REFUGEE STUDIES CENTRE

BACKGROUND PAPER

Environmental Change and Forced Migration

A State of the Art Review

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Contents

1 Introduction

Interest in the link between environmental change and human migration has grown in the last five years, principally due to the mounting body of evidence on the likely impacts of anthropogenic climate change. This growing concern has led to widespread discussion of the potential for climate change to induce population movement. The drivers of such movement include the inundation of settled land due to sea-level rise, accelerated desertification among currently cultivated lands (leading to migration in search for food), and more frequent and severe climatic disasters such as drought, floods and tropical storms.

The political nature of debates pertaining to issues of environment and migration has lead to a highly politicised discussion regarding the potential existence of 'environmental refugees.' While attention to this debate has grown rapidly in recent years, it is worth noting that the term 'environmental refugee' has been in use since the 1970s, well before the climate change debate was established. General confusion over the exact meaning of the terms 'refugee' and 'environment' as well as the heated political nature of the debate on issues of environment and asylum has resulted in a variety of often highly contradictory view points on the topic of environmental change and migration across academic, policy and popular literature. Foremost among these debates is the degree to which 'environmental refugees' -- and indeed the general relationship between environmental change and migration -- should occupy a position of priority in policy discussions.

This paper was prepared to compliment and develop earlier work of the Refugee Studies Centre on this subject (Boano, Zetter and Morris 2009) and to provide background analysis to the recent RSC Workshop on 'Environmental Change and Displacement: Assessing the Evidence and Developing Norms for Response' held from 8-9 January 2009.

The aim of this paper is three-fold. Firstly, it seeks to outline the current debate on the relationship between environmental change and migration. Secondly, it outlines and interrogates the existing empirical data on the relationship between environmental change and migration. Finally, it highlights some existing gaps in the literature and considers methodological issues, making some suggestions for future exploration of the issue.

2 Environmental 'refugees'

Black (2001:2) notes that the term 'environmental refugee' was first formally used, in the 1970s, by Lester Brown of the World Watch Institute. This usage came out of a period when literature on the environment was dominated by the neo-Malthusian writings of groups such as The Club of Rome, whose lily pad metaphors (Meadows, D. and Meadows, D. 1972), combined with the fears of resource scarcity that were generated by the OPEC oil crisis of 1973, re-invigorated discussions in which migration was seen to result from population growth exceeding environmental limits. The term was subsequently used in a 1984 briefing document from the London-based International Institute for Environment and Development (Black 1998, Kibreab 1997, Renaud, Bogardi et al. 2007) and entered common usage in the wake of a 1985 UNEP policy paper by Essam El-Hinnawi, published in 1985.

El-Hinnawi's (1985) paper not only brought the debate around environmental refugees to prominence but also undertook two other major tasks which proved important in framing the debate on environmental refugees. Firstly the paper provided a formal definition of an 'environmental refugee,' an issue that continues to raise its head in the debate today. Secondly, it recognised the potential for heterogeneity amongst environmentally displaced persons and as such sought to generate a number of typologies of environmentally motivated migrants.

As such, El-Hinnawi's work is often taken as the starting point for work on the 'environmental refugee.' Based on this literature other authors began to elaborate on the relationship between environmental change and human mobility. Jacobson (1988) sought to operationalise El-Hinnawi's definition and produced one of the first (and most cited) estimates of the number of existing environmental refugees. Jacobsen placed the figure at 10 million after assessing the number of people thought to have been displaced by the drought that affected much of the African Sahel in the early to mid-1980s.

Jacobson's (1988) paper is notable not only for the fact that it attempts to apply El-Hinnawi's definition and provides an estimate of the number of environmental refugees in existence at the time but also because it undertook the important act of suggesting the potential for climate change to generate future flows of 'environmental refugees.' This paper went beyond the simple and highly criticised neo-Malthusian approach and invoked the growing body of evidence on climate change in the debate on 'environmental refugees'. By applying the powerful discourse of climate science and global climate models to the debate on 'environmental refugees,' Jacobsen introduced an empirical discourse into a discussion which until then had remained entirely theoretical.

With theories of climate change growing in credence and with climate scientists putting forward ever more alarming predictions regarding the potential impacts of such change, a growing number of authors put forward estimates of both the existing number of 'environmental refugees' and of potential future refugee flows in a warmer world. Norman Myers has been one of the most prolific writers on the topic. Over the period spanning 1989 to 2005 he has written a selection of papers and books that deal directly with the topic of environmental refugees, and has also commented on the broader links between environmental change and migration through a number of peripheral papers. He is notable for proposing massive numbers of environmental refugees, scaling up Jacobson's figure of existing environmental refugees from 10 million to 25 million – greater than the current number of recognised 'convention refugees' – and placing future estimates as high as 200 million (Myers 1993, Myers, Kent 1995, Myers 1997, Myers 2002, Myers 2005).

Myers' estimates of 'environmental refugees' are driven by three major sources: population growth, sea-level rise and an increase in extreme weather events (Myers 1993, 1997 and 2002). Myers' scenario relies on Malthusian logic infused with theories of environmental change. As such he cites predicted impacts of climate change and predictions for population growth to paint a picture of an increasingly large and climate-stressed population that is reliant on an ever-dwindling resource base. By Myers' account these problems will be most acute in the developing world where fertility rates are highest and where developmental inequalities have already generated greater vulnerability to environmental change.

Myers also comments on how the combined impact of sea-level rise, increased extreme weather events, and subsidence (a result of ground water extraction) will exacerbate flooding and the salination of soils. This, he argues, will result in the forceful displacement of people living in densely populated, low lying regions such as the Nile Delta, the east coast of China, and Bangladesh (Myers, Kent 1995). Myers also warns of the potential impacts in existing refugee producing areas, such as the African Sahel, where he claims the increased frequency and intensity of droughts and floods combined with increasing population pressure will continue to drive refugee flows (Myers, Kent 1995).

Work by El-Hinnawi, along with Jacobson's figures (1988), not only drew the attention of authors citing massive figures for environmental refugees, but also of authors working in migration studies who sought to contrast claims regarding 'environmental refugees' with their experiences from the field of migration. Such authors include McGregor (1994) and Bilsborrow (1992). These authors are critical of the simplistic conceptualisation of the 'environmental refugee' for the way in which it privileges environment as the sole driver of migration (Bilsborrow 1992) and implicitly denies the capacity of individuals to respond to a changing environment, thereby denying human agency (McGregor 1994).

Having said this, however, many authors still acknowledge the notion of the 'environmental refugee' but argue that such a title is only really appropriate for those migrants fleeing drastic environmental changes (Bilsborrow 1992).

In the early to mid-nineties the literature on the link between environmental change and human mobility shifts from a state of alarm to focus on how best to conceive of the 'environmental refugee', thereby distinguishing between the different types of movements that may occur as a response to environmental change.

Suhrke's (1993 and 1994) work identifies the formation of this polarised debate and is notable particularly for its attempts to make sense of the divergent views through the identification of what she terms the 'maximilist' and 'minimalist' schools on 'environmental refugees.' According to Suhrke the maximilist school contained those authors such as El-Hinnawi who invoke notions of large numbers of existing environmental refugees and who cite more to come (Myers, although not cited by Suhrke, would certainly fall into this school).

Suhrke (1993) contrasted the maximilist school with the 'minimalist school' in which she included authors such as Bilsborrow (1992). These authors highlight the complexity of the interaction between environmental and social systems and thus question the assumption of a direct causal link between environmental change and migration. Suhrke locates herself in the minimalist camp, arguing that migration is not mono-causal. Having made this point, however, she does note that the lack of empirical data on 'environmental refugees' is no reason to dismiss the thesis out of hand For Suhrke (1994) the dearth of empirics on the topic is a result of those processes of environmental change, which act to generate migration, not easily lending themselves to quantification. This in turn renders regression analysis as a means for identifying causal relationships impossible. As such, Suhrke concludes by advocating for more work on this topic (Suhrke 1994).

At this point we can recognise a change in the debate on environmental refugees. Interest in the maximilist school begins to wane as a result of the problem pointed out by Suhrke (1993): that a limited ability to quantify the process of environmental change that drive migration, limits the use of regression analysis and thus denies the argument of a direct relationship between environmental change and migration any scientific legitimacy. As a result far less literature comes out of the maximilist school, save from Myers who continues to cite enormous figures for environmental refugees without addressing the criticisms put forward by the minimalist school. The claims of the maximilist school are also lent credence by findings from the broader scientific community, who continue to generate ever greater consensus on the scale and inevitability of climate-induced environmental change (Hugo 1996).

As such, the authors in the minimalist school, unable to deny the concerning evidence on climate change, yet aware of the problems of over-simplifying the relationship between environmental change and migration, begin to focus less on predicting the numbers of current and future environmental refugees and rather focus on how to best conceive of the relationship between environment, migration and refugee-hood. A major aim within this discussion becomes how to distinguish environmental change from other factors driving migration and how to differentiate between forced and voluntary migrants with environmental motivations.

3 Conceiving the environmental refugee

Authors seeking to formulate an appropriate conception of the relationship between environmental change and migration tend to use El-Hinnawi's (1985) typologies as a starting point. Suhrke (1993), building on the opinion of Bilsborrow (1992), is one of the first to suggest that not all migrants responding to environmental stimuli might be appropriately termed 'environmental refugees'. For Bilsborrow (1992) the issue was not that the legal definition of a refugee failed to make allowances for environmental forcing (an issue that arises later in this work) but rather with the conceptual implications of homogenising all environmentally motivated migrants. Thus, Suhrke argues that individuals who migrate temporarily in response to a cyclical environmental change, and for whom migration has always proved a means of securing a livelihood, are not appropriately conceived of as refugees.

In response to Suhrke's work authors generally attempt to distinguish environmental refugees from voluntary migrants for whom the environment plays a role in their decision to move. The vast majority of this literature makes the distinction reliant on the occurrence of a dramatic shift in environmental quality (Suhrke 1993, Bates 2002). For Suhrke (1993) the distinction between an environmental refugee and a voluntary migrant is based on the degree to which migrants seem able to relocate in advance of deteriorating environmental conditions. Those who act pre-emptively are labelled 'migrants' while those who leave only once conditions can no longer sustain their livelihoods are 'environmental refugees.'

Hugo (1996) expands on this approach. Writing within the minimalist school, he takes it as given that environmental change can act coercively to generate migration. As such, he puts forward a conception of refugee-hood based on the degree of choice and/or coercion in the migrant's decision to move (Hugo 1996). To this end he invokes the use of a 'continuum of choice' to describe the difference between a voluntary and an involuntary migrant. According to Hugo, at one end of the continuum the choice and will of the migrant is the overwhelmingly decisive element encouraging people to move. At the other, migrants are faced with death at the hands of a hostile and degraded environment if they remain in their present place of residence (Hugo 1996). Like Suhrke (1993), Hugo (1996) understands choice in terms of the degree to which a potential migrant can move pre-emptively. In this respect he cites work by Kunz (1973) describing 'kinetic refugees' in order to distinguish between pre-emptive 'migrants' and responsive 'refugees.'

Bates (2002) continues in this vein by implicitly agreeing that environmental change is capable of driving migration and similarly invokes the concept of a continuum of choice to differentiate between types of environmentally motivated migrants. Bates' continuum is comprised of three categories. Those 'involuntary migrants,' for whom the change in environment has been so drastic that a failure to migrate would result in death, she terms 'refugees.' Those 'compelled' by environmental change she terms 'environmental migrants,' and those who move 'voluntarily' she terms 'migrants.'

Bates (2002) also adds another level of sophistication to her conception as she attempts to make greater sense of the ways in which environmental change induces migration by generating typologies of environmental disruption based on the nature of the change in the environment: its origin (natural or technological), its duration (acute or gradual), and the degree to which migration is a planned outcome of the disruption (intentional or not) (Bates 2002).

Despite a concerted effort by migration scholars to accurately theorise the mechanics of the relationship between environmental change and migration writing on the subject, during the middle- to late- 1990's, becomes increasingly polarised. Two authors find themselves at the forefront of this polarised debate. The first, Norman Myers, is mentioned above as an author who throughout the 1990s continued to publish alarming figures on environmental refugees in spite of the criticisms levelled at his work by the minimalist school. The other is Richard Black, who in 1998 and 2001 produced radical work from within the minimalist school which sought to fundamentally undermine the environmental refugee thesis. Indeed, Black's (2001) work was titled nothing less than 'Environmental refugees: Myth or reality?'

This clash of approaches was alarming for the field, for as Castles (2002) points out, it seems inappropriate that two such divergent and compelling viewpoints should exist together within the peer reviewed literature. In order to clarify how such a situation came to be, the following section steps back from the immediate discussion of 'environmental refugees' to comment briefly on some complimentary literature and on the broader political context of the time.

4 The politicisation of terms

An understanding of the broader political context in which the debate on environmental refugees was, and is, taking place is important for a comprehensive understanding of the divergent viewpoints on the subject. As mentioned above, the growing publication of scientific evidence on climate change broadly speaking has played a crucial role in keeping the issue of environmental refugees in the academic and popular spotlight, in spite of the lack of concrete empirical evidence on the subject. Of particular importance has been the growing body of evidence that showed climate change to have anthropogenic causes.

This link generated alarm amongst the environmentally and socially conscious left that actions in the Global North would unquestionably result in the impoverishment of millions in the Global South. As such, popular discourse on environmental refugee-hood has lead to a proliferation of popular writing on the topic. At times, the term 'environmental refugee' has been replaced with the term 'climate refugee' (Friends of the Earth 2008) and in the most extreme cases 'climate justice' groups have spoken of 'climate genocide' (Conisbee, Simms 2003, Christian Aid 2008). These groups have all applied the Malthusian logic found in Myers' work and many have unquestioningly cited his large figures as a justification for their concerns.

It is worth noting that the emotive use of the term 'environmental refugee' is not a new phenomenon that only came about with the growth of evidence on climate change. Initial work on the topic was produced largely by environmental scholars, while specialists in migration initially showed little interest in their findings (McGregor 1994). It is also notable that around the time that the term 'environmental refugee' came into use, the environmental lobby was dominated by the conservation paradigm, and the emotive notion of 'environmental refugees' was very likely employed to stir up support for increased efforts at conservation and environmental protection. Indications of this come from Jacobson's (1988) work in which she argues that the growing number of environmentally motivated migrants is evidence that the world is a less habitable place, and comments that the rising number of environmental refugees represents the best available measure of changes in the earth's physical conditions (Jacobson 1998).

Beyond the emotive power of the term 'environmental refugee' to tap into the public's social conscience, other authors have exploited the connotations of the term 'refugee' with conflict to link concerns about the environment to those of security through a discourse in which environmental scarcity is hypothesised to drive conflict (Myers 2005, O'Lear 1997, Kaplan 1994). This discussion has even less empirical basis than the work on the linkages between environmental change and migration yet it constitutes an important part of the debate on 'environmental refugees'. As such, its contribution will be assessed later in this paper.

Thus it would appear that the environmental lobby has for a long time stoked the political fire on migration for the ends of environmental protection. At the same time however important changes were also taking place in popular and policy discussion on issues of asylum and migration. The waning of the cold war and the fall of the Berlin Wall in 1989, increased the numbers of migrants and asylum seekers from the Global South arriving in the Global North. Improvements in transport increased the numbers of such migrants while their racial distinctiveness made them highly visible.

As a result, issues of asylum and migration in the Global North were driven to public prominence by a discourse of overwhelming numbers of foreigners, compromised sovereignty, and welfare cheats. In this context the anti-asylum lobby began to use the notion of 'environmental refugees' to advocate for greater restrictionism (McGregor 1994). In this case lobbyists used the notion of environmental collapse as a warning against allowing too many people into the Global North, as such an influx of people, fleeing environmental collapse in the South, would, it was argued, lead to a similar collapse in countries of the North (O'Lear 1997).

Additionally, as Black (2001) points out, anti-asylum lobbyists used the discourse on environmental refugees to strengthen the discourse on 'bogus asylum seekers.' This argument claimed that the majority of asylum seekers arriving in the North were actually environmental refugees and as such had no claim to asylum given the conditions of the 1951 convention. Thus the discourse on environmental refugees was used by both anti-asylum lobbyists to increase border restrictions, and by national governments to shirk their international responsibilities to asylum seekers.

As a result a number of authors, worried by this trend, produced papers which called into question the very notion of the 'environmental refugee.' Although Richard Black is one of the most well known writers from the minimalist school, he was not the first to argue this point. Lonegran (1998) for example, argues that because it is impossible to separate the environmental drivers of migration from social and economic contexts, it is correspondingly impossible to discern a linear, deterministic relationship between environmental change and migration. As such Lonergan (1998) considers it nonsensical to speak of 'environmental refugees' or even 'environmentally induced migrants.'

Lonegran (1998) concedes that while it is possible to identify circumstances in which the environment forms an important contributor to movement, there is currently insufficient knowledge about the manner in which such movement will manifest itself. To aid this argument he cites circumstances in which areas experiencing environmental degradation (such as Mexico City which in maximilist models would lead to out-migration) have, in fact, attracted migrants. For these reasons, Lonergan (1998) advocates for more research on the mechanisms by which environmental change interacts with social and economic contexts to generate migration. Lonergan (1998) also points out the significant role development plays in generating vulnerability to environmental change, and thus argues that at the root of what often appears to be environmentally determined migration is actually the developmental disparities between the Global North and the Global South (Lonergan 1998).

Black's (2001) argument takes an even more drastic approach and sets out to debunk the environmental refugee thesis altogether. To do so Black (2001) makes use of three attacks on the maximilist arguments. Firstly he argues against desertification as a source of refugees by citing literature which calls into question the rate at which desertification is assumed to be taking place (this literature will be discussed in detail later in this paper in the section on empirical work).

This critique ascribes events in the Sahel to cyclical changes in rainfall and argues that vegetative cover has for a long time rebounded in the Sahel after periodic droughts. In this scenario migration forms a fundamental part of Sahelian livelihoods that have always been reliant on migration for surviving in a precarious environment. Black goes on to challenge the notion that rising sea levels and increased flooding will generate environmental refugees by echoing Lonergan's (1998) sentiments, which call into question the primacy of environmental change in generating refugees.

Black (2001) argues that poorly planned development and north-south disparities are largely to blame for generating vulnerability to environmental change (in this case, flooding). As such he argues that environmental change is, if anything, only a proximate cause of displacement while the root of the problem lies in global developmental inequalities (Black 2001). It is important to note that in denying the existence of 'environmental refugees' Black (2001) claims not to be denying the existence of a link between environmental change and migration, and his argument on the circular migration in the Sahel is evidence of this. His compliant is with the notion that environmental change can linearly and causatively be related to migration and that such environmental change is the result of humans suddenly reaching the limits of sustainability (Black 2001).

Having described the evolution of the related debates on environmental change and migration and environmental refugees in terms of the changing political context, this paper now turns to describing the debate as it is conducted today, and how this debate is likely to evolve

5 The state of the debate today

Because of the political volatility of issues regarding both climate change and migration, the long evolution of the debate on 'environmental refugees' tends to be ignored by political actors and many authors seem happy to simply cite those sources which most effectively support their argument(s). This means that across public, political, policy, and academic domains the debate on the relationship between environmental change and human mobility has become highly polarised and often unhelpful. This section of the paper seeks to describe the various positions generally put forward by the different domains. Since the distinctions between popular, political, policy and academic circles are artificial what I can offer in this next section can only be generalised statements. As such the following section should simply be seen as indicative of the manner in which the debate is generally undertaken today, not as a hard and fast rule for who will necessarily say what.

Within the context of increasing evidence on the catastrophic impacts of anthropogenic climate change the maximilist school, despite being heavily criticised for its simplistic approach, continues to influence the popular literature where the discourse around 'environmental refugees' is making increasingly novel use of the media (see for example http://www.environmentalrefugee.org). Myers is repeatedly cited in these fora, and the peer reviewed status of his work means that figures remain largely unquestioned.

Aid organisations' citation of large figures also has a heavy influence on popular discourse and imaginations. The motivations for citing such large figures are not entirely clear but humanitarian groups have generally responded quite radically to the 'threat' of large scale, environmentally induced migration. Primary examples of this include Christian Aid's (2007) report 'Human Tide: The real migration crisis', which cites figures of 1 billion displaces by 2050. In addition to humanitarian charities, environmental groups also frequently produce large predictions of 'environmental refugees' in order to advocate greater environmental protection.

Friends of the Earth's document 'A citizens guide to climate refugees' and GreenPeace's (2008) *Blue Alert Report* 'Climate migrants in South Asia: Estimates and solutions', for instance, display this tendency. Groups citing maximilist figures tend to call for action to address the sources of global warming and/or for an expansion of the existing definition of the refugee so that it formally recognises individuals forced from their homes on account of environmental change or catastrophe.

In spite of the influential roles still played by authors writing from within the maximilist paradigm, the major growth in academic literature on this topic has been located, principally, within the minimalist school. Authors within the minimalist paradigm remain critical of the simplistic framework of the maximilist school yet they cannot ignore the overwhelming evidence of the potential impacts of future climate change and the manner in which such impacts might encourage migration.

Within the minimalist paradigm initial reluctance to use the term 'environmental refugee/migrant' – due to the complex set of factors thought to influence migration – has declined with a growing appreciation of the fact that an understanding of the interplay between economic, environmental and developmental forces in driving migration is valuable and that the term 'environmental migrant' highlights this complex relationship (Morrissey 2008).

Although academics acknowledge the potential for (climatically driven) environmental change to induce migration, many continue to point to the fact that there still exists no clear case of an 'environmental refugee'; a condition that they claim is a result of conceptual problems with the term. In an attempt to address this problem the IOM has produced a definition of an environmental migrant, which is being used with increasing popularity (Adamo 2008):

"Environmental migrants are persons or group of persons who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (IOM 2007:1)

While this definition remains controversial and does not address all the conceptual flaws indicated by other authors it is deemed useful for the way in which it encourages empirical work (Morinière 2008), the lack of which is one of the major problems facing the study of environmental change and migration.

Authors increasingly acknowledge the importance of recognising the potential links between environmental change and migration and there remain calls for further empirical work on the topic to determine the degree to which it is possible to separate out environment from other factors driving migration (Raleigh, Jordan et al. ND). However, there have also been a number of arguments made against expanding the convention definition of a refugee for fear of diluting the level of protection afforded to existing convention refugees (King 2006).

Academic writing has in some cases made the case that it may be appropriate at times to conceive of environmental change as forcing migration (Morrissey 2008), with the understanding that such migrants need not be viewed as victims responding without agency to the vagaries of a harsh climate (Bassett, Turner 2007). In a related discussion on the appropriate conceptualization of migrants and their motivations, Hampshire (2002) argues that it may not be suitable to simply classify the migratory motivations of individuals exposed to variable climates in terms of secondary economic impacts. Finally, authors such as Morrissey (2008) have highlighted the manner in which the discourse on environmental refugees has privileged sedentary models of population distribution and that in a world of inevitable climate change (Wigley 2005) it may be more productive to view increased mobility as a viable means for adapting to climate change.

Policy circles remain by nature an important dialectic intersection between academic and popular debates. For instance (as noted above), the IPCC adjusted their tone, formerly so dependent on maximilist school findings, following the publication of dissenting viewpoints from within the minimalist school. A turnaround of even greater scale was made by the UNHCR, which was initially averse to the formal creation of the category 'environmental refugee' for the reasons that it was not part of their mandate nor did they have the capacity to take on the extra load (Gorlick 2007). Subsequently however, a UNHCR representative, at an IPPR conference, expressed a desire to take on the category of 'environmental refugee,' likening the case of formally classifying environmental refugees to that of recognizing internally displaced persons.

Without displaying such a dramatic change of position the IOM also appears to have adopted the notion of the environmental migrant with their recent publication of a working definition (Adamo 2008, IOM 22-23 February 2007). Thus, with policy as the grounds upon which much of the debate regarding the relationship between environmental change and migration is contested, the future of this domain will likely continue to fluctuate as different interest groups make their claims to have policy represent their interests.

Beyond these discussions the topic of climatically driven human displacement is also slowly taking on new approaches. Authors such as Bell (2004) and Byravan and Rajan (2006) invoke political theory in their explorations of the ethical obligations among states when dealing with potential and existing environmental displacees. Other authors such as McNamara (2007) have undertaken discourse analysis in an attempt to understand how the debate on environmental refugees is being represented in the major institutions likely to have to deal with the issue, primarily the UNHCR, UNDP and UNEP.

Within all the schools of writing, but primarily in the maximilist school, uncertainty about the scale of climate change is of concern. Some discussion has been undertaken on the importance of environmental and social tipping points (Alley, Marotzke et al. 2003, Cairns 2004, Cairns 2005, Gilman, Randall et al. 2007, Smith 2007). Tipping points refer to abrupt changes in climate and/or social systems which cause such systems to change their function considerably. In the case of migration, the concern is that population movements may suddenly become required on a large scale to either support a significantly altered social system or to survive in a dramatically altered climate. Literature in this vein has failed to go much beyond the hypothetical, since non-linear responses are difficult to predict in both climatological and sociological models.

The issue of the securitisation of the environmental refugee/migration discourse has been influential in further politicising the debate on environmental change and migration. Authors writing on this topic have put forward a number of theses describing the impact of (climatically driven) environmental change on security concerns. Initially environmental change and conflict was linked to migration through the hypothesis that environmental change resulted in scarcity-driven conflicts (Kaplan 1994). These would in turn, it was thought, generate refugees in the usual way (Barnett, Adger 2007).

The intractable and multi-causal nature of conflict, however, problematized empirical work on this hypothesis (Barnett, Adger 2007, Richards 2005). As such, other theses have been put forward that more closely align with the existing literature on environmental change and migration. Such theses take for granted the link between environmental change and migration and argue that increased environmental change will lead to increased migration.

The suggestion is that migration, in turn, increases the chances of conflict (Smith 2007, Barnett, Adger 2007, Gleditsch, Nordås et al. 2007, Reuveny 2007, Tafesse 2007) or compromises security (Campbell) in receiving communities. Given that this literature assumes that environmental change will generate migration, literature on the security implications of migration can be separated in terms of maximilist or minimalist views of the relationship. The act of securitizing the 'environmental refugee' debate may also serve as a means for advocating environmental protectionism, since it highlights the potential costs of inaction on climate change. A major example of this phenomenon is Al Gore's endorsement of books such as Capbell's (2008) 'Climate cataclysm: The foreign policy and national security implications of climate change'.

In light of the limited empirical basis of the securitization agenda and the political importance of invoking security concerns, it should also be noted that in some ways work on the potential security implications of environmental change transcends the debate on 'environmental refugees' as it is not concerned with the degree to which 'environment' is the sole factor driving migration, nor whether the term 'refugee' has any meaning in such a context. Rather, the issue becomes simply that environmental change will, in certain contexts, accompany human movement. Nevertheless, the ongoing debate regarding the nature of the relationship between environmental change and human mobility make sophisticated writing on the potential link with conflict impossible.

As we have seen, a review of the literature exploring the links between migration and environment reveals the following: Firstly, it is worth noting that this field is one of significant political consequence. As such polemic views on the subject abound because of the way in which public attention rewards alarmism. Unsurprisingly then the maximilist paradigm appears unhindered by the protestations of the minimalists and continues to capture the public's imagination. Given the reliance of international charities on public contributions we can expect this trend to continue, with more charity funded reports citing large figures. However the models from the maximilist school have begun to lose ground in the academic literature. Clear evidence of this has been the scaling down of comments regarding environmentally motivated migration in the latest report of the IPCC (Raleigh, Jordan et al. ND). Literature on the potential environment-migration-conflict nexus also holds serious political sway, however, and thus literature that tacitly supports the views of the maximilist school continues to appear. Finally, within the minimalist school the multiple calls from early authors for more empirical work on the topic are finally being answered, and it is to this literature that this report now turns.

6 Assessing the evidence

Methodologically the challenge of looking at the likely impacts of future environmental change on migration is highly complex. As has been mentioned in the section above there is now general agreement that the initial concerns regarding Malthusian links between environmental change (largely due to issues of population pressure and increased resource consumption) and migration have been dismissed and that the major focus of the discussion has centred on the potential for climatically driven environmental change to impact on migration strategies. This approach however, although now taken seriously among the majority of the community working on the linkages, still presents many challenges. As a result, before I discuss the existing empirical work on the linkages between environmental change and migration I will mention some of the difficulties in undertaking such empirical work.

A major problem when dealing with any issue relating to climate change is how 'change' is defined. Currently the agreed process has been to define a change in climate as a significant shift in average climatic conditions. Although there has been general agreement about this definition it still presents problems for scientists working on the potential impacts of climate change. In the case of climate driven migration such a definition means that one can only ascribe the title 'climate change induced weather events' a number of years after the event once the period in which the event occurred is found to have been part of a different set of average climatic conditions. A result of this is that it will remain exceptionally difficult to identify an individual who has migrated in response to climatically induced environmental change. As such empirical explorations of the potential relationship between environmental change and migration have generally attempted localised studies of events which are analogous to the impacts forecast to accompany future climate change, such as drought and sea-level rise.

The second major problem one encounters when trying to predict the impacts of climate change is that there is little consensus over the scale on which climate change is expected to occur. This problem is in fact two fold: The first aspect of debate pertains to what has been called emission scenarios. Emission scenarios refer to the amount of green house gas emissions which will be released into the atmosphere under different developmental pathways. The existing pathways detailed in the special report on emission scenarios (SRES) describe different economic and social responses to climate change which have different implications for future concentrations of green house gasses (GHG). As it is almost impossible to accurately predict which developmental pathway will be followed the general approach among scientists working on climate change impacts has been to forecast social impacts for the different scenarios (Nicholls 2004).

The second aspect, which relates more to our knowledge of atmospheric physics than to our knowledge of sociological responses, pertains to the relationship between GHG emissions and changes in aggregate temperature . Scientific uncertainty about this relationship in the global atmosphere results in different predicted impacts for the different emission scenarios. On top of these difficulties is the problem of modelling non-linear physical responses to climate change such as the rapid melting of the South West Antarctic Ice Sheet (SWAIS) or the shutting down of the North Atlantic Thermohaline Circulation. The exact dynamics of these events remains unknown and despite the fact that the social impact of such events would be enormous they remain difficult to predict. A result of these problems is that estimates on the size of populations likely to be affected tend to either cover large ranges, or be avoided altogether. In the case of migration, where the exact nature of the relationship between environmental change and social change is not well understood, the range of predictions can be very large.

With these problems in mind the major means of undertaking empirical investigations into the relationship between climatically driven environmental change and migration has been to study conditions analogous to those predicted by climate models to determine the degree to which they impact upon migration strategies. Because the impacts of climate change will affect society in avariety of ways – ranging from an increasing frequency and intensity of extreme weather events to changes in aggregate climatic conditions – and because different climatic stressors are hypothesised to impact migration strategies in different ways there have been a number of different studies undertaken in an attempt to empirically ground the hypothesised relationship between environmental change and migration. Historical works which have been cited and new studies which have been undertaken have looked at both extreme weather events – drought, flooding, tornadoes and tropical storms – and long term processes – desertification, sea-level rise and environmental degradation. In addition to these works other studies have also looked at non-climate driven disaster literature in an attempt to understand how societies enact migration as a generic response to rapid onset environmental changes such as earthquakes.

As well as differentiating by environmental stressor there have also been methodological differences between studies. The major reason for this has been to address different aspects of the debate on environmental change and migration. For those authors seeking to address the degree to which there is a relationship between environmental change and migration, and which sociological factors might mediate this relationship, the focus has been on quantitative analyses and econometric methods.

These studies seek to correlatively link proxies for environmental change with proxies for migration and thereby determine the relative importance of socio-political factors in mediating this relationship. On the other hand authors focussing on the debate over the appropriate characterisation of migrations (forced vs. voluntary) in a context of environmental change have tended to use more qualitative tools, focussing on the experiences of migrants. Both these approaches have their advantages and disadvantages but these aspects will be discussed below after the discussion of empirical evidence on the topic.

Having briefly outlined the manner in which empirical work on the subject of environmental change and migration has been undertaken I turn now to a more detailed review of individual studies of the relationship. Given my argument that debate on environmental change and migration has been in part a product of the broader politics of the time, one could expect that the empirical debate has evolved to match the claims and counter claims made in this initial debate.

As a result of this, and in order to make the review most useful, I have organised the literature in the following way: Firstly I have grouped the studies by common environmental drivers, motivating before each one why such a driver is of importance to our general understanding. This is thought useful for the manner in which it allows one to identify commonalities and contradictions in the literature thereby facilitating a more explicit understanding of the mechanisms which link environmental change with migration. Secondly I have, in order to reflect the evolution of the debate on environmental change and migration (described above), sought to begin with the least revealing, and most generic, of the analogous studies – paleo-climatic and archaeological studies – and then to move onto more detailed studies, citing work in general chronological order.

Paleo-climatic studies

Work detailing previous large scale population movements in response to historical shifts in climate has been of great importance in generating the common sense link between environmental change and migration, and an appreciation that climate change may lead to major shifts in populations. An exhaustive list of such work is not undertaken here because it would be long and of only limited use given its broad approach to study of environmental change and migration.

Studies of paleoclimatic changes and migration tend to focus on the correlation between climatic shifts and shifts in the distribution of populations. In such studies changes in climate are determined through a number of paleo-climatic reconstruction methods including: phonological phenomena, long human records (Fang, Liu 1992, Verschuren, Laird et al. 2000) and soil analysis (Huang, Zhao et al. 2003). Shifts in population distributions are generally measured by historical reports (Fang, Liu 1992), as well as archaeological evidence (Huang, Zhao et al. 2003, Tyson, Lee-Thorp et al. 2002).

Within this literature there exists reference to the hypothesised links between migration and conflict (Fang, Liu 1992, Verschuren, Laird et al. 2000, Huang, Zhao et al. 2003) and some literature goes so far as to link climatic changes with the rise and fall of entire civilisations (Tyson, Lee-Thorp et al. 2002). The fact that the exact nature of the relationship between environmental change and migration is not well understood is usually acknowledged by authors in this field and such writing usually includes reference to the fact that a host of factors, other than environmental change, are important in driving migration. Such factors are thought to include the availability of technologies (Yesner 2001) and the political and social context (Huang, Zhao et al. 2003, Tyson, Lee-Thorp et al. 2002).

There is also some hypothesising within this work about the manner in which environmental change manifests in migration, such as through the generation of famine (Huang, Zhao et al. 2003). Other points of disagreement include the appropriate characterisation of climatically motivated migrations and the degree to which such changes induced migration through the creation of dominant push or pull factors (Yesner 2001). Within this work there is also mention of the fact that low technological inputs in production at the time (such as a reliance on rain-fed agriculture) would have made these groups more vulnerable to climate change than groups may be today (Tyson, Lee-Thorp et al. 2002).

Forward-looking common sense models

With paleoclimatic and archaeological studies making a strong argument for the existence of a link between climatically driven environmental change and human migrations, a common approach among scholars working on the relationship has been to put forward what Perch-Neilsen (2004) have termed: 'common sense models'. These models have tended to populate the maximilist paradigm of thought but, like the paleoclimatic studies which motivate them, they tend to leave out the details of how it is that (climatically driven) environmental change generates migration. The lack of understanding regarding the details of such migrations is sometimes addressed explicitly by authors who accept that migration may take many forms such as 'just up the road' or 'to another country', that they may be permanent or temporary, and that they may or may not result in conflict(s).

The approach generally taken in such models is to assume that large scale environmental deterioration will result in migration. As such these models tend to overlay environmental changes onto predictions of future population growth. Often the assumption within these models is that all the people in a region affected by dramatic environmental change will migrate or that there will be some sort of percentage of the population that will migrate – such as the percentage of the populations exposed to water stress.

The major problem with these models is that they require, what Castles (2002) refers to as, a 'logical leap' to go from exposure to an environmental stressor to migration. The major exception to this is the case of sea-level rise where permanent inundation of areas is thought to force migration in a reasonably direct fashion. Since there exists the capacity to accurately determine what area of land will be inundated given a certain degree of sea-level rise, and there exist good approximations of the distributions of populations that exist within these regions one can get a feel for the scope of the problem posed by sea-level rise (Nicholls 2004, McGranahan, Balk et al. 2007)..

Contemporary analogous approaches

As was discussed previously the political context in which the link between environmental change and migration was debated has been important in polarising the debate. Compelling evidence from paleoclimatic studies generated alarmist common sense models. These models were refuted, by the authors from the minimalist school, who although unable to refute the paleoclimatic data could cite contemporary events in which migration, in response to environmental change, contradicted the notion of a direct causative relationship between environmental change and migration. These contemporary studies have become the mainstay of contemporary academic discussion on the relationship between climate change and migration. This has particularly been the case where contemporary events effectively mimic the conditions predicted under future climate change. As such I term these studies *contemporary analogous studies*. They are thought particularly useful as they provide a context in which the actual mechanics of the relationship between environmental change and migration might be assessed. This next section of the paper details empirical work on contemporary analogous events. Given the general understanding that different types of environmental change will drive migration in different ways, this section of the paper breaks up the review of analogous studies into works exploring specific types of climate change impact. These include: extreme weather events (drought, flooding and disasters, tropical storms and tornadoes), sea-level rise and land degradation.

Extreme weather events

Extreme weather events are predicted to increase with an increase in aggregate global temperatures (IPCC 2007). Such phenomena are thought to contribute very powerful potential drivers for migration (Myers 1993, Myers, Kent 1995, Myers 1997, Myers 2002). However the term 'extreme weather events' also comprises a host of environmental stressors which operate over a vastly different time periods. As such this next section of the paper is broken down into discussing studies which reference: drought, flooding, tropical storms and tornadoes.

Drought and migration

Probably the most extensive body of literature on the link between environmental change and migration comes from the work on drought and desertification and migration. A large amount of this literature comes from the work done in response to the Sahelian droughts of the early 1970s and early 1980s. The Sahelian case has also been privileged because of the prominence of nomadic pastoralism in the area which makes an obvious case for the exploring the potential links between environmental change and migration.

In addition to this, drought and desertification (particularly in the Sahel), as a product of climate change, is cited by the maximilist school as one of the most significant producers of 'environmental refugees' (Jacobson 1998). As a result minimalist scholars have drawn on studies of the area which show the complexity of the relationship between drought, desertification and migration in order to undermine sensationalist claims.

Work on nomadic pastoralists and sedentary farmers in the Sahel has highlighted the degree to which there is an important link between the state of the environment and migration, where migration forms one of the most fundamental elements in nomad strategy for dealing with environmental uncertainty (Swift 1973, de Bruijn, van Dijk 2003, Brooks 2006). In this vein it is often cited that nomadic groups in the Sahel have, for a long time, responded to seasonal changes in environmental conditions by migrating across the area.

However, by highlighting such a link the Sahelian case also undermines the claims of the maximilst school for it would seem a misnomer to refer to those groups who seasonally migrate in response to seasonal shifts in rainfall as refugees (Bilsborrow, DeLargy 1990), or to suggest that such migrations highlight some form of impending ecological/social crisis (Black 2001). While undermining the claims of the maximalists studies of Sahelian migrants also appear to show more complex patterns than simple responses to seasonal variations in rainfall. For along with seasonal migrations there is widespread documentation of a general southerly movement of groups as a result of increasing pressure on dwindling water resources in the north (Swift 1973, de Bruijn, van Dijk 2003). In addition to this there is documentation of forms of 'crisis migration' enacted in response to severe drought conditions (Swift 1973, Findley 1994). These two secondary forms of movement have made an important case regarding the potential for pronounced climatic changes to undermine the migratory livelihoods of pastoralist groups thereby potentially changing both their long-standing form and character.

For example, in a study of the drought conditions which affected northern Nigeria in 1972-1974, Apeldoorn (1981), through interviews with political elites and the examination of official reports, found that drought conditions, amongst principally sedentary farmers, resulted in an intensification of existing migratory patterns. He found that migrations tended to cover greater distances, and last for longer periods during drought conditions. He also found that the prevalence of urban migrations increased under drought conditions (Apeldoorn 1981).

In addition to such findings Apeldoorn (1981) found that migrations changed from involving only a single family member to involving the movement of entire households and that during a drought there was a higher rate of non-return than in 'normal times' (Apeldoorn 1981). Apeldoorn (1981) also found that times of departure became irregular, itineraries and destinations were changed, and that the nature of migration changed from one in which the principal motivation was economic betterment to one in which the principal motivation was survival (Apeldoorn 1981). To bolster the hypothesis of a link between environmental change and changing patterns of migration Apeldoorn (1981) found that the greatest numbers of migrants came from the areas which were most affected by the drought.

Mortimore (1989) looking at farmers experience of 1970's droughts in West Africa, found that levels of outmigration increased during times of drought and that longstanding patterns of migration were altered during such times to avoid those areas impacted by drought. Having said this, and in contradiction to the findings of Apeldoorn (1981), Mortimore (1989) found that despite two years of harvest failure, leading to several years of food shortages, there occurred relatively little permanent redistribution of the population. Mortimore (1989) ascribes this to that fact that circular migration tends to be privileged over permanent migration as it is more suited to managing unpredictable fluctuations in rural and urban economies which are the product of low technological inputs, an unpredictable climate, low education levels and vulnerable national economies (Mortimore 1989). In this context circular migration is preferred as it allows an individual to better maintain networks in both the rural and urban sector (Mortimore 1989).

Findley (1994), working with migrants during the 1983-1985 drought in Mali, also described distress migration in response to drought. Such migration was found principally to be temporary - defined as migration cycles that lasted less than six months and allowed the migrant to retain a role in the social and economic life of the original household – and to be undertaken by both men and women (Findley 1994). In her study Findley (1994) contrasts temporary, intra-continental, cyclic migrations with longer term, more permanent migrations to Europe. She finds that the factors determining the type of migration are intimately tied to household assets, where an availability of labour (to cover the labour lost in a permanent migration), capital (to cover the higher costs of transport and integration of migration to Europe) and education (required to compete in the European labour market) were found to be crucially important in determining the type of migration (Findley 1994).

Findley (1994) noted that international migration was not a viable response to drought because of the high cost of such migration and the manner in which drought impoverished sending households by reducing both cash reserves and available labour. Thus Findley (1994) found drought conditions to change the nature of migrations, reducing the potential for sending migrants internationally and thereby limiting opportunities for diversifying income streams. Findley (1994) also found drought to increase the number of temporary migrants as households sought to reduce demand on household grain reserves. Thus Findley (1994) found that drought disrupts international migratory strategies replacing them instead with short term cyclical migrations.

Supporting Findlay's (1994) findings are those of Wouterse and van den Berg (ND) whose work in Burkina Faso found, through the use of survey data, that in a context of limited rainfall and high levels of land degradation, intercontinental migrations tend to be undertaken more by wealthy households in order to take advantage of better opportunities. Poor households on the other hand tend, mainly, to undertake intra-continental migrations where push factors, such as a lack of employment and/or a lack of access to land, dominate decision making (Wouterse, van den Berg, M. 2004).

Wouterse and van den Berg (ND) found that only today have such migratory movements come to be motivated by environmental stress as they show intra-continental migratory patterns among the Burkinabe to have a long history with their original impetus being the payment of colonially imposed taxes. Wouterse and van den Berg (ND) found that today such intra-continental migrations are undertaken by larger households and with the intention of relieving pressures on household grain reserves as they do not yield significant remittances (Wouterse, van den Berg, M. 2004).

Similar findings came out of work by Ezra and Kiros (2001) who examined outmigration rates in the drought prone regions of Ethiopia for the ten year period 1984-1994 using a survey questionnaire. While they found that surprisingly few migrants appeared to be leaving for economic reasons, they did find that rates of outmigration were highest during the periods of greatest food insecurity so that outmigration rates were highest in 1984, thereby linking drought to migration through food security (Ezra 2001, Ezra, Kiros 2001).

The works described above are generally cited in the literature debating the relationship between environmental change and migration despite the fact that they were not written with the explicit intention of addressing the debate on climate change. More recent work on the topic has sought to address more directly the question of a potential relationship between drought/desertification and migration.

As such this work has undertaken methodologies which attempt to address those specific questions raised in the debate. In this vein work by Meze-Hauksen (2000), on drought in Tigray, Ethiopia, seeks to explore the process by which one becomes a 'climate migrant' and as such seeks to differentiate 'climate migrants' from other migrants. Within this work Meze-Hauksen (2000) assesses climate change as a 'second order' driver of migration. By this Meze_Hauksen (2000) means to explore how climate change drives migration, not by changing the weather itself, but by the manner in which changes in the weather impact on livelihood security through processes such as reducing household agricultural production.

As a result Meze-Hauksen (2000) argues that the link between climate change and migration lies in the occurrence of famine, even if famine and climate change are not simply related. Within this study Meze-Hauksen (2000) finds only a limited relationship between household vulnerability and outmigration. Instead she finds that migration is undertaken at similar times by households with a variety of vulnerability profiles (Meze-Hausken 2000). The only relevant correlation found was that small families tended to migrate first.

Contradicting these findings, Hampshire (2002) found that there were a number of factors which predisposed groups to migration. In a demographic study, complimented by a subsample interview study, of forty Fulani villages in northern Burkina Faso, Hampshire (2002) found that less vulnerable families tended to engage more frequently in migration to towns beyond the borders of Burkina Faso, but within the continent – principally to cities in Côte d'Ivoire (Hampshire 2002). This was found to be the case because such migrations simply did not make sense for vulnerable households for whom the benefit of such migrations would be less (as they had fewer cattle to sell) and the opportunity cost (in the form of lost labour) would be larger. Thus Hampshire (2002) found that within drought prone regions, less vulnerable households were not only more likely to undertake migration but that they stood to benefit more from such migrations.

Notable in the studies discussed above is the degree to which findings of drought related migration are contradictory. For example Swift (1973) describes migrations of increasing distance, permanence and urban character in response to drought while Findley (1994) describes increasing patterns of cyclical, short distance migrations in response to drought. Hampshire (2002) finds correlations between vulnerability and migration while Meze-Hauksen (2000) observes only a limited relationship.

Hampshire and Randal (1999) comment on such contradictions and attribute them to the manner in which studies thus far have tended to homogenise the ethnicity and production systems of different Sahelian inhabitants (Hampshire, Randall 1999). To make this point they describe the migratory strategies employed by Fulani populations (comprised of different sub-ethnic population groups) in Burkina Faso who engage in a variety of different livelihoods (ranging from pastoralism to agro-pastoralism to cultivation).

Although they find a general trend of increasing migration with increasing wealth, they note that this picture is complicated by the fact that agriculturalists are more likely to migrate than pastoralist groups (Hampshire, Randall 1999). They attribute this to the fact that agricultural groups need only work their farms for a limited period of the year while pastoralist groups are required to tend their cattle on a year round basis (Hampshire, Randall 1999).

Thus for pastoralist groups (beyond nomadic pastoralism, i.e. into a new economic function), migration represents a less viable livelihood strategy. As such they suggest that while migration among (aggregately) sedentary agriculturalists might represent a process of accumulation, migration amongst (aggregately) nomadic pastoralists might represent more of a survival strategy (Hampshire, Randall 1999).They also find that for a certain ethnic sub-group (The FulBe DjelgoBe) migration is a less desirable strategy and thus it is employed only during times of extreme duress (Hampshire, Randall 1999).

As such, this work by Hampshire and Randall (1999) highlights the importance of appreciating migratory strategies for the manner in which they compliment the entire suite of livelihood activities employed as well as other coping and adaptation strategies which are employed to deal with the vagaries of the Sahelian climate.

Having discussed a number of studies of the Sahel and pointed out the usefulness of such studies in highlighting the complexity of the relationship between drought, environmental variation and migration it is worth pointing out that the Sahel also provides a unique vantage point from which to study another important analogous element of future climate change.

As has been mentioned above climate change will not simply manifest itself in terms of drought, but rather that it may have important impacts on migratory patterns by the manner in which it increases the frequency and intensity of droughts or leads to an aggregate decrease in available moisture in certain regions. In this vein the Sahel proves valuable for the manner in which it has experienced both a general drying and exceptionally damaging, recurrent droughts, over the last forty years (Brooks 2006, Hulme, Doherty et al. 2001). The discussion thus far has generally focussed on single drought events however the problem with such an approach is that any extrapolation becomes reliant on the assumption of a linear social response to drought. Thus an exploration of the Sahelian region over the last forty years provides us with a unique opportunity to test the assumption of such linearity.

To make this point I can start with the work of Findley (1994) already referenced in this paper. For in addition to finding that in times of drought long distance migration is reduced and short term cyclic migration is undertaken, Findley (1994) also found that during times of drought the role of international remittances became more important. Thus should droughts, which reduce international migration but which increase its importance, become more frequent there may exist a point at which historic coping strategies (of relying on international remittances) can no longer cope with drought conditions. This may well lead to fundamental shifts in historic drought mitigation strategies.

Given the findings of Hampshire and Randall 1999 on the importance of understanding migration as one of a suite of livelihood strategies, such events could lead to entirely new forms of migration during droughts or the failure to migrate at all.

In a similar vein Hampshire (2002) finds that although migration has for a long time constituted a major means for coping with the vagaries of the Sahelian climate, the form of migration she terms exode – in which migrants undertake temporary migrations beyond the border of their native Burkina Faso with the intention of making money – she claims is relatively new, beginning as a response to the 1973 drought which severely affected agro-pastoral livelihoods in the region. This process was exacerbated by the 1983 drought which affected the area before groups had been able to fully recover from the drought ten years earlier (Hampshire 2002). Hampshire (2002) considers such migrations to be significant for the manner in which they fall entirely outside of the agro-pastoral sphere and remove economically active people from that sphere for at least part of the year.

What such examples show us is that migratory responses to drought might not simply follow linear forms in which a more sever drought leads to more intense migratory response of proportional equivalence. They show instead that single, extremely damaging droughts, or increasingly frequent major droughts, may generate entirely new forms of migration which could have profound impacts on the existing structures of social organisation.

In a more comprehensive study of the Sahel De Bruijn and Van Dijk (2003), based on interviews and observations from fifteen years of engagement with the region, describe how the Fulbe of the Sahel have been undergoing a general southerly migration since the 1960s. They describe how the droughts of the 1980s forced pastoral groups to sell large numbers of cattle stocks to less affected sedentary farmers in the south in order to purchase cereals (de Bruijn, van Dijk 2003). Thus there was a transfer of cattle from nomadic to sedentary farmers who then needed labour to tend such cattle. The impoverished nomadic groups were thus employed by sedentary farmers in order to tend the herds they had once owned.

De Bruijn and Van Dijk (2003) describe how this process impoverished the sending areas by removing valuable labour – these individuals tending the cattle in the south often failed to send back remittances – and thus created a second wave of impoverished migrants who had been left behind and were thus forced to seek employment in the cities. De Bruijn and Van Dijk (2003) found that the result of this process was the wide dispersion of the Fulbe people who they described as a population invisible to the state, intensely impoverished, exploited by the sedentary farming groups and living on the margins of society (de Bruijn, van Dijk 2003). Their migratory patterns now appear varied with some groups settling on the outskirts of single villages, others roving between a number of villages and still other setting up their own small settlements (De Bruijn and Van Dijk 2003). Their motivations for migration are also thought to have changed from being principally political in nature to principally ecological and economic (de Bruijn, van Dijk 2003).

Such work, while dealing explicitly with the potential for non-linear migratory responses to drought also highlights the potential complexity of such migrations as they are intimately linked to economic processes of exchange. The general southerly migration of nomadic groups in the Sahel has shown the complexity of the link between climatic changes and migration. However in addition to the types of migratory response there remain other questions regarding the character of these migrations.

As has already been discussed, authors have highlighted the importance of the potential changing character of migrations – changing aims from accumulation of wealth to survival, and changing motivations from political to ecological/economic. However in addition to characterising the experience of migration at the level of the individual, of great importance to authors writing on 'environmental refugees' is the manner in which these migrations are expressed in terms of the collective.

Writing on this topic Basset and Turner (2007) contest the classic characterisation of the southerly movement of pastoralism from the Sudano-Sahelian zone into the more humid Sudanic and Guinean Savannas. Basset and Turner (2007) seek to undermine the argument that such southerly movement was rapid and driven by the droughts of the 1970s and 1980s, whose same climatic forcings also reduced the severity of tsetse fly populations in the Savanna region. They argue instead that such southerly moves had in fact been preceded by a number of strategies, such as the cross breeding of herds with hardier animals from the Sudanic zone and the undertaking of recognisance on potential rangelands, both processes that operate on decadal time scales (Bassett, Turner 2007).

As such they argue that the southerly movement of the Fulbe people's is better conceived of in terms of Stenning's (1960) 'migratory drift' rather than a dramatic shift in population which they believe undermines accepted logic regarding the social mediation of physical (climatic) responses (Bassett, Turner 2007). They argue instead that the reason the southerly migration of the Fulbe could be possible at all, given their levels of wealth, was because it comprised of a cascading series of shorter movements rather than large social and biophysical adjustments (Bassett, Turner 2007).

In addition to the migrations among groups in the drought affected Sahel, there are also other iconic examples of migration in response to droughts. One such case is that of the Great Plain states of the U.S. during the dustbowl years of the 1930s. McLeman and Smit (2006) and McLeman et al (2007), in their studies of climatic data and Oklahomans who lived through the dustbowl years, found that migrants identified climatic events (which were verified in the climatic record) as driving them from the land through the manner in which it lead to the collapse of the cotton crop (McLeman, Smit 2006).

As well as drought it was found that the size of landholdings, the nature of tenure agreements and dominant agricultural practices were interrelated and important factors in generating the crop failure which forced migration (McLeman, Smit 2006, McLeman, Mayo et al. 2007). As with cases from the Sahel it was found that it was often the poorest groups who were least able to migrate, and many had to stop in neighbouring states en route to California – the final destination of many migrant households (McLeman, Smit 2006, McLeman, Mayo et al. 2007). McLeman (2007) also found that there was very little technological innovation – little change of crops or farming methods – undertaken by farmers in Oklahoma and that migrations were enacted as a means for survival.

In addition McLeman (2007) cites the different political responses undertaken by Presidents Hoover and Rooseveld as being important in shaping the migratory response. In contradiction to the general findings from the Sahelian literature McLeman (2007) found that migrants experiencing drought tended to undertake longer and more permanent migrations in response to the drought as historically established migratory patterns failed because they too had been hit by the drought (again this example points to the potential for non-linear migratory responses to droughts of increasing magnitude).

Thus, the literature suggests that drought has the capacity to induce migration in a variety of ways. Although, initially seeming contradictory it appears that the more detailed analyses of the socio-economic and cultural context of the groups impacted by droughts might provide the most useful means for discerning the degree to which migration might constitute a response to environmental change.

Flooding and migration

Another major potential driver of migration under future climates is the more frequent occurrence of greater intensity flooding. Such events are thought to have the potential to induce migration in a number of ways. This next section of the paper discusses empirical studies detailing such processes by focussing on riverbank erosion and temporary inundation. Much of this literature comes out of research in the flood plains of South Asia. Flooding due to sea-level rise is discussed in a separate section.

Kayastha and Yadava (1985) in their study of flood induced migration in the Ghaghara Zone in India found (through the use of questionnaires, interviews, observations and the consultation of official documents) that flooding generated population mobility through complex pathways with flooding both increasing the attractiveness of land for settlement and forcing people from settled land. Land was made more attractive through manner in which alluvial deposits fertilise farmland, while it forced migration through the destruction of household assets as riverbanks were eroded and property washed away (Kayastha, Yadava 1985).

In this context it was found that migrants employed both temporary and permanent migration in response to flooding. Permanent migration was usually undertaken in response to severe flooding which had destroyed both crops and property (Kayastha, Yadava 1985). Such permanent migration was found principally to be local and to take place within the flood plain (Kayastha, Yadava 1985). Temporary migration usually involved moving to higher ground in search of shelter and temporary jobs. It was usually undertaken over as short a distance as possible and by a principally illiterate, low-skilled labour force (Kayastha, Yadava 1985).

Haque and Zaman (1989) and Zaman (1991), examining the impact of flood-induced riverbank erosion in the delta region of Bangladesh, describe the principal means by which flooding forces migration as being through the erosion of lands in the floodplain of the Brahmaputra-Jamuna River. They describe how predicting the location of such erosion is impossible despite the fact that such erosion takes place every year (Haque, Zaman 1989). They also note, however, that while flooding erodes land it also makes new land (or previously submerged land) available for settlement. Rights to settle newly re-emergent land was found to be a generalised source of ongoing dispute (Haque, Zaman 1989).

The major driver of migration in the area was found to be flood induced erosion and slumping with groups living on riverbank islands found to be at greater risk of displacement than mainland communities (Haque, Zaman 1989). Within the study area it was found that the majority of displaced people resettled within their original administrative zone despite the fact that the area experienced a net loss of land (Haque, Zaman 1989). The authors found that short distance moves were privileged because affected groups believed their land would soon remerge and because of the prohibitive cost of long distance migration (Haque, Zaman 1989). Since both patronage and social networks were forged most strongly in people's original places of residence and because – in a context without state support – such networks were required to survive both day to day stresses as well as displacement shocks people's ability to migrate long distances was constrained (Haque, Zaman 1989, Zaman 1991).

Lein (2000) contests the general findings of Zaman (1991) and argues that instead of conflict over re-emergent land being a dominant feature of life on the Jamuna River, major social institutions exist which allow for people to effectively resettle after their land has been washed away. Despite differences in her assessment Lein (2000) found that migrations (in response to flood-induced erosion) were principally local. Again this was found to be because of the prohibitive cost of moving greater distances. Despite this Lein (2000) found that the major reason for migrating to Dhaka's slums were a lack of land, employment and income opportunities in the rural areas. Of secondary importance were environmental hazards such as drought, riverbank erosion, cyclones and floods (Lein 2000).

Thus work on flooding – and riverbank erosion – appears to generate complex incentives for migration. It appears that such complex motivations lead to a privileging of short distance migrations. Having said this we find, once again, that an important co-consideration is the social and political context in which the environmental stress takes place. These studies showed that a limited political willingness to provide relief leaves people with diminished stores of capital and reliant on social networks. This then limits them to migrations which can be only local in scale.

Disasters, tropical storms, tornadoes and migration

The scientific evidence on the relationship between tornado frequency and intensity and climate change remains ambiguous however there appear intuitive reasons for believing that an aggregately warmer climate will lead to more frequent and intense tornadoes which occur over longer seasonal windows and across wider geographic areas. Similarly the case of tropical storms is one in which the scientific evidence remains inconclusive but there are intuitive reasons for believing that warmer oceans will result in more tropical storms operating with more intense pressure gradients, over longer periods and across wider geographical areas. Regardless of such ambiguity there remains general agreement that with higher average sea-levels (a now inevitable outcome of climate change (Wigley 2005)) the potential for damage as a result of coastal storm surges will increase quite dramatically (Nicholls, Hoozemans et al. 1999).

This next section of the paper deals with empirical data on the migratory response to tropical storms and tornadoes. The related phenomenon of sea-level rise is dealt with in a separate section. Because of the analogous approach to studies of future environmental change and migration as well as the discussion of non-climate related environmental changes (such as volcanic eruptions) in the 'environmental refugee' debate this section of the paper will also briefly deal with some of the generic disaster literature looking at links with human mobility. Such studies are thought useful for the manner in which they shed light on the potential for intense, rapid-onset shocks to generate migration.

Belcher and Bates (1983) in their study of Hurricane David, which impacted the Dominican Republic in 1979, found absolute damage to be the most effective predictor of mobility. They found inter-residential mobility to be highest into areas which had been affected, but in which housing structures had been left intact, and outmigration to be greatest in areas which had been completely destroyed by the hurricanes (Belcher, Bates 1983). They also found that mobility was highest in those partially destroyed areas (areas which experienced both total destruction of housing and just superficial damage) because affected households had moved short distances in order to live with family and friends in the same neighbourhood. These partially impacted areas also experienced in-migration as family and friends, living outside of the affected area, arrived to attend to the sick and elderly. In those areas in which entire communities were heavily impacted by the hurricane inhabitants could not turn to social networks for support and thus outmigration rates were high with people forced to seek shelter in refugee-type camps (Belcher, Bates 1983).

The study also found that refugee-type camps were populated most heavily by landless individuals for whom the destruction of their property represented an enormous loss of wealth and for whom the camps represented the first step of a longer process of migration in the search of better life opportunities (Belcher, Bates 1983). Importantly Belcher and Bates (1983) found that the desire of impacted communities to remain in their pre-hurricane residential communities was high and not related to the scale of the damage in any simple way. Rather it was found that the desire to remain in one's original, pre-hurricane community was determined by the degree to which economic livelihoods had been impacted by the hurricanes. In this case people working in the coffee plantations, whose crop had been destroyed by the hurricane, generally desired to move onwards. Those people employed in the sugar cane industry, on the other hand, in which processing had just begun and the crop had not been destroyed, generally wished to remain (Belcher, Bates 1983).

Frey and Singer (2006), in their analysis of U.S. census data after Hurricane Katrina, found that hurricane-impacted areas experienced both a growth and decline in population. The study found that in New Orleans poor groups tended to comprise the majority of permanent out-migrants, with little return migration amongst this group. Important in explaining these findings was the fact that permanent out-migrants were also found to be less likely to have both access to a vehicle and to own property. As a result their ability to return to New Orleans was compromised as was their incentive as the majority of their owned property would have been destroyed by the flooding (Frey, Singer 2006).

Thus Frey and Singer (2006) found that Katrina impacted New Orleans in a way that removed poor communities – black and single-female headed households who were non-home or vehicle owning – more permanently than it did wealthier (white) communities. Notable here is the fact that the state response was fundamentally important in determining the character of the migratory response. The evacuation of people who were poor (and immobile) and who lacked the capacity to return meant that unlike other studies this work found that the poorest groups were most likely to form long distance, permanent migrants (Frey, Singer 2006).

This point is further highlighted by an analysis of population movements along other parts of the affected coastline where it was found that well-off households were more likely to migrate. This is thought to be the case because there was less public pressure to evacuate poor groups outside of New Orleans. In these areas it was also found that households without children were more likely to migrate (Frey, Singer 2006).

In a similar study, this time of the impacts of Hurricane Andrew in the U.S., Smith et al (2006) also found that population responses were best determined by looking at household wealth and the distribution of damages. In their study of inter-residential movers in response to the hurricane, Smith et al (2006) found that middle income households who – by a factor of geographical chance – were affected most severely by the hurricane were most likely to migrate permanently. Within this context poor households were also found to be highly mobile as they moved into the areas vacated by middle income households (Smith, Carbone et al. 2006). The study also found that wealthy households were least likely to migrate as they had the capacity to privately insure themselves against losses (Smith, Carbone et al. 2006).

Looking at other climate related, rapid onset environmental shocks, Paul (2005) found the 2004 Bangladesh tornado to have little, to no, impact on outmigration from the affected area. This is attributed to the comprehensive aid and recovery packages which were made available to people after the disaster (Paul 2005). Paul (2005) found that the types of relief provided included emergency food, water purification kits, soap, household utensils, oil, blankets, plastic sheeting, medicine, clothing and cash grants (Paul 2005).

In this study Paul (2005) found that people generally felt that they had received an adequate quantity of relief goods, that they had benefited from the goods they were given, that the right type of goods were distributed and dissemination was fair. In this context Paul (2005) found that very little outmigration had occurred. Some migration into the affected area had taken place as carpenters and other artisans had come in to take advantage of the rebuilding work that had become necessary (Paul 2005). Another group of in-migrants included people coming into the area to collect relief on the part of family members who had been hospitalized as a result of the tornado and thus were not able to collect their relief themselves (Paul 2005).

Exploring empirical evidence on other rapid onset environmental changes Belcher and Bates (1983) found (in their analysis of the Guatemalan earthquake of 1976) that two years after the event 90% of initial out-migrants from the effected area had migrated back to their homes. Here it was found that earthquake damage was not the most meaningful predictor of migration, but rather household ownership prior to the earthquake that determined the degree to which people employed migration as a response (Belcher, Bates 1983).

Also exploring migration as a response to earthquake stress, Osterling (1979), in an analysis of the Peruvian earthquake of 1970, found that the failure of government rehabilitation and the long term downturn in economic productivity which resulted from the earthquake lead to large amounts of outmigration. Osterling (1979) notes that migrants from the affected area generally did not ascribe their motivations for migrating in terms of the earthquake but rather in terms of an exacerbation of the existing poverty level. In this context migration was found to be dominated by young males and to take place, principally, to coastal cities and other rural areas (Osterling 1979).

Osterling (1979) found that existing seasonal migratory routes to the orchards were intensified after the earthquake. In addition to this migration Osetrling (1979) found that seasonal migrations to the orchards, which are located closer to Lima than their original place of residence, formed part of a process of eventual urban migration on the part of the seasonal migrants. The orchards were seen as a place to travel, learn new skills, get to know Lima and enjoy some of the amenities of the urban areas. Notable here is the manner in which a once off event has lead to a fundamental change in the patterns of migration which were still evident nine years after the earthquake occurred (Osterling 1979).

In generic work on the relationship between mobility and natural disasters Morrow-Jones and Morrow Jones (1991) found, in an examination of survey data from the U.S., that groups who moved in response to disasters tended to over represent widows, female headed households, and people of African American descent. The study also found that disasters impacted people's long term wealth as they tended to force previous home owners into rental housing and people previously in rental housing into public housing (Morrow-Jones, Morrow-Jones 1991).

This data, which shows economically marginalized groups to be more likely to migrate in response to 'natural disasters', contradicts other studies for reasons which are not clear. There are numerous potential explanations (such as the importance of the political response to such disasters) however without access to more detailed metadata on this study such explanations remain only speculative.

One additional consideration may be Morrow-Jones and Morrow-Jones (1991) assumption that 'natural disasters' affect people equally across different income groups. This assumption has, in disaster literature, been found to be problematic with evidence of marginalized groups being forced to occupy lands more exposed to 'natural disasters' (Wisner, Blaikie et al. 2004). A result of this has been the contestation of the term 'natural disaster' as it suggests a dichotomous relationship between 'nature' and 'society' and hides the social elements of the processes which leave marginalized groups more exposed to disaster events with a 'natural' trigger.

Sea-level rise

Sea-level rise is thought to pose one of the clearest cases for the generation of 'environmental refugees'. The clearest case of such 'refugees' are thought to come from small island states which may well be entirely inundated as a result of changes to the climate in the future (Barnett, Adger 2003). The case of small island states is iconic in the literature on 'environmental refugees' for the manner in which it will necessarily force people across an international border therefore meeting one of the major criteria of the 1951 convention definitions of a 'refugee'.

However, even within the literature on environmental refugees, there is a general appreciation that global sea-level rise may generate migration in far more complex ways than the case of island states. Such migration may not result in cross border movement but may well require a movement from one's existing place of residence. Such cases could include migration in response to reduced access to water as a result of the salination of aquifers, the permanent inundation of currently populated coastal areas; and the threat of an increased regularity of coastal flooding which is related to the occurrence of tropical storm events.

One of the encouraging aspects regarding the sea-level rise component of climate change induced migration is that we can, more so than with other climatically induced environmental changes, determine with some accuracy the extent of the likely impacts. By predicting sea-level rises for different carbon emission scenarios, models can forecast the likely area to be inundated with water, and thus one gets some idea of the numbers of people that will likely be directly affected by the event.

In this vein Nicholls (1999), in a study of changes in coastal flooding as a consequence of sea-level rise based on World Bank population data and global circulation models, found that the most important increase in flood damages came not from the increased populations likely to be exposed to future flooding as a result of the inland expansion of the floodplain, but rather in the form of groups who already live in the floodplain and for whom flooding would become a more frequent event (Nicholls, Hoozemans et al. 1999). Nicholls (2004) subsequent work enriched these findings by incorporating the Special Reports on Emissions Scenarios (SRES) which highlighted the importance of considering different developmental trajectories in determining the future populations which will likely be exposed to flooding as a result of green house gas induced sea-level rise (Nicholls 2004).

In a study of a similar sort, McGranaham et al (2007), using data sets from the Shuttle Radar Topography Mission (SRTM) and Columbia University's Global Rural Urban Mapping Project (GRUMP), estimate that the low elevation coastal zone (LECZ) covers 2% of the earth's surface but contains 10% of its population. They also find that settlements in the LECZ are principally urban in character and that such an urban bias tends to be greatest among least developed countries. From this position they argue that the impacts of sea-level rise will likely be greatest in poorer nations because of the importance of urban centres for economic growth and because poorer nations have the least access to technological means for successfully adapting to climate change (McGranaham et al 2007).

Analogous studies of sea-level rise are scarce but work by Arenstam Gibbons and Nichols (2006), who document the abandonment, in the 20th century, of Holland Island in Chesapeake Bay, U.S.A.; shows the importance of social forces in the mechanics of migration even in the face of inevitable inundation as a result of sea-level rise. Arenstam Gibbons and Nichols (2006) show how, on Holland Island, which has been disappearing at a rate of about 30-40cm per year, abandonment occurred over in a mere twenty year period from 1900-1920 despite the fact that the population of the island grew between 1850 and 1920.

They show how abandonment occurred much more quickly than it would have if sea-level rise had forcefully expelled people from the island and in so doing highlight the importance of both social and physical mechanisms in driving migration (Arenstam Gibbons, Nicholls 2006). In the case of Holland Island it was found that once a significant portion of the population left the island (because they believed abandonment was inevitable), the island's other inhabitants were forced to leave because the small remaining population was not sufficient to support the social institutions (churches, schools etc.) required for the maintenance of the community (Arenstam Gibbons, Nicholls 2006).

While sea-level rise is thought to be one of the major cases in which the link between climate driven environmental change and migration is most explicit there are also ways in which sea-level rise is thought capable of influencing migration indirectly. For example the repeated inundation of farmlands with saline water can render them less productive thereby influencing economic decisions to migrate. This next section of the paper deals with empirical studies of climate change, environmental change and migration by explicitly exploring the process of land degradation as a mechanism for potentially linking migration with environmental change.

Land degradation

At numerous occasions in the literature discussed above (particularly regarding that literature focussing on drought and desertification) there has been mention of the role played by land degradation in driving migration (de Bruijn, van Dijk 2003, Meze-Hausken 2000, McLeman, Smit 2006, McLeman, Mayo et al. 2007).

A major reason for focussing on land degradation, as opposed to climatic events, is that made by Meze-Hauksen (2000) who argues that in many cases it is not changes in climate, in and of themselves, that generate migration, but rather that climate change acts as a second-order driver of migration as it leads to environmental changes which compromise household security (economic productivity, exposure to disease, etc.).

A major manifestation of such migratory impetus, in the face of climate change, is thought to be the degradation of farm lands, particularly in subsistence farming communities. With environmental degradation being an event which has been experienced on numerous occasions in history and with climate change forecast to reduce land productivity and environmental quality in large regions of the world, the analogous approach to studying the potential relationship between climate-change induced land degradation and migration is both obvious and useful. Thus this next section of the paper details empirical work relating to the importance of environmental degradation and migration.

Work by De Bruijn and Van Dijk (2003) mentioned above, found that the marginalised position of dispersed Fulbe groups in relation to sedentary Dogon society was manifest in major part due to the overpopulated and degraded nature of the Bandiagara escarpment which left little fertile land available for cultivation. This work also found that the pressures on cultivatable land were so great that farmers were unable to implement a fallow season and thereby environmental quality could only deteriorate (de Bruijn, van Dijk 2003). De Bruijn and Van Dijk (2003) also considered such circumstances to have limited the potential social mobility of Fulbe people who are now not able to gain access to sufficiently productive land so as to allow them to accumulate wealth.

Also mentioned above was the study by McLeman et al (2007) of the drought related outmigration from Oklahoma during the dustbowl years. McLeman et al (2007) argues that the impacts of the droughts were exacerbated by the intense manner in which lands were farmed which lead to desiccation and nutrient depletion of the soils. McLeman and Smit (2006) describe that an important part of the land degradation process was the fact that migrants moving into the area – themselves forced by the existing drought in the semi-arid western regions of Oklahoma – had driven up land rents, therefore placing pressure on the amount of land which could be farmed. Also of importance in damaging the land was the fact that tenancy was highly informal and thus insecure. As a result farmers had little incentive to invest in the land which increased the exploitative nature of farming practices (McLeman, Mayo et al. 2007).

Henry et al (2004) in his work in Burkina Faso, states explicitly that he thinks studies of single drought events are not sufficient for the manner in which they fail to appreciate the way in which environmental variables interact to generate mobility. As such his work looks at rainfall and land degradation data to determine the environmental quality of an area. From this work Henry et al (2004) found that less people migrate out of areas with unfavourable climatic conditions compared with those areas with favourable climatic conditions. Similarly it was found that people living in highly degraded areas migrated less than people from less degraded areas.

Thus Henry et al (2004) found that unfavourable environmental conditions in combination with other non-environmental factors may limit people's ability to invest in migration (Henry, PichAco et al. 2004). Henry et al (2004) also found land degradation to be a more compelling factor for migration than episodic unfavourable climatic conditions.

Massey et al (2007) in his work on outmigration and environmental degradation in Nepal sought to correlate indicators of environmental degradation with rates of outmigration. The work found that only 'perceived declines in agricultural productivity' were significant in predicting the odds of moving both locally and long distance, although with a skew towards local migrations (Massey, Axinn et al. 2007). Insignificant, positive relationships were found between 'share of neighbourhood covered in green' and 'greater time to gather firewood', while 'time to gather fodder' and 'neighbourhood population density' were found to have no influence on migration (Massey, Axinn et al. 2007).

Massey et al (2007) in their findings point out that the preference for local moves among those exposed to environmental degradation is very different from the context of socio-economic motivations for migration which tend to generate long distance moves. Other factors found to be important in migration were schooling which increased the odds of a long distance migration as did whether or not a household contained other members with migratory experience (Massey, Axinn et al. 2007). Land ownership was found to decrease the odds of migration as was age (older people were less likely to migrate) and gender (men were more likely to migrate) (Massey, Axinn et al. 2007). With reference to gender, Massey (2007) did find that greater degrees of environmental degradation for variables specific to the gendered division of labour (men collecting firewood and women collecting fodder) lead to greater rates of mobility among that gender.

In similar work looking at environmental stress and short distance urban migration in highland Ethiopia, Morrissey (2008) found that land ownership, population pressure, land degradation and exposure to environmental shocks were all related to migration in complex ways. In this relationship population pressure and political circumstance lead to land degradation which exacerbated environmental shocks. Such shocks then increased pressure on land which in turn increased degradation.

Within this context, land scarcity, environmental degradation and environmental shocks were all found to be important in driving migration (Morrissey 2008). Environmental shocks (particularly drought) were found to generate immediate, temporary migration to both rural and urban areas while the long term recurrence of such shocks generated a desire for more permanent urban migration (Morrissey 2008).

Morrissey (2008) also highlighted the importance of the socio-political context in influencing migration. In this vein he found land ownership, family size and age to co-vary and reduce the likelihood of migration. Ethnicity, gender and access to capital and skills, were found to influence the choice of destination and success of migrants (Morrissey 2008). Finally Morrissey (2008) found that the character of migrants citing environmental degradation as a reason for migrating could be appropriately conceived of all along the continuum of 'forced' to 'voluntary' migration (Morrissey 2008).

Generic findings

A brief reading of the findings above may lead one to see the existing work on environmental change and migration as unclear and contradictory, however taking ones cue from De Bruijn and Van Dijk (2003) and disaggregating the environmental change by cultural and socio-political context, environmental stressor and livelihoods strategy one can gain some insight into the relationship between migration and environmental change. I highlight here, what appear to be some of the lessons from these empirical works.

Firstly, as paleoclimatic studies show, there does appear to be an important link between (climatically driven) environmental change and migration. Such migration, it appears, could well prove to be large scale and permanent, fundamentally shifting the distribution of populations. In addition to this, the empirical evidence makes clear the case for some form of migration as a response to once off shocks. Notable within these findings though is the importance of the economic, cultural and socio-political context which acts to modify and influence the many different features of any migration.

The literature also seems to indicate that environmentally related migrations may take both temporary and more permanent forms. Once off extreme events tend to generate short term, short distance migrations (although this is not always the case) while longer onset, and more permanent changes to the environment tend to generate longer distance more permanent migrations (even if such migrations take place as a sequence of small scale moves).

Short distance, cyclical moves tend initially to take the form of an intensification of existing migratory pathways, or slightly modified ones. This finding highlights both the importance of seeing migration as an existing feature of societies regardless of environmental change, while at the same time appreciating the role of environmental change in modifying such pathways. Such shorter term, shorter distance, cyclical migrations appear to be undertaken by poorer groups as long distance migrations appear to be the purview of the relatively wealthy. Extending these findings, it appears that impoverished groups are less able to invest in migration and therefore the least likely to migrate. This finding complicates the simple conception of hapless people fleeing environmental catastrophe as it appears that those most vulnerable groups will be least able to migrate in the context of environmental catastrophe.

We can also see that the political context is enormously important in determining the degree to which migration might be enacted as a response to environmental change. Here the role of both governmental and non-governmental actors in providing relief/support/assistance is crucial in understanding the character (or existence) of a migratory response.

In addition, it appears that the best predictor of migration may well not simply be the scale of the damage – measured in some generic way – but rather the manner in which such damage impacts upon people's livelihoods and cultural practices. Having said this, in the case of rapid onset disasters, immediate migratory responses are usually best predicted by intensity of damage.

This statement ties into a broader and more important finding: that mobility will be enacted in response to environmental change by groups who are most mobile – lack land ownership, are not reliant on local social networks, have small families and have access to capital. As such we need to appreciate that migration is enacted as a response when it fits with the entire suite of livelihood/coping/adaptation strategies employed by a household or individual.

With these findings in mind it should be remembered that migration need not be viewed as necessarily negative. We should be wary of overly privileging the sedentary model of human settlement. A major theme from these findings is that in the face of environmental catastrophe, it is the wealthiest groups that migrate as a means for coping or adapting. We should not therefore make the case that migration will not form a major response to environmental change because of its impoverishing influence. Rather we should seek to enhance people's mobility in order to better aid them in responding to climate change and securing their livelihoods.

7 Methodological considerations

From our consideration of the literature on the issue of environmental change and forced migration, it is possible to discern a number of commonalities in the methods used to explore the relationship between these two phenomena.

First, we have the analogous studies which explore different aspects of the relationship between climate change, environmental change and migration. Such studies include paleoclimatic work, studies of once-off extreme weather events, and studies of longer term events looking at processes such as sea-level rise and land degradation.

The other approach to such study is forward looking 'common sense' models which have been undertaken with varying degrees of rigour. Such works include predictions of increased flooding due to sea-level rise and general analyses of future 'environmental refugee' populations.

Another major cleavage separating approaches has been that between their qualitative or quantitative focus. Different approaches have been taken to address different aspects of the 'environmental refugee' debate and both appear important. In this conclusion I discuss the usefulness of different approaches and suggest some recommendations for ways to move forward.

While the forward looking 'common sense' models employed by the maximilist school have generally been overly simplistic, they will remain an important part of the work exploring the relationship between environmental change and migration. Forward looking models are important not only for the obvious benefits they provide to policy makers but also due to the fact that forecasting of numbers is incredibly powerful in influencing popular sentiment. Thus although such models have been useful for highlighting the potential scale of the impacts of environmental change on migration their simplistic application and poor resolution mean that new, more reliable models are required.

It must also be noted that the accurate development of such models – particularly improvements in their resolution – will only become possible with further study into the mechanisms by which environmental change leads to migration. This is demonstrated by the manner in which studies of environmental change which are analogous to what might be experienced under future climates have been invoked to criticize many of the existing common sense models. Thus, greater knowledge of the mechanisms by which different types of environmental change lead to migration is vital if we are to produce the accurate, forward looking models which are so desired by policy makers.

Qualitative and quantitative approaches have different merits, and in some cases the questions being asked dictate which type of approach is required. Having said this, however, the different modes of investigation do, to a large degree, determine what can be gleaned from different investigations and as such the merits of the different approaches are discussed below.

Quantitative approaches have been used primarily as a means for exploring the degree to which a relationship exists between environmental change and migration. The major approach has been to undertake econometric analyses of different proxies for 'environment' and 'migration' and determine the degree to which changes in 'environment' lead to changes in 'migration'. The advantage of such methods is that they highlight the relationship between different aspects of environmental quality and migratory preferences/responses. They also allow for studies to be undertaken on meaningfully large samples.

Problematically though, quantitative approaches tend to reify 'environment' and 'migration' to the proxies used for their measurement. They also often fail to account for the fact that environmental change may act as a second order driver of migration as it impacts migration as a by-product of its impact on economic wellbeing. As such econometric analyses may well miss the linkages between environmental change and migration, thereby producing findings which understate the problem.

Qualitative studies, on the other hand, have generally been used to interrogate questions regarding the character of migrations (forced or voluntary) undertaken in response to environmental change. They have also been used to highlight the degree to which environmental change acts as a second order driver of such migration thereby interrogating the processes by which migration decisions are impacted by environmental change. Problems with qualitative approaches are that they do not give useful measures of the strength of the relationships between different aspects of environmental change and migration and that they are also usually limited to undertaking relatively small studies – a particularly important limitation given the desire among policy makers for global predictions.

Thus it would appear that some mix of the two approaches would be most useful. In such a mixed approach one might first undertake a qualitative study in order to gain an understanding of the relationship between environmental change and migration and then undertake an appropriately designed quantitative study in order to increase the studied population as well as generate some information on the strength of the linkages between environmental change and migration. Following this it would be useful to undertake follow-up qualitative work so as to better understand the nature of the quantified relationships.

In spite of the utility of such mixed approaches, the problem remains of how to incorporate non-linear responses and how to account for the multitude of different developmental pathways upon which the manifestation of climate change is reliant. While we may be able to learn something about non-linear responses from studies of analogous cases, such non-linear responses remain incredibly hard to predict.

At the same time, our reliance on emission scenarios for predicting climate change impacts means that we will only ever be able to provide predictions of migration which have wide ranges.

Another major problem in this work is the difficulty of providing global predictions of environmentally related migrations. The scope of such a problem in a data scarce environment both provides an incentive for undertaking analogous studies (which provide data) and challenges even powerful quantitative models which become unwieldy and overly simplistic when applied on global scales.

Given the pressing nature of the problem Perch-Neilsen (2004) has tried to address this by suggesting a combination of 'common sense' and empirical approaches, in which common sense models are informed using existing empirical literature on the relationship between migration and environment. In this vein it remains useful to continue undertaking analogous studies and to periodically commission reviews of the existing literature (which can be verified by the contributing authors) so that one might provide a useful document from which to inform the common sense models.

8 Conclusion

From this background paper it is clear that formulating a coherent debate and setting the research agenda for work on the relationship between environmental change and migration requires a comprehensive look at the historical generation of the debate on this topic. It also requires a contextualisation of the debate in terms of the broader politics of the late 20th century in order to make its seemingly intractable elements more comprehensible.

It is notable that a popular claim from work on this topic is that there exists a dearth of empirical work on the relationship between environmental change and migration. This lack of evidence has been cited as a justification for running headlong into potentially ill-advised policy, with a popular defence of simplistic models being that "one is better of being approximately right than exactly wrong". Contrary to this, this paper has shown that there exists a fair body of empirical work on the relationship between environmental change and migration.

It has in fact shown that the notion of a link between environmental change and migration is not fanciful but rather there appears a fair body of evidence (from both paleoclimatic and contemporary analogous studies) that a real relationship does exist. Having said this, however, instead of a simple causal relationship, around which one could easily build models, we find a highly complex body of evidence in which empirical findings appear, at first glance, highly contradictory. Such contradictory findings appear explainable on an individual basis when one explores the importance of the social, political and economic contexts in which such change occurs but making sense of the relationship more generally still appears impossible.

Finally then, given that the relationship between environmental change and migration appears both real and complex, and given that the impacts of climate change appear significant, ongoing research into this topic is considered exceptionally valuable. A greater understanding of the general relationship between environmental factors and migration theory can only improve our ability to afford rights to migrants more generally, while at the same time allowing us to successfully mitigate the potential human insecurity that will be generated by climate change in particular.

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