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Environmental Research Letters

EDITORIAL

Focus on environmental risks and migration: causes and consequences

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Abstract

Environmental change poses risks to societies, including disrupting social and economic systems such as migration. At the same time, migration is an effective adaptation to environmental and other risks. We review novel science on interactions between migration, environmental risks and climate change. We highlight emergent findings, including how dominant flows of rural to urban migration mean that populations are exposed to new risks within destination areas and the requirement for urban sustainability. We highlight the issue of lack of mobility as a major issue limiting the effectiveness of migration as an adaptation strategy and leading to potentially trapped populations. The paper presents scenarios of future migration that show both displacement and trapped populations over the incoming decades. Papers in the special issue bring new insights from demography, human geography, political science and environmental science to this emerging field.

1. Landscapes of movement and risk

As populations grow, and as economies grow, people move from one place to another in order to avail themselves of opportunities, to make a better life and to avoid undesirable risks and harm. Migration is therefore a significant social and economic phenomenon in historic and contemporary societies. With growing mobility and growing human population, there is now a greater stock of migrants in the world than at any point in the past, with the dominant flows of people being from rural areas to urban settlements over the past decades. At the same time, and for related reasons, the world is in the throes of global changes to land use, pollution loading, and systemic change to biodiversity climate and other earth system processes. Yet many accounts of this global environmental change, from discussions of the great acceleration, the anthropocene, planetary boundaries or extinction crises, fail to systematically account for the role of people moving from one place to another as either a cause or consequence of emerging environmental risks.

Hence this special issue of *Environmental Research Letters* sets out a number of research challenges and new findings on issues around (a) the processes linking migration with environmental risks and (b) the broad empirical and policy trends in this area.

The set of papers forms part of a resurgence of interest in migration and environmental risks, with international research programmes, international scholarship, and increasing policy focus. These include the UK Foresight project on *Migration and Global Environmental Change* (Foresight 2011), from which much of this set of papers was first initiated. The field is expanding rapidly with major international comparative research projects (Afifi and Jäger 2010, Warner and Afifi 2014, Piguet *et al* 2011). For the first time the Intergovernmental Panel on Climate Change has directly engaged and assessed migration as both impact and adaptation to climate change. These are

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summarized in various chapters of the IPCC's Fifth Assessment reports (human security—Adger *et al* 2014; poverty—Olsson *et al* 2014; urban areas—Revi *et al* 2014; emerging risks—Oppenheimer *et al* 2014; rural areas—Dasgupta *et al* 2014; Africa—Niang *et al* 2014).

Migration and environmental change is a research frontier. It is a frontier for various reasons. First, the world is becoming more mobile and more urban. Hence the scale and complexity of migration patterns has grown in recent decades. There are diverse accounts of how economic growth and industrialization drive migration patterns (Hatton & Williamson 2008, De Haas 2010, Hugo 2011). Clearly labour intensive primary and secondary industries draw workers from agriculture and other primary sectors into urban areas. But as Hugo (2011) describes, demographic transitions in developing economies (declining death rates and high population growth rates sustained over decades) also drive the observed rural to urban migration and play a part in international migration rates. Changing practices in agriculture and decreases in the real costs of migration to urban centres, such as relaxing of registration regulations, have also been shown to contribute to increased mobility and migration trends (UNDP 2009).

A second issue making migration-environment an emerging research frontier is systematic environmental change. This includes increased loss of environmental functions and ecological services across many social-ecological systems, as well as greater recorded impacts of extreme weather events causing temporary displacement. It remains difficult to attribute individual events to longer-term changes in climate and earth systems (Stone *et al* 2009). Yet there is less doubt that the economic costs, both incurred and uninsured, of extreme weather events are increasingly significantly (Neumayer *et al* (2014)). These trends of increased exposure of populations to environmental risks are, of course, in part driven by demographic and migration trends towards settlement in risky environments in all continents (de Sherbinin *et al* 2012).

The research frontiers of migration and environmental change are contested. Piguet (2013) explains the resurgence of interest as a reaction to the simplistic deterministic assumption of people being in the way of hazards and simply moving. Such accounts, often expressed as aggregate estimates of so-called environmental refugees (Gemenne 2011), have stimulated demographers to question such numbers and engage with the environment as a major driver of migration. The political focus on security of borders, and the so-called securitization of migration policy has stimulated research into the political geography of migration, not least because of the securitization of climate change impacts (White 2011, Bettini (2013)). Others have questioned whether a focus on migration and environment represents a 'neoliberal' turn towards viewing both phenomena as capable of expression in terms of financial risk (Felli and Castree 2012).

Most strikingly, however, the scientific evidence on the likely unfolding of climate change over the incoming decades makes research on migration and other demographic aspects of responses more urgent. The IPCC Synthesis Report articulates clearly climate change as a real and looming issue, with major consequences for economies, ecological systems and localities (IPCC 2014). It suggests that without significant mitigation efforts, the world is locked into high levels of impacts in all social and ecological arenas associated with 4 °C or more mean warming, unevenly distributed in speed and magnitude (Betts *et al* 2011).

Climate change involves major impacts on economies. Even strong decarbonization action involves social conflicts and potential displacement: hydropower developments for example displace settlements, and some zoning and planning incentivizing shifts in populations away from risky areas, often to the detriment of those being forcibly moved (de Sherbinin *et al* 2011, Wilmsen and Webber 2015).

Although underexploited till now, there is in effect as significant knowledge base in all these areas of how climate change will interact with migration patterns. Much of the evidence comes from demography, development economics, policy sciences and human geography, with evidence of how past changes in the viability of economies affect the movement of people, through to contemporary and predictive modeling of future changes (e.g. Barbieri *et al* 2010, McLeman 2011).

One key issue is how migration and mobility feed into scientific assessments of future worlds. The principal means is through the development of scenarios. The international environmental science community has developed, for use in climate and other sciences, the widely used set of scenarios known as the Representative Concentration Pathways (RCPs) and the shared socio-economic pathways (SSPs). They are descriptions of plausible future evolution of the world economy, demographic patterns and governance (O'Neill *et al* 2015) and are articulated as story lines and in quantitative terms. The storylines show for example, that in a stabilized world population in the 21st century, that migration becomes more important determinant of settlement patterns and populations shifts (Samir and Lutz 2015).

The Foresight Report on Migration and Global Environmental Change developed its own projections of global economic, environmental and demographic futures in order to explore the consequences for migration. These are based on and consistent with the main global projections embedded in the SSPs. The principal drivers of migration outcomes are those of the scale, connectivity and openness of the economy in the regions of the world, along with the policy stance and governance of that economy, its labour markets and social tensions and conflict (see Black *et al* 2011a on the global drivers). These drivers create the two

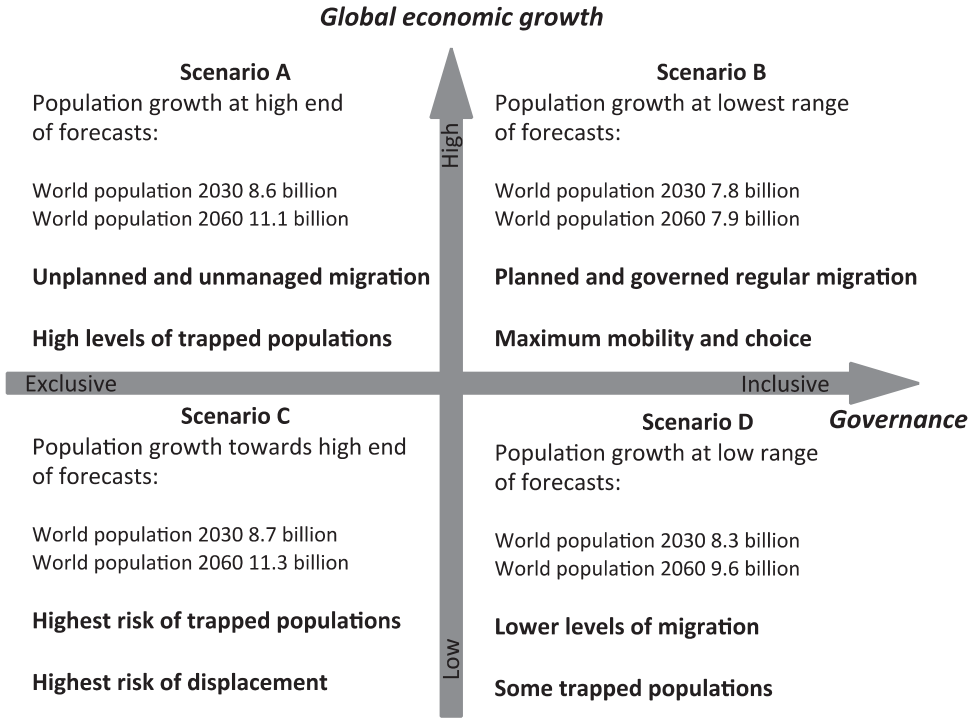


Figure 1. Scenarios of global migration trends, mapped by global growth and political and social governance factors. Source: Foresight (2011).

dimensional space in figure 1 where different storylines for world futures, neutrally named Scenarios A to D, play out. The axes are high or low economic growth and the inclusiveness-exclusiveness of governance structures.

The analysis in figure 1 shows that sustained economic growth creates mobility and opportunities for migration and that where governance and policies are sensitive to that demand, that regular migration patterns can be managed and there is the highest possibility for migration to be integral to the world's response to climate change impacts. This is scenario B in figure 1. By contrast, low economic growth, but with continued environmental degradation risks the greatest levels of populations without the resources to be mobile but still exposed to significant environmental risks. These trapped populations are highest in scenarios C and D. These dimensions of where populations are and where the demand is for relocation and migration need to be incorporated in a systematic way into the global SSPs.

Building on the scenario and other analyses of drivers, the Foresight (2011) report highlights that the world is increasingly mobile and that migration is integral to many social and economic processes, rather than simply an outcome of environmental risks. The analysis also highlights that low mobility is critical—that populations may be, in effect, trapped in places where environmental risks are increasing (Black *et al* 2013). The Foresight analysis demonstrates how migration is a well-documented and often effective adaptation to environmental risks (Black *et al* 2011b). At the same time, however, populations are moving to areas which themselves are subject to climate change impacts and risks. Hence cities are set to become the crucibles for climate change impacts, increasing populations exposed, and requirement for planning responses.

2. Contributions of this special issue

The papers in this special issue highlight the social and demographic dimensions of migration flows and decisions. A first set of papers build on theory and observational studies on migration to illuminate issues of policy relevance. A further set of papers highlights the specific role of environmental risks, especially projected climate change, in migration responses.

2.1. Climate change amplifying migration outcomes

de Sherbinin *et al* (2012) put some numbers to the global picture of migration. They give fresh insight into those global flows, by mapping where people have moved in the past decades by the social-ecological systems in which they reside. They use the standard residual method to estimate migration flows between census periods, to provide these first global estimates. This shows, for example, that the observed population growth in the world's coastal regions is partly driven by migration, confirming the so-called drift to the coast (Small and Nicholls 2003). Dryland areas and mountain ecosystems globally are net sources of emigration. Such figures of course hide the role of

increasing population densities in urban centres, including the expansion of major cities in coastal areas, and indeed in large deltas around the world (Seto 2011). The estimates point to the challenges that economic opportunities override most other drivers of migration, and people are moving to places that are better economically connected, even if they face potentially new and rising hazards.

The challenges of turning observations on migration into predictive models migration flows under environmental change includes knowledge about the likelihood of non-linear changes and 'events' that constitute environmental risks in source and in destination areas. Smith *et al* (2012) review the scientific basis of predicting weather and climate conditions at seasonal and decadal scales. Clearly seasonal anomalies, such as droughts associated with ENSO events, are part of the landscape of migration for pastoralists throughout the world, as well as affecting more sedentary farming systems and the demand for labour in agriculture, in every part of the world. While Patt *et al* (2005) demonstrate that the adoption of seasonal forecasts is important but patchy across Africa, the level of forecast skill, according to Smith and colleagues is increasing and hence makes the use of such forecasts more robust.

Decadal forecasts are also increasing in forecast skill, though not yet at a level that makes a significant difference for predictive models of societal response, given the complexity of migration and other adaptive behavior. The use of forecasting is made more critical by the projections that ENSO events are likely to become more intense with mean warming, affecting many parts of the world with major periodic impacts (Cai *et al* 2015).

The level of certainty concerning future sea level change is greater, though still constrained by knowledge of the physical processes and coastal morphology response. What are the likely responses to sea level change in high population coastal areas? Hallegatte (2012) shows that coastal regions are likely to lose physical and natural capital with land inundation, and that these have a direct impact on economic growth and long-term prospects. One aspect of the economic cost is that resources diverted into coastal protection have an opportunity cost—they are diverted from more productive uses and investments. Individual disasters and events also negative economic impacts—Hallegatte (2012) emphasizes the prospect of people losing their assets and falling into poverty traps. A lack of capital at the individual level is, indeed, one of the principal causes of immobility and potentially trapped populations (Black *et al* 2013).

If climate change impacts increase migration flows, should climate policy be part of the response? The consequences of climate change are in the mind of policy-makers everywhere and take real form in the international climate regime though the UN Framework Convention on Climate Change. Hence Gibb and Ford (2012) examine the case for so-called climate migrants being included and recognized within the Convention. Others have largely dismissed the likelihood of such movement being identifiable and legible to the Geneva Convention relating to the Status of Refugees (McAdam 2011). But the Climate Change Convention does recognize migration as a legitimate and effective adaptation under its Cancun Accords (see Warner (2012)) and Gibb and Ford make the case for further integration, ultimately promoting mechanisms for relocation and compensation for those permanently displaced as a result of climate change. They raise the unresolved issue of pinning down climate change and of the single cause of migration or displacement that constrains all such arguments—what Hulme (2011) calls 'reducing the future to climate'.

2.2. The social dynamics of environment and migration interactions

A second set of papers in this themed issue highlights key social processes that affect migration flows, decisions and policies: ageing, gender, place attachment, conflict, conservation and remittances. They highlight the need for considered and comprehensive social science insights to explain its social dynamics. Harper (2012), for example, explores the role of international migration in economies where population levels are stable and ageing. She argues that Europe, in particular, has a demographic deficit and hence its economic competitiveness requires importance of human capital and skilled labour. Such demands for the importation of labour will be affected by future environmental risks. The role of migrant labour in agriculture and other sectors, and how that might change given likely shifts in agricultural production in Europe, has, however, not yet been systematically addressed.

For individuals, the environment and its role in lives and experiences, is a factor in deciding to shift locations. While much work focuses on downside environmental risks and motivations for push migration, the environment as a resource and set of services can explain why population persist even when there are economic opportunities elsewhere. Adams and Adger (2013) demonstrate that ecosystem services contribute to what they term place utility, and that attachment to place and community are powerful forces in keeping populations in rural Peru even with declining environmental quality. When thresholds are crossed, however, land degradation and lack of opportunities in agricultural-dependent economies does result in outmigration. López-Carr (2012) shows land degradation as a major factor in source regions in Guatemala. And in that country the migration is to forest frontiers, with migrants being the agents for further habitat conversion and loss.

Deshingkar (2012) reviews a set of cases and evidence on climate risks in agricultural systems, from India, Mexico and Burkina Faso, to seek patterns that explain migration outcomes. She highlights the role of remittance income in investments to intensify and

capitalize agricultural activities, often seen as a potential for reducing environmental impact and making agriculture sustainable. Hence, she argues, that cyclical migration is part of the solution to environmental degradation in agricultural economies, building linkages and resilience into such systems.

Yet migration systems create their own vulnerabilities and groups. Chindarkar (2012) argues that women are disproportionally vulnerable to environmental risks in low income regions and rural economies because of outmigration of men. Climate change has been shown to have significant health burdens on women through higher mortality in places of residence in natural disasters, through differences in wealth, and through gender differences in access to services following disasters (Smith *et al* 2014 outlines the health outcome issues). Hence there is a need to understand who migrates, at what point in their life-course, and the implications of environmental risks for women, men and communities

One reason why migration is contested in politics is the perception that migration increases and causes social tension, and potentially even conflict. Whether and how migration flows interact with both environmental risks and with conflict risks is of continued interest to domestic and foreign policy agencies. Bernauer *et al* (2012) review the evidence on direct and indirect interactions that link environmental change with conflict. They point to discrepancies in findings between major research traditions: micro-level studies on individual conflict events tend to find a plausible environmental risk factor or trigger for the conflict. Yet analysis of patterns across multiple conflict events are much more equivocal about the role of environmental risk or resource scarcity in triggering or perpetuating conflict. As Gemenne *et al* (2014) and others have noted, the search for causation is fruitless with underpinning theoretical understanding of conflict and of the absence of conflict in the face of climate and other risks.

Bernauer *et al* (2012) conclude that pathways such as unanticipated migration flows and displacement of whole populations are plausible routes to conflict. This assessment adds to the broad conclusion that displacement risks and trapped populations have significant social and economic costs, unaccounted for in many models and scenarios.

3. Conclusions

The vigorous and burgeoning interaction between the social sciences of migration and those of environmental risks throw up new and nuanced challenges for responses to global change. The evidence base on the role of migration in adapting to environmental change, in particular, poses significant questions for policy and governance (Geddes *et al* 2012). Environmental change and risks are pervasive but linked to wider landscapes of social and economic change. Hence, interventions and policies need to take account of the role of the movement of people and the dominant flows of migrants. In this set of papers some key policy areas stand out. First there is a need to build adaptive capacity to environmental change in ways that build flexibility and agency at the generic level. Second there needs to be further account of how to deal with those displaced by environmental change, within states and across state borders. And finally the trends suggest an urgent need to address urban sustainability, protection of the rights of migrants and a greater realization of the role of migration in economic development and progress.

The papers in this themed issue form part of this new science. Taken together, the emerging evidence base demonstrates that migration involves personal stories of loss, opportunity and upheaval that reverberate through generations, within a wider context of changing societies and environments. This special issue demonstrates, as a contribution to this research field, that societies are adaptable to global environmental changes, and that societal resilience is a goal that needs to be pursued with action and evidence.

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