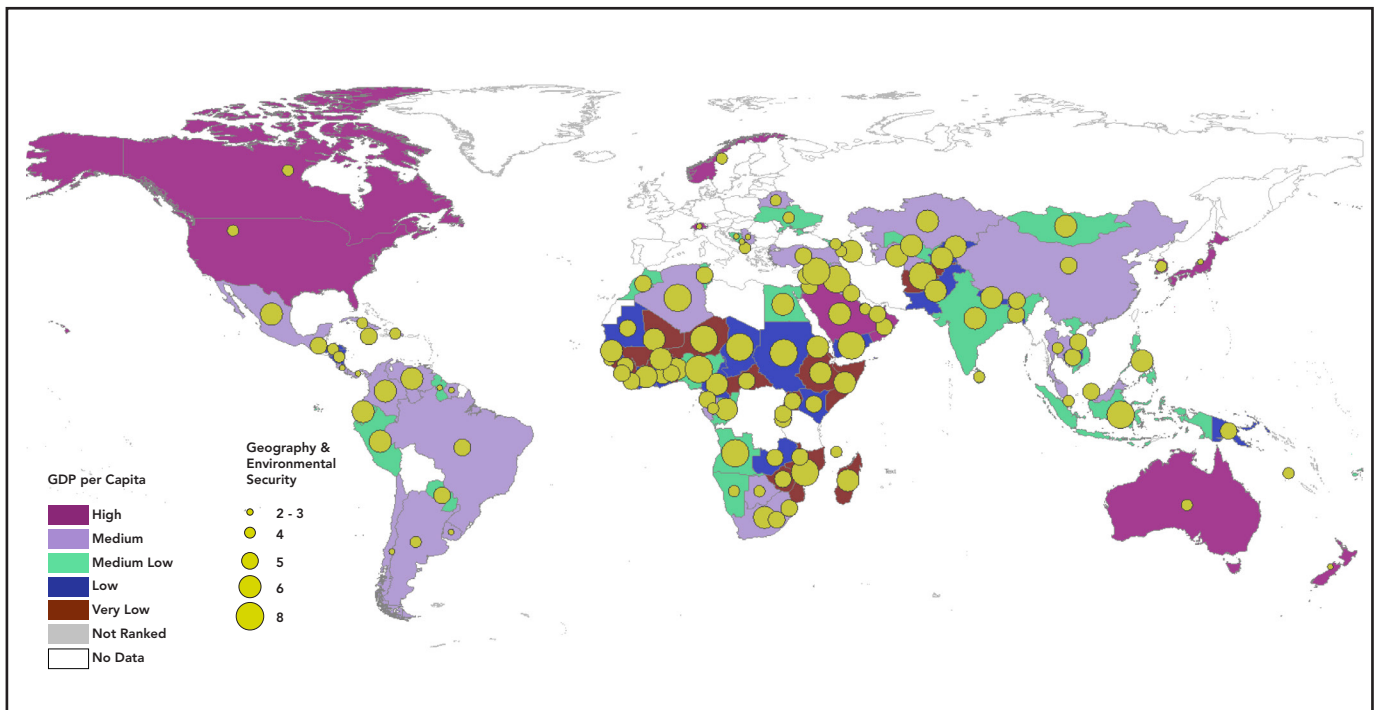
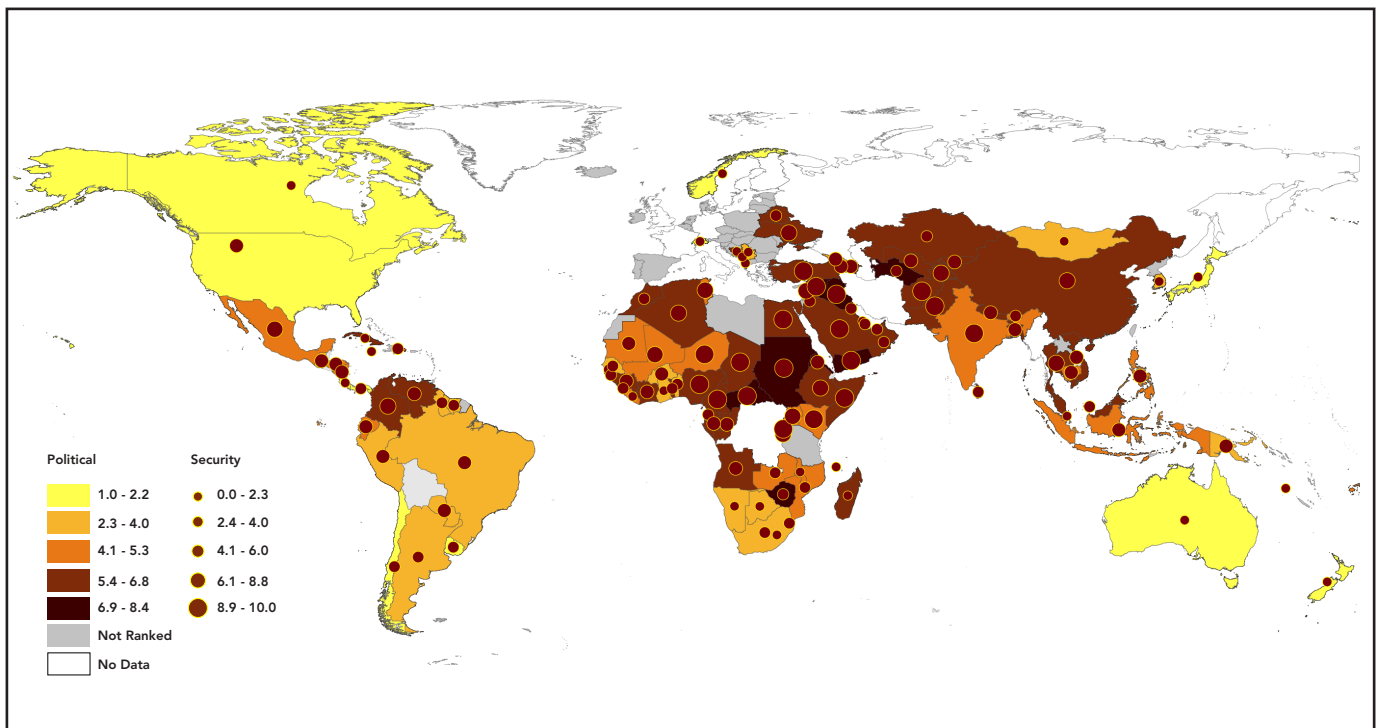


Figure 11. The maps of GCRI index components i) political stability and security aspects (top) and the economic and geographical/ environmental dimensions (bottom). The economic dimension is demonstrated through GDP per capita, and the geographic/ environmental dimension is shown through geography and environmental indices. Low value and smaller dots imply the index coding, blank regions, or countries that have no data currently.

al. 2018). Migration and displacement add an additional layer of burden and uncertainty to “conventional” gender roles and responsibilities. According to Lambrou and Piana (2006), women who live in low-income agricultural societies are the most vulnerable to climate and water-related events, including droughts and floods. It is well-established that a water crisis is a gendered problem as women are responsible for sourcing water, especially within low-resource regions. Women in Africa and Asia collect 70% of household water while men collect 30% (Andajani et al. 2015). Domestic water systems are equated to women, and the maintenance of irrigation water systems to men (Meeks, 2018).

Men tend to migrate more than women in crises related to food, water, and climate (Meeks, 2018). As women stay behind, they take on the responsibilities of the men; yet, they are faced with unequal access to resources (e.g., financial, social, etc.); thus, gaining an increase in responsibilities with fewer rights and accessibility. Out-migration of men leads to a double burden on women (Jobbins et al. 2018; O’Neil et al. 2016) where they not only have their household responsibilities (e.g., water collection, child-rearing, etc.) but as well now take up the burden of men’s previous responsibilities (e.g., farming, etc.) to generate income (Anderson et al. 2016). For example, women in the Sonora state of Mexico experienced a double burden as the men had to migrate due to water availability declining as a result of climate change; and, women had to work not only part-time in the food processing industry, besides their primary responsibility as caregivers for the families and household, including the duty of water collection (Chindarkar, 2012). As a result of droughts and floods, women of the Sonora State of Mexico were further burdened with water-related responsibilities as water sources were polluted; this increased their travel times to either fetch or purchase water (Buechler, 2009). Importantly, the impact of out-migration not only impacts women’s livelihood but their overall safety because they are at an increased risk of exploitation or sexual violence (Buechler, 2009; Kolmannskog, 2009). If and when women migrate as a result of environmental factors, they usually migrate to urban centers, which challenge in finding employment opportunities and face discrimination; thus, they can fall into a poverty trap as they face long hours and low-paying jobs especially in low- and middle-income countries. Also, women are

often found in the services sector rather than the agricultural sector, which is dominated more by men (Chammartin, 2008). Overall, while interlinkages between water, migration, and gender are complex and multifaceted, migration impacts women in a different aspect due to their role of acting as water purveyors (Miletto et al. 2017).

In the case where women and men are equally likely to migrate (i.e., migrations of households) their post-migration conditions may differ. Particularly, women migrants face specific water-related challenges, including water, sanitation, and hygiene (WASH), which can be explained by their household roles as water purveyors. For example, 53% of women migrants in urban areas of India had no access to safe drinking water; in turn, they were forced to gather water from pumps or public taps. Furthermore, 20% of these migrants were reported to have no access to a toilet area (Bhagat, 2017). In Bangladesh, women are likely to migrate due to challenges in acquiring land tenure as well as crop failures due to frequent flooding (Miletto et al. 2017).

WATER-RELATED MIGRATION AGREEMENTS AND POLICIES

Evolution of water and climate-related migration policy instruments at the global scale

Migration-related policies and agreements at the global level started to emerge explicitly, and relatively, they trace back to the United Nations High Commissioner for Refugees (UNHCR) to the year 1950. Figure 12 demonstrates an overview of migration and water-related policies that indirectly or directly address the migration context. A specialized United Nations agency, UNHCR, was founded in 1950 after World War II resulted in millions of people leaving their homes. The UNHCR was created with the mandate to protect refugees, forcibly displaced communities and stateless people, and assist in their voluntary repatriation as well as local integration or resettlement. In January 1992, the Dublin principles were formed at the International Conference on Water and the Environment, whereby the value of water is highlighted. Ten years later, the UNHCR released General Comment Number 15, “The right to water,” which described how the right to water

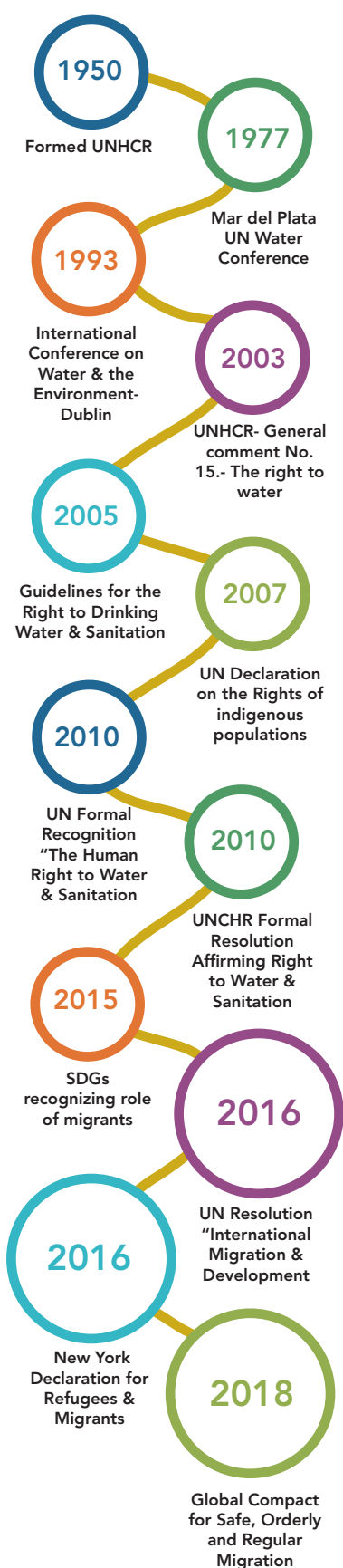


Figure 12. An overview of international governance tools and instruments that reflect the water-migration interlinkages directly or indirectly.

should apply to everyone, including refugees, internally displaced populations, and so forth. In 2005, the guidelines for the realization of the right to drinking water and sanitation delineated how water and sanitation needs of those vulnerable and marginalized, including refugees, should be addressed. Post the SDGs launch in 2015, international governance mechanisms for managing migration include the resolution on international migration and development and the New York Declaration for Refugees. These documents both included the necessity of water and sanitation for refugees and migrants. Most recently, in 2018, the member states of the UN formed the Global Compact for safe, orderly, and regular migration, which strengthens the global community's response towards sustainable solutions in addressing the situation surrounding migrants.

New York Declaration for Refugees and Migrants

The New York Declaration for Refugees and Migrants (2016) acknowledges that migration (voluntary or forced) is a significant developmental challenge emphasizing the need for enhanced cooperation at the global level and represents a commitment to holistically address the associated interconnections of human migration in all aspects. The UN General Assembly of September 2016, where the declaration was adopted, was followed by a range of actionable commitments, means of implementation, and a framework and review among the Member States regarding international migration, and creation of the Global Compact [Draft resolution A/71/L.1]. This declaration does reflect on water, climate, conflicts, poverty, and vulnerability aspects to some extent, but the explicit mention is lacking. However, Item 43 of the Draft resolution does capture some of the drivers and factors connecting to the migration discourse with the 2030 Agenda. This statements also ties in with the human right approach to adequate and safe drinking water, open access to water, and accessible water to all (Resolution A/RES/64/292). Table 1 summarises elements of the New York Declaration for Refugees and Migrants that apply to the water and climate-driven migration. In the Declaration, 193 member states of the United Nations reaffirmed the importance of the international protection regime and committed to strengthening and enhancing mechanisms to protect people on the move. They also agreed to work toward the adoption of a global compact on

Table 1. Elements of the New York Declaration for Refugees and Migrants that relate to water and climate aspects.

Item as stated	Context and Explanation
Item 1: <i>"in response to the adverse effects of climate change, natural disasters (some of which may be linked to climate change), or other environmental factors..."</i>	Water and climate are acting as direct and indirect drivers of migration. Focus on how water and climate challenge interplays with social and political systems, as well as the ownership structure of water is integrated.
Item 18: <i>"the Sendai Framework for Disaster Risk Reduction (2015-2030) and its recommendations concerning measures to mitigate risks associated with disasters. ...the Paris Agreement on climate change ... committed to its implementation. Addis Ababa Action Agenda of the Third International Conference on Financing for Development... including its provisions, applicable to refugees and migrants..."</i>	Reflects on the water footprint in disasters. (Resolution 69/283, Annexes I and II) The focus on extreme water events is integrated and relational aspects of a water crisis with climate change is integrated in this item
Item 43: <i>"addressing the drivers that create or exacerbate large movements. Analyze and respond to the factors, including in countries of origin, which lead or contribute to large movements. cooperate to create conditions that allow communities and individuals to live in peace and prosperity in their homelands".</i>	Links SDG 6 (water) and 16(peace and justice) of the Agenda 2030 is noted – focus in direct and indirect drivers of migration reflected a fair extent
Item 50: <i>"assist, impartially and based on needs, migrants in countries ...experiencing conflicts or natural disasters...in coordination with the relevant national authorities..."</i>	The water context in the Declaration is limited to 2 items – both related to post-migration WASH.
Item 5, part c, of the Annex I (Comprehensive refugee response framework) states, <i>"...assess and meet the essential needs of refugees, including by providing access to adequate safe drinking water, sanitation, food, nutrition, shelter, psychosocial support and health care...and assistance to host countries and communities in this regard, as required".</i>	Links with the notion that access to adequate and safe drinking water is a human right. Links with WASH and SDG 6 goals and targets is also clear
Item 80: <i>"committed to providing humanitarian assistance to refugees to ensure essential support in key life-saving sectors, such as health care, shelter, food, water and sanitation. Support to host countries and communities. Use of locally available knowledge and capacities, while supporting community-based development programmes for the benefit of all..."</i>	This point closely relates to the large and pressing issue of water-crisis migration and water distribution: the need for water to be open to all, regardless of price. Focus on a participatory and interdisciplinary approach that embeds local capacity, knowledge, and "community-based development programs for the benefit of all," is highlighted.

https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/71/1

refugees and a global compact for safe, orderly, and regular migration (McAdam, 2019).

Global Compact for safe, orderly, and regular migration and other recent policy tools

The Global Compact for safe, orderly, and regular migration (GCM) got adopted in December 2018 as an inter-governmental negotiation aligning with the guiding principles of the ‘Modalities Resolution.’ The GCM was piloted by the United Nations to address all issues of international migration. This compact is a non-binding United Nations agreement that focuses on migration-related aims to facilitate the involvement of state and non-state actors on important challenges. It calls for an open, transparent, and inclusive process of consultations and negotiations for efficient management of migration-related challenges, through the participation of all stakeholders and by outlining the relevant procedures and policies to support means for safe and orderly migration.

The key points from the GCM that can serve to mainstream the water and climate context in future migration discussions are listed in Table 2.

Other global agreements and policy documents with relevance to the water and climate aspects of migration include: the UN General Assembly Resolution 71/237 or so-called as the UN Resolution on “International Migration & Development” (2016) that focuses on migration and development although, it does not clearly echo on the water and climate context. The UN General Assembly Resolution on “International Migration & Development” (A/RES/71/237) explains the pervasiveness of human migration, emphasizing the New York Declaration as an international instrument to addressing large movements of refugees and migrants. The resolution also bridges the migration-related challenges with the 2030 Agenda, the New Urban Agenda, and other global sustainable development commitments.

Table 2. Elements of the Global Compact for Safe, Orderly, and Regular Migration (GCM) that relate to water and climate.

Item as stated	Context and Explanation
<i>“Addressing drivers of migration, including adverse effects of climate change, natural disasters and human-made crises, through protection and assistance, sustainable development, poverty eradication, conflict prevention and resolution.” (GCM, 2018)</i>	Reflects on the rights of Migrants i. e access to food and water. Calls for better understanding of influencers of migration relating natural resources, like water, how do they drive migration. Calls to focus on community-based interventions and empowering and engaging with international obligations such as Paris Agreement and 2030 Agenda.
<i>“... establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response.” (Article 7)</i>	Managed migration re-looked as a viable option The link with climate change adaptation planning is noted
<i>...” with focus on building capacity and awareness read: “...focus on those vulnerable to the adverse effects of climate change, such as SIDS, to take effective action, including,to implement adaptation, and facilitate technology development, dissemination and deployment, access to climate finance, relevant aspects of education, training, and public awareness, and the transparent, timely and accurate communication of information” (Article 11)</i>	Links SDG 6 (water) and 16(peace and justice) of the Agenda 2030 is noted – focus in direct and indirect drivers of migration reflected a fair extent

Water and Climate-related Policies for Migration at the Regional or National level

Clear institutional arrangements and coordination for safe and orderly migration in countries of origin, transit, and destination are often either lacking or exist at a rudimentary level. In some cases, a foreign ministry may oversee emigration, and a dedicated agency may be in place to deal with immigration. In other cases, internal displacements may be solved through disaster-related ministries. Some regional and local migration-related policies provide examples of institutional tools in the water-migration context. For example, the managed migration initiative in the SIDS, the CARICOM Free Movement Protocol (1989), was initiated at the intra-regional level (e.g., nearly 50% migration in the Caribbean is intra-regional). The Caribbean region serves as a transit for migration flows from South America, West Africa, and the Caribbean to North America. Remittances are crucial to the Caribbean GDP (in Haiti, they account for >21% of the GDP) (IOM, 2017). Remittances can assist in tackling poverty and helping feed the population to better organize water and food provisioning services. The Pacific islands, with its associated push factors, such as a lack of economic opportunities, or sea-level rise, floods, and tectonic subsidence, reported a significant impact on communities to migrate (Kelman, 2015). The government of Kiribati has set up a 'migration with dignity' program that teaches individuals skills to help them migrate to Australia and New Zealand (McNamara, 2015). Such arrangements can potentially be expanded to

integrate water and climate-driven migration flows. In New Zealand's Climate Change Adaptation Planning document, a mention concerning the flow of migrants from Kiribati, Tonga, and Tuvalu (Farquhar, 2015) reflects pre-emptive planning to ensure accessibility of water and food delivery. Australia and New Zealand as common recipient nations of migration from the Pacific region are revising programs for seasonal work in their agricultural sector. An agenda for long-term solutions for enhancing migration management capabilities through better international and inter-agency cooperation and data/knowledge platforms is pertinent (Box 2).

Water, Migration, and the Sustainable Development Goals (SDGs)

It is increasingly acknowledged that migration policies need to move a step further in integrating migration issues across government sectors (e.g., Article 10.7 of the GCM, 2018). Water and migration issues are implicit or explicit in many of the SDGs across the 2030 Agenda. The efforts geared for SDG 5 (gender equality and women's empowerment) and SDG 6 (clean water and sanitation for all) can assist to better inform technical and institutional aspects of migration at the point of origin, transit, and in recipient states. Targets 6.2 and 6.3 on water and sanitation focus on provisioning these services for all, including migrants. Migrants face both monetary as well as non-financial constraints for access to water. Unregistered or undocumented migrants, as well as people in transit, might face

Box 2: United Nations Human Rights Council on Migration, Climate Change and Human Rights

A recent statement released by UNHRC focuses on nations and governing authorities to consider the influence of climate change while evaluating the 'deportation' of asylum seekers. Although notifications by UN agencies are not legally binding, the statement could present as a reference for addressing how to best weigh the cases of forced or voluntary migration triggered by water and crises. Special mention of SIDS migrants (e.g., Kiribati population) seeking asylum in New Zealand. Due to rising sea levels and other climate change impacts, the island is losing the habitable landscape, reporting a crisis of freshwater supply and an increase in soil salinity. Predictions for the coming decade add to the existing set of challenges for the state, communities, and citizens. This case remained active in high-level discussions related to migration from 2015 to demonstrate that the real impact of climate change on the lives of the vulnerable and poor. The UN agencies did acknowledge that water and climate crises do represent a considerable threat to life and should be taken note when considering immigration and asylum decision-making. UNHRC recognizes that climate change impacts can have immediate and long-term effects and thus, need to be integrated into migration assessments and related policy decisions. Without solemn support of states to acknowledge these migration narratives and without international cohesion to mitigate the impacts of water and climate crises, then the existing situations can transform into extreme settings of geopolitical crises and humanitarian mayhem.

(Adapted from <https://news.un.org/en/story/2020/01/1055671>). January 2020

substantial difficulties in accessing water. Refugee camps and informal settlements report on the crisis surrounding water access and availability related issues, including challenges of groundwater contamination or wastewater management that can have a detrimental impact on health (WWAP, 2019). This is more crucial for regions in the Global South (Asia, Africa, and South America). The GCRI analysis largely feeds into SDG 16, indicator 16.1.2 “Conflict-related deaths/100,000 population, by sex, age and cause” and target 16.3 “Promote the rule of law at the national and international levels and ensure equal access to justice for all.”

It is also important to highlight the inconsistencies in the SDG framework. Though migration is explicitly mentioned in some instances, it is embedded in uncertainties and lacks both local and de-territorialized aspects that apply to migration. Despite internal migration accounting for 75% of migrant populations globally, the SDGs mostly focus on international migration. Rural-urban and irregular patterns of migration, stemming from water quality, quantity, and extreme events are scarcely addressed in the 2030 Agenda (Nijenhuis & Leung, 2017).

CONCLUSIONS

The relationship between water, climate, and migration is complex and cannot be easily quantified or separated from other contributing and driving factors. Towards a more in-depth understanding of the specific triggers of such interlinkages, the specific local context is necessary. Water, climate, and other environmental influences synergize to create various impacts and outcomes- migration is one such outcome. Accordingly, current data on the water-migration nexus are limited, disaggregated, or embedded. Migration and water interlinkages remain under-investigated and limited, especially when considering quantitative information. The challenges related to migration assessments exist not only in terms of data deficiency but also in data collection mechanisms, specifically primary data collection. For example, the gender disaggregated data in migration assessments are often missing, although migration and displacement add an additional layer of burden and uncertainty to “conventional” gender roles and responsibilities.

It appears logical to try and examine water-related migration in terms of three interconnected dimensions – water quantity, water quality, and water extremes. Water quantity can progressively increase or decrease overall in a region, creating more humid or arid conditions, which can either stimulate or attract migrants. Deteriorating water quality may be a migration trigger on its own, as it affects water availability. Increasing frequency and magnitude of water-related extremes are causing threats to human life and property, maybe acting as a trigger to migration in/under certain circumstances. Extremes impact the water quantity and quality directly or indirectly; for instance, accessible drinking water sources are contaminated by floodwater, in turn, affecting availability.

Institutional and community capacity development to address multi-faceted dimensions linked to migration is severely lacking, particularly in developing regions in the Global South. Government agencies and humanitarian organizations involved in mitigation and the recovery of natural disasters (i.e., forced evacuation and shelters) record the number of displaced; however, this exercise is restricted to planning response measures. In the absence of clear mechanisms to extract information on water-related migration from overall migration flows, the case study approach illustrated in this synthesis report may help build on relevant knowledge. A comprehensive assessment of water-related migration, as attempted in this synthesis, is vital to steer the institutional and policy reforms as well as to complement efforts that focus on building an enhanced understanding of migration.

The case studies presented provide insights into understanding the interlinkages at the local and regional scale. The proposed 3D framework can serve as a useful tool for communities, states, and international agencies to maintain a clear record of how the water-migration interconnections operate. The framework can assist researchers, development agencies, and planners to understand better how water crisis settings and the related climate change impacts influence migration.

Future migration assessment can adopt or adapt the 3D framework to develop a comprehensive methodology for better aggregation of direct and indirect drivers and to investigate some of

the outlined gaps. Furthermore, a better focus on migration as an adaptation strategy to maximize on the interconnectedness with the SDGs can help the migration discourse to shift away from a preventative and problematic approach to a one that views migration as a contributor to sustainable development. SDGs 5, 6, and 16, present goals and targets to strengthen the human, technical, and institutional capacities related to water, gender, climate, and institutions. Importantly, the GCRI analysis reflects how migration can stem from a conflict situation or may lead to a conflict. The international and inter-agency cooperation agreements, tools, and policies such as the New York Declaration and GCM or others that reflect on migration challenges either indirectly or straightforwardly offer potential towards presenting long-term solutions for enhancing migration management capabilities through better coordination and consensus-building.

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REFERENCES

- Andajani-Sutjahjo, S., Chirawatkul, S., & Saito, E. (2015). Gender and water in northeast Thailand: Inequalities and women's realities. *Journal of International Women's Studies*, 16(2), 200-212.
- Anderson, T., Shamsuddoha, Md., & Dixit, A. Climate Change Knows No Borders: An analysis of climate induced migration, protection gaps and need for solidarity in South Asia. Retrieved from https://actionaid.org/sites/default/files/climate_change_migration_in_south_asia_web_version.pdf
- Ataniyazova, O.A. (2003). Health and Ecological Consequences of the Aral Sea Crisis. the 3rd World Water Forum. In 3rd World Water Forum, Regional Cooperation in Shared Water Resources in Central Asia, http://www.caee.utexas.edu/prof/mckinney/ce385d/papers/atanizaova_wwf3.pdf
- Bhagat, R.B. (2017). Migration, Gender and Right to the City: The Indian Context. *Economic & Political Weekly*, 52(32), 35.
- Brown, O. (2008). Migration and Climate Change(No.31). Retrieved from https://www.iom.cz/files/Migration_and_Climate_Change_-_IOM_Migration_Research_Series_No_31.pdf
- Buechler, S. (2009). Gender, water, and climate change in Sonora, Mexico: implications for policies and programmes on agricultural income-generation. *Gender & Development*; 17(1);51-66, <https://doi.org/10.1080/13552070802696912>
- Bunce, M., Mee, L., Rodwell, L.D., & Gibb, R. (2009). Collapse and recovery in a remote small island- A tale of adaptive cycles or downward spirals? *Global Environmental Change*, 19(2), 213-226. <https://doi.org/10.1016/j.gloenvcha.2008.11.005>
- Castelli, F. 2018. Drivers of migration: why do people move? *Journal of travel medicine*, 25(1), <https://doi.org/10.1093/jtm/tay040>
- CIA-Central Intelligence Agency. 2020. THE WORLD FACTBOOK. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/fields/347.html>
- Chammartin, G.M.-F. (2009). Overview Paper: Migration, Gender, and Equality and Development. In the International conference on Gender, Migration and Development seizing opportunities, upholding rights, Manila.
- Chindarkar, N. (2012). Gender and climate change-induced migration: proposing a framework for analysis. *Environmental Research Letters*; 7(2), 025601. DOI: [doi:10.1088/1748-9326/7/2/025601](https://doi.org/10.1088/1748-9326/7/2/025601)
- Eldeberky, Y. (2016). Dealing with Future Risks of Sea-Level Rise in the Nile Delta: Impacts and Adaptation Measures. DOI: 10.13140/RG.2.1.3129.2406
- Egyptian Meteorological Authority. 2014. Drought condition and management strategies in Egypt. https://www.droughtmanagement.info/literature/UNW-DPC_NDMP_Country_Report_Egypt_2014.pdf
- FAO-Food and Agriculture Organization of the United Nations. 2016. Dry Corridor Central America Situation Report. Retrieved from <http://www.fao.org/3/a-br092e.pdf>
- FAO-Food and Agriculture Organization of the United Nations. (2018). The state of food and agriculture-migration, agriculture and rural development. Retrieved from <http://www.fao.org/3/i9549EN/i9549en.pdf>
- Fanchette, S. (1992). Migratory strategies in the overpopulated Nile Delta region. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/12285676>
- Françoise De Bel-Air, F. (2016). Migration Profile: Egypt. Policy Brief. Migration Policy Center. Issue, 2016/01 February 2016. European University Institute. ISBN 978-92-9084-389-4 https://cadmus.eui.eu/bitstream/handle/1814/39224/MPC_PB_2016_01.pdf
- Farquhar, H. (2015). "Migration with Dignity": Towards a New Zealand Response to Climate Change Displacement in the Pacific. *Victoria University of Wellington Law review*, 1(46), 29
- Gao, H., Bohn, T. J., Podest, E., McDonald, K. C., & Lettenmaier, D. P. (2011). On the causes of the shrinking of Lake Chad. *Environmental Research Letters*, 6(3), 034021. DOI: [10.1088/1748-9326/6/3/034021](https://doi.org/10.1088/1748-9326/6/3/034021)
- Global Compact on Refugees, UN Doc. A/73/12 (2018); Global Compact for Safe, Orderly and Regular Migration, UN Doc. A/RES/73/195 (Dec. 19, 2018) [hereinafter Migration Compact].

- Gheuens, J., Nagabhatla, N., & Perera, E.D.P. (2019). Disaster-risk, water security challenges and strategies in small island developing states (SIDS). *Water*, 11(4), 637. <https://doi.org/10.3390/w11040637>
- Halkia, M., Ferri, S., Deepen, Y., Papazoglou, M., Van Damme, M.-S., & Baumann, K.M. (2019). The Global Conflict Risk Index: Artificial Intelligence for Conflict Prevention. Retrieved from https://publications.jrc.ec.europa.eu/repository/bitstream/JRC118746/ai_gcric_technical_report.pdf
- Handmer, J., & Nalau, J. (2018). Understanding Loss and Damage in Pacific Small Island Developing States. In *Loss and Damage from Climate Change* (pp. 365-381), https://doi.org/10.1007/978-3-319-72026-5_15
- Hereher, M.E. (2010). Vulnerability of the Nile Delta to sea level rise: an assessment using remote sensing. Retrieved from <https://www.tandfonline.com/doi/full/10.1080/19475705.2010.516912>
- IDMC-Internal Displacement Monitoring Centre. 2018. EGYPT. Retrieved from <https://www.internal-displacement.org/countries/egypt>
- IOM. 2019. Within and Beyond Borders: Tracking Displacement in the Lake Chad Basin - Regional Displacement and Human Mobility Analysis, March 2019. The International Organization for Migration. Available at: <https://displacement.iom.int/reports/lake-chad-basin-crisis-%E2%80%94-within-and-beyond-borders-tracking-displacement-and-human-mobility>
- IOM- International Organization for Migration. (2020). World Migration Report 2020. Retrieved from https://publications.iom.int/system/files/pdf/wmr_2020.pdf
- IOM-International Organization for Migration. (2009). Migration, Environment and Climate Change: Assessing the evidence. Retrieved from https://publications.iom.int/system/files/pdf/migration_and_environment.pdf
- IOM-International Organization for Migration. (2017). MIGRATION IN THE CARRIBEAN: CURRENT TRENDS, OPPORTUNITIES, AND CHALLENGES. Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/Working%20papers_%20en_baja_20.06.17.pdf
- IOM-International Organization for Migration. (2018). IOM's contribution for the High Level Political Forum 2018 "Transformation towards sustainable and resilient societies". Retrieved from https://sustainabledevelopment.un.org/content/documents/18741Input_to_the_HLPF_2018_IOM.pdf
- IOM- International Organization for Migration. (2019). West and Central Africa- Within And Beyond Borders: Tracking Displacement and Human Mobility in the Lake Chad Basin. Retrieved from <https://displacement.iom.int/reports/lake-chad-basin-crisis-%E2%80%94-within-and-beyond-borders-tracking-displacement-and-human-mobility>
- Ionesco, D., Mokhnacheva, D., & Gemenne, F. (2017). The Atlas of Environmental Migration. 978-1138022065.
- Jobbins, G., Langdown, I., & Bernard, G. (2018). Water and sanitation, migration and the 2030 Agenda for Sustainable Development. Retrieved from <https://www.odi.org/sites/odi.org.uk/files/resource-documents/12299.pdf>
- Julca, A., & Paddison, O. (2009). Vulnerabilities and migration in Small Island Developing States in the context of climate change. *Natural Hazards*, 55(3), 717-728. <https://doi.org/10.1007/s11069-009-9384-1>
- Kamel, B. (2017). Climate Migrants Might Reach One Billion by 2050. Retrieved from <http://www.ipsnews.net/2017/08/climate-migrants-might-reach-one-billion-by-2050/>
- Kelley CP, Mohtadi S, Cane MA, Seager R, Kushnir Y. Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the National Academy of Sciences of the United States of America*. 2015 Mar;112(11):3241-3246. DOI: 10.1073/pnas.1421533112.
- Kelman, I. (2015). Difficult decisions: Migration from Small Island Developing States under climate change. *Earth's Future*, 3(4), 133-142, <https://doi.org/10.1002/2014EF000278>
- Kolmannskog, V. (2009). Climate change, disaster, displacement and migration: initial evidence from Africa. Retrieved from <https://www.unhcr.org/4b18e359.pdf>
- Lambrou, Y., & Piana, G. (2006). GENDER: the missing component of the response to climate change. Retrieved from <http://www.fao.org/3/i0170e/i0170e00.pdf>
- Link, O.M., Scheffran, J., & Ide, T. (2016). Conflict and cooperation in the water-security nexus: A global comparative analysis of river basins under climate change. *Wiley Interdisciplinary Reviews: Water*, 3(4), 495-515, <https://doi.org/10.1002/wat2.1151>

- Mach, E. (2017). Water and Migration: How Far Would You Go For Water? Retrieved from <http://www.fciv.org/downloads/WP8-Book-2017-08-31.pdf>
- Missirian, A. and Schlenker, W. 2017. Asylum applications respond to temperature fluctuations. *Science*, 358, 1610–1614
- Marriner, N., Flaux, C., Morhange, C., & Kaniewski, D. (2012). Nile Delta's sinking past: Quantifiable links with Holocene compaction and climate-driven changes in sediment supply? *Geology*, 40(12), 1083–1086, <https://doi.org/10.1130/G33209.1>
- McLeman, R.A., & Hunter, L.M. (2010). Migration in the context of vulnerability and adaptation to climate change: insights from analogues. *Wiley Interdisciplinary Reviews: Climate Change*, 1(3), 450–461. <https://doi.org/10.1002/wcc.51>
- McAdam, J., 2019. Global Compact for Safe, Orderly, and Regular Migration. *International Legal Materials*. The American Society of International Law. Volume 58, Issue 1. February 2019, pp. 160–194. DOI: <https://doi.org/10.1017/ilm.2019.6>
- McNamara, K.E. (2015). Cross-border migration with dignity in Kiribati. *Forced Migration Review*, (49), 62.
- MSF- Médecins Sans Frontières. 2003. Karakalpakstan: A Population in Danger. The impact of the Aral Sea disaster and a worsening economic climate and the health and wellbeing of the people of Karakalpakstan. Retrieved from <https://www.aerzte-ohne-grenzen.de/sites/germany/files/attachments/2003-04-karakalpakstan-report-population-in-danger.pdf>
- Meeks, S. (2018). Water, Women, and Migration: Examining the Interconnections Between Water Scarcity, Environmental Migration, and Women in Bolivia. Retrieved from <http://thesis.honors.olemiss.edu/1098/1/Final%20Honors%20Formatted%20Thesis%204.24%2C11am.pdf>
- Miletto, M., Caretta, M.A., Burchi, F., & Zanlucchi, G. (2017). Migration and its interdependencies with water scarcity, gender and youth employment. UNESCO. 978-92-3-100235-9.
- Nagabhatla N, Sahu S, Gaetaniello A, Wen L, Lee W (2015) Understanding impacts of climate variation in varied socio-ecological domains: a prerequisite for climate change adaptation and management. In *Handbook of climate change adaptation*. Leal Filho W (Ed.) Springer Publications. 1–25. ISBN 978-3-642-38669-5- <https://www.springer.com/gp/book/9783642386695>
- New York Declaration for Refugees and Migrants, UN Doc. A/RES/71/1 (Sept. 19, 2016).
- Nelson, G.C., Rosegrant, A.P., Gray, I., Ingersoll, C., Robertson, R.D., Tokgoz, S., Zhu, T., Sulser, T.B., Ringler, C., Msangi, S., & You, L. (2010). Food security, farming, and climate change to 2050: Scenarios, Results, Policy Options. IFPRI. Retrieved from <https://www.ifpri.org/publication/food-security-farming-and-climate-change-2050>
- Nijenhuis, G., & Leung, M. 2017. Rethinking Migration in the 2030 agenda: Towards a De-Territorialized Conceptualization of Development. *Forum for Development Studies*, 44(1), 51–68, <https://doi.org/10.1080/08039410.2016.1276958>
- OECD- Organization for Economic Cooperation and Development. (2001). Glossary of statistical terms. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=2349>.
- OCED-Organization for Economic Cooperation and Development. (2004). Development and Climate Change In Egypt: Focus on Coastal Resources and the Nile. Retrieved from <https://www.oecd.org/env/cc/33330510.pdf>
- O'Neil, T., Fleury, A., & Foresti, M. (2016). Women on the move: migration, gender equality and the 2030 Agenda for Sustainable Development. Retrieved from <https://www.odi.org/sites/odi.org.uk/files/resource-documents/10731.pdf>
- Sakho, S., & Aguero, M.A. 2019. Guaranteeing water security, a priority for Central America. Retrieved from <http://blogs.worldbank.org/latinamerica/guaranteeing-water-security-priority-central-america>
- Small, I., van der Meer, J., & Upshur, R.E.G. (2001). Acting on an Environmental Health Disaster: The Case of the Aral Sea. *Environmental Health Perspectives*, 109(6), 547–549, <https://doi.org/10.1289/ehp.01109547>
- Stamatia, H., Stefano, F., Ines, J.-B., Francesca, S., & Mayeul, K. (2017). The Global Conflict Risk Index (GCRI) Regression model: data ingestion, processing, and output methods. Retrieved from https://publications.jrc.ec.europa.eu/repository/bitstream/JRC108767/3_the_global_conflict_risk_index_regression_model.pdf
- UNDESA- United Nations Department of Economic and Social Affairs. (2019). Population Facts. Retrieved from https://www.un.org/en/development/desa/population/migration/publications/populationfacts/docs/MigrationStock2019_PopFacts_2019-04.pdf

UNHCR- United Nations Commission on Human Rights. (2020). UN human rights ruling could boost climate change asylum claims. Retrieved from <https://news.un.org/en/story/2020/01/1055671>

UNHCR.2020-Figures at a glance. Available from: <https://www.unhcr.org/figures-at-a-glance.html>

UN-OHRLLS- Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. (2011). Small Island Developing States: Small Islands Big(ger) stakes. Retrieved from <http://unohrlls.org/custom-content/uploads/2013/08/SIDS-Small-Islands-Bigger-Stakes.pdf>

UNU-United Nations University. (2009). In search of Shelter: Mapping the Effects of Climate Change on Human Migration and Displacement. 6th session of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention, Bonn.

Waehler, T.A., & Dietrichs, E.S. (2017). The vanishing Aral Sea: health consequences of an environmental disaster. Tidsskrift for den Norske laegeforening: tidsskrift for praktisk medicin, ny raekke, 137(18). DOI: 10.4045/tidsskr.17.0597.

Wernick, A. (2018). Climate change is contributing to the Central American refugees. Retrieved from <https://www.pri.org/stories/2018-07-15/climate-change-contributing-migration-central-american-refugees>

World Bank. (2018). Internal climate migration in Latin America (English). Groundswell policy note; no. 3. Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/983921522304806221/Internal-climate-migration-in-Latin-America>

Wrathall, D.J., Van Den Hoek, J., Walters, A., & Devenish, A. (2018). Water stress and human migration: a global, georeferenced review of empirical research. Retrieved from <http://www.fao.org/3/i8867en/i8867EN.pdf>

WWAP- World Water Assessment Programme. (2019). The United Nations World Water Development Report 2019: leaving no one behind. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000367306>

Warner, K., Hamza, M., Oliver-Smith, A., Renaud, F., & Julca, A. (2010). Climate change, environmental degradation and migration. Natural Hazards, 55(3), 689-715, 689. doi:10.1007/s11069-009-9419-7

Yonetani, M., Albuja, S., Bilak, A., Ginnetti, J., Glatz, A.-K., Howard, C., Kok, F., McCallin, B., Swain, M., Turner, W., & Walicki, D. (2015). Global Estimates 2015: People displaced by disasters. Retrieved from <https://www.internal-displacement.org/sites/default/files/inline-files/20150713-global-estimates-2015-en-v1.pdf>



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