

Assessing climate change induced displacements and its potential impacts on climate refugees: How can surveyors help with adaptation?

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SUMMARY

Global warming and climate change pose severe threat to many countries, territories and cultural heritage of humanity on earth in the 21st century. One of the ensuing effects of climate change is the issue of climate induced displacements and the consequent migrant (climate refugees). Over the past two decades, the debate about “climate refugees” among experts, advocacy groups and social scientists has produced lots of different scenarios about environmentally induced migration. However, the term “environmental refugee” or “climate refugee” remains somewhat vague and has no international charter. Hence, a significant number of people who are climate refugees at the moment are not accorded the need support under the 1951 United Nations (UN) convention and 1967 Protocol on the Status of Refugees. This paper review literature and uses qualitative analysis to evaluate recent climate induced displacements, potential future scenarios (2050 as baseline), and international legal regime to assess global capacity to deal with the threat. In the past three years, long icy winter conditions at the polar and temperate regions have also caused significant displacements and migrations due to significant loss of livelihood. In addition, climate induced sea-level rise also threatens coastal settlements and low-lying small island states, particularly; those in the Pacific Ocean are vulnerable. It has been predicted by the Intergovernmental Panel on Climate Change (IPCC), 2007 that all these climatic conditions and their impacts are likely to intensify from now to 2050. These clearly highlight the need to build strong global capacity and strategies for managing the risk and impacts of climate induced displacements and climate refugees. Surveyors already have strong capacity and expertise in disaster risk management; therefore, they could be engaged in the planning and development of climate change adaptation strategies to accommodate the impacts of climate change, particularly, the issue of climate refugees.

Key words: Climate change, climate induced disaster, sea level rise, Disaster-Risk Management, climate refugee, adaptation

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1. INTRODUCTION

About 23 years ago, the United Nations Environmental Programme (UNEP) reported that as many as 50 million people could become environmental refugees by 2050 if the world did not act to support sustainable development (Tolba, 1989). Since then, the debate about “climate refugees”/“environmental refugees” among researchers, advocacy groups and social scientists has produced lots of different assessments, and scenarios about environmentally induced migration (El-Hinnawi, 1985; Black, 2001; Myers, 2002; Bates, 2002; Boano et al, 2008; Gemenne, 2011a; Piguet, 2012).

The proposed linkages between climate change and forced migration is highly contested by some policy analysts and researchers (Renaud et al. 2007; Keane 2004). They have labelled the term “climate refugee” as “alarmist rhetoric”. Their argument is based on the ground that though climate change poses risk to human security, principally through its potentially negative effects on people’s livelihoods and habitat, caution should be used in linking environmental change to conflict and forced migration. Supporters of this argument have the view that migration has been part of human history and that displacement for environmental reasons is not a recent occurrence. However, what their argument failed to acknowledge is the fact that due to high population growth and overexploitation of the Earth resource, the carrying capacity of the Earth is far over-stretched and less sustainable compared to the historical past. There is the need therefore, to pursue the issue of climate refugees proactively, rather than relying on historical resilience of our planet. There is enough evidence to suggest that impacts of present changing climate will be more severe on our planet than in the past, since human activities has significantly damage the resilience of our planet. For instance, in 2011 alone, flooding in places like Genoa and Turin, Italy; Zhejiang and Hubei, China; Sindh province, Pakistan; Pennsylvania and Binghamton (NY), USA; Orissa, India; Queensland, Australia and the long droughts in countries like Ethiopia, Uganda, Kenya, Somalia and Djibouti caused millions of displacements and migrations.

Climate refugee has no accepted place in international refugee law, for environmental conditions do not constitute a basis for international protection (Boano et al, 2008). The 1951 United Nations (UN) convention and 1967 Protocol on the Status of Refugees (United Nations High Commission for Refugees UNHCR, 2006) is well established, but does not clearly offer protection for those affected by environmental factors. The guiding principles on internal displacement (Deng, 1998; Kalin, 2000) also do not address the full range of climate and environmental variables that also bear on displacement.

Regardless of the recognition of an international status, the issue of right for those who are either being displaced now or could be displaced in the near future by adverse climatic conditions are urgent matters for policy, risk-management and adaptation planning. The focus of this paper is three-pronged. First, to assess whether the problem of climate refugees is real

or a myth, second, relate the outcome of the first assessment to the available adaptation policies to identify vulnerability and finally, to examine possible contributions surveyors could offer in the development and implantation of the adaptation strategy.

2. DEFINITIONS

El-Hinnawi (1985) defined ‘environmental refugees’ as those people who have been forced to leave their traditional habitat, temporarily (internal) or permanently (international), because of a marked environmental disruption that jeopardised their existence and/or seriously affected the quality of their life. This definition addresses all types of environmental changes, and not only those induced by climate change (Gemenne, 2011b). El-Hinnawi’s definition was criticised because of its large scope. Bates (2002) observed that the definition makes no distinction between refugees who flee volcanic eruptions and those who leave their homes as soil quality declines or because of persistent adverse climatic conditions.

Myers (2002) defines ‘environmental refugees’ as people who can no longer gain a secure livelihood in their homelands because of drought, soil erosion, desertification, deforestation and other environmental problems, together with the associated problems of population pressures and profound poverty. The International Organisation for Migration [IOM] (2007) introduced a broader term “environmentally induced migrants” and defined it as persons or groups of persons who, for compelling reasons of sudden or progressive changes 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.

It is clear from the above definitions that climate refugee is not synonymous to environmental refugee. Climate refugees exclude peoples who migrate as a result of displacement caused by certain environmental disasters like volcanic eruptions, earthquakes, subsidence and landslides which are not influenced by climatic factors. Climate refugee therefore, may be defined as a person or group of persons who are displaced by environmental conditions which are influenced by climate change (e.g. droughts, cyclone/monsoon, rainfall induced-flood, climate induced sea level rise and intense icy winters) and can no longer gain a secure livelihood in their homelands/habitats and are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently and within their country or abroad.

3. METHODOLOGY

Using empirical evidence from the literature review, the paper assesses the evidence of adverse climatic disasters which are influenced by climate change, their potential to cause displacements and migrations and international legal regime that cut off climate refugees from the needed international assistance. Seven case studies of recent occurrences of climate induced disaster and displacements were analysed and used as evidence to demonstrate the scale of the problem. The evidence from the case studies were qualitatively analysed. The outcome of the analysis facilitated the evaluation of potential future intensity of climate induced displacement by 2050 and global capacity to deal with the threat. Following that is an assessment of the

available adaptation policies to identify vulnerability and examination of global capacity to develop and implement pro-active risk-management strategies that could be pursued to accommodate/manage climate refugees. All the assessment including the literature review was based on reflective and qualitative analysis of the problem.

4. LITERATURE REVIEW: CLIMATE INDUCED DISPLACEMENTS AND MIGRATIONS

Climate change is predicted to bring about more frequent and severe disasters, such as droughts, floods, storms, and hurricanes (cyclones and typhoons). IPCC (2007) identified four zones as among the most susceptible to climate change: low-lying coastal settlements; rain-fed farm regions and those dependent on rivers fed by snow and glacier melt; sub-humid and arid regions; and humid areas in Southeast Asia vulnerable to changes in monsoon patterns. The climatic changes that threaten these zones are: sea level rise, drought, changes in rainfall pattern, flood, glacial melting and extreme weather conditions.

IPCC (2007) predicted that sea levels will rise worldwide by 0.18 to 0.59 meters by the end of this century. Sea-level rise could cause greater erosion and flooding in coastal and delta regions (Boateng, 2010; Boateng, 2012). This would lead to the gradual disappearance of small island nations in the South Pacific and Caribbean (Fritz, 2010; Boateng, 2010). Sea level rise has also been linked to more frequent seismic activity and volcanic eruptions, according to researchers at the University of Oxford (Fritz, 2010). Even small changes in sea level, they suggest, can create enough added pressure to the seabed to have a significant effect. Warner et al, (2009) identified in their report *In Search of Shelter* that 1 metre rise in the sea level could affect nearly 24 million people in the densely populated Ganges, Mekong, and Nile river deltas, and significantly reduce the production of life sustenance in those areas. Figure 1 below shows some of the effects of rising sea levels to a small island state and coastal settlement.

Figure 1: Threat of Sea Level Rise to Small Island State and Coastal Settlement



Vulnerable Maldives Islands in the Indian Ocean. Photo: danksy/flickr



Erosion doubles along Alaska's Arctic coast. Photo: coastal care

It is anticipated that rising sea levels will displace hundreds of millions of people in developing countries by the end of the century (Fritz, 2010). Already rising sea levels have caused the resettlement of Carteret Islands, north-east of the Papua New Guinean island of Bougainville and the first group relocated from Tuvalu to New Zealand have been dubbed the world’s first environmental refugees. New Zealand has undertaken in principle to resettle the entire population. Australia, which has not ratified the Kyoto Protocol, has refused to receive migrants from Tuvalu, and has been accused of ‘eco-terrorism’ by the authorities of the sinking atoll (Boano et al, 2008).

Drought is one of the effects of climate change. IPCC (2007) reported a global temperature rise of 2 to 3 degrees Celsius by 2100 could contribute to lower crop yields in Africa, the Middle East, and Southern Asia by 30 to 40 percent. The same report also revealed that yields from rain-fed agriculture could fall by up to 50 percent by 2020. Already, worst droughts have been experienced in Africa in the last three decades, particularly, the Sahel belt in sub-Saharan Africa, which stretches across the northern part of Africa from Senegal and Mauritania in the west to Sudan and Eritrea in the east (Fritz, 2010). As a result households have increasingly turned to temporary migration as a way to cope (adaption strategy) with more frequent and prolonged periods of drought and the pressures that a growing population place on the limited availability of agricultural land and other resources. The problem of drought does not affect Africa alone but a significant portion of the world as shown in Figure 2 below.

Figure 2: Drought risk hotspot in the world (Source: Ehrhart et al, 2009)

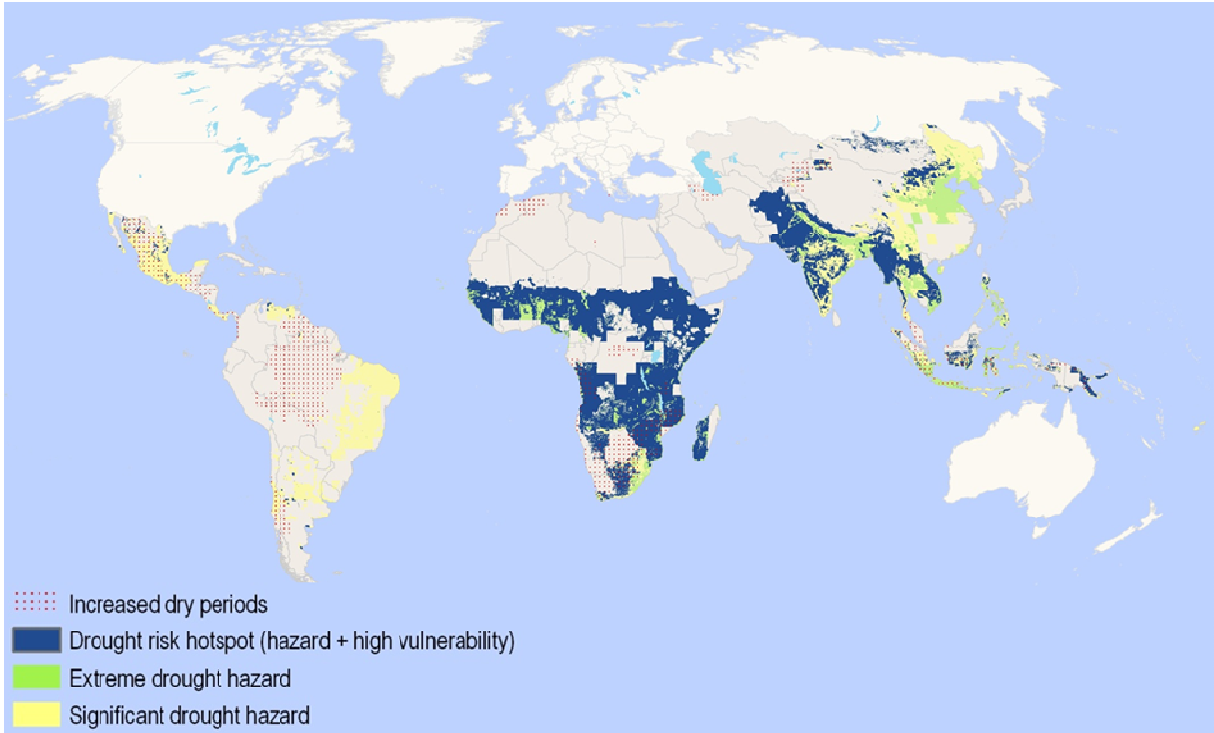


Figure 3: Flood risk hotspot in the world (Source: Ehrhart et al, 2009)

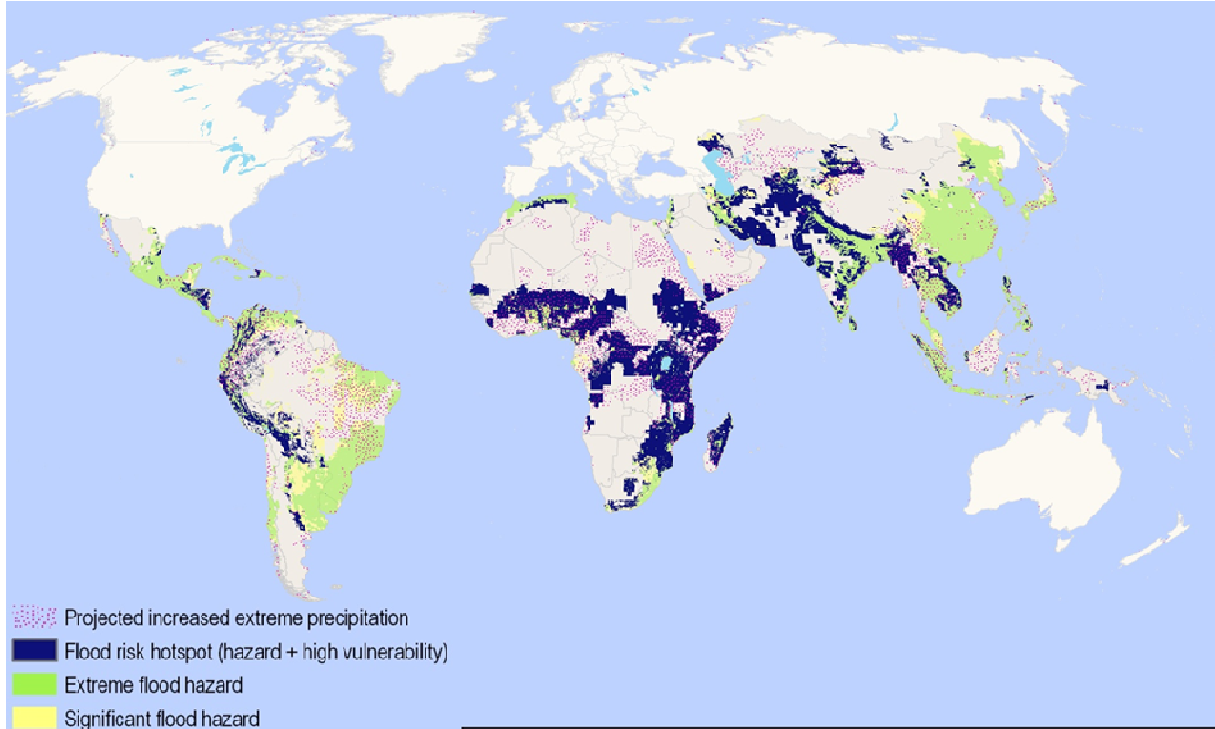
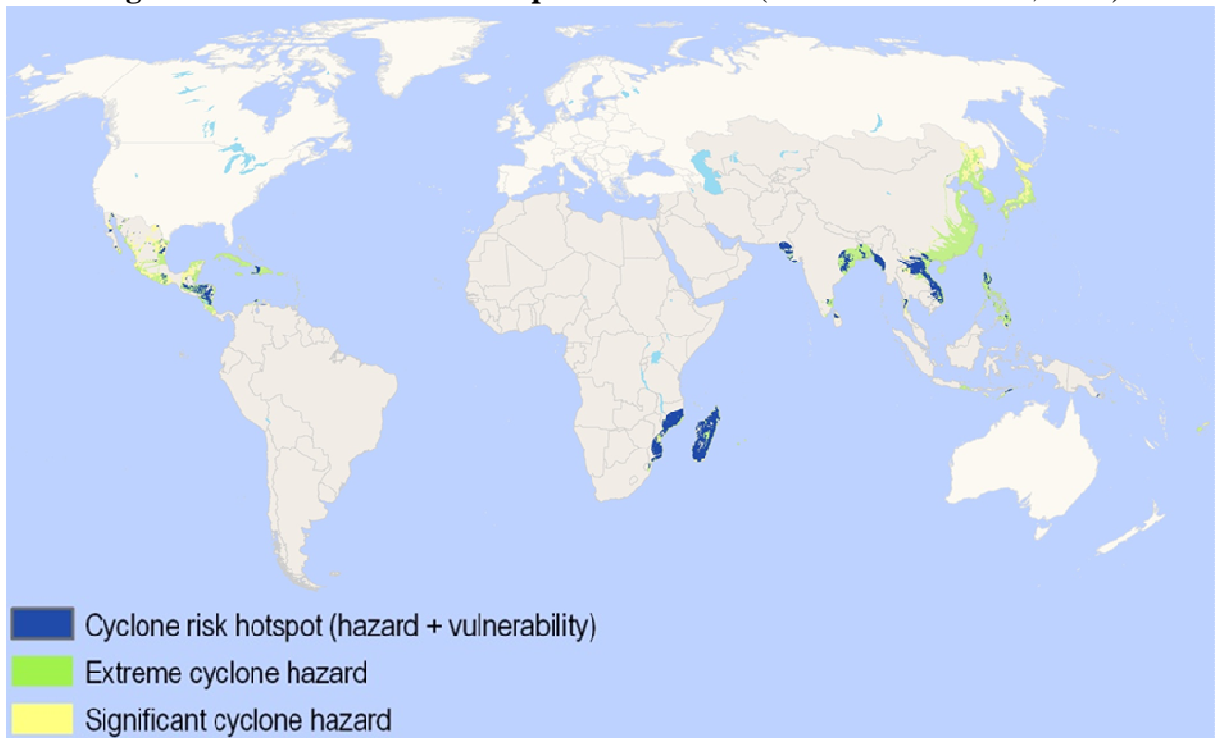


Figure 4: Extreme weather hotspot in the world (Source: Ehrhart et al, 2009)



One of the effects of climate change is flooding. Changes in rainfall patterns can make some areas drier and more prone to drought, while subjecting other areas to increased precipitation and flooding. Both situations can destroy crops and make it even more difficult for people, especially those dependent on rain-fed agriculture, to have food security. IPCC (2007) has predicted that South Asia is likely to experience higher-intensity precipitation within an even stronger monsoon season (Figure 3). While annual flooding is already embedded in the cultural and livelihood traditions of many South Asians, climate change is expected to worsen these conditions. Houghton (2005) estimated that India and Bangladesh will experience up to 20 percent more rainfall by 2050. Already, over 500,000 Bangladeshis are displaced by floods every year, and more are likely to face the devastating loss of home, incomes and life from cyclones and floods (Fritz, 2010).

Glaciers serve an important ecological function in regulating the flow of rivers and the agricultural cycle by storing water during winter months, which feeds rivers in the summer months (Fritz, 2010). However, over the last century, glaciers have been melting at a fast rate; winter snow packs are no longer sufficient to replace the summer melt. The problem of melting glacier contributes to the risk of flooding, mudslides, and avalanches in the short-term, but may also reduce the sustainability of water supply to support the growing populations of the regions that depend on this runoff.

In the next 20-30 year period, the intensity, frequency, duration and extent of weather-related hazards will increase in many parts of the world. However, we are unlikely to see significant changes in the location of these hazards (Ehrhart et al, 2009). While extreme weather events can hit any part of the world, their impact is most acute in least developed countries, where the poor often live in marginal lands subject to flooding or mudslides, and therefore, are more prone to being displaced (Fritz, 2010). Here are a few recent examples of extreme weather conditions. Hurricane Katrina in the southern USA in 2005, the 2007 floods in Tewkesbury, UK; Burma; Bangladesh; and the multiple hurricanes that nearly destroyed Haiti in 2008, and the numerous typhoons in Asia in 2009 brought huge displacements, catastrophic losses of life and livelihood and made many refugees. Figure 4 above shows areas in the world that are likely to experience extreme weather condition.

The evidence from the review above clearly shows that the impacts of climate change is already causing significant displacements and migrations in the world. It is anticipated that a large number of future displacements and migrations will be induced by the impacts of climate change. As the frequency and intensity of climate related hazards increase, so too will the number of temporarily displaced people and those either seeking new or long-term homes. Displacement will be most pronounced where worsening hazards coincide with high or increasing population density (Ehrhart et al, 2009). This will increase climate induced migration in the world. Though reasons why people migrate are complex, but frequently reflect a combination of environmental, economic, social, and/or political factors (Warner, 2009). The influence of climate change on migration is noticeably growing in the world.

Again, a review of the Figures 2, 3 and 4 above revealed that the following areas are likely to be Humanitarian hotspots for climate related disasters:

- **Flood-risk** hotspots occur in Africa, including the Sahel, the Horn of Africa, Great Lakes region, Central Africa and Southeast Africa; Central, South and Southeast Asia; and Central America and the western part of South America.
- **Drought-risk** hotspots are mainly located in sub-Saharan Africa; South Asia, particularly Afghanistan, Pakistan and parts of India; and South East Asia, particularly Myanmar, Vietnam and Indonesia.
- **Cyclone-risk** hotspots include Mozambique and Madagascar, Central America, Bangladesh, several parts of India, Vietnam and other Southeast Asian countries. As the range and intensity of cyclones increases, so too will the number of communities at high risk. This will include communities' further in-land that are not used to coping with such hazards.

4.1 Estimates and Forecasts of Climate Refugees

Many researchers have agreed that climate induce disasters will exacerbate the problem of climate refugees. However, opinion differs when it come the exact number of people likely to become climate refugees. The International Organisation for Migration (IOM) estimate that about of 200 million people will be climate induced migrants by 2050 (Brown, 2008).

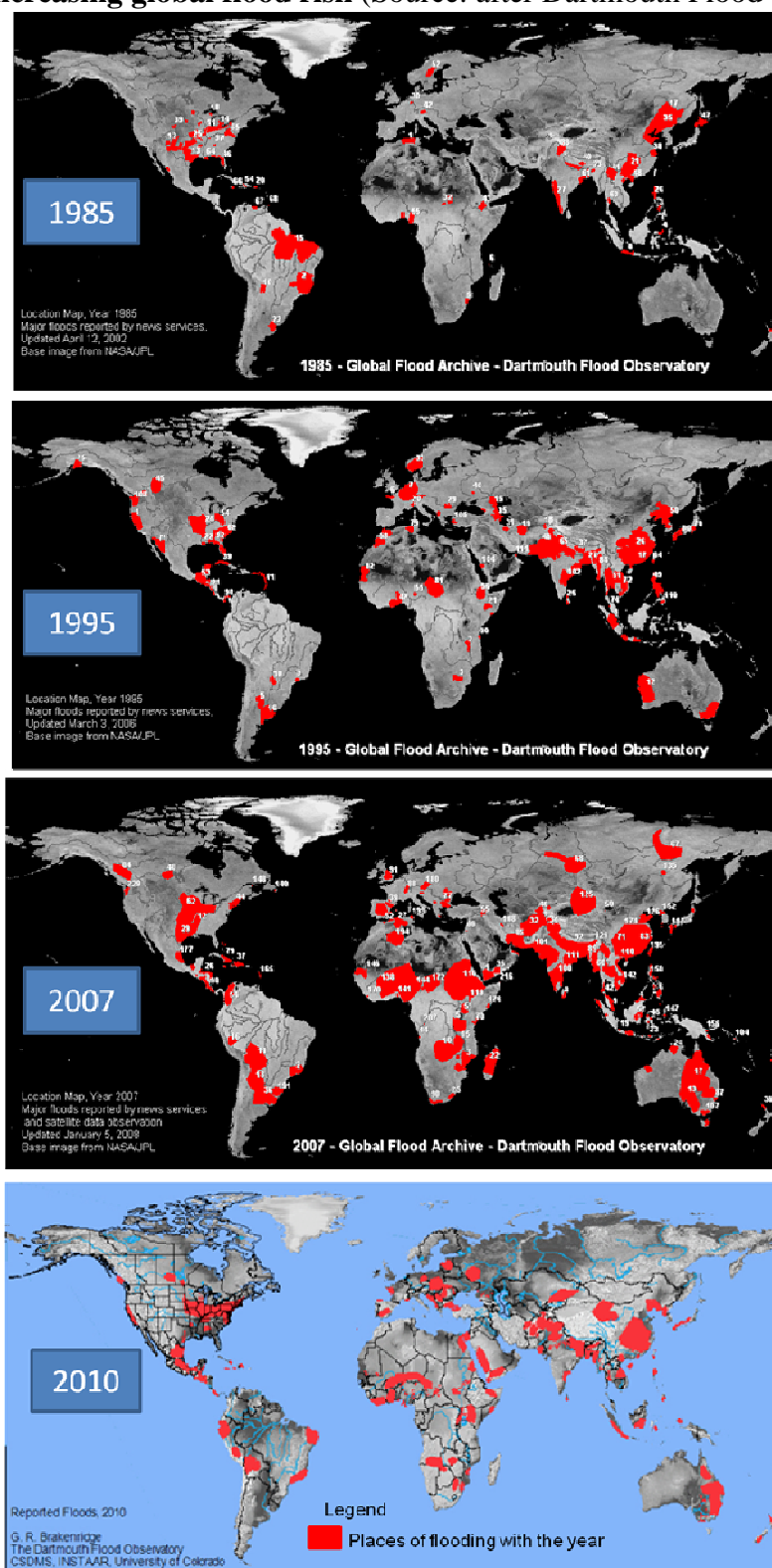
Table 1 below provides summary of estimates and forecasts of peoples displaced by climate change. Some researchers suspect that these figures lack any empirical basis, and are put forward with the sole purpose of raising awareness and gaining media attention around the issue of climate change or climate refugees. However, the figures are important, as they are often requested by policy-makers in order to assess the importance of the phenomenon and develop policy responses (Gemenne, 2011).

Table 1 Estimates and forecasts of the number of people displaced by climate changes

Source	Estimates at the time of publication of the report	Predictions by 2010	Predictions by 2050
UNEP (Tolba, 1989; Milan, 2004)	30 million	50 million	-
Jacobson (1988)	10 million	-	-
Myers (1993, 2002)	25 million	-	150, then 200 million
Myers and Kent (1995)	25 million	50 million	212 million
Red Cross (2001)	More than people displaced by war	-	-
UNU-EHS (Adam 2005; Renaud et al., 2007)	10 million/year	50 million	200 million
Stern (2007)	-	-	150–200 million
Christian Aid (2007)	25 million	-	300 million
Biermann and Boas (2010)	-	-	200 million

(Source: Gemenne, 2011b)

Figure 5: Increasing global flood risk (Source: after Dartmouth Flood Observatory)



5. CASE STUDIES

There are compelling cases worldwide that suggest that wet places are getting wetter while dry places are become drier due to climate change. By 2050, annual average river runoff and water availability are projected to increase by 10-40 percent at high latitudes and in some wet tropical areas. The frequency of heavy precipitation events is also likely to increase over most land areas. Furthermore, there is growing evidence to support the fact that cyclone and hurricane severity is above and beyond any natural decadal cycles (Ehrhart et al, 2009; IPCC, 2007). These changes will result in increased drought and more flash floods. These are likely to cause more climate change induced displacements and climate refugees.

A brief outline of a few cases of flood and drought displacements and fatalities in 2011 at different parts of the world would highlight the enormity of the issue of climate refugees and provide strong support and justification for the need to develop international adaption strategy and charter for climate refugees. First of all, Figure 5 provides an overview of the increasing scale and the rife of global flooding over the last 30 years.

Some of the recorded floods and droughts from news reports in 2011 outlined in the case studies 1 to 7 (Table 2-8) and evidence from Figure 5 confirm the scientists' predictions that climate change will cause an increase in flooding and droughts in the 21st century. Meteorological data are shows a doubling of recorded climate induced disasters over the past two decades. The fact still remains that climate change has increased the frequency and intensity of extreme weather events, glacial melting and sea level rise. These extreme conditions cause severe climatic and environmental induced disasters which do not only affect the basic necessities of life (food, water and shelter) but the foundation of human existence (land) in many parts of the world. Most of life sustenance is connected to land, therefore, continuous attack/destruction of land through the effects of climate change (drought, flood, sea level rise, hurricane or cyclone) in some part of the world (Figures, 2, 3, and 4) is likely to cause migration.

Table 2: Case Study 1, 2011 Flooding in Genoa and Turin, Italy



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: November 2011</p> <p>Headline: Northern Italy inundated many dead</p> <p>Heavy rains with insufficient runoff channels have apparently been the cause of this catastrophe. Damage to property and disrupted business will take months to even calculate. Seven people have been killed in Genoa after flash floods devastated the port city. Thousands of people in low-lying areas near Turin have been told to leave their homes, while the city's schools, as well as those in Milan, were ordered to close.</p> <p>Source: <i>World disaster report, November, 2011</i></p>	 <p>Flooding at Turin, Italy (photo: Fausto Guzzetti)</p>  <p>Flooding at Genoa, Italy (photo: Black Panther)</p>

Table 3: Case Study 2, 2011 Flooding at Hubei and Zhejiang, China



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: June 2011</p> <p>Headline: Torrential rain began to lash Hubei, Hunan, Jiangxi, and Anhui provinces.</p> <p>The rainfall triggered floods and landslides which had forced over 55,000 people to evacuate their homes. Previous heavy rainfall had already caused widespread destruction in Xianning, leaving dozens dead. The Ministry of Civil Affairs says flooding and landslides triggered by an earlier two rounds of rainstorms. The flooding had left 105 people dead, 100 injured and 63 more missing in the south over the past 10 days.</p> <p>Source: Global time.CN, June 2011</p>	 <p>Flooded village at Hubei (Photo: Global time.CN)</p>  <p>Flooded town at Zhejiang (Photo: Global time.CN)</p>

Table 4: Case Study 3, 2011 Flooding at Pennsylvania & Bringhamton, USA



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: September, 2011</p> <p>Headline: Flood Water in New York, Pennsylvania</p> <p>Officials in north-eastern Pennsylvania called for a mandatory evacuation of more than 100,000 residents living along the Susquehanna River on Thursday due to expected flooding. Emergency management officials in Broome County ordered additional evacuations early Thursday for Binghamton neighbourhoods near where the Susquehanna and Chenango rivers converge. Mandatory evacuation orders were also issued for the neighbouring villages.</p> <p>Source: The Blaze (Associated Press, AP), September, 2011</p>	 <p>Flooding at Pennsylvania, USA (photo: AP)</p>  <p>Flooding at Bringhamton, USA (photo: AP)</p>

Table 5: Case Study 4, 2011 Flooding at Sindh Province, Pakistan



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: September, 2011</p> <p>Headline: Severe floods in Sindh:</p> <p>Torrential rains have strucked southern Pakistan in recent days, causing at least 209 dead so far and 5.3 million displaced in the province of Sindh. Rescue operations and emergency efforts are slow due to the difficult weather conditions and flooded lands. In 2010, Pakistan's worst flooding in nearly a century affected more than 14 million people and left at least 1,600 dead in the same area, UN said. The Chinese embassy in Pakistan has promised support for 4.7 million dollars to deal with the emergency and help the victims in Sindh. Prime Minister Yousaf Gilani has confirmed that about 700 thousand houses are damaged; at least 150 thousand people who have sought refuge in emergency centres are in need of immediate assistance.</p> <p>Source: AsiaNews, August, 2010</p>	 <p>Flood Victims at Sindh Province, (photo: Reuters)</p>  <p>Call for rescure at Sindh Province, (photo:Reuters)</p>

Table 6: Case Study 5, 2011 Flooding at Orissa, India



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: September 2011</p> <p>Headline: Orissa has become a victim of climate change</p> <p>Flooding has left at least 26 people dead and about 200,000 others homeless in the eastern Indian state of Orissa. An Indian official announced, "we have evacuated 193,000 people to relative safety." Torrential monsoon rains caused water levels to breach river banks and trigger the floods in the region. Officials warned that the death toll was likely to rise and noted that a total of 2.1 million people in the state of 40 million people had been affected by the flood. Meanwhile, the Indian Navy deployed warship to the area to carry out relief missions and dispensed over 30,000 kilograms of relief supplies to the disaster-stricken public.</p> <p>Source: Press. TV, September 2011</p>	 <p>Flood victims at Orissa (photo: Press.TV)</p>  <p>Flood displacement at Orissa (photo: Press.TV)</p>

Table 7: Case Study 6, 2011 Flooding at Queensland, Australia



Brief News about the Flooding	Evidence of Flood Devastations
<p>Date: January 2011</p> <p>Headline: Australia flooding could continue for weeks.</p> <p>Water up to 16 metres deep has flooded towns and roads. Sydney-based freelance reporter Peter Hadfield said. The rain eased Thursday, but river levels continued to rise in many locations and the Queensland disaster management agency said some areas are still bracing for more flooding. The crisis has been triggered by Australia's wettest spring on record. At least six river systems across Queensland have broken their banks. The floods have killed 35 people and have displaced about 200,000 people, and many homes have been evacuated.</p> <p>Source: CBC news, January 2011</p>	 <p>Aerial view of Queensland flooding, Australia (photo: CBC news)</p>  <p>Displaced neighbourhood by Queensland flooding, Australia (photo: CBC news)</p>

Table 8: Case Study 7, 2011 Drought at Some East African Countries



Brief News about the Flooding	Evidence: Photos of the Flooding Devastations
<p>Date: November 2011</p> <p>Headline: An epic drought has been cast upon countries like Kenya, Ethiopia, Somalia and Uganda.</p> <p>The severe drought, that now occurs year on year, has lead to severe shortages of not only water, but food and livestock. This has displaced over 360,000 people to refugee camp in Dadaab. It is estimated that 23million people are threatened by the crisis. The most severely affected area encompassed the semi-arid regions of eastern and northern Kenya, western Somalia and some southern border areas of Ethiopia. The drought developed in parts of east Africa in late 2010 and continued through most of 2011. Over eastern and northern Kenya; it was the driest 12-month period on record at some locations within the region. This has led to the death hundreds of peoples, thousands of livestock and loss of livelihood and migration.</p> <p>Source: The watchers, November, 2011</p>	 <p>Severe drought killed live stock in Kenya (photo: Global Changes)</p>  <p>Severe drought causes water shortage in Addis Ababa Ethiopia, (photo: Red Cross)</p>

Table 9: Summary of 2011 climate change induced flooding disaster case studies

Case study number	Location	Number of death reported	Number of displaced people
1	2011 flooding in Genoa and Turin, Italy	10	Greater than 1000
2	2011 flooding at Hubei and Zhejiang, China	105	55,000
3	2011 flooding at Pennsylvania & Bringhamton, USA	15	100,000
4	2011 flooding at Sindh Province, Pakistan	1,600	5.300,000
5	2011 flooding at Orissa, India	26	193,000
6	2011 flooding at Queensland, Australia	35	200,000
7	2011 drought at some East African countries	Several 100	360,000
Total		> 1,891	> 6, 209,000

> Greater than

6. RESULTS AND DISCUSSION

Analysis of the seven (7) case studies of climate induced disasters in 2011 (Tables 2 to 9) alone show that climate induced disasters are becoming intense on a global scale. The summary of the case studies (Table 9) revealed that 2011 flood disasters from just seven case study areas, caused over 2000 death and over 6.3 million displacements. Significant number of the displaced people (about a million) from less economically developed countries (Pakistan, India and East Africa: Case studies 5, 6, and 8 respectively) could be climate refugees. Evidence from both the literature and the case studies clearly demonstrate that impacts of climate change have been causing massive displacements, humanitarian emergencies and climate refugees over the past decade. For instance, the resettlement of people displaced on the Carteret Islands of the Pacific Ocean by sea level rise (Boano et al, 2008) and the experience of Hurricane Katrina, clearly showed that people displaced by natural disasters were not always able to go home. A significant proportion of the population of New Orleans has still not returned, and seems unlikely to do so in the future. It is now increasingly acknowledged that disasters result in both temporary and permanent displacement, as well as in both pro-active and re-active displacement (Gemenne, 2011a).

Truly, the rights of these people have been overlooked for far too long and it is time that something is done to correct this international injustice. How long are we going to behave like the proverbial ostrich who buries its head in the sand in the face of a challenging problem?

It is an indisputable fact that the issue of climate refugees is greatly complex, and potentially expensive, with some countries and global organisations already overwhelmed by the demands of the 1951 conventionally-recognised refugees. However, doing nothing about the looming climate refugee problem, which could potentially cause global humanitarian disaster, is not the best option. On many occasions, the action by the global humanitarian community is either too little or too late. This often results in a cycle of poverty and vulnerability to disasters that is difficult to break. There is the need to develop an international convention on climate refugees for rectification by nations and enforced by the UN. The UN and other regional bodies like the EU, AU, ASEAN, ECOWAS and other should pursue vigorous adaptation strategy for climate refugees now, before disaster strike as the current regime is very weak and unsustainable. It is time for the UN agencies to accept the facts on this subject and act on it because the evidence are staggering, though prediction of future numbers (Table 1) have some inconsistencies (El-Hinnawi, 1985; Tolba, 1989; Myers, 2002; IPCC, 2007; Boano et al, 2008; Ehrhart et al, 2009; Warner et al, 2009).

6.1 Adaptation Strategy for the Problem of Climate Refugees

The key issue is the extent to which climate induced displaced people are accorded international recognition or status (Boano et al, 2008). Since the 1951 UN Convention and 1967 Protocol on the Status of Refugees (UNHCR, 2006) does not offer protection for those affected by adverse climatic factors. Many have argued that unless it is assumed that 'nature' or the 'environment' can be the persecutor, the term 'refugee' should not be used to describe those forced to migrate, either in part or entirely, by environmental factors (Renaud et al, 2007; Keane 2004). Some authors suggest that because not all people displaced by climate

change will be migrating within a nation or across national border, it is essential to avoid classification of them as refugees.

Notwithstanding, climate refugees is one of the challenges of climate change which is likely to increase in the years ahead. The issue could have significant adverse impacts on both the origin and the destination, and potentially affect international and human security (Brown et al, 2007) if it is not well managed. It is possible to mitigate climate change impacts through adaptation strategies, and to mitigate climate change itself by reducing greenhouse gas emissions. Thus the future impacts of climate change on societies will greatly depend on future levels of greenhouse gas emissions, as well as on the adaptation strategies that will be developed and implemented in vulnerable regions. Some impacts can be avoided through significant emissions cuts, while adaptation strategies can help populations cope with the impacts that cannot be avoided.

6.2 Climate Refugees' Adaptation Policies

Based on knowledge gained from the literature (IPCC, 2007; Ehrhart et al, 2009; Gemenne, 2011a) and the evaluation of the case studies, the following climate refugee's adaptation policies have been identified and could be pursued by the international community to deal with this ensuing global problem:

- Develop a charter that will offer some international protection or assistance to climate refugees
- Pursue disaster-risk reduction particularly at the vulnerability communities rather than just reacting to emergencies. Set up both national and international funds for climate refugees.
- Promote and encourage migration as one of the adaptation response to some vulnerability. Migration has been prominent historical adaptation strategy to environmental change. The current barriers to migration have to be relaxed for migration to achieve its full potential as an adaptation strategy, particularly, for vulnerable small island states in the Pacific Ocean.
- Develop faster and efficient response strategy towards disaster. Invest in early warning systems, drought and flood resistant crops and build elevated storm shelters with flood and medical storage at vulnerable communities.
- Pursue strategies that do not only prevent displacement at the origin of climate refugees, but also develop policies that build capacity at the destinations to facilitate accommodation and integration of the additional population.
- Support capacity building and climate change adaptation initiatives by the local people

and avoid providing assistance which will potentially destroy the local economy and leaving the people poor and worse off.

- Develop timely and efficient disaster recovery and reconstruction strategies.

6.3 Climate Induced Disaster-Risk Management

The core of adaptation strategy for climate induced displacement should be disaster risk management. The International Federation of Surveyors [FIG], 2006) suggested that Disaster-Risk Management is multi-disciplinary task forces activity. Figure 6 below shows that natural Disaster-Risk Management is cyclical process with seven stages. Each stage should be planned and implemented effective in advance in order to achieve reduction of the impact of nature disaster events. There is the need therefore, for the international community to build global capacity for climate change induced disaster-risk management in advance. The risk management strategy outlined in Figure 6 may require a good spatial data and multidisciplinary taskforce to be effective.

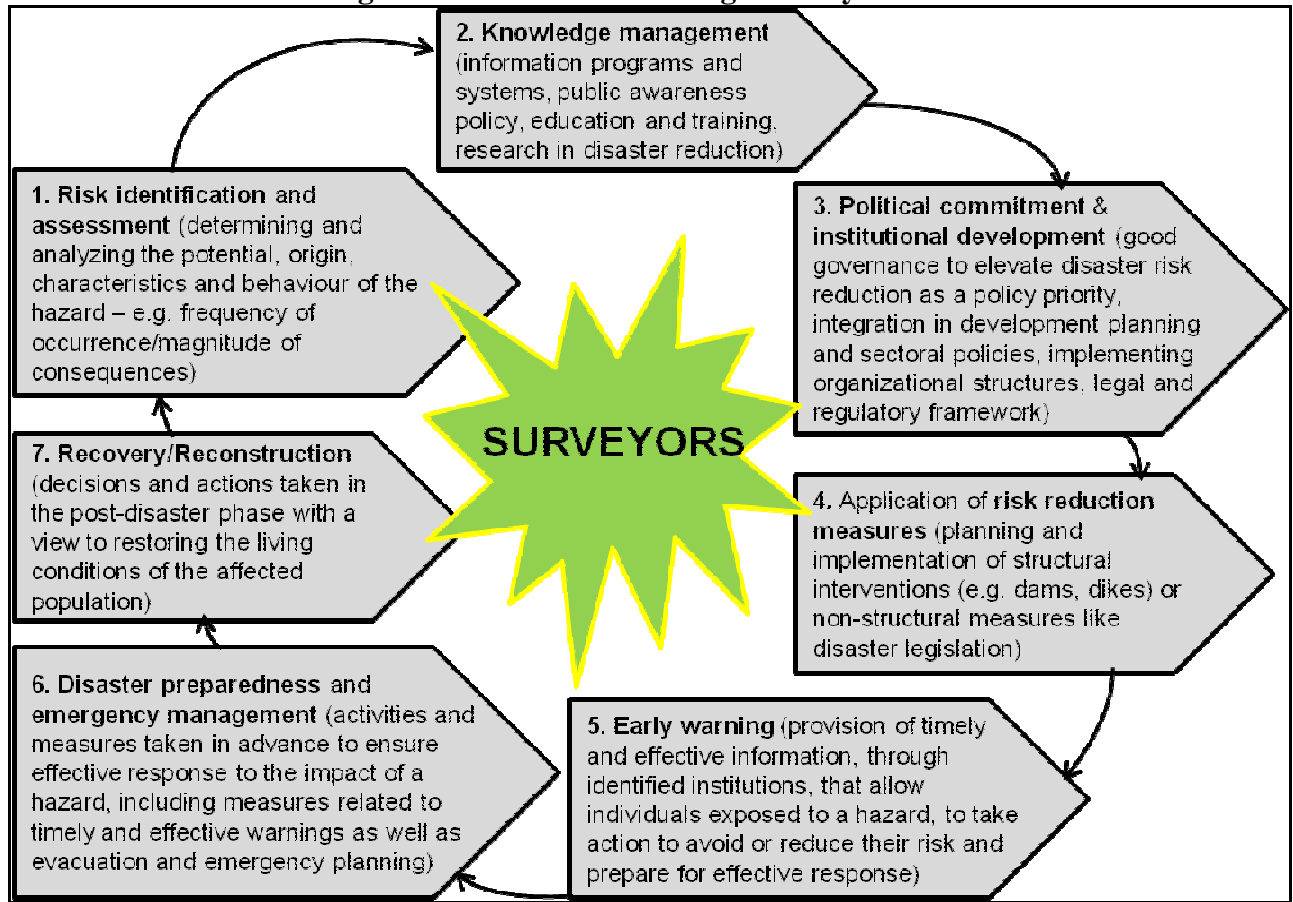
7. HOW CAN SURVEYORS HELP?

a) Disaster risk management: analysis of the seven (7) case studies of climate induced disasters in 2011 and Climate refugees' adaptation policies (section 6.2) show that the core of adaptation strategy for climate refugees is disaster risk management. The FIG publication number 38: The Contribution of the Surveying Profession to Disaster Risk Management (International Federation of Surveyors [FIG], 2006) demonstrate clearly that modern surveyors play an important role in the field of disaster risk management, although in most cases, the activities take place as part of multi-disciplinary task forces. Figure 6 below shows that surveyors are at the centre stage of disaster risk management process.

In fact, surveyors' foot-print are always present when it comes to disaster risk management, though their contribution is neither spectacular nor in the spotlight as it is with rescue teams, policemen, doctors, etc. Nevertheless, the surveyors' role is very substantial, but most often, unknown or misunderstood (Roberge, 2005).

b) Geo-reference spatial data: according to Magel (2005) about 80% of daily decisions on national or local level, either in economy, demography, spatial planning, environment, hazard areas, infrastructure, housing, cultural heritage, etc. are spatially or geo-referenced. In most countries, surveyors do not only collect and process spatial data for development, but also act as custodians of these data. This indicates surveying is a central pillar of each country and its economy. Surveyors, therefore, have first hand information/knowledge of vulnerable territories and environment that are threatened by the impacts of climate change, which require protection, adaptation and management.

Figure 6: Disaster risk management cycle



(After FIG., 2006)

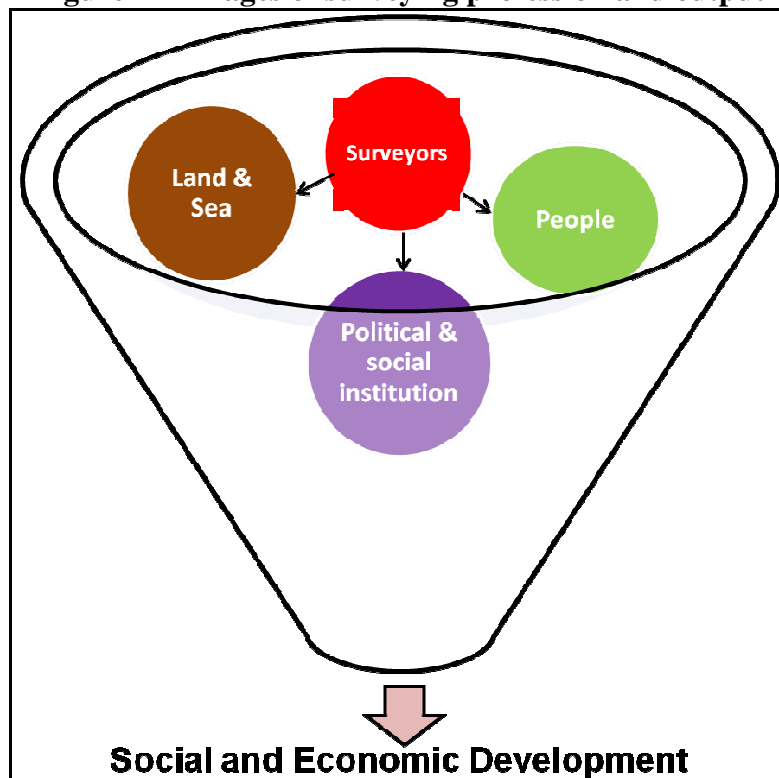
c) Interdisciplinary knowledge and technical skills: surveyors have the knowledge, professionalism and the technical skills needed for disaster risk reduction and strategic planning for sustainable adaptation of climate refugees. Modern surveying is more interdisciplinary. It involves skills and knowledge in urban and rural planning, land management and development, GIS and spatial data management, environmental management, building and land law, real estate and business administration, ecology and hydrography, nature and landscape conservation as well as social network. This broad base subject knowledge and professional experience make surveyors holistic problem solvers and integrated managers, which are among the requirements for planning climate change impact adaptation.

d) Professionally connected with the key areas of the problem: professionally, surveyors work with the land, people, political and social institutions to bring about socio-economic development (Figure 7). These important professional connections occur both at local and international levels. This relationship places surveyors at a very important position to advocate and to pursue the agenda to protect and accommodate present and future victims of climate induced disasters, particularly, those living in vulnerable communities, which we are

already aware are being displaced or losing their livelihood.

Local surveying institutions could pursue this agenda (adaptation and protection for potential climate refugees) nationally and the FIG could also engage its partners like the UN, FAO, UN-habitat and the World Bank on the same agenda internationally. It is important to state that the issue of climate refugees is very complex and may require a huge effort and engagement of the international community. However, surveyors are used to dealing with complex problems and taking a lead role on this issue is not beyond their capacity. Taking such a leading advocacy role based on surveyors' knowledge on vulnerability clearly connects the surveying profession to managing territories, protecting the environment and evaluating the cultural heritage.

Figure 7 Linkages of surveying profession and output



8. CONCLUSION

Many of the impacts of global warming and climate change that scientist have predicted over the past two decades are occurring now. Some of these impacts (flooding, drought, and sea level rise) are not only occurring, but also becoming more intense. These extreme impacts are causing large scale environmental disasters in many nations and territories of the world. The destructions of livelihood, infrastructures and displacements associated with the intense

environmental disasters are making lots and lots of people climate refugees.

Sadly, climate refugees have no accepted protection in international refugee law, because the proponents of the 1951 United Nations convention of refugees thought environmental conditions do not constitute a basis for international protection at that time. In addition, many countries and global organisations are already overwhelmed by the demands of the 1951 conventionally-recognised refugees, hence the international community perceive accepting this new breed of ‘refugees’ within international frameworks as making a bad situation worse. However, doing nothing about the looming climate refugees’ problem, which could potentially cause global humanitarian disaster, is not the best option. The facts and evidence clearly shows that the numbers of climate refugees are growing and experts have predicted that without international protection and implementation of sustainable adaptation policies, climate refugees could cause global humanitarian crisis by 2050. There is the need to develop an international convention and vigorous adaptation strategy for climate refugees now, before disaster strike.

Professionally, surveyors have the knowledge, experience, resources and the technical skills required for adapting to the impacts of climate change. Furthermore, surveyors work with the land, people, political and social institutions to bring about sustainable socio-economic development. These professional connections places surveyors at a very important position to advocate and to lead the agenda to protect and accommodate present and future victims of climate induced disasters, particularly, those living in vulnerable communities, which we are already aware, are being displaced or losing their livelihood and could eventually become climate refugees. This agenda could be pursued by local surveying institutions at the national level and FIG at the international level. This is what could connect the surveying profession to managing territories, protecting the environment and evaluating the cultural heritage.

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BIOGRAPHICAL NOTES

Dr. Isaac Boateng is a keen individual with interdisciplinary knowledge. He has both academic and professional experience in environmental management, climate change vulnerability assessment and adaptation, applied coastal geomorphology, and coastal and marine resource management. Currently, he is a senior lecturer at the School of Civil Engineering and Surveying, University of Portsmouth and a member of the FIG Task Force on Surveyors and Climate Change. Isaac chaired the FIG Commission 8 working group 8.4 that produced the FIG publication NO. 55: Spatial Planning in Coastal Regions: facing the impact of climate change. Isaac would be interested in consultancy, research collaboration and supervision of PhD research in any of the subject areas mentioned above.

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