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Climate Change, Environmental Degradation, and Migration: A Complex Nexus

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CLIMATE CHANGE, ENVIRONMENTAL DEGRADATION, AND MIGRATION: A COMPLEX NEXUS

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ABSTRACT

The individual or combined effects of climate change are likely to trigger mass human movement both within and across international borders. The United Nations High Commissioner for Refugees ("UNHCR") predicts that between 50 and 200 million people may be displaced by 2050. Thus, the human impact on the environment is creating a new kind of global casualty for the twenty-first century—an emergent class of environmental migrants. The exact number of individuals cannot be predicted as scholars and international agencies provide varying statistics depending on underlying methods, scenarios, time frames, and assumptions. Many authors challenge the concept of climate change as a primary cause of forced displacement. Some authors even refute the existence of "environmental migration" because of the problem of multi-causality associated with the issue. They claim that the decision to move in most cases depends on a combination of other complex socioeconomic factors. In this context, this Article first examines the possible link between environmental change and consequent human migration. It shows how the major impacts of climate change play a substantial role in triggering human migration. Then it analyzes the types of environmental migration found in the literature on causes and extent of movement. Providing an overview of predicted numbers and figures of environmental migration, this Article also analyzes debates associated with environmental migration mainly based on the problem of multi-causality to show the diversity and complexity of issues related to environmental migration. Finally, this Article argues for recognition of and protection for migrants forced to move to safer places due to certain direct impacts of climate change, notwithstanding the existence of multi-causality.

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INTRODUCTION

The link between climate change caused by human interferences with the world and environmental vulnerability has now been well-established.[1] The causes of climate change and its potential impact on many different natural and social systems have been documented in recent scientific reports and studies.[2] The individual or combined effects of climate change are likely to trigger mass human movement both within and across international borders.[3] Thus the human impact on the environment is creating a new kind of global casualty for the twenty-first century[4]—an emergent class of environmental migrants.[5] The Intergovernmental Panel on Climate Change ("IPCC")[6] has already indicated that one of the greatest

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[1] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, SUMMARY FOR POLICYMAKERS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 2–16 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf. [hereinafter IPCC: SUMMARY FOR POLICYMAKERS] (discussing generally the current state of trends related to human-induced climate change).

[2] *See id.*; CAMILLO BOANO, FORCED MIGRATION ONLINE, FMO RESEARCH GUIDE ON CLIMATE CHANGE AND DISPLACEMENT 3 (2008), *available at* http://www.forcedmigration.org/research-resources/expert-guides/climate-change-and-displacement/fmo046.pdf.

[3] FRANK LACZKO & CHRISTINE AGHAZARM, MIGRATION, ENVIRONMENT AND CLIMATE CHANGE: ASSESSING THE EVIDENCE 1 (2010), *available at* http://publications.iom.int/bookstore/free/migration_and_environment.pdf.

[4] Norman Myers, *Environmental Refugees*, 19 POPULATION & ENV'T 167, 175 (1997) ("The issue of environmental refugees . . . promises to rank as one of the foremost human crises of our times.").

[5] MOLLY CONISBEE & ANDREW SIMMS, ENVIRONMENTAL REFUGEES: THE CASE FOR RECOGNITION 17–18 (2003), *available at* http://files.uniteddiversity.com/More_Books_and_Reports/Environmental_Refugees-The_Case_for_Recognition.pdf. A note on terminology: throughout this Article, the terms "environmental migrants," "environmental displacement," "climate change migrants," and "climate change displacements" are used interchangeably to refer to all movements away from the usual place of residence, whether these are internal or international, permanent or temporary, forced or voluntary.

[6] The IPCC was set up jointly by the World Meteorological Organization ("WMO") and the United Nations Environment Programme ("UNEP") in 1988 to "assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation." INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC ANNIVERSARY BROCHURE: 16 YEARS OF SCIENTIFIC ASSESSMENT IN SUPPORT OF THE CLIMATE CONVENTION (2004), *available at* http://www.ipcc.ch/pdf/10th-anniversary/anniversary-brochure.pdf. The IPCC is open to all members of the WMO and UNEP and meets annually at the plenary level of government representatives in sessions attended by officials and experts from relevant ministries, agencies, and research institutions from member countries and from participating organizations. *Id.* at 2. Its first assessment, released in 1990, was the impetus for the creation of the

effects of climate change may be on human migration.[7] The United Nations High Commissioner for Refugees ("UNHCR") predicts that between 50 and 200 million people may be displaced by 2050 "either within their countries or across borders."[8] The exact numbers of these migrants cannot be predicted as scholars and international agencies provide varying statistics "depending on underlying methods, scenarios, timeframes, and assumptions."[9] Although all the current predictions are challenged by authors as having "methodological problems and caveats," the available literature confirms that this potential catastrophe will exceed all instances of "refugee crises in terms of the number of people affected."[10] Various intergovernmental agencies such as IPCC, UNHCR,[11] International Organization for Migration ("IOM"),[12] and many scholarly articles warn

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United Nations Framework Convention on Climate Change ("UNFCCC") in 1994, whose purpose is to serve as an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. *Background on the UNFCCC: The International Response to Climate Change*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/essential_background/items/6031.php (last visited Mar. 16, 2012); *see also* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, FIRST ASSESSMENT REPORT: IPCC OVERVIEW (1990), *available at* http://www.ipcc.ch/ipccreports/1992%20IPCC%20Supplement/IPCC_1990_and_1992 _Assessments/English/ipcc_90_92_assessments_far_overview.pdf.

[7] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE: THE IPCC IMPACTS ASSESSMENT 3, 2–22, 5-6 to 5-8 (WJ. McG. Tegart et al. eds., 1990), *available at* http://www.ipcc.ch/ipccreports/far/wg_II/ipcc_far_wg_II_full_report.pdf [hereinafter IPCC 1990 IMPACTS ASSESSMENT]; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 488 (2007), *available at* http://www.ipcc.ch/ipccreports/ar4-wg2.htm [hereinafter IPCC, IMPACTS, ADAPTATION AND VULNERABILITY] (describing sea level increases); HER MAJESTY'S TREASURY, STERN REVIEW REPORT ON THE ECONOMICS OF CLIMATE CHANGE 111 (2006), *available at* http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/d/Part_II_Introduction_group.pdf [hereinafter STERN REVIEW REPORT].

[8] UNITED NATIONS HIGH COMMISSIONER FOR REFUGEES, FORCED MIGRATION IN THE CONTEXT OF CLIMATE CHANGE: CHALLENGES FOR STATES UNDER INTERNATIONAL LAW 3 (2009).

[9] Frank Biermann & Ingrid Boas, *Preparing for a Warmer World: Towards a Global Governance System to Protect Climate Refugees* 10 GLOBAL ENVTL. POL. 60, 61 (2010).

[10] *Id.* at 61, 67.

[11] The Office of the United Nations High Commissioner for Refugees was established on December 14, 1950 by the United Nations General Assembly. *About Us*, UNHCR, http://www.unhcr.org/pages/49c3646c2.html (last visited Mar. 16, 2012) ("The agency is mandated to lead and co-ordinate international action to protect refugees and resolve refugee problems worldwide.").

[12] *See About IOM*, INT'L ORG. FOR MIGRATION, http://www.iom.int/jahia/Jahia/about-iom/lang/en (last visited Mar. 16, 2012) ("Established in 1951, IOM is the leading Intergovernmental organization in the field of migration and works closely with governmental, Intergovernmental and non-governmental partners.").

about future waves of climate change-induced forced migrants.[13] With all the dangers predicted by scientists, the issue of environment-related migration has rarely received attention from policy makers.[14] The indifference arises, according to Frank Laczko and Christine Aghazarm, partly due to lack of consensus among migration researchers and experts on issues related to the nexus between environment, migration, and the concept of environmental displacement.[15] Many authors challenge the conceptualization of climate change as a primary cause of forced displacement.[16] Some authors even refute the existence of "environmental migration" because of the potential of multi-causality associated with the issue.[17] They claim that the decision to move in most cases depends on a combination of other complex socioeconomic factors.[18] Moreover, there is a serious dearth of empirical research on the nexus between migration and climate change.[19]

As a consequence, the available predicted figures and numbers of "environmental migration" or "climate migration" are diverse and debatable. There is no universal definition to identify this category of human displacement and so it remains difficult to estimate future trends.[20] Therefore, this category of people is still in search of recognition in international law.

Part I of this Article examines the possible link between environmental change and consequent human migration. It shows how the major impacts of climate change play a substantial role in triggering human migration. Part II analyzes the typologies of environmental migration found in the literature on causes and extent of movement. Part III provides an overview of predicted numbers and figures of environmental migration. Part IV analyzes the debates associated with environmental migration surrounding the problem of multi-causality to show the diversity and complex

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[13] In 1992 the IOM published a report on migration and the environment in which it stated "[l]arge numbers of people are moving as a result of environmental degradation that has increased dramatically in recent years. The number of such migrants could rise substantially as larger areas [of] the earth become uninhabitable as a result of climate change." INT'L ORG. FOR MIGRATION, MIGRATION AND THE ENVIRONMENT (1992), *available at* http://wp.socialwatch.org/?p=130.

[14] LACZKO & AGHAZARM, *supra* note 3, at 1.

[15] *Id.*

[16] *Id.* at 17.

[17] *Id.*

[18] *Id.*

[19] REFUGEE STUDIES CENTRE, FORCED MIGRATION RESEARCH AND POLICY: OVERVIEW OF CURRENT TRENDS AND FUTURE DIRECTIONS 12 (2010), *available at* http://www.rsc.ox.ac.uk/pdfs/RSC-FM-policy-and-research-overview.pdf.

[20] Biermann & Boas, *supra* note 9, at 67; SUSANA B. ADAMO, ENVIRONMENTALLY INDUCED POPULATION DISPLACEMENTS 15 (2009), *available at* http://petdb.ldeo.columbia.edu/documents/environinduced-s.adamo-IHDPupdate-2009.pdf.

issues related with environmental migration. Finally, the conclusion argues for the recognition of and protection for migrants forced to move to safer places due to certain direct impacts of climate change, notwithstanding the existence of multi-causality.

I. ENVIRONMENTAL CHANGE, CLIMATE CHANGE, AND MIGRATION NEXUS

Human migration as a result of environmental change is not a new phenomenon.[21] People move from one place to another for many reasons.[22] A range of factors motivate the migration decision, including "[e]conomics, nationality, religion, war, ethnic hatred, and political turmoil."[23] Thus many and varied factors trigger millions of people to leave their home for a better lifestyle, social security, or religious tolerance.[24] After the Second World War, thousands of people migrated from one region to another in search of food, shelter, and safety.[25] However, the environment has always been a unique triggering factor for forced displacement throughout human history.[26] Migration is considered "one of the oldest coping strategies" in the face of life-threatening environmental crises.[27] Before the Industrial Revolution, these mass movements mainly took place due to natural environmental degradation or catastrophe, including hurricanes or storms that caused major flooding or owing to scarcity of land resources.[28] In the twentieth century, the nature and extent of environmental migration have substantially been changed due to environmental degradation as a result of global climate change. Since the start of the Industrial Revolution

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[21] Arthur H. Westing, *Environmental Refugees: A Growing Category of Displaced Persons*, 19 ENVTL. CONSERVATION 201, 201 (1992); Dana Zartner Falstrom, *Stemming the Flow of Environmental Displacement: Creating a Convention to Protect Persons and Preserve the Environment*, 1 COLO. J. INT'L ENVTL. L. & POL'Y 1, 3 (2001); LACZKO & AGHAZARM, *supra* note 3, at 13.

[22] *See* Falstrom, *supra* note 21, at 3.

[23] *Id.*

[24] *See, e.g.*, *id.*

[25] *See, e.g.*, Jeffrey G. Williamson, *Global Migration*, INT'L MONETARY FUND FIN. & DEV. (2006), http://www.imf.org/external/pubs/ft/fandd/2006/09/williams.htm.

[26] *See* LACZKO & AGHAZARM, *supra* note 3, at 13.

[27] TINA ACKETOFT, COMM. ON MIGRATION, REFUGEES, & POPULATION, COUNCIL OF EUR. PARLIAMENTARY ASSEMBLY, ENVIRONMENTALLY INDUCED MIGRATION AND DISPLACEMENT: A 21ST CENTURY CHALLENGE 2 (2008), *available at* http://assembly.coe.int/Documents/WorkingDocs/Doc08/EDOC11785.pdf; Hermen J. Ketel, *Global Warming and Human Migration*, *in* CLIMATE CHANGE, HUMAN SYSTEMS AND POLICY 1 (Antoaneta Yotova ed., 2004); *see also* Falstrom, *supra* note 21, at 3.

[28] Falstrom, *supra* note 21, at 3.

"[e]missions of [carbon dioxide ("CO_2")], the principal greenhouse gas, have risen more than ten-fold" and are now at a higher concentration in the atmosphere than they have been for many thousands of years.[29] Chemical analysis of the carbon particulates demonstrates that this increase is due largely to the burning of fossil fuels—coal, oil and gas.[30] This burning of fossil fuels consequently damages the ecological balance of the earth, thickening the natural greenhouse layer, which causes the warming of the earth: a process popularly known as "global warming."[31] Due to global warming, the physical environment is now changing in ways that make human populations more vulnerable to environmental stress.[32]

Since mid-1990, after publication of the First Assessment Report of IPCC, apart from the "tentative and theoretical" scientific reports on the cause and effects of climate change, a growing international consensus has developed on this issue.[33] The IPCC, since its very inception, has continuously warned the international community about the potential impacts of climate change on many different natural and social systems.[34] According

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[29] SUDHIR CHELLA RAJAN, CLIMATE MIGRANTS IN SOUTH ASIA: ESTIMATES AND SOLUTIONS—A REPORT BY GREENPEACE 2 (2008).

[30] *See id.*; IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 2.

[31] *See, e.g.*, Nat'l Aeronautical & Space Admin., *Global Warming*, EARTH OBSERVATORY, http://earthobservatory.nasa.gov/Features/GlobalWarming/page2.php (last visited Mar. 16, 2012).

[32] *See* BOANO, *supra* note 2, at 3.

[33] Sara C. Aminzadeh, *A Moral Imperative: The Human Rights Implications of Climate Change*, 30 HASTINGS INT'L & COMP. L. REV. 231, 233 (2007). This issue has become the most popular, and perhaps most discussed, international agenda as a result of the growing awareness of the reality of climate change and its possible implications. United Nations Secretary General Ban Ki-Moon singled out climate change as the greatest challenge facing the world during his keynote speech to the World Federation of United Nations Associations. Jeremy Hance, *Ban Ki-Moon: Climate Change 'Greatest Collective Challenge We Face,'* MONGABAY (Aug. 10, 2009), http://news.mongabay.com/2009/0810-hance_un_climate.html ("We have less than 10 years to halt the global rise in greenhouse gas emissions if we are to avoid catastrophic consequences for people and the planet. It is, simply, the greatest collective challenge we face as a human family."). President Barack Obama also addressed the seriousness of the climate change dilemma in a speech at a United Nations Climate Change Summit. President Barack Obama, Remarks at the United Nations Secretary General Ban Ki-Moon's Climate Change Summit (Sept. 22, 2009), *available at* http://www.whitehouse.gov/the_press_office/Remarks-by-the-President-at-UN-Secretary-General-Ban-Ki-moons-Climate-Change-Summit ("That so many of us are here today is a recognition that the threat from climate change is serious, it is urgent, and it is growing. Our generation's response to this challenge will be judged by history, for if we fail to meet it—boldly, swiftly, and together—we risk consigning future generations to an irreversible catastrophe.").

[34] The IPCC has already published four assessment reports to date. The fifth assessment report committee has recently started its work. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, http://www.ipcc.ch (last visited Mar. 16, 2012).

to the IPCC, climate change, altering the atmosphere and the global environment through anthropogenic greenhouse gas emissions, is changing the physical environment in ways that make human populations more vulnerable to environmental stress.[35] In the latest Fourth Assessment Report in 2007, the IPCC calls human-induced climate change "unequivocal" and authoritatively establishes that it is accelerating and already has had severe impacts on the environment and the deterioration of living conditions of human beings in many parts of the world, bearing great stress on ecosystems, socioeconomic systems, and human welfare.[36] "There is a growing consensus between researchers and politicians that the negative impacts of climate change" will increase the risk of environmental vulnerability.[37] Manifestations of climate change are numerous and include rising sea levels, increasing global warming, glacier melting, multiplication of extreme weather events such as storms, cyclones, and droughts, desertification, scarcity of water resources, and depletion of natural resources due to more frequent and severe climatic disasters.[38] Natural disasters[39] and calamities have already increased in many parts of the world in terms of frequency, intensity, and severity, which have no precedent in human

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[35] *See generally* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 2–16; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERNATIONAL PANEL ON CLIMATE CHANGE 9, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf [hereinafter IPCC: SUMMARY FOR POLICYMAKERS (WG-II)].

[36] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 5, 9; *see also* BOANO, *supra* note 2, at 3; MARCOS A. ORELLANA, PRACTICAL APPROACHES TO INTEGRATING HUMAN RIGHTS AND CLIMATE CHANGE LAW AND POLICY 8 (2009).

[37] Walter Kälin, Representative of the Secretary-General on the Human Rights of Internally Displaced Persons and Co-Director, Brookings-LSE Project on Internal Displacement, The Climate Change—Displacement Nexus (July 16, 2008) (speech delivered at the ECOSOC Panel on Disaster Risk Reduction and Preparedness: Addressing the Humanitarian Consequences of Natural Disasters).

[38] *See* IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 9, 14; JAMES MORRISSEY, REFUGEE STUDIES CTR., ENVIRONMENTAL CHANGE AND FORCED MIGRATION: A STATE OF THE ART REVIEW 28 (2009); Robert Stojanov, *Environmental Refugees—Introduction*, 38 GEOGRAPHICA 77, 78–80 (2004); Orellana, *supra* note 36, at 8.

[39] The International Disaster Response Law Guidelines put forward by the International Federation of Red Cross and Red Crescent Societies ("IFRC") defines a disaster as "a serious disruption of the functioning of society, which poses a significant, widespread threat to human life, health, property or the environment, whether arising from accident, nature or human activity, whether developing suddenly or as the result of long-term processes, but excluding armed conflict." INT'L FED'N OF RED CROSS & RED CRESCENT SOC'YS, INTERNATIONAL DISASTER RESPONSE LAW GUIDELINES 14 (2011), *available at* http://www.ifrc.org//PageFiles/41203/1205600-IDRL%20Guidelines-EN-LR%20(2).pdf.

history.[40] According to an IOM report on migration, environment, and climate change, the number of recorded natural disasters including storms, floods, and drought have increased more than threefold over the past thirty years.[41] For example, "there has been an increase in the reporting of natural disasters, from 100 in 1974 to 400 in 2003."[42] Along with the higher frequency, the intensity and severity of climate related disasters have also increased.[43]

Apart from the ecological effects, the human dimensions of climate change are huge and multifarious.[44] One of the most important implications is potential mass human displacement—either within states or across international borders due to increased vulnerability arising from the impacts of climate change.[45] These direct effects of climate change undermine the viability of ecosystem-dependent livelihoods (such as rained agriculture, herding, and fishing) and impact people's ability to subsist in certain parts of the world.[46] Moreover, the loss of livelihoods and living spaces as a result of environmental stress exacerbate the vulnerability of people already on the brink of disaster.[47]

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[40] *See, e.g.*, Falstrom, *supra* note 21, at 3; VIKRAM KOLMANNSKOG, NORWEGIAN REFUGEE COUNCIL, CLIMATE CHANGE, DISASTER, DISPLACEMENT AND MIGRATION: INITIAL EVIDENCE FROM AFRICA 2 (2009), *available at* http://www.unhcr.org/4b18e3599.html. Now natural disasters are "more intense and frequent and the human impacts are more devastating." *Climate Change Could Become the Biggest Driver of Displacement: UNHCR Chief*, UNHCR (Dec. 16, 2009), http://www.unhcr.org/4b2910239.html [hereinafter *Climate Change Could Become the Biggest Driver of Displacement*] (quoting United Nations High Commissioner for Refugees António Guterres's remarks at a press conference at the United Nations Climate Change Conference in Copenhagen, Denmark).

[41] LACZKO & AGHAZARM, *supra* note 3, at 259.

[42] *Id.*

[43] KOLMANNSKOG, *supra* note 40, at 2; *see also Climate Change Could Become the Biggest Driver of Displacement*, *supra* note 40.

[44] *See, e.g.*, DAVID CORLETT, STORMY WEATHER: THE CHALLENGE OF CLIMATE CHANGE AND DISPLACEMENT 14 (2008).

[45] *See, e.g.*, BOANO, *supra* note 2, at 3; KOKO WARNER, IN SEARCH OF SHELTER: MAPPING THE EFFECTS OF CLIMATE CHANGE ON HUMAN MIGRATION AND DISPLACEMENT 1 (2009) [hereinafter WARNER, IN SEARCH OF SHELTER]; Rex Victor Cruz et al., *Asia*, *in* IPCC, IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 484, 488; W. Neil Adger et al., *Assessment of Adaptation Practices, Options, Constraints and Capacity*, *in* IPCC, IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 733–34; Robert J. Nicholls & Richard S. J. Tol, *Impacts and Responses to Sea-Level Rise: A Global Analysis of the SRES Scenarios Over the Twenty-First Century*, 364 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y 1073, 1074 (2006); Biermann & Boas, *supra* note 9, at 61; STERN REVIEW REPORT, *supra* note 7, at 111.

[46] *See* Falstrom, *supra* note 21, at 3; WARNER, IN SEARCH OF SHELTER, *supra* note 45, at 3.

[47] *See* WARNER, IN SEARCH OF SHELTER, *supra* note 45, at 3.

Displacement can occur due to various combinations of environmental factors. Specifically, global warming, rising sea level, glacier melting, floods, drought, and desertification are the most important drivers for this movement.[48] Sir Nicholas Stern warned in the review of the economic consequences of global warming delivered to the British Government in November 2006 that "greater resource scarcity, desertification, risks of droughts and floods, and rising sea levels could drive many millions of people to migrate."[49]

> In 1992, at the UN Conference on Environment and Development, the UN High Commissioner for Refugees noted that "more and more people are being forced to flee for a complex combination of reasons, linked as much to population growth, poverty, famine and environmental degradation as to mass violations of human rights, social and ethnic tensions and armed conflict. . . . This relationship between refugees and the environment has long been overlooked."[50]

Recently, in 2008, the UNHCR chief also identified environmental impacts of climate change as the key driver of forced displacement in the near future.[51] Thus, environmental migration appears to be a rapidly growing form of forced displacement that will continue to affect the world in future decades.[52]

Before environment can be considered a major cause of population movements, it is essential to develop an improved understanding of what is meant by "environmental degradation," and more specifically how the impacts of climate change directly cause human displacement. Research on global climate change suggests certain types of environmental change through which people are commonly displaced out of their current habitat.[53]

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[48] Falstrom, *supra* note 21, at 3.
[49] STERN REVIEW REPORT, *supra* note 7, at 111.
[50] *See* Brooke Havard, Comment, *Seeking Protection: Recognition of Environmentally Displaced Persons Under International Human Rights Law*, 18 VILL. ENVTL. L.J. 65, 78 (2007) (quoting United Nations High Commissioner for Refugees Sadako Ogata's statement at the UN Conference on Environment and Development).
[51] Julian Borger, *Conflicts Fueled by Climate Change Causing New Refugee Crisis, Warns UN*, GUARDIAN (June 16, 2008), http://www.guardian.co.uk/environment/2008/jun/17/climate change.food (quoting United Nations High Commissioner for Refugees António Guterres).
[52] *See* Graeme Hugo, *Environmental Concerns and International Migration*, 30 INT'L MIGRATION REV. 105, 117 (1996); Aminzadeh, *supra* note 33, at 256.
[53] Angela Williams, *Promoting Justice Within the International Legal System: Prospects for Climate Refugees*, *in* CLIMATE LAW AND DEVELOPING COUNTRIES: LEGAL AND POLICY CHALLENGES FOR THE WORLD ECONOMY 85 (Benjamin J. Richardson et al. eds., 2009).

The latest report of the IPCC also enumerates most threatening potential causes of migrations in this century.[54] According to IPCC, the drivers of such movement principally include: global warming; the inundation of settled land due to sea level rise; melting glaciers; accelerated drought, desertification and scarcity of water resources; and depletion of natural resources due to more frequent and severe climatic disasters.[55] Thus the impacts of climate change have an effect on human life that has direct influence on displacement of people in many and varied ways.[56]

A. Global Warming

"The foremost evidence for worldwide climate change has been global warming."[57] It is one of the most important factors contributing to environmental degradation and disasters.[58] Evidence indicates that the Earth's climate system is warming in a way that has no precedent in the history of human civilization.[59] The continuing temperature acceleration "might break the balance of a human ecosystem that has been long established at a lower temperature."[60] The latest report of the IPCC estimates a rise in the global average surface temperature from 1990 to 2100 of between 1.8° C and 4° C, although it could possibly be as high as 6.4° C.[61]

The sea level has risen between 1993 and 2003 at a rate of 3.1 millimeters per year due to melting polar ice caps and seawater expansion (due to warmer climate); rainfall patterns have been changing with increased droughts in some areas and heavier rain in others; glaciers and snow melting have been increasing water in rivers at certain times; winds are increasing in power and cyclones are shown to be increasing in frequency; and ocean temperatures have been rising.[62]

Global warming is likely to influence the average weather patterns by gradual changes in average weather patterns and "increased variability

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[54] IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 18.
[55] *Id.*
[56] Williams, *supra* note 53, at 84.
[57] JAMES S. PENDER, WHAT IS CLIMATE CHANGE? AND HOW IT WILL EFFECT BANGLADESH 11 (2008).
[58] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1.
[59] *See id.*; STERN REVIEW REPORT, *supra* note 7, at 11.
[60] David D. Zhang et al., *Global Climate Change, War, and Population Decline in Recent Human History*, 104 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE U.S. 19214, 19219 (2007).
[61] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 13.
[62] *See* Nathaniel L. Bindoff et al., *Observations: Oceanic Climate Change and Sea Level*, *in* IPCC, IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 387.

of extreme weather events associated with changes in surface temperature and precipitation."[63] In the last few decades, ninety percent of natural disasters have been caused by climate-related natural hazards; and there is scientific evidence that most of them have their roots in global warming.[64] The effects of warming and drying in some regions will reduce agriculture potential and undermine "ecosystem services" such as clean water and fertile soil.[65] Thus, the environmental impacts as a result of global warming have a deleterious effect on the living environment of large populations, which ultimately leads to mass migration.[66]

B. Sea Level Rise

Rising sea levels have the potential to cause considerable displacement, as the phenomenon is virtually irreversible and manifests itself over a long period of time.[67] According to the latest information from the IPCC, global sea levels will rise by at least eighteen centimeters, but in the worst case scenario it could be as much as fifty-nine centimeters by the year 2100.[68] Recent scientific analysis indicates that this figure could be closer to 150 centimeters within the same time frame.[69] The Garnaut Review noted that "[s]ome of the recent scientific work suggests that future sea-level rise could be much worse than the sea-level rise outcomes projected in the IPCC's Fourth Assessment Report."[70] An estimated forty-four percent of the world's population lives within 150 kilometers of the sea coast.[71] The rising sea level is likely to have an impact on salt water intrusion, inundation, coastal erosion, more destructive storms, and decreased freshwater ability.[72] Consequently, there is strong evidence that all of these

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[63] BOANO, *supra* note 2, at 16.
[64] *See id.*; Ketel, *supra* note 27, at 1.
[65] *See* BOANO, *supra* note 2, at 16.
[66] *See id.*; Ketel, *supra* note 27, at 1.
[67] *See* ETIENNE PIGUET, CLIMATE CHANGE AND FORCED MIGRATION 7 (2008); Angela Williams, *Turning the Tide: Recognizing Climate Change Refugees in International Law*, 30 L. & POL'Y 502, 504–06 (2008) (calling for regional efforts under the UNFCCC umbrella).
[68] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 13.
[69] Richard Black, *Forecast for Big Sea Level Rise*, BBC NEWS (Apr. 15, 2008), http://news.bbc.co.uk/2/hi/7349236.stm.
[70] ROSS GARNAUT, THE GARNAUT CLIMATE CHANGE REVIEW: FINAL REPORT 94 (2008).
[71] INT'L ORG. FOR MIGRATION, NO. 10, INTERNATIONAL DIALOGUE ON MIGRATION, EXPERT SEMINAR: MIGRATION AND THE ENVIRONMENT 26 (2008).
[72] WARNER, IN SEARCH OF SHELTER, *supra* note 45, at iv; Derek R. Bell, *Environmental Refugees: What Rights? Which Duties?*, 10 RES PUBLICA 135, 135 (2004); Andrew Morton et al., *Human Security Policy Challenges*, 31 FORCED MIGRATION REV. 5, 5–6 (2008).

impacts of sea level rise threaten to undermine crop growth, destroy subsistence food resources and water supplies, vital infrastructure, and inundate low-lying coastal areas that are home to millions of people.[73] Many atolls may even completely disappear or become uninhabitable during this century if rates of sea level rise accelerate.[74] Several small island state nations including the Maldives in the Indian Ocean and the Marshall Islands and Tuvalu in the Pacific are at serious risk of complete destruction by the end of this century.[75] Papua New Guinea's Carteret Islands are among the most affected islands in the Pacific and "may be completely submerged by as early as 2015" by rising seas.[76] In 2005, the government evacuated the 2600 Carteret islanders in response to the ever-rising sea levels and resettled them on the larger Bougainville Island.[77]

However, "the predicted rise in sea level does not only threaten small island states," some developing countries are also especially vulnerable to sea level rise due to their low-lying nature and limited financial resources to respond.[78] "[T]he threat is even more pronounced in regions with high population density" in deltaic coastal regions, such as Bangladesh, Vietnam, China, the Philippines, Indonesia, the Maldives, the Marshall Islands, and Egypt.[79] For example, "[t]he Ganges-Brahmaputra-Meghna

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[73] WARNER, IN SEARCH OF SHELTER, *supra* note 45, at iv; Bell, *supra* note 72, at 135; Morton et al., *supra* note 72, at 5–6.

[74] *See* Bonnie Docherty & Tyler Giannini, *Confronting a Rising Tide: A Proposal for a Convention on Climate Change Refugees*, 33 HARV. ENVTL. L. REV. 349, 355–56 (2009); N.W. Arnell et al., *The Consequences of CO_2 Stabilization for the Impacts of Climate Change*, 53 CLIMATIC CHANGE 430, 431–32 (2002); Bell, *supra* note 72, at 135–36; Robert J. Nicholls et al., *Increasing Flood Risk and Wetland Losses Due to Global Sea-Level Rise: Regional and Global Analyses*, 9 GLOBAL ENVTL. CHANGE 81, 81 (1999); Jane McAdam & Ben Saul, *An Insecure Climate for Human Security? Climate-Induced Displacement and International Law* 3 (Sydney Centre for International Law, Sydney Centre, Working Paper No. 4, 2008), *available at* http://sydney.edu.au/law/scil/documents/2009/SCILWP4_Final.pdf.

[75] *See* Docherty & Giannini, *supra* note 74, at 355–56.

[76] Int'l Org. for Migration, *Migration, Climate Change and the Environment* 4 (IOM Policy Brief, 2009).

[77] *Id.*

[78] Williams, *supra* note 67, at 505.

[79] *Id.* Two populous island nations, the Philippines and Indonesia, have millions who face displacement from their homes as sea levels rise. *Id.*; Svitlana Kravchenko, *Right to Carbon or Right to Life: Human Rights Approaches to Climate Change*, 9 VT. J. ENVTL. L. 513, 527 (2008). Several small island state nations including the Maldives in the Indian Ocean and the Marshall Islands and Tuvalu in the Pacific could face destruction within this century if rates of sea level rise accelerate. Docherty & Gianni, *supra* note 74, at 355–56. GermanWatch, in its recent report, found that Bangladesh is the coastal country most vulnerable to climate change. G. M. Mourtoza, *GermanWatch Finds Bangladesh Most Vulnerable to Climate*, CLIMATE CHANGE MEDIA PARTNERSHIP (Dec. 11, 2009), http://www

river delta, which stretches from India and Bangladesh, to Nepal, China, and Bhutan, is home to approximately 129 million people."[80] Bangladesh, one of the poorest countries in the world, has a large population "near sea level who are vulnerable to rising seas and stronger storms."[81] According to an IOM report, "a rise in sea level of 10 centimetres could result in the flooding of most of Bangladesh."[82] Due to salt contamination as a result of sea level rise, the fertile agricultural land, previously used for producing rice and essential foods, now has been replaced with export-based shrimp farms that affect the supply of nutrition and employment of local people.[83] Two populous island states, the Philippines and Indonesia, also have millions of people who face displacement from their homes from sea level rise.[84]

Thus, sea level rise will possibly motivate resettlement, forced migration, or other forms of human mobility.[85] The IPCC notes that "migration is the only option in response to sea-level rise that inundates islands and coastal settlements."[86] People living in the coastal areas of developing countries are mostly affected by storm surges and flooding because of sea level rise.[87] Flooding "already affects around 46 million people a year . . . [b]ut with a 50 cm sea-level rise, this figure could double to 92 million."[88]

C. Flood

Flood has been a known and common natural hazard throughout human history.[89] The risk, magnitude, and frequency of floods are likely

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.climatemediapartnership.org/reporting/stories/germanwatch-finds-bangladesh-most-vulnerable-to-climate/.

[80] Williams, *supra* note 67, at 505.

[81] Kravchenko, *supra* note 79, at 527.

[82] INT'L ORG. FOR MIGRATION, *supra* note 71, at 26.

[83] Donatien Garnier, *Bangladesh's Climate Refugees*, LE MONDE DIPLOMATIQUE, May 1, 2007; Ann McFerran, *Bangladesh: A Nation in Fear of Drowning*, INDEPENDENT, Apr. 18, 2007.

[84] THE GLOBAL MECHANISM, UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION, CLIMATE CHANGE IMPACTS: SOUTH EAST ASIA 2 (2009).

[85] Gordon McGranahan et al., *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*, 19 ENV'T & URBANIZATION 17, 17–18 (2007).

[86] Rex Victor Cruz et al., *Asia*, *in* IPCC, IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 492. It has been argued that although adaptation to five meters of sea level rise is technically possible, a lack of resources means that realistically this is outside the scope of adaptation for many vulnerable states. Richard S. J. Tol et al., *Adaptation to Five Metres of Sea Level Rise*, 9 J. RISK RES. 467, 467 (2006).

[87] PENDER, *supra* note 57, at 15.

[88] *Id.*

[89] *See* Sabine L. Perch-Nielsen et al., *Exploring the Link Between Climate Change and Migration*, 91 CLIMATIC CHANGE 375, 377 (2008).

to increase due to increased precipitation, melting glaciers, and deforestation as a result of global climate change in many parts of the world.[90] "Up to 20% of the world's population live in river basins that are likely to be affected by increased flood hazard by the 2080s."[91] "Indeed, it is estimated that by 2025 *over half* of all people living in developing countries will be highly vulnerable to floods and storms."[92] The possible result of flooding from sea level rise is global and massive displacement.[93] According to the Fourth Assessment Report of the IPCC, more than 100 million people will be displaced each year by flooding even when the sea level has risen by only forty centimeters.[94] Even a seemingly minimal increase in global temperatures by three to four degrees Celsius could expose an additional 170 million people per year to coastal flooding.[95] "Millions more people risk facing annual floods due to sea-level rise by the 2080s, mostly in the mega-deltas of Asia and Africa."[96] Floods in coastal Bangladesh and India, for example, are expected to affect several million people, leading to mass displacement.[97]

Floods cause displacement "in a simple manner."[98] Floods damage and destroy land, houses, infrastructure, and other tangible goods and assets.[99] The loss of standing crops causes a serious decline in income for a family dependent on agriculture.[100] Moreover, a landowner whose crops are damaged no longer needs labor for agricultural works.[101] Consequently, the inability to work, arising from injury or redundancy, seriously threatens

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[90] CLIONADH RALEIGH ET AL., ASSESSING THE IMPACT OF CLIMATE CHANGE ON MIGRATION AND CONFLICT 6 (2008).
[91] *See* Nigel Arnell et al., *Freshwater Resources and Their Management*, *in* IPCC: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 323, 334.
[92] SARAH LA TROBE, CLIMATE AND POVERTY 12 (2002); *see also* ANDREW SIMMS ET AL., UP IN SMOKE? THREATS FROM, AND RESPONSES TO, THE IMPACT OF GLOBAL WARMING ON HUMAN DEVELOPMENT 18 (2004).
[93] Kravchenko, *supra* note 79, at 527.
[94] *See* Nicholls et al., *Coastal Systems and Low-Lying Areas*, *in* IPCC: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 334.
[95] CAMILLO BOANO ET AL., ENVIRONMENTALLY DISPLACED PEOPLE: UNDERSTANDING THE LINKAGES BETWEEN ENVIRONMENTAL CHANGE, LIVELIHOODS AND FORCED MIGRATION 15 (2008); ROBERT BREARS, ENVIRONMENTAL REFUGEES FROM THE MALDIVES: ARE THEY PROTECTED? 2 (2009), *available at* http://ssrn.com/abstract=1438822.
[96] KATE RAWORTH, OXFAM INT'L, CLIMATE WRONGS AND HUMAN RIGHTS tbl.2 (2008), *available at* http://www.oxfam.org.uk/resources/policy/climate_change/downloads/bp117_climatewrongs.pdf.
[97] *See* Williams, *supra* note 67, at 505.
[98] Perch-Nielsen et al., *supra* note 89, at 377.
[99] *Id.* at 378.
[100] *Id.* at 379.
[101] *Id.*

the livelihood of many families dependent on agriculture.[102] Besides loss of income and direct injury, "flooding can indirectly take a heavy toll on human health by bringing about a sharp increase in diseases. . . . Injuries and diseases can render people unable to work long after the floods have subsided."[103]

D. Glacier Melt

In addition to the previously discussed issues of sea level rise and flooding, climate change will have serious deleterious repercussions for people for whom glacial meltwater is indispensable to maintain supplies during the dry season.[104] Water volumes stored in glaciers and snow cover are very likely to decline, reducing summer and autumn flows.[105] Moreover, "the melting of glaciers in mountain regions results in huge unstable lakes."[106] Consequently, the glacier retreat, decreasing the supply of fresh water, threatens the existence of lower-lying communities dependent on glacial melt for their livelihoods.[107] All told, up to one billion people in Asia alone (more than one sixth of the world's population) could be affected by reduced water flow from mountain glaciers.[108]

Most of the largest rivers in Asia including the Ganges, which provides water to around 500 million people, survive on meltwater from glaciers in the Himalaya–Hindu Kush region.[109] "In China, 23% of the population (250 million people) lives in the western region that depends principally on glacier meltwater."[110] The recent increase in the frequency of glacial lake flooding, particularly in the Himalayan region, has caused extensive fatalities, property damage, and the destruction of forests, farms, and mountain infrastructure in downstream areas.[111] Thus glacier melts have been directly linked to environmental migration in Asia.[112]

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[102] *Id.*
[103] *Id.*
[104] STERN REVIEW REPORT, *supra* note 7, at 63.
[105] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND WATER 127 (Bryson Bates et al., eds., 2008).
[106] Williams, *supra* note 67, at 505–06.
[107] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 5–7.
[108] RAWORTH, *supra* note 96, at 3 tbl.1.
[109] STERN REVIEW REPORT, *supra* note 7, at 63.
[110] *Id.*
[111] *See* Richard Kattelmann, *Glacial Lake Outburst Floods in the Nepal Himalaya: A Manageable Hazard?*, 28 NAT. HAZARDS 145, 146–49 (2003).
[112] *See, e.g.*, Shahid Husain, *Nearly 15 Million Environmental Refugees Likely*, THE NEWS (Pak.), Dec. 30, 2008, *available at* http://climateark.org/shared/reader/welcome.aspx?linkid=114286&keybold=water%20AND%20%20scarcity%20AND%20%20Asia.

Over the past thirty years, nearly twenty-five percent of the area once covered by glaciers has melted in the Andes in South America.[113] "Some small glaciers are likely to disappear completely in the next decade given current trends."[114] Many large cities such as La Paz, Lima, and Quito, and approximately forty percent of the Andean Valley agriculture depend on glacial meltwater supplies.[115] As a result, when the dry season arrives, up to fifty million people in the area surrounding the Andes will be affected by loss of glacial meltwater.[116] The Inuit communities in North America and Greenland also fear displacement as mountain glaciers continue to melt at an unprecedented rate.[117] In such situations the only viable option that remains for them is "forced relocation" to safer areas.[118]

E. Drought, Desertification, and Water Scarcity

Drought and water scarcity is the third main climate change impact that may significantly contribute to climate-related migration. Droughts, desertification, and water scarcity are likely to increase because of global warming.[119] These phenomena are projected to affect about one-third of the world's current population.[120] Droughts are likely to displace millions of people all over the world, affecting food insecurity and human livelihoods.[121] Sea level rise will extend areas of salinization of groundwater and estuaries, resulting in a decrease in freshwater availability for humans and ecosystems in coastal areas.[122] Moreover, changing precipitation patterns create pressures on the availability of clean water supplies.[123]

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[113] STERN REVIEW REPORT, *supra* note 7, at 63.
[114] *Id.*
[115] *Id.* at 64.
[116] *Id.* at 64, 105.
[117] McAdam & Saul, *supra* note 74, at 3.
[118] Williams, *supra* note 67, at 506.
[119] Frank Biermann & Ingrid Boas, *Protecting Climate Refugees: The Case for a Global Protocol*, ENVIRONMENT (Dec. 2008), http://www.environmentmagazine.org/Archives/Back Issues/November-December 2008/Biermann-Boas-full.html.
[120] Janos Bogardi & Koko Warner, *Here Comes the Flood*, NATURE REP. CLIMATE CHANGE (Dec. 11, 2008), http://www.nature.com/climate/2009/0901/full/climate.2008.138.html.
[121] MICHELLE LEIGHTON, CLIMATE CHANGE AND MIGRATION: KEY ISSUES FOR LEGAL PROTECTION OF MIGRANTS AND DISPLACED PERSONS 1 (2010), *available at* http://www.scribd.com/doc/33894001/Climate-Change-and-Migration-Key-Issues-for-Legal-Protection-of-Migrants-and-Displaced-Persons.
[122] *See* Nicholls et al., *Coastal Systems and Low-Lying Areas*, *in* IPCC: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 335.
[123] *See* Williams, *supra* note 53, at 85.

People living in Asia and Africa are most likely to be impacted by drought and water scarcity.[124] "Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption and . . . agriculture."[125] Hundreds of millions of people who depend on glacier melt for their water supply could experience severe water stress as "[w]ater availability will be reduced in certain areas, especially the Mediterranean and Middle East, Southern Africa and Latin America."[126] Assuming even low population growth, some studies predict that a temperature increase of two degrees Celsius could cause water resource-related suffering for between 800 and 1800 million people, mostly in Asia, Africa, Europe, and South America.[127] For instance, growing scarcity of water resources may affect the livelihood of people living downstream of the Himalaya–Hindu Kush mountain ranges—a region that encompasses approximately fifty to sixty percent of the world's population.[128] It is estimated that by the year 2020, between 75 and 250 million people in Africa are likely to face increased drought based on global warming and its effects.[129] The latest report of the IPCC also predicts increased water shortages in Africa for between 74 and 250 million people affected by 2020, and further states that in Asia:

> [f]reshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease due to climate change which, along with population growth and increasing demand arising from higher standards of living, could adversely affect more than a billion people by the 2050s.[130]

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[124] Docherty & Giannini, *supra* note 74, at 355. *See generally* KOLMANNSKOG, *supra* note 40 (discussing several African nations as case studies).
[125] IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 14.
[126] Kälin, *supra* note 37, at 1; *see also* T. P. Barnett et al., *Potential Impacts of a Warming Climate on Water Availability in Snow-Dominated Regions*, 438 NATURE 303 (2005).
[127] Rachel Warren et al., Understanding the Regional Impacts of Climate Change: Research Report Prepared for the Stern Review on the Economics of Climate Change 16 (2006). For more estimates on the number of people at risk of hunger caused by drought in developing countries, see IPCC, IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 299, tbl.5.6.
[128] *See* Barnett et al., *supra* note 126, at 306.
[129] Purple Romero, *Wealthy Nations' Failure to Mitigate Climate Change Violates Rights in Developing Countries*, ABS-CBNNEWS (Sept. 15, 2008), http://www.abs-cbnnews.com/special-report/09/15/08/wealthy-nations%E2%80%99-failure-mitigate-climate-change-violates-rights-developing-.
[130] IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 13.

Desertification has been recognized as one of the major causes of displacement and migration.[131] It gradually diminishes productivity of land, affects livelihood, and thus compels people to move to other areas once their land becomes uninhabitable.[132] Increased desertification threatens to trigger almost 135 million human displacements.[133]

F. Extreme Weather Events: Storms, Hurricanes, and Cyclones

Climate change is likely to "increas[e] the frequency and severity of natural disasters, particularly hydrometeorological events."[134] The increased prevalence of extreme weather patterns will have deleterious effects, potentially displacing millions of people in many areas around the world.[135] The impacts of hurricanes and cyclones manifest in population displacement "in a brutal and direct manner."[136] However, while other effects of climate change may be more predictable, scientists are still unsure of how climate change may affect cyclone activity, but "available estimates point to a 5–10% increase in peak intensities and a 20–30% increase in precipitation rates."[137] The IPCC found observational evidence that intense tropical cyclone activity in the North Atlantic had increased since about 1970 and states that "it is *likely* that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures."[138]

G. Depletion of Natural Resources Due to Frequent and Severe Natural Disasters

The changing climate is likely to decrease the arable land that is able to be utilized for agriculture as well as the length of the growing season.[139]

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[131] *See* Docherty & Giannini, *supra* note 74, at 352.
[132] *See id.*
[133] *See* Myers, *supra* note 4, at 168.
[134] Elizabeth Ferris, Senior Fellow and Co-Director, Brookings-Bern Project on International Displacement, Making Sense of Climate Change, Natural Disasters, and Displacement: A Work in Progress (Dec. 14, 2007).
[135] *See* Williams, *supra* note 53, at 85–86.
[136] PIGUET, *supra* note 67, at 5.
[137] RALEIGH ET AL., *supra* note 90, at 7.
[138] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 15.
[139] BOANO ET AL., *supra* note 95, at 14.

The 2007 IPCC Fourth Assessment Report warns that agricultural production will be severely compromised by climate variability and change.[140] Many plant and animal species are extremely vulnerable and in "immediate danger of extinction" mainly due to the impacts of climate change.[141] "The extinction of plant and animal species is getting faster with 11% of the world's species of birds, 25% of its species of mammal, and around 34% of its fish species" in danger of becoming extinct.[142] If the average global temperature increases more than 1.5 to 2.5 degrees Celsius, there will be an even further increased risk of extinction for approximately twenty to thirty percent of plant and animal species assessed.[143] "Coral bleaching and coastal erosion will affect fish stocks—currently the primary source of animal protein for one billion people."[144] Local extinctions of particular fish species are expected at edges of ranges.[145] The degradation of crop production due to coastal erosion, salt contamination, and destruction of stocks of natural marine resources as a result of coral bleaching, put stress on food security, which ultimately causes displacement.[146]

Thus, the scientific evidence clearly establishes that climate change is real and it can generate considerable migration flows all over the world by increasing the intensity of tropical cyclones and other natural disasters.[147] The international community is coming to recognize the imminent danger of climate change-related displacement of hundreds of millions of people.[148] Human migration, forced or otherwise, will undoubtedly be one of the most significant consequences of environmental degradation and climate change in decades to come.[149] Scientists and experts confirm that large numbers of people have already been displaced due to the impacts of climate change. With the development of climate change, millions

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[140] *See* IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 13–14.
[141] *See* PENDER, *supra* note 57, at 17.
[142] *Id*.
[143] *See* IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 11.
[144] Romero, *supra* note 129. This accounts for approximately one-sixth of the world's population. *See* STERN REVIEW, *supra* note 7, at 72.
[145] *See* IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 12.
[146] Williams, *supra* note 53, at 85.
[147] *See* Meinhard Doelle, *Climate Change and Human Rights: The Role of the International Human Rights in Motivating States to Take Climate Change Seriously*, 1 MACQUARIE J. INT'L COMP. ENVTL. L. 179, 179 (2004); PIGUET, *supra* note 67, at 8.
[148] *See* Morton et al., *supra* note 72, at 5–7 (discussing the international response to climate change). As early as 1990 the IPCC argued that "the greatest single impact of climate change could be on human migration." OLI BROWN, INT'L ORG. FOR MIGRATION, MIGRATION AND CLIMATE CHANGE 11 (2008).
[149] *See, e.g.*, Morton et al., *supra* note 72, at 6.

more people are projected to be displaced in the near future.[150] Summing up just a few of the possible effects of climate change, some twenty-five million people will be threatened by coastal flooding, 180 to 250 million by malaria, and 200 to 300 million by water shortages by middle of the century.[151] The melting or collapse of ice sheets alone threatens the homes of nearly one in every twenty people.[152] Increased desertification and the alteration of ecosystems, by endangering communities' livelihoods, are also likely to trigger large population displacements.[153] While predictions of the potential scale of displacement are fraught with difficulties, current estimates point to between 200 million and one billion people who may face the loss of home, land, and livelihood in the twenty-first century due to rising sea levels, floods, droughts, famine, and hurricanes.[154]

II. TYPOLOGY OF ENVIRONMENTAL/CLIMATE CHANGE MIGRATION

The existing migration literature describes a wide variety of typologies for environmental migration based on "the relative permanency of the move, the distance traversed, the nature of the boundaries crossed, the causes of the move, [and] the characteristics of the movers."[155] For example, IOM draws an overall distinction between "natural" and "man-made" causes of environmental displacement.[156] On the other hand, Refugee Policy Group ("RPG") draws distinctions between "emergency vs. slow-onset movements, temporary, extended and permanent movements, and internal and international movements."[157] The environmental displacement can be categorized based on two interrelated factors: the nature of environmental disasters and the extent of movement.[158] First, the movement may be caused by progressive changes in the environment that take effect slowly

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[150] Achim Steiner, *Foreword*, 31 FORCED MIGRATION REV. 4 (2008).
[151] Martin Parry et al., *Millions at Risk: Defining Critical Climate Change Threats and Targets*, 11 GLOBAL ENVTL. CHANGE 181, 182 (2001).
[152] *See* STERN REVIEW REPORT, *supra* note 7, at 57 tbl.3.1.
[153] *See, e.g.*, BROWN, *supra* note 148, at 33.
[154] *See* STERN REVIEW REPORT, *supra* note 7, at 56, 77; CHRISTIAN AID, HUMAN TIDE: THE REAL MIGRATION CRISIS 5 (2007).
[155] Hugo, *supra* note 52, at 106.
[156] *See* INT'L ORG. FOR MIGRATION, ENVIRONMENTALLY-INDUCED POPULATION DISPLACEMENTS AND ENVIRONMENTAL IMPACTS RESULTING FROM MASS MIGRATION 14 (1996).
[157] Richard Black, *Environmental Refugees: Myth or Reality?* 2 (United Nations High Comm'r for Refugees, Working Paper No. 34, 2001), *available at* http://www.unhcr.org/research/RESEARCH/3ae6a0d00.pdf.
[158] Tracey King, *Environmental Displacement: Coordinating Efforts to Find Solutions*, 18 GEO. INT'L ENVTL. L. REV. 543, 546 (2005).

and gradually for a long time, or movement may result from sudden acute disasters.[159] Second, movement may be temporary, with the possibility of return, or permanent, without possibility of return.[160]

A. Typology of Environmental Migration Based on Cause of Movement

Essam El-Hinnawi of UNEP, the first author to bring attention to the issue of environmental migration, identified three broad categories of environmental displacement, namely (1) people temporarily displaced due to natural hazards, whether natural or anthropogenic, who return to their habitat when the environmental disruption has ended and the area has been rehabilitated (migration primarily caused by natural disasters); (2) people permanently displaced due to drastic and marked environmental disruptions, such as the construction of dams (primarily as a result of development projects); and (3) people displaced, temporarily or permanently, due to progressive or gradual deterioration of environmental conditions, who left their home in search of a better quality of life.[161] As an additional but smaller category, he included those people who were displaced by the destruction of their environment as an act of warfare.[162] Jodi L. Jacobson broadened the definition and typology described by El-Hinnawi to include persons displaced by development projects (such as the Three Gorges Dam) or industrial accidents (such as Bhopal and Chernobyl).[163] She identifies different types of environmental refugees:

- "those displaced temporarily because of a local disruption such as an avalanche or earthquake;"[164]
- "those who migrate because environmental degradation has undermined their livelihood or poses unacceptable risks to health;"[165] and
- "those who resettle because land degradation has resulted in desertification or because of other permanent and untenable changes in their habitat."[166]

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[159] *Id.*
[160] *Id.*
[161] ESSAM EL-HINNAWI, ENVIRONMENTAL REFUGEES 4–5 (1985).
[162] *Id.* at 38.
[163] JODI L. JACOBSON, ENVIRONMENTAL REFUGEES: A YARDSTICK OF HABITABILITY 37 (1988).
[164] *Id.* at 37–38.
[165] *Id.* at 38.
[166] *Id.*

Fabrice Renaud, Janos J. Bogardi, Olivia Dun, and Koko Warner offer the most useful typology, providing three different categories for environmentally related mass movement,[167] namely:

- "[e]nvironmentally motivated migrants" who "may leave a steadily deteriorating environment in order to pre-empt the worse;"[168]
- "[e]nvironmentally forced migrants" who "have to leave in order to avoid the worst;"[169] and
- "[e]nvironmental refugees" who must flee immediately in response to natural disasters such as flood or hurricane.[170]

Steve Lonergan also notes that five groups of factors can be singled out as environmental push elements that might lead to migration, namely: (1) natural disasters; (2) development projects that involve changes to the environment; (3) progressive evolution of the environment; (4) industrial accidents; and (5) environmental consequences due to armed conflicts.[171]

Walter Kälin, Representative of the Secretary-General on the Human Rights of Internally Displaced Persons, urges "a thorough analysis of the different contexts and forms natural disaster-induced displacement can take."[172] To precipitate this, he identifies five displacement-triggering scenarios that are widely used by other scholars.[173] These are (1) "hydro-meteorological disasters (flooding, hurricanes/typhoons/cyclones [sic], mudslides etc.);"[174] (2) zones designated by governments as being too high-risk and "too dangerous for human habitation;"[175] (3) "[e]nvironmental degradation and slow onset disasters (e.g., reduction of water availability, desertification, recurrent flooding, salinisation of coastal zones etc.);"[176] (4) "[t]he case of 'sinking' small island states;"[177] and (5) violent conflict triggered

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[167] FABRICE RENAUD ET AL., CONTROL, ADAPT OR FLEE: HOW TO FACE ENVIRONMENTAL MIGRATION? 29–30 (2007), *available at* http://www.each-for.eu/index.php?module=main.
[168] *Id.* (internal quotation marks omitted).
[169] *Id.* (internal quotation marks omitted).
[170] *Id.*
[171] STEVE LONERGAN, THE ROLE OF ENVIRONMENTAL DEGRADATION IN POPULATION DISPLACEMENT 9 (1998).
[172] *See* Kälin, *supra* note 37.
[173] *See id.*
[174] *Id.*
[175] *Id.*
[176] *Id.*
[177] *Id.*

by a decrease in essential resources (e.g., water, land, food) owing to climate change.[178]

This classification has also been recently adopted by the Inter-Agency Standing Committee ("IASC")[179] Working Group on Migration/Displacement and Climate Change, which was established to define migration and displacement induced by climate change.[180] The IASC identifies four causes of movement in the context of climate change.[181] First, "[h]ydro-meteorological extreme hazard events;" second, "[e]nvironmental degradation and/or slow onset extreme hazard events;" third, "[s]ignificant permanent losses in state territory as a result of sea level rise;" and last, "[a]rmed conflict/violence over shrinking natural resources."[182]

Within the scope of environmental degradation, some particular incidents play major roles in making a particular place inhabitable and consequently trigger mass human displacement.[183] While the variety of typologies provided by different authors and organizations demonstrate that there is no single widely accepted standard for classifying disasters that trigger environmental migration, five standards have found common ground amongst the scholarly literature.[184]

1. Sudden Hydro-Meteorological Disasters

The increase in both number and severity of sudden-onset natural disasters because of climate change, particularly hydro-meteorological disasters such as flooding, hurricanes, typhoons, cyclones, and mudslides, can cause large-scale displacement.[185] As Margareta Wahlström points

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[178] *See* Kälin, *supra* note 37.

[179] The Inter-Agency Standing Committee ("IASC") is a unique interagency forum for humanitarian coordination and, for its members, a policy development and decision-making forum involving key UN and non-UN humanitarian actors. The IASC was established in June 1992 in response to UN General Assembly Resolution 46/182 on the strengthening of humanitarian assistance. *Welcome to the IASC*, IASC, http://www.humanitarianinfo.org/iasc (last visited Mar. 16, 2012).

[180] *See* Inter-Agency Standing Comm., *Climate Change, Migration and Displacement: Who Will Be Affected?* 1, 4 (Working Paper, 2008), *available at* http://unfccc.int/resource/docs/2008/smsn/igo/022.pdf.

[181] *Id.* at 2–3.

[182] *Id.*

[183] Aurelie Lopez, *The Protection of Environmentally-Displaced Persons in International Law*, 37 ENVTL. L. 365, 369 (2007).

[184] LACZKO & AGHAZARM, *supra* note 3, at 250.

[185] *Displacement Caused by the Effects of Climate Change: Who Will Be Affected and What are the Gaps in the Normative Frameworks for Their Protection* (Inter-Agency Standing

out, "[o]ver the past 30 years, disasters—storms, floods and droughts—have increased threefold, according to the UN International Strategy for Disaster Reduction."[186] In 2008, 20,293,413 people were displaced as a result of climate-related disasters.[187] Such disasters can cause immediate and sudden casualties and obviously large-scale displacement.[188]

Displacement caused by sudden-onset disasters is easily identifiable because environmental disasters are easy to observe and, in some cases, reported by the media.[189] When such disasters occur, people often must flee from the affected area to avoid physical harm or loss of life.[190] During and in the aftermath of natural disasters, people often lose their livelihoods, harvests, crops, and livestock are destroyed, at a minimum interrupting their ability to subsist off the land.[191] These kinds of impacts can influence population movement.[192] When the disasters are over, people's ability to return to their homes is dependent on the measures adopted for recovery of "social, economic and physical characteristics of the affected area."[193] In most cases, this type of displacement "need not be long-term and return in principle remains possible as [a] durable solution."[194] Thus, mobility

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Comm. Background Paper, Oct. 10, 2008) (noting that "many hydro-meteorological disasters will occur regardless of climate change and other disasters such as volcanoes or earthquakes presumably have no linkage to such change. Nevertheless, they too may cause movement of persons and such persons should not be treated differently from those affected by the effects of climate change.").

[186] Margareta Wahlström, *Before the Next Disaster Strikes: The Humanitarian Impact of Climate Change*, 44 U.N. CHRON. 30, 30 (2007), *available at* http://www.un.org:80/wcm/content/site/chronicle/home/archive/issues2007/pid/4829.

[187] UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMAN AFFAIRS, MONITORING DISASTER DISPLACEMENT IN THE CONTEXT OF CLIMATE CHANGE 12 (2009), *available at* http://www.internal-displacement.org/8025708F004BE3B1/%28httpInfoFiles%29/12E8C7224C2A6A9EC125763900315AD4/$file/monitoring-disaster-displacement.pdf [hereinafter OCHA, MONITORING DISASTER DISPLACEMENT].

[188] Walter Kälin, *Displacement Caused by the Effects of Climate Change: Who Will Be Affected and What Are the Gaps in the Normative Framework for Their Protection?* (Brookings Inst. Working Paper, Oc. 10, 2008), *available at* http://www.brookings.edu/papers/2008/1016_climate_change_kalin.aspx.

[189] Koko Warner, *Global Environmental Change and Migration: Governance Challenges*, 20 GLOBAL ENVTL. CHANGE 402, 405 (2010) [hereinafter Warner, *Global Environmental Change and Migration*].

[190] *Id.*

[191] KOKO WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEEDS RELATED TO ENVIRONMENTAL CHANGE AND HUMAN MIGRATION 2 (2010), *available at* http://www.ehs.unu.edu/file/get/5301 [hereinafter WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEED].

[192] *Id.*

[193] Warner, *Global Environmental Change and Migration*, *supra* note 189, at 405.

[194] Kälin, *supra* note 188.

decisions of people displaced by sudden hydro-meteorological disasters are based on disaster management by the concerned authority.[195]

2. Slow-Onset Environmental Degradation

Long-term and gradual environmental degradation, such as drought, desertification, reduced water availability due to melting glaciers, land erosion, long-term effects of recurrent flooding, and increased salinity in coastal zones due to sea level rise all cause large-scale progressive displacement.[196] These gradual changes deteriorate herding, farming, and fishing, and may negatively affect livelihood systems that ultimately motivate people to move in the long term.[197] Communities in the affected areas may increasingly choose to move to safer places to avoid life-threatening environmental degradation likely to arise in the near future and avail themselves of higher-quality living standards.[198] Such migration is a challenging and complex issue.[199] The gradual environmental impacts that comprise a more systematic environmental degradation are rarely reported by media and concerned authority until the degradation transforms into severe crisis.[200] People may not return to their original homes due to loss of the physical existence of their land (because of sea level rise and coastal erosion) or livelihood (due to desertification, salinity, or extinction of fish and other species).[201] Provided the physical land is available, people may still choose to return to their original homes if they can adopt an alternative livelihood.[202] Kälin explains:

> Such deterioration may not necessarily cause forced displacement in the strict sense of the word but, among other reasons, will incite people to move to regions with better income opportunities and living conditions. However, if the areas become uninhabitable because of complete desertification or sinking coastal zones, then population movements amount to forced displacement and become permanent.[203]

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[195] *See* WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEED, *supra* note 191, at 2.
[196] *See, e.g.*, *id.* at 4–7.
[197] *Id.* at 4.
[198] *See id.*
[199] *See, e.g.*, Warner, *Global Environmental Change and Migration*, *supra* note 189, at 409.
[200] WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEED, *supra* note 191, at 4.
[201] Warner, *Global Environmental Change and Migration*, *supra* note 189, at 409.
[202] *Id.*
[203] Kälin, *supra* note 188, at 3.

However, slow-onset environmental changes tend to affect a larger number of people than sudden acute disasters.[204] For example, during the period from 1979–2008, 718 million people were affected by storms compared to 1.6 billion people affected by droughts.[205]

3. Small Island States at Risk of Disappearing Because of Sea Level Rise

When lands are completely submerged due to sea level rise or the area is no longer liveable because of a lack of basic infrastructure or the inability to grow crops or obtain fresh water, people are compelled to move to safer places. In these cases, permanent relocation requires people to move to the mainland within either their own country or others, since the alternative is not possible as the affected area no longer exists.[206] In this situation, people have no choice but to leave their homes. In some extreme cases, the remaining territory of affected states can no longer accommodate the whole population and some states, such as Tuvalu and the Maldives, are at risk of complete submersion under water.[207] Tuvalu, a nation of 11,000 people is the first nation at risk to be completely submerged under water by this century.[208] "Even if the country does not sink, it could become increasingly inhospitable" due to the impacts of global warming and sea level rise.[209] The plants and crops may be destroyed due to salt water intrusion and extreme weather events.[210] "The coral reefs could be devastated by rising sea temperatures and ocean acidification."[211] All of these factors have a severe impact on the food security of the islanders.

The most important feature of this type of movement is that the migrants cannot return to their original home and are permanently displaced to other countries.[212] Although no substantial displacement occurred until recently due to permanent loss of territory as a result of sea level rise, "it is likely to be a significant driver of forced displacement in the future. Approximately 146 million people live in areas with an elevation of less

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[204] *See* LACZKO & AGHAZARM, *supra* note 3, at 15.
[205] *International Disaster Database*, EM-DAT, http://www.emdat.be/database (last visited Mar. 16, 2012) (Select "Advanced Search." Select all under "Location," select "1970–2008" under "Timeframe," and select "Drought" and "Storm" under "Disaster Type.").
[206] WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEED, *supra* note 191, at 5.
[207] *See* Kravchenko, *supra* note 79, at 527; Kälin, *supra* note 188.
[208] CORLETT, *supra* note 44, at 14.
[209] *Id.*
[210] *Id.*
[211] *Id.*
[212] *See* Kälin, *supra* note 188.

than one met[er] above sea level."[213] When the whole state is at risk of complete submersion, such as in the Maldives and Tuvalu, relocation to other states is essential.[214] The United Nations Office for the Coordination of Humanitarian Affairs ("OCHA") and International Displacement Monitoring Centre ("IDMC") study identified "forced displacement of 2,000 inhabitants of the Tulun (Carteret) and 400 of the Takuu (Mortlock) islands in Papua New Guinea" as the permanent displacements that had occurred as of 2008.[215] However, according to current IPCC findings, this trend is likely to substantially accelerate in the future.[216]

4. Government-Initiated Planned Evacuation in Response to Disasters

In case of natural disasters such as floods, earthquakes, volcanic eruptions, hurricanes, storm surges, or tsunamis, the most common and fastest response is evacuation.[217] "This will occur, for example, because of an increased risk of mudslides in mountain regions, andalong [sic] rivers and on coastal plains prone to flooding."[218] Usually, governments designate the affected areas which are dangerous for human habitation as high-risk zones.[219] Then, governments initiate planned evacuation from such areas that usually only involve a displacement a short distance away from the high-risk zone.[220] However, sometimes this sort of evacuation process may lead to permanent internal displacement until other durable solutions are found for those affected.[221]

5. Risk of Conflict Over Essential Resources

Environmental degradation is considered as both cause and effect of armed conflict.[222] The potential consequences of climate change are

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[213] OCHA, MONITORING DISASTER DISPLACEMENT, *supra* note 187, at 13.
[214] *See* Jane McAdam, *Environmental Migration Governance* 9 (University of New South Wales Faculty of Law Research Series Paper 1, 2009), *available at* http://law.bepress.com/cgi/viewcontent.cgi?article=1143&context=unswwps.
[215] OCHA, MONITORING DISASTER DISPLACEMENT, *supra* note 187, at 12.
[216] *See* Nobuo Mimura et al., *Small Islands*, *in* IPCC: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 692–93.
[217] Lori M. Hunter, *Migration and Environmental Hazards*, 26 POPULATION & ENV'T 273, 283 (2005).
[218] Kälin, *supra* note 37.
[219] *Id.*
[220] ADAMO, *supra* note 20, at 14.
[221] *See* McAdam, *supra* note 214, at 9.
[222] ADAMO, *supra* note 20, at 18.

scarcity of water availability, food insecurity, depletion of natural resources, and prevalence of disease.[223] These impacts of climate change ultimately lead to scarcity of resources and destroy infrastructure vital to livelihood.[224] As a result, many people, especially in economically weak countries, have to share limited resources. These circumstances "have been identified as triggers or concomitant factors in the emergence or aggravation of conflict situations."[225] The lack of security arising out of conflict ultimately leads to mass migration. According to the OCHA and IDMC, forty-two million people were displaced, including internally displaced persons ("IDPs") and refugees from conflict, in 2008.[226]

For example, drought, scarcity of water resources, and food insecurity are presently the most important climate change-induced vulnerabilities contributing to conflict and mass displacement in Africa.[227] The increasing competition for scarce land and water resources, as reported by humanitarian agencies, ultimately leads to cross-border resource-based armed conflicts and loss of life of people living along the borders of Sudan, Kenya, Ethiopia, Tanzania, and Uganda.[228]

In each of these scenarios, people are displaced due to environmental degradation caused by either man-made or natural disasters. However, the definitions of an environmental refugee provided by El-Hinnawi, Jacobson, Lonergan, and Bates explicitly include both natural and human-caused harm in their broader definitions of environmental refugee.[229]

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[223] *See, e.g.*, *supra* notes 72–73 and accompanying text.
[224] ADAMO, *supra* note 20, at 18.
[225] *Id.*
[226] OCHA, MONITORING DISASTER DISPLACEMENT, *supra* note 187, at 12.
[227] LEIGHTON, *supra* note 121, at 4.
[228] *Id.*
[229] *See, e.g.*, EL-HINNAWI, *supra* note 161, at 4; JACOBSON, *supra* note 163, at 38; Diane C. Bates, *Environmental Refugees? Classifying Human Migrations Caused by Environmental Change*, 23 POPULATION & ENV'T 465, 466 (2002); LONERGAN, *supra* note 171, at 7. These authors interprets environment very widely and includes two other circumstances as causation in their "environmental refugee" definitions. These are:

a. Technological hazards due to industrial accidents:

> Industrial accidents as distinguished from natural hazards have the potential role to degrade environmental conditions and cause mass human displacement. Technological hazards as a result of natural disasters may occur due to release of toxic materials, episodes of severe contamination, structural collapse, and transportation, construction or manufacturing accidents. There are many instances of this sort of disasters including fatal gas leak in Bhopal, India (1986), radioactive releases from nuclear plants in Chernobyl, Ukraine (1986) and Three Mile Island (TMI),

However, many other scholars, including Frank Biermann and Ingrid Boas, suggest protection for displacement stemming only from the specific impacts of climate change.[230] Although it is scientifically challenging to identify the exact causation of these impacts,[231] the IPCC classifies certain natural events ranging from "virtually certain" to "extremely unlikely" which are likely to occur due to direct impacts of anthropogenic climate change.[232] This study considers only those impacts of climate change that are identified by the IPCC as "virtual certainty" to "likely," representing a probability range of sixty percent to ninety-nine percent when examining protection mechanisms for environmental displacement.

> Pennsylvania (1979) in the 20th century. Most of these displacements were, however, temporary.
>
> b. Development projects:
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> Development projects such as dams and irrigation projects may lead to large human movement. The Three Gorges Dam project in China is the most glaring example of this which displaced over 1 million persons. The construction of a dam on Kaptai Lake in Bangladesh for generation of hydro-electric power also caused large number of displacement from Bangladesh to neighbouring Assam in India. Over 100000 people lost their homes and received no compensation from the then Pakistani government as well as the succeeding Bangladeshi government.

EL-HINNAWI, *supra* note 161, at 4. In these two scenarios, climate change is not directly responsible for human displacement. Rather the displacements are caused by human action. For those migrations, there are separate national and international protection mechanisms. For example, tort law is applicable to industrial accidents; international humanitarian law ("IHL") is applicable for armed conflicts; and international human rights law and UN Guiding Principles on IDP are applicable to development-induced migration.

[230] *See* Biermann & Boas, *supra* note 9, at 25.

[231] According to the IPCC,

> determining whether a specific, single extreme event is due to a specific cause, such as increasing greenhouse gases, is difficult, if not impossible, for two reasons: 1) extreme events are usually caused by a combination of factors and 2) a wide range of extreme events is a normal occurrence even in an unchanging climate.

Gabriele C. Hegerl et al., *Understanding and Attributing Climate Change*, *in* IPCC: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 7, at 696.

[232] *See* IPCC: SUMMARY FOR POLICYMAKERS, *supra* note 1, at 3. Where uncertainty in specific outcomes is assessed using expert judgment and statistical analysis of a body of evidence (e.g., observations or model results), then the following likelihood ranges are used to express the assessed probability of occurrence: virtually certain >99%; extremely likely >95%; very likely >90%; likely >66%; more likely than not >50%; about as likely as not 33% to 66%; unlikely <33%; very unlikely <10%; extremely unlikely <5%; exceptionally unlikely <1%. *See id.*

B. Typology of Environmental Migration Based on Extent and Permanency of Movement

The impacts of climate change may be perceived differently by people around the world due to geophysical variations (slow onset or sporadic environmental impacts) as well as "variable coping capacities of local social, political, and economic structures."[233] Consequently, a similar climatic phenomenon might not have the same effects on displacement. For this reason, the types of human migration in response to the impacts of climate change are diverse and complex.[234] The victims of climate change may move "as individuals, families, small groups, large groups, or massive crowds."[235] The extent of their movement could be over short or long distances, and be permanent or temporary.[236] Based on the possibility of return to their original homes, people may choose to do so when conditions so allow, or migrants may be unwilling or unable to return, resulting in a permanent migration.[237] The movement may be either internal, with people moving shorter or longer distances to find new homes and livelihoods within their own countries, or it can be international, with people who move much further away crossing an international border or borders.[238] Consequently, such variety of typologies of climate change displacement makes the study of environmental displacement difficult.[239]

Displacement Solutions states that displacement due to climate change is likely to manifest itself in essentially six primary ways. These are temporary displacement, "permanent local displacement," "permanent internal displacement," "permanent regional displacement," "permanent intercontinental displacement," and "temporary regional or international displacement."[240] However, movements due to environmental change can

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[233] BOANO ET AL., *supra* note 95, at 13.
[234] *See* Ketel, *supra* note 27, at 1; ADAMO, *supra* note 20, at 16–19.
[235] Ketel, *supra* note 27, at 1.
[236] ADAMO, *supra* note 20, at 14.
[237] Susan F. Martin, *Climate Change and International Migration* 2 (The German Marshall Fund of the United States Background Paper, 2010), *available at* http://isim.georgetown.edu/publications/Martin_VB.pdf.
[238] Ketel, *supra* note 27, at 1; UNITED NATIONS HIGH COMM'R FOR REFUGEES, CLIMATE CHANGE, NATURAL DISASTERS AND HUMAN DISPLACEMENT: A UNHCR PERSPECTIVE 4 (2009), *available at* http://www.unhcr.org/refworld/docid/4a8e4f8b2.html.
[239] Black, *supra* note 157, at 1.
[240] DISPLACEMENT SOLUTIONS, CLIMATE CHANGE, HUMAN RIGHTS AND FORCED HUMAN DISPLACEMENT: CASE STUDIES AS INDICATORS OF DURABLE SOLUTIONS 4 (2008), *available at* http://www.displacementsolutions.org/files/documents/Climate_Change_Displacement_Meeting_Paper.pdf.

be classified according to the extent of movement and the possibility of return.[241] Broadly, people are displaced either within or across borders. While most of the movements are temporary, sometimes they become permanent.[242] Based on this trend, displacements can be classified in four categories.

1. Temporary Internal Displacement

Traditionally, most displacement due to environmental change has occurred within national boundaries.[243] In the case of natural disasters such as floods, earthquakes, volcanic eruptions, hurricanes, storm surges, or tsunamis, people are generally displaced temporarily and within very short distances.[244] In most cases, "people can to return to their habitats and start rehabilitation [of] livelihoods and reconstruction [of] their houses" once the event has ceased.[245] Of course, some evacuees may choose to permanently relocate to distant, safe places.

2. Permanent Internal Displacement

Slow onset movements are likely to be caused by direct impacts of climate change, such as sea level rise, coastal inundation, and increasingly frequent storm surges.[246] These degradations cause irreversible changes to the living environment and make certain areas unliveable due to depletion of natural resources.[247] In this situation, entire communities need to be permanently relocated to less dangerous locales.[248] When people move far enough away from their places of original residence in response to progressive environmental degradation, return to their original homes tends to be unlikely or impossible.[249] Usually, this type of displacement occurs domestically.[250] For example, many people who are compelled to leave their homes due to flood, cyclone, and river erosion in Bangladesh are moving toward the capital city, Dhaka, for work and shelter.[251] However, this local

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[241] King, *supra* note 158, at 545.
[242] ADAMO, *supra* note 20, at 14.
[243] Hugo, *supra* note 52, at 105.
[244] ADAMO, *supra* note 20, at 14.
[245] Stojanov, *supra* note 38, at 79; *see also* ADAMO, *supra* note 20, at 14.
[246] King, *supra* note 158, at 548–49.
[247] *See id.* at 548.
[248] *See* ADAMO, *supra* note 20, at 5.
[249] *See* Kälin, *supra* note 188, at 5.
[250] Khalid Koser, *Gaps in IDP Protection*, FORCED MIGRATION REV., Oct. 2008, at 17.
[251] *See* Hugo, *supra* note 52, at 114, 119.

permanent displacement is difficult in densely populated developing countries like Bangladesh where a large number of people have to share limited resources.[252] There is also a risk that land owners may refuse to allow the settlement of migrated victims of natural disasters.[253]

3. Temporary International Displacement

The environmental degradation severely affecting livelihood and basic infrastructure in a particular area may motivate people to cross an internationally recognized state border to secure life and shelter. The degradation may be due to both sudden and gradual natural disasters. Migrants leave their own countries because their countries' protection and assistance capacities are exhausted or they expect better protection and assistance elsewhere.[254] After the 2004 tsunami in Asia, many people from Sri Lanka sought refuge in India.[255] Many groups of tsunami victims were received temporarily by other countries until permanent solutions were negotiated and planned.[256] However, this is a very rare phenomenon. It is not easy to cross secured international borders unless neighboring or other countries offer refuge on humanitarian grounds.[257] Moreover, under many immigration systems, and even some refugee programs, migrants need education and sufficient resources to travel abroad.[258] Thus, Norman Myers's assumption that a large of number of environmental migrants will rush to developed countries is unlikely to happen in reality.[259] Moreover, environmental refugees' status in international law is still unclear.

4. Permanent Cross-Border Displacement

In some extreme cases, environmental changes may deteriorate conditions in such a way that the areas may become uninhabitable because

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[252] *See id.* at 124.
[253] ADAMO, *supra* note 20, at 14.
[254] Kälin, *supra* note 188, at 2.
[255] *See, e.g.*, TAMIL INFORMATION CENTRE, SRI LANKA TSUNAMI SITUATION: REPORT NUMBER 6, at 15 (2006).
[256] *See, e.g.*, *id.*; DISPLACEMENT SOLUTIONS, *supra* note 240, at 4–5.
[257] *See* Martin, *supra* note 237, at 4.
[258] *See id.* at 3, 6.
[259] *See generally* Myers, *supra* note 4 (arguing that as environmental degradation continues, environmental refugees from developing nations will flood into the developed world in search of a better life).

of complete desertification, salination of soil and groundwater, or sinking of coastal zones.[260] In such circumstances, the inhabitants of such regions tend to migrate to nearby countries for permanent protection.[261] They decide to move from their homes and cross the border because they have no choice but to leave permanently, and they cannot find any durable solutions either in the form of relocation or adaptation for their displacement within their own countries.[262] In some scenarios, they cannot return to their country of origin because of a lack of security or sustainable livelihoods there after natural disasters cease.[263] This scenario is most likely to arise in response to permanent inundation of small island states in the Asia Pacific.[264] This would involve, for instance, a citizen of Vanuatu or Tuvalu migrating on a permanent basis to New Zealand, or people of the Maldives to neighboring India or Sri Lanka. The President of the Maldives has already expressed his desire to purchase land for the Maldivians in India, Sri Lanka, or Australia.[265] Vanuatu and Kiribati are also sending educated and skilled citizens to neighboring developed countries such as Australia and New Zealand to establish a network so that other people from the island may follow if the situation deteriorates.[266]

The classification based on crossing "an internationally recognized state border" will help to determine the jurisdiction and protection mechanism.[267] However, it is urgently needed to promote the development of more sophisticated typologies of environmentally induced migration, since each

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[260] Kälin, *supra* note 188.
[261] *Id.*
[262] *Id.*
[263] *Id.*
[264] *Id.*
[265] Cristine Russell, *First Wave*, SCI. NEWS, Feb. 28, 2009, at 27. Former President Mohamed Nasheed announced at the end of 2008 that the Maldives was establishing a sovereign wealth fund which could be used to purchase a new island for the country's population. *Id.* According to Nasheed, "[t]his trust fund will act as a national insurance policy to help pay for a new homeland, should future generations have to evacuate a country disappearing under the waves." *Id.*
[266] Maryanne Loughry & Jane McAdam, *Kiribati—Relocation and Adaptation*, FORCED MIGRATION REV., Oct. 2008, at 51–52, *available at* http://www.fmreview.org/FMRpdfs/FMR31/FMR31.pdf. Anote Tong, President of Kiribati, has also made it clear that the population of his island might be forced to relocate en masse. *Id.* His focus has been on identifying immigration possibilities for Kiribati nationals in nearby countries, particularly Australia and New Zealand. *Id.* at 52. In a recent trip to New Zealand, he suggested that the best educated Kiribatis should emigrate first, in an orderly fashion, and then establish communities which others could join as the situation requires. *Id.*
[267] Kälin, *supra* note 188, at 2.

of the available forms of migration requires significantly different approaches and policy frameworks.[268]

III. OVERVIEW OF PREDICTED NUMBERS AND FIGURES OF ENVIRONMENT/CLIMATE–INDUCED DISPLACEMENT

Climate change impacts are likely to produce considerable numbers of displaced people, either temporarily or permanently, all over the world.[269] As the Earth's climate is rapidly changing, exceeding current scientific forecasts presented by the IPCC and other scientists regarding the potential impacts of such change, a growing number of authors are putting forward estimates of both the existing number of environmental displacements and of potential future migration flows all over the world.[270] United Nations High Commissioner for Refugees António Guterres predicted at a press conference at the United Nations Climate Change Conference 2009 in Copenhagen that "climate change will become the biggest driver of population displacements, both inside and across national borders, within the not too distant future."[271] Currently, there is no uniform global estimate for the number of people displaced by climate change since no international organization collects information on persons displaced by natural disasters.[272] Developing countries and the international community also lack sufficient capacity to gather this type of data.[273] So, the existence and scope of the issue of climate displacement are often established by reference to estimated figures of displaced people.[274]

The estimates of the potential magnitude of climate change-related displacement vary depending on sources and methods.[275] The consideration

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[268] BOANO ET AL., *supra* note 95, at 1–2, 13, 16, 31; Martin, *supra* note 237, at 2.
[269] *See, e.g.*, STERN REVIEW REPORT, *supra* note 7, at 111–14.
[270] *See, e.g.*, MORRISSEY, *supra* note 38, at 4.
[271] *Climate Change Could Become the Biggest Driver of Displacement*, *supra* note 40.
[272] *See* VIKRAM ODEDRA KOLMANNSKOG, NOR. REFUGEE COUNCIL, FUTURE FLOODS OF REFUGEES: A COMMENT ON CLIMATE CHANGE, CONFLICT AND FORCED MIGRATION 13–14 (2008), *available at* http://www.nrc.no/arch/img/9268480.pdf.
[273] OLI BROWN, HUMAN DEVELOPMENT REPORT: CLIMATE CHANGE AND FORCED MIGRATION: OBSERVATIONS, PROJECTIONS AND IMPLICATIONS 17 (2007), *available at* http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/brown_oli.pdf.
[274] *See* Tess Burton & David Hodgkinson, Towards a Convention for Persons Displaced by Climate Change: A Discussion Note on the Relationship Between Adaptation and Displacement 5 (unpublished manuscript) (on file with The Hodgkinson Group—Climate Change and Aviation Advisors), *available at* http://www.hodgkinsongroup.com/documents/Draft%20Discussion%20Note%20Adaptation%20and%20Displacement.pdf.
[275] *See* Docherty & Giannini, *supra* note 74, at 353; KOLMANNSKOG, *supra* note 272, at 9; Williams, *supra* note 67, at 504; RENAUD ET AL., *supra* note 167, at 17; Black, *supra* note

of different time frames also makes comparisons complicated.[276] Basically, migration experts and related organizations produce evidence depending on their respective definitions of environmental displacement. Some researchers have strict reservations in attempting to make predictions, while others provide estimates with respect to numbers and figures of environmental displacement.[277] Based on a plausible range of emission scenarios, current estimates typically range from twenty-five million to one billion people, but is usually estimated that around 200–250 million people will be displaced under any environmentally related circumstances by 2050.[278]

As far as actual numbers are concerned, there is little doubt that "current predictions are fraught with numerous methodological problems and caveats."[279] These figures have also been extensively debated in the literature based on the issues of multi-causality of environmental displacement and extent of migrants' movement.[280] There is a lack of rigorous empirical research on this issue, but it is impossible to write about environmental migration without some reference to statistics. Keeping these shortcomings in mind, this section provides a review of the current state of estimated environmental displacement and the existing debates over the numbers.

A. Predicted Numbers and Figures

The available estimates of environmental displacement mainly vary because of different time frames researchers provide for their predictions. While some researchers predict current numbers of displacement, others provide displacement estimates through 2050 or 2100.

157, at 2–7; Stephen Castles, *Environmental Change and Forced Migration: Making Sense of the Debate* (United Nations High Comm'r for Refugees Working Paper No. 70, 2002).

[276] ADAMO, *supra* note 20, at 13–14; King, *supra* note 158, at 544.

[277] *See* KOLMANNSKOG, *supra* note 272, at 15–16.

[278] *See* CHRISTIAN AID, *supra* note 154, at 50; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, THIRD ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 15–18 (2001); NORMAN MYERS, ENVIRONMENTAL REFUGEES: AN EMERGENT SECURITY ISSUE 1–2 (2005); RENAUD ET AL., *supra* note 167, at 17; STERN REVIEW REPORT, *supra* note 7, at 56, 77; Docherty & Giannini, *supra* note 74, at 353; Williams, *supra* note 67, at 506; Norman Myers, *Environmental Refugees in a Globally Warmed World*, 43 BIOSCIENCE 752, 752–53 (1993); Robert J. Nicholls, *Coastal Flooding and Wetland Loss in the 21st Century: Changes Under the SRES Climate and Socio-Economic Scenarios*, 14 GLOBAL ENVTL. CHANGE 69–71 (2004); Biermann & Boas, *supra* note 9, at 9–10; Black, *supra* note 157, at 7.

[279] Biermann & Boas, *supra* note 9, at 9.

[280] *See* DOMINIC KNIVETON ET AL., CLIMATE CHANGE AND MIGRATION: IMPROVING METHODOLOGIES TO ESTIMATE FLOWS 5 (2008); *see also* Black, *supra* note 157, at 1–2; Castles, *supra* note 275, at 3–5.

1. Current Environmental Displacement

The impacts of climate change have already started to take place in some parts of the world, thus contributing to displacement and migration.[281] Recent studies confirm that the number of environmental migrants has increased significantly in recent years.[282] It is estimated that there are currently twenty-five million people worldwide who have been displaced for environmental reasons, making environmental refugees the single largest migrant group in the world.[283] In 1989, the Executive Director of UNEP reported that "as many as 50 million people could become environmental refugees."[284] Stressing that climate change should not be considered a distant worry, António Guterres, United Nations High Commissioner for Refugees, noted in 2009 that a staggering thirty-six million people were displaced by natural disasters in 2008; more than twenty million were forced to move by climate-related factors.[285] In 2005, the United Nations University's Institute for Environment and Human Security estimated a potential fifty million "environmental refugees" by 2010.[286] In 2007, the Secretariat of the UNFCCC also offered similar estimates.[287]

2. Future Predictions by 2050 or 2100

In 1990, the First Assessment Report of the IPCC estimated that by 2050, 150 million people could be displaced by climate change-related phenomena, such as floods, storms, desertification, and increasing water scarcity.[288] To put this estimate in perspective, environmental refugees

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[281] WARNER, IN SEARCH OF SHELTER, *supra* note 45, at iv.
[282] *See, e.g.*, Falstrom, *supra* note 21, at 4.
[283] *Id.* (citing an interview with Michelle Leighton, Director of Human Rights and Environment Programs for the National Heritage Institute); *see also* CONISBEE & SIMMS, *supra* note 5, at 36; Falstrom, *supra* note 21, at 4; Jessica B. Cooper, Note, *Environmental Refugees: Meeting the Requirements of the Refugee Definition*, 6 N.Y.U. ENVTL. L.J. 480, 485 (1998); Havard, *supra* note 50, at 70.
[284] Mostafa K. Tolba, *Our Biological Heritage Under Siege*, 39 BIOSCIENCE 725, 727 (1989).
[285] *Climate Change Could Become the Biggest Driver of Displacement*, *supra* note 40.
[286] Oli Brown, *The Numbers Game*, 31 FORCED MIGRATION REV. 8, 8 (2008).
[287] Press Release, UNFCCC Secretariat, UNFCCC Executive Secretary Says Significant Funds Needed to Adapt to Climate Change Impacts (April 6, 2007), *available at* http://unfccc.int/files/press/news_room/press_releases_and_advisories/application/pdf/070406_pressrel_english.pdf.
[288] *See* IPCC 1990 IMPACTS ASSESSMENT, *supra* note 7, at 3, 20, 2–22, 5–8; *see also* EQUITY & JUSTICE WORKING GROUP BANGLADESH, CLIMATE CHANGE INDUCED FORCED MIGRANTS: IN NEED OF DIGNIFIED RECOGNITION UNDER A NEW PROTOCOL (2009), *available at* http://www.equitybd.org/notice_board_contain/cop16/Climate%20Migrant%20Printed%20Position.pdf.

could comprise more than 1.5% of the predicted global population of nine billion people in 2050.[289] Advocacy groups and social scientists have produced a burgeoning literature about this category of migrants and recent studies estimate even more people to be displaced by the same time.[290]

Perhaps the best-known estimate for future migration forced by climate change was made by Professor Norman Myers of Oxford University, a widely known expert on this topic. In 1995, he observed that "global warming could put large numbers of people at risk of displacement by the middle of next century if not before."[291] He predicted the existence of more than twenty-five million environmental refugees (ten million recognized, fifteen million unrecognized) in 2002, which was greater than the eighteen million then officially recognized refugees (political, religious, and ethnic).[292] Looking ahead to 2050, he argued that "when global warming takes hold there could be as many as 200 million people overtaken by disruptions of monsoon systems and other rainfall regimes, by droughts of unprecedented severity and duration, and by sea-level rise and coastal flooding."[293] Regarding the regional estimation, Myers and Kent continued:

> Preliminary estimates indicate the total [number] of people at risk of sea-level rise in Bangladesh could be 26 million, in Egypt 12 million, in China 73 million, in India 20 million, and elsewhere 31 million, making an aggregate total of 162 million. At the same time, at least 50 million people could be at risk through increased droughts and other climate dislocations.[294]

These estimates are, however, criticized by other scholars, including Dominic Kniveton, as stemming from a very rudimentary methodology.[295] Yet, they have become the yardstick adopted in most of the reports and studies in the absence of a more precise data set.[296]

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[289] CONISBEE & SIMMS, *supra* note 5, at 36.
[290] *See, e.g.*, NORMAN MYERS & JENNIFER KENT, CLIMATE INST., ENVIRONMENTAL EXODUS: AN EMERGENT CRISIS IN THE GLOBAL ARENA 8 (1995).
[291] *Id.*
[292] Norman Myers, *Environmental Refugees: A Growing Phenomenon of the 21st Century*, 357 PHIL. TRANSACTIONS: BIOLOGICAL SCI. 609, 613 (2002).
[293] Myers, *supra* note 278, at 1.
[294] MYERS & KENT, *supra* note 290, at 8.
[295] Dominic Kniveton, Climate Change and Migration: Developing Methodologies, Presentation to the Environment, Forced Migration and Social Vulnerability Conference (Oct. 9, 2008); *see also* KNIVETON ET AL., *supra* note 280, at 29; McAdam, *supra* note 214, at 1–2.
[296] McAdam, *supra* note 214, at 1–2.

Sir Nicholas Stern, in his authoritative review of climate change, maintained that Myers and Kent's earlier estimate of 150–200 million "has not been rigorously tested" and the estimate of 200 million is "problematic" and "conservative."[297] But, echoing the concern that the climate change will lead to hundreds of millions of climate change migrants, the Stern Review estimated that the scale of migration will reach 200 million by 2050.[298]

Other estimates vary dramatically in terms of "numbers, time frame and causes."[299] Friends of the Earth, an international non-governmental organization ("NGO") based in Australia, predicts 150 million climate refugees worldwide, including 1 million from small island states, by 2050.[300] Offering the highest estimate, Christian Aid estimates that one billion people will be forcibly displaced by 2050, principally arising from climate change-induced natural disasters.[301] In another estimate, Nicholls suggests that between 50 and 200 million people could be displaced as a result of climate change by 2080.[302] However, most of the available predictions, in general figure out of about 200–250 million environmental migrants by middle of the century.[303]

IV. DEBATE OVER PREDICTED NUMBERS, NATURE, AND EXTENT OF ENVIRONMENTAL MIGRATION

The predicted amount of future environmental migrants is a "daunting figure, a ten-fold increase on today's entire population of documented refugees and [internally displaced persons]."[304] However, Norman Myers's prediction of 200 million environmental migrants by 2050 is the currently accepted estimate.[305] This means that by 2050 one in every forty-five people in the world will be displaced by climate change.[306]

However, the prediction of the scale and extent of environmentally induced displacements is probably the most debatable issue in existing literature.[307] Migration and environment research tends to fall into two

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[297] STERN REVIEW REPORT, *supra* note 7, at 77.
[298] *Id.* at 56.
[299] Brown, *supra* note 286, at 8.
[300] FRIENDS OF THE EARTH, A CITIZEN'S GUIDE TO CLIMATE REFUGEES, at Fact Sheet 4 (2007).
[301] CHRISTIAN AID, *supra* note 154, at 5.
[302] Nicholls, *supra* note 278, at 71–72.
[303] Biermann & Boas, *supra* note 9, at 9–10.
[304] Brown, *supra* note 286, at 8.
[305] *See, e.g.*, *id.* at 8–9.
[306] EQUITY & JUSTICE WORKING GROUP BANGLADESH, *supra* note 288, at 1.
[307] ADAMO, *supra* note 20, at 13.

broad and extreme categories: the "minimalists," who consider that the environment plays a relative and nominal role in migration decisions; and the "maximalists," who propose that environment can be a distinct factor that causes people to be forced to leave their homes.[308] The available predictions vary significantly because no measurable definition exists.[309] Many fundamental questions about the numbers are raised in scientific, policy, and academic literature.[310] The available estimates are fiercely contested.[311] The main issue raised by the debate is whether it is possible to predict with any degree of certainty the likely number and distribution of persons displaced by environmental change.[312] Critics argue that there is "no evidence that environmental change leads directly to mass refugee flows, especially flows to developed countries."[313] They also argue that such estimates have a large margin of error and mostly depend on faulty assumptions about population growth, economic development, temperature increase, or the degree and timing of climate change.[314] Black has criticized estimates of "environmental refugees" by numerous authors as being "without independent verification of [their] accuracy."[315] There is strong advocacy from scholars including Black and Castles for recognition of the multi-causality of environmental displacement.[316] They criticize the uncritical acceptance of a direct causal link between environmental stress and human displacement.[317] However, several issues center around the debates on estimated numbers, nature, and extent of environmental migration.

A. Multi-Causality of Environmental Migration

Migration is often the result of an intricate matrix of factors.[318] The conditions under which people leave their homes and migrate generally do little to illuminate structural or root causes of their movement.[319] In reality,

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[308] LACZKO & AZAGHARM, *supra* note 3, at 14.
[309] Warner, *Global Environmental Change and Migration*, *supra* note 189, at 403.
[310] BOANO, *supra* note 2, at 13.
[311] Burton & Hodgkinson, *supra* note 274, at 2.
[312] *Id.* at 3.
[313] Castles, *supra* note 275, at 2.
[314] *See, e.g.*, Astri Suhrke, *Environmental Degradation and Population Flows*, 47 J. INT'L AFF. 478, 478–79 (1994); Castles, *supra* note 275, at 2–3; Black, *supra* note 157, at 2–3.
[315] Black, *supra* note 157, at 1.
[316] *See supra* note 314 and accompanying text.
[317] *See, e.g.*, LONERGAN, *supra* note 171, at 8.
[318] King, *supra* note 158, at 545; *see also* LACZKO & AGHAZARM, *supra* note 3, at 51.
[319] Ketel, *supra* note 27, at 1.

"people make decisions over time to leave their communities for a complex interplay of reasons."[320] Factors that play a significant role in this type of migration include availability of sufficient resources to move, network (i.e., family and friends both at home and at potential points of destination), and level of information and knowledge about the receiving country.[321] Environmental degradation as a result of climate change may be one of the many triggering factors for migration,[322] but, as expounded by Black, Castles, and others, "it is hardly the only and often not even the most important cause."[323] It is also difficult "to single out the impact of the environmental effects of climate change on these decisions."[324] So it is often criticized that most authors who provided a definition of "environmental refugee" failed to recognize the multi-causality aspects of environmental migration.[325]

Implicit in the idea of environmental migration is the belief that environmental degradation—as a possible cause of population displacement—can be separated from other social, economic, or political causes.[326] But environmental hardships are often aggravated by issues such as economic hardship, military conflict, insecurity, social upheaval, exclusion, injustice, and political instability.[327] So when environmental deteriorations cause displacements, they are often the byproduct of economic, demographic, or political factors.[328] Some people leave voluntarily for "economic opportunities, family, clan, or nationality reunion, and organized resettlement schemes."[329] While some people flee because there is no other choice, others flee preemptively before arrival of the compelling situation. Each factor has the potential to trigger population movement.[330] "The different degrees of force and the complex set of influencing factors" made the

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[320] Elizabeth Ferris, Co-Director, Brookings-Bern Project on Internal Displacement, Speech (Oct. 17, 2008), *available at* http://www.brookings.edu/speeches/2008/1017_natural_disasters_ferris.aspx.
[321] King, *supra* note 158, at 545.
[322] *See id.*
[323] Black, *supra* note 157, at 2–7; Castles, *supra* note 275, at 2–3; *see also* Gaim Kibreab, *Environmental Causes and Impact of Refugee Movements: A Critique of the Current Debate*, 21 DISASTERS 21–23 (1997); David Keane, Note, *Environmental Causes and Consequences of Migration: A Search for the Meaning of "Environmental Refugees,"* 16 GEO. INT'L ENVTL. L. REV. 209, 221 (2004).
[324] Ferris, *supra* note 320.
[325] *See* Black, *supra* note 157, at 12–14.
[326] LONERGAN, *supra* note 171, at 8.
[327] Ketel, *supra* note 27, at 2.
[328] *See* Hugo, *supra* note 52, at 113–15.
[329] Ketel, *supra* note 27, at 2.
[330] GER. ADVISORY COUNCIL ON GLOBAL CHANGE, CLIMATE CHANGE AS A SECURITY RISK 1 (2008).

study of environmental migration difficult.[331] So it is difficult to point to a single factor responsible for migration due to environmental reasons, as the causes in most cases are intermixed.[332] The conflict in Darfur, for example, has been recognized as stemming from an ecological crisis in the region, which, at least in part, was caused by climate change.[333]

Richard Black, after reviewing a wide range of studies on environmental degradation-induced migration, claims that there is no convincing evidence that it leads to large-scale displacement.[334] He also points out that the links postulated in the literature between environment and migration are not explicitly demonstrated.[335] Black recognizes that environmental degradations and catastrophes, such as rising sea levels, flood, cyclones, and declining water supplies are very real and important factors in the decision to migrate.[336] But he finds little evidence of actual permanent large-scale displacement directly caused by these factors.[337] "Rather they are part of complex patterns of multiple causalit[ies], in which natural and environmental factors are closely linked to economic, social and political ones."[338] Many other interrelated issues, such as conflict, human rights, gender, levels of development, public health, and governance question decisions to migrate for environmental reasons.[339] For this reason, he considers the "conceptualization [of environment] as a primary cause of forced displacement" as "unhelpful and unsound intellectually, and unnecessary in practical terms."[340]

In this context, Lonergan suggests that environmental factors cannot be easily separated from other socioeconomic and political factors and processes triggering migration.[341] Castles takes a more nuanced view, noting that migration involves "complex patterns of multiple causality, in which natural and environmental factors are closely linked to economic, social, and political ones."[342] Dominic Kniveton and his co-authors accept

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[331] *See* ACKETOFT, *supra* note 27, at 2.
[332] Havard, *supra* note 50, at 67.
[333] DAN SMITH & JANANI VIVEKANANDA, A CLIMATE OF CONFLICT: THE LINKS BETWEEN CLIMATE CHANGE, PEACE AND WAR 12 (2007) (quoting United Nations Secretary General Ban Ki-Moon).
[334] *See* Black, *supra* note 157, at 3–5.
[335] *Id.* at 5.
[336] *Id.* at 14.
[337] *Id.*
[338] Castles, *supra* note 275, at 5.
[339] Int'l Org. for Migration, *supra* note 76, at 2.
[340] *See* Black, *supra* note 157, at 1.
[341] LONERGAN, *supra* note 171, at 10.
[342] Castles, *supra* note 275, at 5.

the idea of multiple factors influencing migration decisions.[343] They state their position that "[i]t has become evident . . . that the assumption that climate variability leads to migration in a linear way is not supported by empirical investigation. In short, these studies have found that many other factors play into the nexus between climatic factors and migration."[344]

Thus, there is fierce debate among academia and policymakers stemming from confusion regarding the multi-causality of environmental migration. Summarizing the debate, IOM states:

> [P]art of the controversy stems from the fact that those who migrate partly or wholly for environmental reasons span a large continuum—from those who are suddenly displaced by an extreme environmental event to those who pre-emptively migrate due to deteriorating environmental conditions. While most of these migrants remain within their countries of origin, some cross international borders. Similarly, some migrate temporarily and others permanently.[345]

However, trying to isolate specific reasons why people migrate and focusing too much on the problem of multi-causality has the dangerous risk of denying the rights of forced climate migrants. The policymakers, relying on this excuse, may fragment the issue and responsibility for it, which will ultimately lead to the denial of migrants' rights.[346]

B. Migration as a Coping Strategy

Refuting the existence of environmental migration, some scholars regard migration as one of a variety of important survival strategies used by people in the face of natural or man-made disasters since the dawn of civilization.[347] For example, Black considers environmental migration as a "customary coping strategy."[348] Migration in the Sahel zone and similar regions is a coping strategy that has been used by those people for centuries, and is cyclical rather than permanent.[349] Migration is thus considered "an

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[343] KNIVETON ET AL., *supra* note 280, at 37.
[344] *Id.* at 6.
[345] INT'L ORG. FOR MIGRATION, *supra* note 71, at 21.
[346] Merit Hietanen, Summary of Professor Roger Zetter's Comments at Environmental Change and Displacement Workshop: Assessing the Evidence and Developing Norms for Response (Jan. 8–9, 2009).
[347] *See* Hugo, *supra* note 52, at 105.
[348] *See* Black, *supra* note 157, at 6.
[349] *Id.* at 6–7.

essential part of the economic and social structure of the region, rather than a response to environmental decline."[350]

Rafael Reuveny also views environmental migration as an adaptive strategy to confront climate change.[351] Reuveny's premise is that individuals have agency in their decisions to migrate, and they will prefer to move if they consider the net benefit of moving to be larger than that of remaining in their current locations.[352] Among possible options of destinations both within and across their home countries' borders, their decision-making comes through "the largest net benefit" criteria; they choose the option which is ultimately the most beneficial for them.[353] Thus, migration may be a probable coping strategy in response to impacts of climate change. As Boano stated, "climate change itself is unlikely to be the sole or even the most important 'push factor' in [a] migration decision."[354]

C. The Complexity of Linking Migration Responses to Environmental Events

Some authors argue that environmental displacement is a complex and challenging issue not because the environmental impacts cannot be fully known; rather, the ways humans respond to such changes make the study complicated.[355] They identify faults in some of the statistical analysis. According to Black, the causal link postulated between an identified environmental event, such as drought, and human movement is not explicitly demonstrated.[356] In many cases, researchers calculate the extent of environmental displacement by simply considering the predicted environmental changes and the number of current or predicted population in the affected areas without applying any widely accepted methodology.[357] Their assumption is based merely on "common sense" that people will eventually decide to flee in the face of environmental disasters.[358] These generalized assumptions about "common sense" often fail to take into account human

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[350] RICHARD BLACK, REFUGEES, ENVIRONMENT AND DEVELOPMENT 28 (1998).
[351] Rafael Reuveny, *Climate Change–Induced Migration and Violent Conflict*, 26 POL. GEOGRAPHY 656, 658 (2007).
[352] *Id.*
[353] *Id.*
[354] BOANO, *supra* note 2, at 9.
[355] *See, e.g.*, CORLETT, *supra* note 44, at 14–15.
[356] *See* Black, *supra* note 157, at 8.
[357] Biermann & Boas, *supra* note 9, at 9 (noting that the number of people affected by climate change during a given time period depends on the assumed population growth rate).
[358] *See* Castles, *supr*a note 275, at 3.

reaction and adaptation to environmental change.[359] Thus it remains unclear whether and how many people at risk choose migration as the main strategy.[360]

Leaving aside the human response to impacts of environmental change, in some cases there is also a "lack of consideration of changes in human behavior leading to different adaptive practices."[361] There is always an obvious link between the quantity of environmentally displaced persons and the level of poverty in migrants' home areas.[362] Susceptibility to climate change mostly "depends on the extent to which [people] are dependent on natural resources and ecosystem[s]."[363] The more people are dependent on natural resources and the less they rely on economic or human capital, the more vulnerable they are to the impacts of climate change.[364] Consequently, they are at risk in environmental degradations due to climate change since these may affect declining natural resources.

However, some predictions do not consider the possibility of changes in human behavior and adaptation programs.[365] People may adapt to changed circumstances and become resilient with environmental changes, building dikes, inventing new agricultural processes, and improving relocation systems.[366] The Stern Review Report is clear in this respect and states that "[t]he exact number of people who will actually be displaced or forced to migrate will depend on the level of investment, planning and resources" that the government has to implement such strategies.[367] Apart from impacts of climate change to vulnerability of poor countries, a combination of poor socioeconomic conditions (including high debt levels, failing economies, a malfunctioning of the rule of law, poor governance, corruption, and transnational organized crime) and natural resource and space limitations (including population growth, ecosystem degradation, and competition for limited resources) aggravate the situation making it difficult for such states to adapt to climate change.[368] For example, small island states

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[359] *See* LONERGAN, *supra* note 171, at 11.
[360] Black, *supra* note 157, at 7–8; Castles, *supra* note 275, at 3.
[361] ADAMO, *supra* note 20, at 5.
[362] Ketel, *supra* note 27, at 1–2.
[363] Jon Barnett & W. Neil Adger, *Climate Change, Human Security and Violent Conflict*, 26 POL. GEOGRAPHY 639, 641 (2007).
[364] *Id.*
[365] *See* Biermann & Boas, *supra* note 9, at 9.
[366] *Id.*
[367] STERN REVIEW REPORT, *supra* note 7, at 112.
[368] McAdam & Saul, *supra* note 74, at 6; *see also* John Connell, *Environmental Change, Economic Development, and Emigration in Tuvalu*, 22 PAC. STUD. 1 (1999).

(such as Kiribati, Tuvalu, and the Maldives) are particularly more vulnerable and less resilient to impacts of climate change because of their small size, fragile economy, developmental inequality, and low adaptive capacity.[369] The costs involved for adaptation programs including building infrastructure and settlement protection, are a significant proportion of their gross domestic product ("GDP"), and are well beyond the financial means of most small island states.[370] Thus small island states are less able to mitigate or adapt to climatic changes and climatic impacts therefore disproportionately affect their people.

On the other hand, some states with financial and logistic resources might be able to adapt to changes caused by climatic shifts and adopt appropriate protection to mitigate the impacts of climate change by building sea dykes and embankments.[371] For example, the Netherlands, though situated below sea level, like Bangladesh, has better adaptive capacity due to an abundance of resources.[372] The Netherlands has built up huge capital resources which it can harness toward protection of its own people by raising the height of dykes or building new ones.[373] Conversely, Bangladesh and other deltaic and low-lying countries in the global south do not possess the same capital wealth.[374] Lack of extensive capital resources puts Bangladesh in a highly vulnerable position.[375]

D. Lack of Clear Definition of Environmental/Climate Change Migration

There is no internationally recognized term to date to define the people moved for environmental reasons.[376] Terms and concepts such as environmental migration, climate change-induced migration, ecological or environmental refugees, climate refugees, climate change migrants, and environmentally induced forced migrants are found scattered throughout the emerging literature.[377] The authors interpret these terms haphazardly

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[369] *See* Mimura et al., *supra* note 216, at 692–93.
[370] *Id.* at 694.
[371] McAdam & Saul, *supra* note 74, at 6.
[372] *See id.* n.37.
[373] *Id.*
[374] *See* Peter Custers, *Bangladesh: Climate Change as a Burning Political Issue*, NEW AGE (June 13, 2009), http://banglapraxis.wordpress.com/2009/06/13/bangladesh-climate-change-as-a-burning-political-issue.
[375] *See id.*
[376] Int'l Org. for Migration, *supra* note 76, at 4.
[377] Generally, persons forcibly displaced across borders for environmental reasons have been referred to as "environmental refugees" or "climate refugees." No existing legal instrument explicitly protects people who flee environmental threats. For a definition of that group,

based on their own concepts and the protection mechanisms they suggest.[378] The variety of terms interchangeably used by the researchers and policy-makers thwarts progress on the recognition of and legal protection for environmentally displaced persons.[379] Warner identifies two substantial points responsible for the failure to establish clear definitions of concepts and terms related to climate change-induced displacement.[380] First, the inherent difficulties in isolating environmental factors from other migration drivers make the conceptualization of the issue complex.[381] Second, "defining" climate change displacement creates obligations on the international community to adopt appropriate institutional and governance measures to address the problem.[382] The international community, and in particular developed countries, has yet to reach on consensus on recognition of this category of people.[383] Developed nations have strong reservations against "environmental migrants," as they fear that the concept would open the floodgate of migrants from developing and least developed countries ("LDC") to developed countries in the guise of "environmental migrants."[384]

However, the definition, adopted by consensus, serves an instrumental purpose in delimiting rights and obligations of displaced people.[385] After creating a definition, a legal and institutional framework can be constructed to relocate communities. Castles observes, "we cannot get around [the] definitional issue . . . easily, for definitions are crucial in guiding the policies of governments and international agencies towards mobile people."[386] This is also necessary in order to ensure coherence across regions and between populations.[387] Myers and Kent observe that "[t]here

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therefore, one must turn to academic literature, in which there is a lively theoretical debate. Most of those who study environmental migration discuss the broader class of environmental refugees rather than the more specific subset of climate change refugees. They use a variety of terms to refer to this group of people and its subcategories.

[378] *See, e.g.*, LACZKO & AGHAZARM, *supra* note 3, at 18–19.

[379] ACKETOFT, *supra* note 27, at 1, 3. This conclusion parallels Walter Kälin, who argues: "We should not be distracted by semantic discussions with little practical meaning about whether to call affected persons 'climate change refugees,' 'environmental migrants,' or something else. Instead what is needed is a thorough analysis of the different contexts and forms natural disaster induced displacement can take." Kälin, *supra* note 188.

[380] WARNER, ASSESSING INSTITUTIONAL AND GOVERNANCE NEED, *supra* note 191, at 1, 2.

[381] *Id.* at 1.

[382] *Id.* at 2.

[383] *See* BROWN, *supra* note 148, at 14.

[384] *See id.*

[385] McAdam, *supra* note 214, at 7.

[386] Castles, *supra* note 275, at 9.

[387] *Cf.* McAdam, *supra* note 214, at 7 ("The absence of definition may allow for more flexible responses—ad hoc responses within a formalized framework. It may permit States a limited

is need of a definition that (a) is easily understood, (b) commands a wide measure of agreement, (c) is capable of ready documentation and quantification, and (d) proves acceptable to policy makers and planners as well as scientific analysts."[388] The lack of agreement over a consistent definition has further complicated the complex nature of environmental migration.

V. THE CLIMATE CHANGE, ENVIRONMENT, AND MIGRATION NEXUS: COMPLEXITY VERSUS REALITY AND EQUITY

Most of the arguments about the multi-causality of environmental migration are based on the notion that it is difficult to distinguish between migrants driven by environmental factors and those forced by political and socioeconomic problems.[389] They argue that "poverty, scarcity of natural resources, and political conflict [may] influence the nexus between environmental stressors and migration."[390] However, there are many instances where there is an interrelationship between poverty and depletion of natural resources due to environmental degradations, especially when the community is dependent on natural resources for their livelihood.[391] Thus, "[e]nvironmental degradation and resource depletion play a contributing role in affecting population movement, as they are often filtered through contexts of poverty, food deficiency, social inequity and personal insecurity."[392] The result is that people can be forced to leave their traditional habitat, temporarily or permanently, because of a lack of access to natural resources and/or an environmental disruption that jeopardized their existence and seriously affected the quality of their life.[393]

According to Myers, "people who migrate because they suffer outright poverty are also frequently driven by root factors of environmental destitution."[394] In any case, environmental degradation and depletion of natural resources play a significant role in determining economic

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discretion, either by failing to define the term or by giving it a particular meaning in particular instruments. It is not yet clear whether a universally applicable definition of those displaced by climate change is necessary or desirable.").

[388] MYERS & KENT, *supra* note 290, at 17.

[389] *See, e.g.*, LACZKO & AGHAZARM, *supra* note 3, at 17.

[390] *See, e.g.*, KNIVETON ET AL., *supra* note 280, at 32.

[391] Robert Stojanov, *Environmental Migration—How Can Be Estimated and Predicted*, *in* GLOBALIZATION AND ITS IMPACT TO SOCIETY, REGIONS AND STATES 302–11 (2006), *available at* http://www.vos.cz/imdr/documents/EM-How_can_be_predicted.pdf.

[392] *Id.* at 302.

[393] *Id.* at 304.

[394] *See* Myers, *supra* note 278, at 2.

development or vulnerability and also in migration decisions.[395] "Myers's estimates of 'environmental refugees' are driven by three major sources: population growth, sea-level rise and an increase in extreme weather events."[396] Developing countries suffer from the impacts of climate change, as the population growth is very high and they are already vulnerable to environmental change due to a lack of good governance and prevailing developmental inequality.[397] "[P]eople living in densely populated, low lying regions such as the Nile Delta, the east coast of China, and Bangladesh" are likely to face forced displacement due to the combined impact of sea level rise, increased extreme weather events, flooding, and the salination of soil.[398]

Of course, Myers recognizes the multiplicity of factors working behind environmental migration.[399] There exist two types of displacement populations at opposite ends of the spectrum.[400] One is driven mainly by environmental problems; the other, though affected by environment, is mainly moved by economic reasons, for better opportunities or lifestyle.[401]

Indeed, "migration always involves a multiplicity of causation" and is the outcome of the complex interaction of many environmental and other socioeconomic factors.[402] The decision of traditional refugees who flee due to persecution also depends on various other factors. The "fear of persecution" in traditional refugee law may arise from socioeconomic factors such as poverty, impoverishment, lack of good governance, and social and political instability.[403] A refugee can invoke protection even though the chance of "well founded fear of persecution" is less than fifty percent.[404] The UNHCR Handbook states:

> In general, the applicant's fear should be considered well-founded if he can establish, to a reasonable degree, that his

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[395] Stojanov, *supra* note 38, at 82.
[396] MORRISSEY, *supra* note 38, at 4; *see also* Myers, *supra* note 292, at 609.
[397] MORRISSEY, *supra* note 38, at 4.
[398] *Id.*
[399] Myers, *supra* note 292, at 610.
[400] *Id.*
[401] *Id.*
[402] Gregory S. McCue, *Environmental Refugees: Applying International Environmental Law to Involuntary Migration*, 6 GEO. INT'L ENVTL. L. REV. 151, 157 (1993).
[403] *See, e.g.*, INS v. Cardoza-Fonseca, 480 U.S. 421, 431 (1987); Chan v. Minister for Immigration & Ethnic Affairs (1989) 169 CLR 379, 397 (Austl.).
[404] *Cardoza-Fonseca*, 480 U.S. at 431; Chan v. Minister for Immigration & Ethnic Affairs (1989) 169 CLR 379, 397 (Austl.).

> continued stay in his country of origin has become intolerable to him for the reasons stated in the definition, or would for the same reasons be intolerable if he returned there.[405]

Environmental migration should not be treated in a different and exceptional way.[406] No one single environmental factor motivates people to migrate.[407] Myriad factors can work simultaneously to inspire movement.[408] Thus, it is difficult to distinguish between migrants driven by environmental factors and migrants driven by other socioeconomic problems.[409] It is not justified to ignore the protection of environmental migration due to the existence of the problem of multi-causality.[410] This Article argues for protection of those migrants for whom the environment is the primary cause of movement. The causes of environmental displacement are complex and interdependent. Generally, the concept of "environmental disruption" is defined widely in the definitions of El-Hinnawi, Jacobson, and Myers.[411] Many scholars argue that the concept of environmental refugees fails to explain in which way exactly environmental factors force people to migrate.[412] Other scholars have limited the environmental factors to certain environmental degradations that directly displace people. For example, Biermann and Boas propose a restrictive notion of environmental degradations as a result of climate change to arrive at a conceptualization of "climate refugee" which is "analytically valuable and politically acceptable and meaningful for a global governance regime."[413] They exclude certain types of environmental displacement from their definition of "climate refugee."[414] Biermann and Boas exclude the following categories of people from their protection regime: (1) those climate migrants who have no apparently credible cause for forced migration, or if any, that is only marginal (such

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[405] UNITED NATIONS HIGH COMM'R FOR REFUGEES, HANDBOOK ON PROCEDURES AND CRITERIA FOR DETERMINING REFUGEE STATUS UNDER THE 1951 CONVENTION AND THE 1967 PROTOCOL RELATING TO THE STATUS OF REFUGEES para. 42 (1992).
[406] MYERS & KENT, *supra* note 290, at 29.
[407] *Id.*
[408] *Id.*
[409] *Id.* at 17.
[410] Stephen Castles, *Afterword: What Now: Climate-Induced Displacement After Copenhagen*, *in* CLIMATE CHANGE AND DISPLACEMENT: MULTIDISCIPLINARY PERSPECTIVES 244 (Jane McAdam ed., 2010).
[411] *See, e.g.*, EL-HINNAWI, *supra* note 161, at 4; Myers, *supra* note 278, at 752.
[412] *See* Perch-Nielsen et al., *supra* note 89, at 376.
[413] Biermann & Boas, *supra* note 9, at 4.
[414] *Id.*

as heat waves and the spread of tropical diseases); (2) people who are displaced due to factors related to the mitigation of, or adaptation to, climate change; (3) migration related to other types of environmental degradation (such as industrial accidents or disasters unrelated to human activities, such as volcano eruptions); and (4) secondary, or indirect, impacts of climate change (such as conflicts over diminishing natural resources).[415] Astri Suhrke divides her own discussion into migration stimulated by "deforestation, rising sea levels, desertification and drought, land degradation, and . . . water and air degradation."[416]

Although science cannot determine specifically if climate change caused a particular environmental event, the latest IPCC Report enumerates a list of natural events that it describes as "consistent with" anthropogenic climate change, including warmer temperatures, more frequent droughts, more intense storms, and rising sea levels.[417] The IPCC describes the occurrence of higher temperatures as "virtually certain," and the other changes listed above as "very likely" or "likely."[418] The IPCC identifies (a) increased incidence of extreme high sea level (excluding tsunamis); (b) intense tropical cyclone activity increases; and (c) areas affected by drought increases, as "likely," that is, with more than sixty-six percent probability.[419] Climate change science continues to evolve to determine more accurately the impacts of climate change on human life.[420] The obvious link between these impacts and human movement is established by various reports and studies.

Notwithstanding the existence of multi-causality in environmental migration, there are certain types of population displacements where people are forced to move from their habitat due to loss of land, resources, or infrastructure. Indeed, there are some locales and communities, especially in rural areas, that are exclusively dependent upon the environment for their sustenance; they are often identified as amongst

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[415] *See id.*

[416] ASTRI SUHRKE, AM. ACAD. OF ARTS & SCI., PRESSURE POINTS: ENVIRONMENTAL DEGRADATION, MIGRATION AND CONFLICT 11–13 (1993).

[417] IPCC: SUMMARY FOR POLICYMAKERS (WG-II), *supra* note 35, at 18.

[418] *See id.* According to the IPCC standards, "virtually certain" means more than a ninety-nine percent probability; "very likely" means more than ninety percent probability; and "likely" means more than sixty-six percent probability. *Id.* at 21.

[419] *See id.* According to the IPCC standards, "virtually certain" means more than a ninety-nine percent probability; "very likely," means more than ninety percent probability; and "likely" means more than sixty-six percent probability. *Id.* at 21.

[420] The IPCC is writing its fifth assessment report. *Home*, IPCC, http://www.ipcc.ch/ (last visited Mar. 16, 2012).

the most vulnerable to climate change.[421] For these people, ecology is indistinguishable from economy.[422] In this type of displacement, push factors relating to their homes are more important than pull factors such as social and economic conditions.[423]

There are two important features of this type of environmental displacement: first, the environment in a particular area has been degraded in such a way that human life is impossible, and second, that environmental degradation is directly responsible for human movement.[424] For example, drought, one of the prominent impacts of climate change, makes it impossible for farmers to sustain their livelihoods.[425] Consequently, they are compelled to move elsewhere as they can no longer continue lives at their original homes because of forces beyond their control.[426] They do not freely make the choice to leave their communities "in search of better life—a higher income or improved access to services" like economic migrants.[427] Rather, they leave as life becomes impossible in their home communities.[428] But the question of habitability should not remain as "purely subjective."[429] Humans have attained the capacity to adapt to the most extreme environmental conditions; be it "amid ice and darkness or in the glare of desert heat."[430] As a general rule, people do not want to leave their traditional homelands.[431] If they are compelled to leave their homes, people usually prefer to return as soon as possible.[432] Measuring compulsion and assessing when a particular place becomes uninhabitable should be founded on objective criteria based on the questions as suggested by Corlett:

> How do you determine and measure climate related factors leading to displacement? How will they be separated from other factors, including other environmental factors, which may lead to dislocation? At what point does a physical

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[421] *See* Burton & Hodgkinson, *supra* note 274, at 6.
[422] *See* Myers, *supra* note 278, at 752.
[423] ADAMO, *supra* note 20, at 14.
[424] *See* Bates, *supra* note 229, at 468–69.
[425] Ferris, *supra* note 320.
[426] *Id.*
[427] *Id.*
[428] *Id.*
[429] *See* CORLETT, *supra* note 44, at 50.
[430] *Id.*
[431] *See, e.g.*, *id.*
[432] *Id.*

> environment become so degraded that it is no longer capable of sustaining a human existence?[433]

This Article proposes that there should be a protection mechanism for four main climate change-related displacement scenarios, where displacement is caused by: (a) global warming and sea level rise, i.e., sinking of coastal zones and possible total submersion of low-lying island states; (b) weather-related disasters, such as hurricanes, flooding, drought, desertification and melting of glaciers; (c) depletion of natural resources due to gradual environmental deterioration; and (d) increased slow-onset disaster risks resulting in relocation of people from high-risk zones.

It must be conceded that it is not very easy to draw a clear distinction between voluntary and forced movement.[434] Sometimes, people face refugee-like situations where the victim has limited control over the whole process and a high degree of vulnerability.[435] On the other hand, there are some occasions where people face migrant-like situations where they have greater control over the process and less vulnerability even though people are moving in response to deteriorating situations.[436] Between these extremes, environment-induced displacement would be characterized as voluntary, with displaced person having "more control over timing and direction and less vulnerability than refugees have, but less control and more vulnerability than migrants."[437]

CONCLUSION

The environment, climate change, and migration nexus is a complex one.[438] Yet emerging scientific studies confirm that climate change has a substantial role in human displacement.[439] "Climate change, in itself, does not directly displace people but it produces environmental effects that make it difficult" or impossible for people to sustain their livelihoods.[440] Sea level rise caused by glacial melt is likely to cause flooding of coastal areas.[441] People may be compelled to move as the low-lying coastal areas

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[433] *Id.*
[434] *See, e.g.*, Bates, *supra* note 229, at 467.
[435] *Id.* at 473.
[436] *See* ADAMO, supra note 20, at 14.
[437] *Id.*
[438] *See, e.g.*, LACZKO & AGHAZARM, *supra* note 3, at 13.
[439] *See, e.g.*, Warner, *Global Environmental Change and Migration*, *supra* note 189, at 402.
[440] LACZKO & AGHAZARM, *supra* note 3, at 248; *see also* Ferris, *supra* note 320.
[441] Nils Petter Gleditsch et al., *Climate Change and Conflict: The Migration Link* 4–5 (Coping with Crisis Working Paper Series, Int'l Peace Acad., 2007), *available at* http://www.undp.org/cpr/iasc/content/docs/Jan08_Links/Doc_3.pdf.

may be contaminated with saline water and thus affect human habitats.[442] Scarcity of water resources due to drought and desertification may motivate people to migrate from "unproductive and water-scarce areas" to safer places.[443] The changed and variable weather patterns "lead to dramatic climate events such as hurricanes, typhoons," and flooding, which may also affect human habitat.[444]

"The simple fact is," as Oli Brown observes, that "nobody really knows with any certainty what climate change will mean for human population distribution."[445] Environmental migration cannot be predicted with much accuracy or certainty due to several factors. Laczko and Aghazarm identify four important reasons for this uncertainty.[446]

First, there is limited reliable data that confirms the exact number of people to be displaced due to climate change "in developing countries which are likely to be most vulnerable to climate change."[447]

Second, a variety of factors often guide the decision to migrate, of which environmental change is only one.[448] It is difficult to disaggregate the role of climate change from other economic, political, and social factors which also contribute to triggering migration.[449] The uncertainty arises partly due to disagreement among experts on the role of the environment in inducing migration.[450] The wide variety of estimates of the number of displaced persons offers an "inadequate basis for formulating policies."[451]

Third, there is an absence of an adequate definition for what constitutes a climate change refugee in international law.[452] The disagreement on the role of the environment in inducing migration leads to further disagreement over terminology.[453] That is why, still, there is no consensus on the definition of climate or environmental migration among researchers.[454] How the people who move based fully or partially on environmental reasons are characterized "as economic migrants, migrant workers, de facto

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[442] *See id.* at 4.
[443] *Id.*
[444] *Id.*
[445] BROWN, *supra* note 273, at 6.
[446] LACZKO & AZAGHARM, *supra* note 3, at 20.
[447] *Id.*
[448] *Id.* at 20; BOANO, *supra* note 2, at 15.
[449] LACZKO & AZAGHARM, *supra* note 3, at 20.
[450] *See id.* at 19.
[451] BOANO ET AL., *supra* note 95, at 1.
[452] LACZKO & AZAGHARM, *supra* note 3, at 20.
[453] *See id.* at 19.
[454] *See* Biermann & Boas, *supra* note 9, at 9.

refugees, or as some hybrid" carries implications for estimates.[455] Researchers use different terminology and definitions in their studies, which leads to inconsistencies in results.[456] Many researchers interpret the concepts of climate or environmental refugees widely; this, as Suhrke correctly observes, "invite[s] large numbers."[457] "Myers himself admits that his estimate, although calculated from the best available [and limited] data, required some 'heroic extrapolations.'"[458]

Fourth, no one can predict the impacts of environmental change with certainty.[459] The "[e]xact numbers remain controversial, partly because scientists cannot predict with precision how quickly sea levels will rise" and where and how the effects of climate change will manifest.[460] Moreover, apart from climatic changes, the calculation of numbers depends on "different methods of projecting displacement; . . . [and] unknowable human variables such as strategies to mitigate, adapt to, and cope with the effects of climate change in particular localities."[461] Still climate change science has not developed to reach the capacity to measure the "impact of individual choice, the potential for international action, and the variability of future emissions and meteorological scenarios."[462]

However, regardless of the lack of precise estimates and questions of geographic distribution, there is widespread acceptance that environmental degradation and stresses as a result of global climate change play an increasingly significant role in causing or intensifying "major forced displacements" over time.[463] The scope and scale of such flows, both internally and across national boundaries, is expected to mount drastically in coming years.[464] Thus environmental displacement, as reported in many studies and scientific reports, has rapidly been emerging as a delicate problem involving international peace and security which deserves the attention

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[455] McAdam & Saul, *supra* note 74, at 4.
[456] *See* Biermann & Boas, *supra* note 9, at 9.
[457] Suhrke, *supra* note 314, at 478.
[458] BROWN, *supra* note 273, at 6.
[459] *See* LACZKO & AZAGHARM, *supra* note 3, at 20.
[460] McAdam & Saul, *supra* note 74, at 4.
[461] *Id*.
[462] LACZKO & AZAGHARM, *supra* note 3, at 20.
[463] PIGUET, *supra* note 67, at 8; *see also* Nurit Kliot, *Environmentally Induced Population Movements: Their Complex Sources and Consequences: A Critical Review*, *in* ENVIRONMENTAL CHANGE AND ITS IMPLICATIONS FOR POPULATION MIGRATION 75 (Jon D. Unruh et al. eds., 2004).
[464] Int'l Org. For Migration, *supra* note 76, at 1; *see also* WARNER, IN SEARCH OF SHELTER, *supra* note 45, at iv.

of the international community.[465] Once this widely agreed-upon point is accepted, the role of climate change in population movement should not be ignored.[466] Academic and political discourse on the issue of environmental refugees should not be exclusively limited to the highly contentious debate over the potential numbers of "climate change displaced persons."[467]

It is true that "[t]here are complex linkages between climate change and human mobility."[468] Nonetheless the existence of a clear link between anthropogenic climate change and consequent displacement has been increasingly recognized.[469] However, the tools of analysis are insufficiently sophisticated to determine who will migrate, when, and why.[470] Moreover, there is no accepted form of methodology for calculating the number of climate migrants due to the problem of multi-causality.[471] This debate and confusion ultimately raise the question to what extent it is possible to consider specific forms of protection for a migratory process that does not have a clearly established "cause."

But the problem of multi-causality should not be an excuse to ignore the necessity of developing a protection framework for climate-induced displacement.[472] Even the existing refugee structure itself "is not immune from this causal complexity."[473] Indeed, it is impractical to assess each individual against the Refugee Convention definition of a refugee, especially in cases involving massive numbers of forced migrants.[474] Instead, the current refugee framework, including UNHCR and other international organizations, treats a large number of people who flee their homes because of persecution, war, and famine as "persons of concern" and extends protection and assistance.[475]

Given the uncertainty in predicting exact numbers of climate change displacement and the problem of multi-causality of environmental displacement, national governments and the international community should develop norms and a framework for the protection of the rights

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[465] *See* Williams, *supra* note 67, at 506.
[466] STEVE LONERGAN & ASHOK SWAIN, AVISO, ENVIRONMENTAL DEGRADATION AND POPULATION DISPLACEMENT 2 (1999).
[467] Burton & Hodgkinson, *supra* note 274, at 3.
[468] Inter-Agency Standing Comm., *supra* note 180, at1; KOLMANNSKOG, *supra* note 40, at15.
[469] *See* KOLMANNSKOG, *supra* note 272, at 5.
[470] *See* Burton & Hodgkinson, *supra* note 274, at 6.
[471] *See, e.g.*, BOANO ET AL., *supra* note 95, at 12.
[472] *See* Castles, *supra* note 410, at 244.
[473] CORLETT, *supra* note 44, at 48.
[474] *Id.* at 48–49.
[475] *Id.* at 49.

of the environmental migrants.[476] Such norms and a framework will help to build consensus on a specific causal relationship as well as a uniform definition.[477] The framework should also establish a sophisticated institutional architecture to integrate complex issues of causality and evolving science into decision-making with respect to climate change migration based on objective, rather than subjective, criteria.[478] The international community, far more crucially, should employ all possible efforts for the assessment of the capacity of our institutions and normative frameworks to respond to the needs of the vulnerable.

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[476] *See* Roger Zetter, *The Role of Legal and Normative Frameworks for the Protection of Environmentally Displaced People*, *in* FRANK LACZKO & CHRISTINE AGHAZARM, MIGRATION, ENVIRONMENT AND CLIMATE CHANGE: ASSESSING THE EVIDENCE 395 (2009).
[477] *See id.*
[478] *See, e.g.*, David Hodgkinson et al., *Copenhagen, Climate Change 'Refugees' and the Need for a Global Agreement*, 4 PUB. POL'Y 155, 163 (2009).