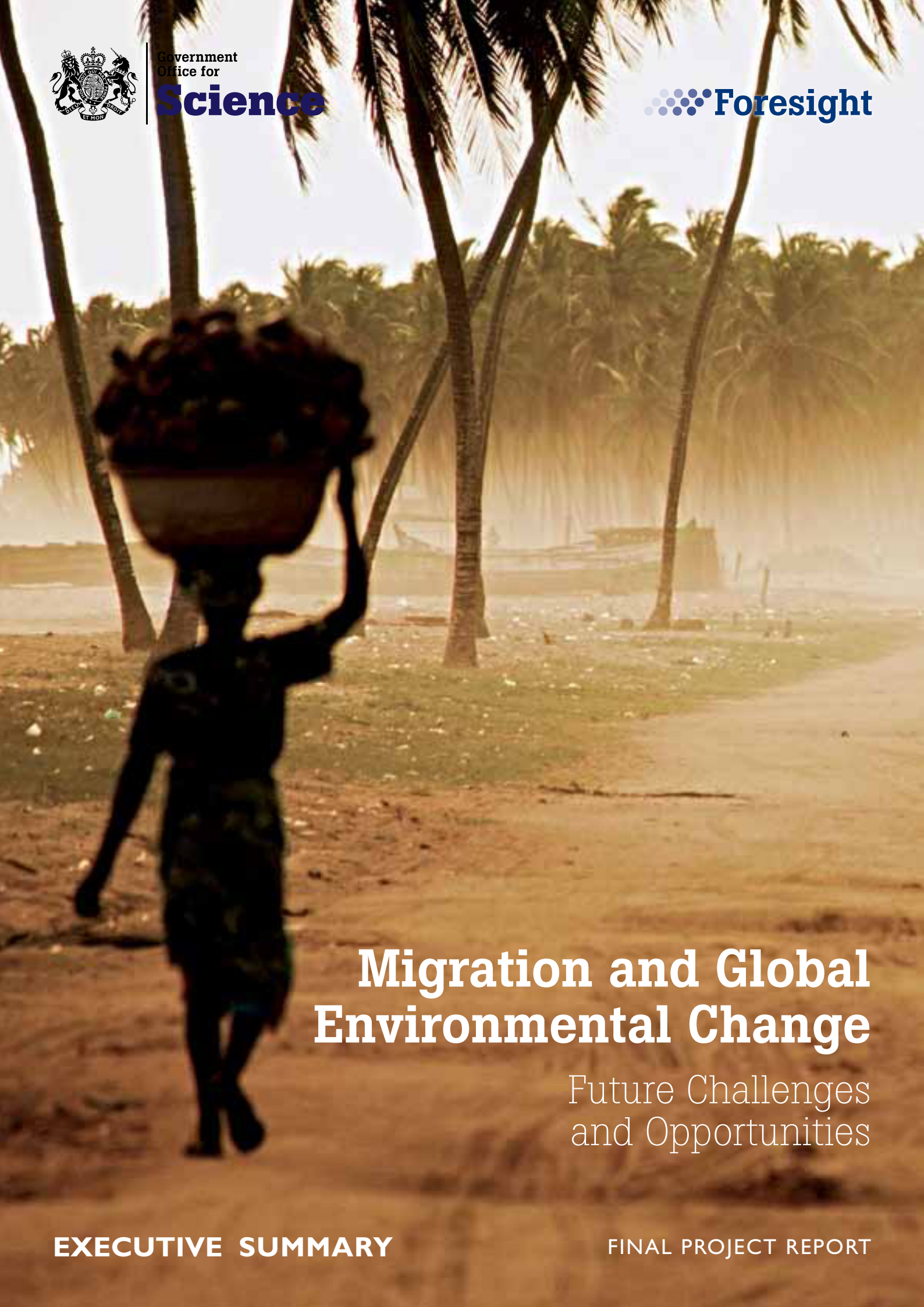


Government Office for Science

Foresight

Migration and Global Environmental Change

Future Challenges and Opportunities

EXECUTIVE SUMMARY

FINAL PROJECT REPORT

Migration and Global Environmental Change

Future Challenges and Opportunities

EXECUTIVE SUMMARY

This report is intended for:

Policy makers and a wide range of professionals and researchers across the world whose interests relate to environmental change and the many forms of human migration. It will also be of interest to those working in the many areas that interact with migration, for example conflict and security, the sustainability of communities, food supply, climate change mitigation and adaptation, and also developmental and humanitarian agendas.

This Report should be cited as:

Foresight: Migration and Global Environmental Change (2011)
Final Project Report: Executive Summary
The Government Office for Science, London

Foreword

A range of major forces are set to cause profound changes in natural and human environments across the world over the next 50 or so years. Besides climate change, examples include the growth of mega-cities, land degradation and the profound consequences of an increasing global population which is consuming ever more natural resources. The key aim of this Foresight project has been to consider how these global drivers could affect the volume and patterns of human migration out to 2030 and thence to 2060; and, importantly, the decisions that need to be taken today by policy makers at national and international levels to address the future challenges.

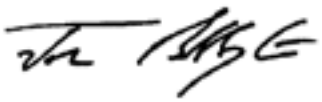
Some of the results have been surprising, if not counterintuitive. For example, recognising in particular that most migration will be within countries, the project has found that broadly as many people could move *into* areas of environmental risk as migrate from them. Also, a major challenge concerns the large populations in vulnerable areas that may become trapped, or indeed choose not to move. Such consequences raise concerns for policy makers which go far beyond the management of migrating populations. These relate to issues such as climate change adaptation, urban planning, developmental assistance and conflict management. The diversity of these challenges argues for a new strategic approach towards policy development, and exploring this has been a theme running throughout the work.

I am particularly grateful to the lead expert group who oversaw much of the work and also to the Foresight team.

I am also most grateful to the group of senior stakeholders who have provided advice throughout the project, and to the 350 or so contributing experts based in over 30 countries, and representing disciplines as diverse as geography, migration studies, climate science, anthropology, economics and international politics. They have all made important contributions, whether in producing evidence papers, undertaking essential peer review or providing regional perspectives by participating in our international expert workshops. Together they have ensured the project and report have a broad, global perspective.

Other important elements of the work include the use of cutting-edge science and the innovative approach taken in considering the issues of migration and environmental change. The result has been a range of fresh insights across a broad front. A report of this breadth aims to provide signposts to important future challenges, and to present a range of options for policy makers.

Through the publication of the final report, I have pleasure in presenting the findings to the many interested stakeholders from across the world.



Professor Sir John Beddington CMG FRS
Chief Scientific Adviser to the UK Government

Lead expert group overseeing the project:

Professor Richard Black (Chair)	Head of the School of Global Studies and Professor of Geography at the University of Sussex
Professor Neil Adger	Professor of Environmental Economics, University of East Anglia, and Programme leader at the Tyndall Centre
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For further information about the project please visit:

http://www.bis.gov.uk/foresight/our-work/projects/current-projects/global-migration

Jian Long Hotel

Executive Summary

Key conclusions

This report considers migration in the context of environmental change over the next 50 years. The scope of this report is international: it examines global migration trends, but also internal migration trends particularly within low-income countries, which are often more important in this context. The report has the following key conclusions:

- **Environmental change will affect migration now and in the future, specifically through its influence on a range of economic, social and political drivers which themselves affect migration. However, the range and complexity of the interactions between these drivers means that it will rarely be possible to distinguish individuals for whom environmental factors are the sole driver ('environmental migrants').** Nonetheless there are potentially grave implications of future environmental change for migration, for individuals and policy makers alike, requiring a strategic approach to policy which acknowledges the opportunities provided by migration in certain situations.
- **Powerful economic, political and social drivers mean that migration is likely to continue regardless of environmental change.** People are as likely to migrate *to* places of environmental vulnerability as *from* these places. For example, compared to 2000, there may be between 114 and 192 million additional people living in floodplains in urban areas in Africa and Asia by 2060, in alternative scenarios of the future. This will pose a range of challenges to policy makers.
- **The impact of environmental change on migration will increase in the future.** In particular, environmental change may threaten people's livelihoods, and a traditional response is to migrate. Environmental change will also alter populations' exposure to natural hazards, and migration is, in many cases, the *only* response to this. For example, 17 million people were displaced by natural hazards in 2009 and 42 million in 2010 (this number also includes those displaced by geophysical events).
- **The complex interactions of drivers can lead to different outcomes, which include migration and displacement.** In turn, these types of outcomes can pose more 'operational' challenges or more 'geopolitical' challenges. There are powerful linkages between them. Planned and well-managed migration (which poses operational challenges) can reduce the chance of later humanitarian emergencies and displacement.
- **Environmental change is equally likely to make migration less possible as more probable.** This is because migration is expensive and requires forms of capital, yet populations who experience the impacts of environmental change may see a reduction in the very capital required to enable a move.
- **Consequently, in the decades ahead, millions of people will be *unable* to move away from locations in which they are extremely vulnerable to environmental change.** To the international community, this 'trapped' population is likely to represent just as important a policy concern as those who do migrate. Planned and well-managed migration can be one important solution for this population of concern.
- **Preventing or constraining migration is not a 'no risk' option.** Doing so will lead to increased impoverishment, displacement and irregular migration in many settings, particularly in low elevation coastal zones, drylands and mountain regions. Conversely, some degree of planned and proactive migration of individuals or groups may ultimately allow households and populations to remain in situ for longer.

The challenges of migration in the context of environmental change require a new strategic approach to policy. Policy makers will need to take action to reduce the impact of environmental change on communities yet must simultaneously plan for migration. Critical improvements to the lives of millions are more likely to be achieved where migration is seen as offering opportunities as well as challenges.

- **Measures that prevent harmful environmental changes, reduce their impact, and build resilience in communities** will diminish the influence of environmental change on migration but are unlikely to fully prevent it.
- **Migration can represent a 'transformational' adaptation to environmental change, and in many cases will be an extremely effective way to build long-term resilience.** International policy should aim to ensure that migration occurs in a way which maximises benefits to the individual, and both source and destination communities.
- **Cities in low-income countries are a particular concern, and are faced with a 'double jeopardy' future.** Cities are likely to grow in size, partly because of rural–urban migration trends, whilst also being increasingly threatened by global environmental change. These future threats will add to existing fragilities, whilst new urban migrants are, and will continue to be, particularly vulnerable. Yet this report argues against trying to prevent rural–urban migration, as this could lead to graver outcomes for those who are trapped in vulnerable rural areas.

In summary, the key message of this report is that migration in the face of global environmental change may not be just part of the 'problem' but can also be part of the solution. In particular, planned and facilitated approaches to human migration can ease people out of situations of vulnerability. In light of this, international policy makers should consider the detailed evidence from this report in a range of areas, with the following of particular priority:

1. **Many of the funding mechanisms for adaptation to environmental change are currently under discussion.** It is imperative that these mechanisms are not developed in isolation from migration issues and, furthermore, that the transformational opportunities of migration is recognised.
2. **Whilst the twin challenges of population growth and environmental change will pose an increasing threat to urban areas in the future, cities in many countries are already failing their citizens.** Action is required before the situation becomes irreversible, to build urban infrastructure that is sustainable, flexible and inclusive.

The cost of inaction is likely to be higher than the costs of measures discussed in this report, especially if they reduce the likelihood of problematic displacement. Giving urgent policy attention to migration in the context of environmental change now will prevent a much worse and more costly situation in the future.

1. The aims and scope of the project

The aim of this report has been to use the best available science and other evidence to:

- develop a vision for how human population movements across the world could be affected by global environmental changes between now and 2060; with a focus on the diverse challenges and opportunities for migrants and populations in originating and receiving regions;
- identify and consider the decisions and choices that policy makers need to take today so that new policies are resilient to the wide range of future uncertainties.

A global perspective

The report takes an unequivocally global approach to the issue of migration in the context of environmental change. This has involved:

- analysing international migration on a global level, between low-income and high-income countries and among low-income countries;
- analysing internal migration, particularly in low-income countries, which are most vulnerable to environmental change;

- looking at the impact of environmental changes arising from climate change, as well as land degradation and coastal and marine ecosystems degradation;
- understanding that links between migration and environmental change are particularly important in three key global ecological regions: drylands, low-elevation coastal zones and mountain regions;
- recognising that the impact of environmental change on future migration is uncertain – different growth, governance and environmental scenarios have diverse implications for migration influenced by environmental change.

A robust and independent approach

The analysis provides an independent look at the challenges ahead and how they might best be addressed. Whilst the work has been led by the UK Government Office for Science, the findings do not constitute the policy of the UK or any other government. The report's added value is the robustness of the evidence it uses, and the scrutiny and engagement it has received from a wide range of experts:

- The report uses cutting-edge science from the broadest possible range of disciplines: from migration studies, economics, climate and environmental change, social sciences, demography, and geography. More than 70 papers and other reviews of the state of the art of diverse areas of science were commissioned to inform the analysis[1].
- The development of the report has seen the involvement of around 350 leading experts and stakeholders from 30 countries worldwide. This has been crucial in enabling diverse regional perspectives and understanding to inform the work.

2. What is the relationship between migration and environmental change?

It is almost impossible to distinguish a group of 'environmental migrants', either now or in the future.

There are a number of existing estimates of the 'numbers of environmental/climate migrants', yet this report argues that these estimates are methodologically unsound, as migration is a multi-causal phenomenon and it is problematic to assign a proportion of the actual or predicted number of migrants as moving as a direct result of environmental change. A deterministic approach that assumes that all or a proportion of people living in an 'at-risk' zone in a low-income country will migrate neglects the pivotal role that humans take in dealing with environmental change, and also ignores other constraining factors which influence migration outcomes.

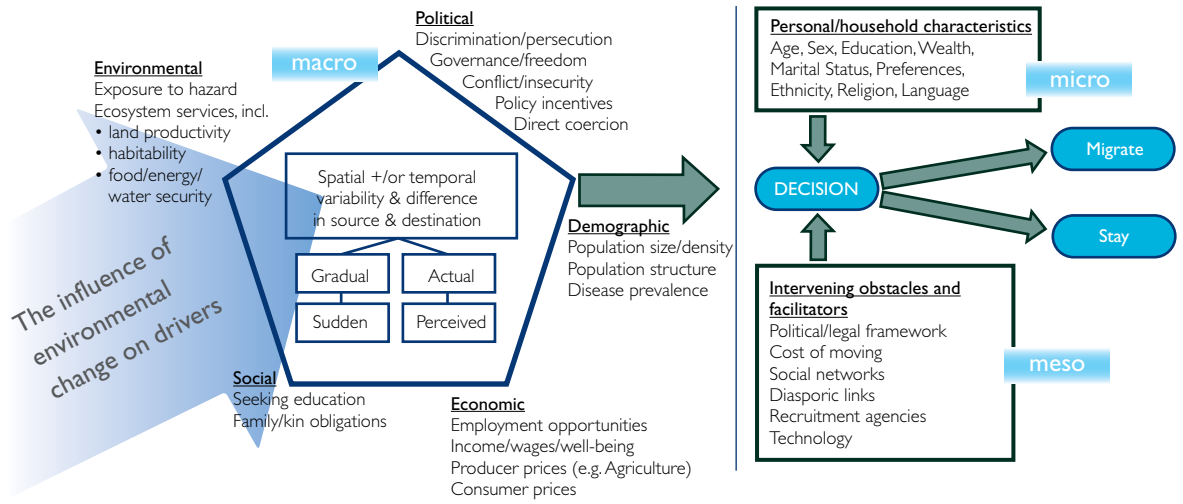
This is not to say that the interaction of migration and global environmental change is not important: global environmental change does have real impacts on migration, but in more complex ways than previous cause–effect hypotheses have indicated.

Foresight's conceptual approach: global environmental change affects the drivers of migration.

The decision to migrate is influenced by five broad categories of 'driver'. These drivers are set out at the vertices of the pentagon in Figure ES.1. This framework acknowledges that migration is already occurring in most parts of the world as a result of these drivers: indeed there were approximately 740 million internal migrants in 2000–02 and 210 million international migrants in 2010. Environmental change will influence migration outcomes through affecting existing drivers of migration. This influence is most pronounced for economic, environmental and, to a lesser degree, political drivers. This conceptualisation recognises that the powerful existing drivers of migration, with economic drivers foremost, will continue to be the most powerful in most situations. However, environmental change will affect these drivers by having impact, for example, on rural wages, agricultural prices, exposure to hazard and provisioning ecosystems.

1 See Annex for a complete list. Apart from workshop reports and working papers, all evidence papers have been peer reviewed to a 'double-blind' standard. All are freely available, as indicated in the Annex.

Figure ES.1: The conceptual framework that has been used in this project, showing the 'drivers' of migration and the influence of environmental change[2]



Environmental change is equally likely to prevent migration as it is to cause migration.

An important feature of the diagram above is that the existence of migration drivers does not necessarily imply that migration will occur: whether migration occurs or not depends on a series of intervening factors and personal and household characteristics. This is important in the context of environmental change. Substantial social, economic and human capital may be required to enable people to migrate, especially internationally.

This may mean that environmental change affects a driver, for example agricultural productivity, yet affected individuals do not have the financial capacity to respond to this change by migrating. Environmental change may also erode important assets, meaning that in some situations environmental change can make migration less likely. This has important implications for poorer individuals who are unable to finance migration, but are also vulnerable to environmental change. For example, evidence from Uganda suggests that, in contrast to Kenya (see below), migration is costly with high 'barriers to entry'. In situations like this, where there are reduced opportunities for migration, soil quality acts as capital to facilitate migration; deterioration in soil quality makes migration less likely.

3. What does future migration in the context of environmental change look like?

Key themes about future migration in the context of environmental change have been distilled through evidence gathering across three vulnerable regions, and applied to the socioeconomic and political dimensions of four future scenarios. The themes are as follows:

Migration is often undertaken to secure livelihoods in adverse environmental conditions.

A powerful conclusion from the analysis of the three key vulnerable ecological regions is that migration is often a response taken at the household level to diversify income streams and secure livelihoods in the face of deteriorating environmental conditions. For example:

- A case study in Kenya between 2004 and 2005 found that migration was an important form of income diversification for households which experienced poor soil quality, and reduced agricultural yields.
- In Burkina Faso in the 1970s, a common and widespread early response to drought was short-term, rural–rural migration to diversify incomes.
- A study in the Ethiopian highlands between 1996 and 2001 found that labour-related migration was a key coping strategy following drought.

2 The Final Project Report explains this in more detail in Chapters 1 and 2.

- Evidence from Vietnam suggests that flooding can destroy crops and act as a trigger to livelihood stress, which then directly causes migration.

Migration as a form of livelihood diversification has been shown to occur after environmental events such as drought and flooding. Climate models predict that events such as these are likely to become more frequent for some regions after 2030 and 2060.

Rural–urban migration is increasing in some situations because of environmental change, and people arriving in cities are vulnerable.

Evidence from Bangladesh suggests that rural–urban migration can be a coping strategy for households affected by environmental events. A survey from the island of Hatia, coastal Bangladesh, found that 22% of households used migration to cities as a coping strategy following tidal surges, and 16% following riverbank erosions. A cross-country analysis of determinants of urbanisation in sub-Saharan Africa suggests that deteriorating rainfall conditions do increase rural–urban migration. In contrast, however, evidence from Mali during the 1983-85 droughts shows that people who have been affected by drought are less able to afford to migrate to cities.

In some respects, whether environmental change affects these rural migration flows is of less importance than the fact that major economic, political and social factors will continue to drive migration to cities in low-income countries, and that many of these cities are particularly vulnerable to environmental change.

- The number of people living in floodplains of urban areas in East Asia may rise from 18 million in 2000 to 45–67 million by 2060, and:
- from 4 million in 2000 to 35–59 million by 2060 in South-Central Asia;
- from 7 million in 2000 to 30–49 million by 2060 in South-Eastern Asia;
- from 2 million in 2000 to 26–36 million by 2060 in Africa (depending on various scenarios of the future).

Environmental change can influence future displacement, as well as migration.

- There is evidence that exposure to hazards such as floods and storm surges is a major source of displacement of populations, both temporary and permanent, in coastal areas. For example, in the New Orleans area in 2005, Hurricane Katrina displaced north Gulf Coast residents for months and, in some cases, years: by 2010 (using 2005 as a base year) the population of the New Orleans region had declined by 25.4%. Texas received over 250,000 Katrina migrants.
- Displacement can also occur in drylands. In the late 1980s and early 1990s, around 100,000 people moved out of Karakalpakstan, in part because of loss of livelihoods related to the desiccation of the Aral Sea, representing 1 in 16 of the population.

Where people have reduced options for migration, they are likely to be trapped in locations vulnerable to environmental hazards, or be forced to migrate in ways which increase their vulnerability.

Reduced options for migration, combined with incomes threatened by environmental change, mean that people are likely to migrate in illegal, irregular, unsafe, exploited or unplanned ways. People are also likely to find themselves migrating to areas of high environmental risk, such as low-lying urban areas in mega-deltas or slums in water-insecure expanding cities.

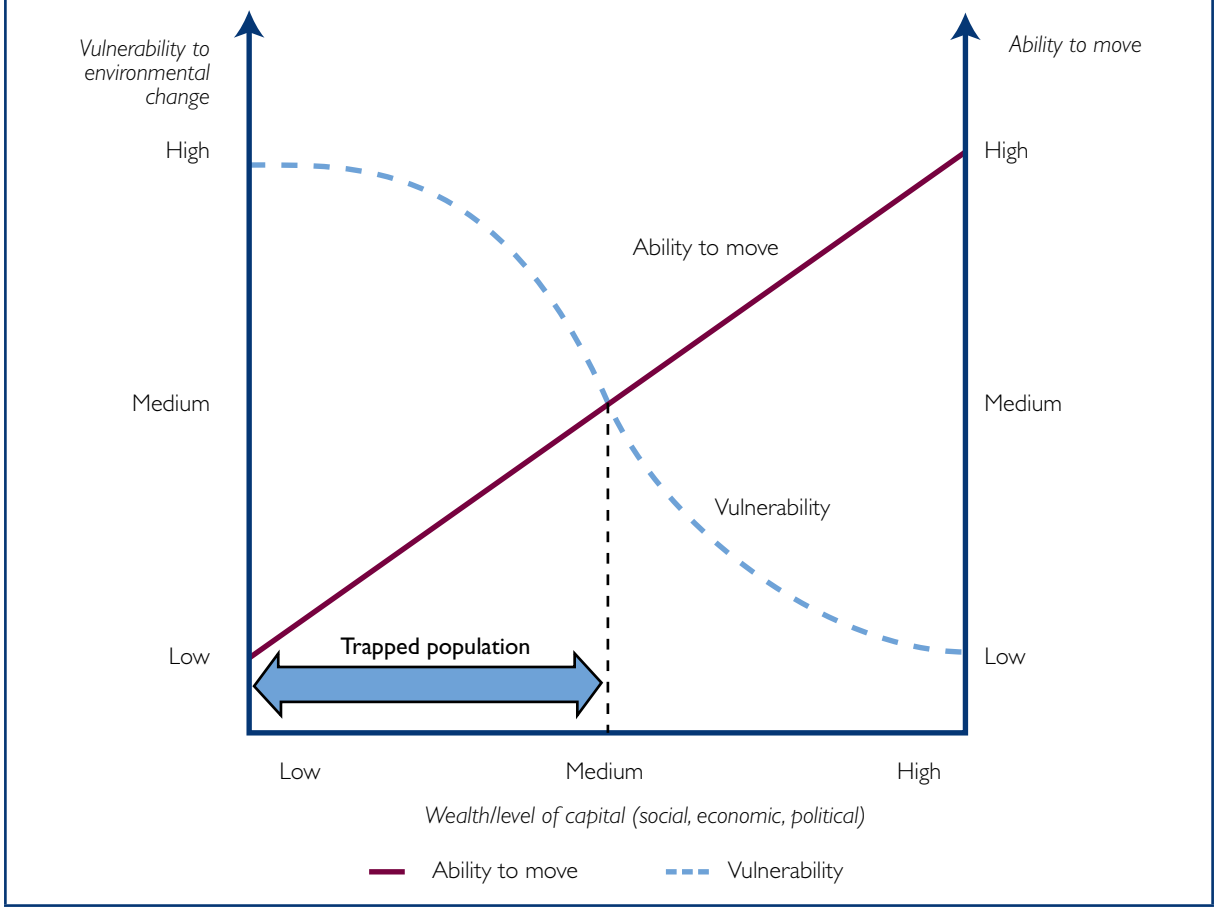
Many populations will be at risk because safe migration channels from small island environments and marginal agricultural lands in the world's drylands and mountains are unavailable to them. This means that they may become trapped in poor areas, where they are likely to be more vulnerable to increasingly worse environmental conditions.

- For example, in small island states and other islands, people living in flood-prone areas, or close to exposed coasts, are already relatively poor and are unable to respond to hazards by moving, since migration (especially international migration) is selective by economic status.

- In New Orleans during Hurricane Katrina, the wealthy were able to migrate proactively, whilst the lower-income and less educated population group remained in their homes, or sought shelter in makeshift and potentially dangerous emergency shelters in the aftermath, and were disproportionately affected.

Many studies in a wide range of countries have shown that migration is positively associated with wealth and social capital, while vulnerability to environmental change is negatively correlated with wealth and social capital, as shown in Figure ES.2 below. Those with lower wealth or capital face a double set of risks from future environmental change: their reduced level of capital means that they are unable to move away from situations of increasing environmental threats; yet, at the same time, this very lack of capital makes them even more vulnerable to environmental change. These populations are likely to become trapped in places where they are vulnerable to environmental change (see Figure ES.2).

Figure ES.2: Schematic representation of 'trapped populations'

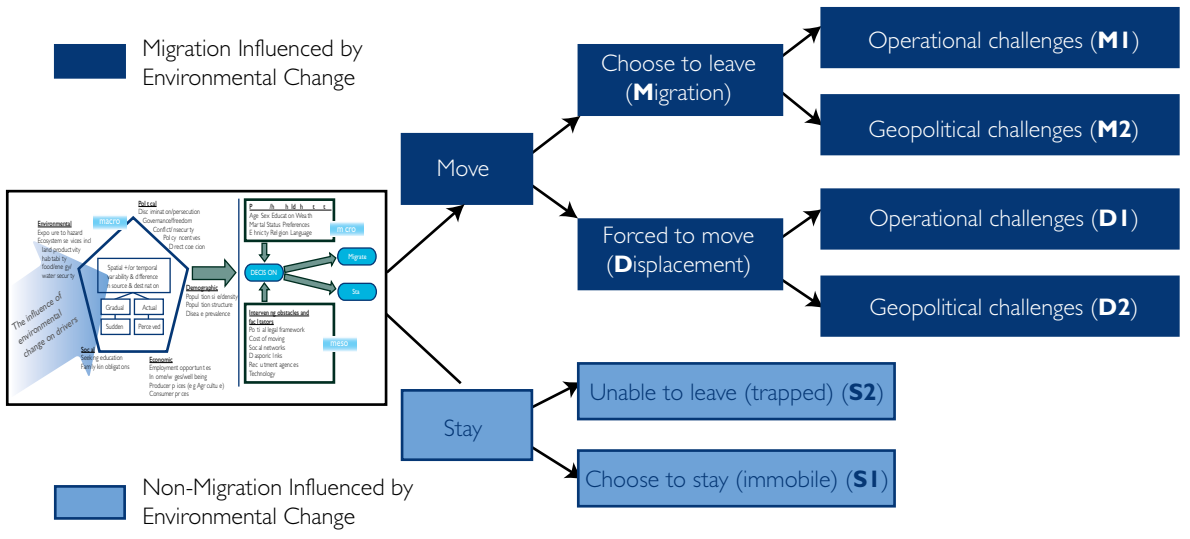


4. What are the implications for policy makers?

The evidence suggests there are a range of outcomes which result from the impact of global environmental change on migration.

This report has found that migration in the context of environmental change can lead to six distinct 'human mobility outcomes' which represent challenges to policy makers. These are shown in Figure ES.3.

Figure ES.3: Six human mobility outcomes



- *Migration posing operational challenges:* Future environmental change, in combination with other factors, could significantly alter existing volumes and patterns of migration. These may pose relatively routine, if diverse, operational challenges if they represent small or slow adjustments to the status quo. For example, *the number of African urban poor is expected to exceed 400 million by 2015, compared with 240 million in 1990.* If, as predicted, rural–urban migration increases, whilst environmental conditions worsen, this trend will represent a significant operational and technical challenge for city planners in terms of sustainable urban growth, pressure on water and transport, increased pollution in large cities and waste creation.
- *Migration posing geopolitical challenges*: Unplanned, unpredictable and concentrated movements of people are more likely in scenarios of the future characterised by high global growth, but fragmented social, political and economic governance. Whenever migration becomes large or rapid, or sensitive international boundaries are crossed, then geopolitical challenges may follow. For example, destination areas may face challenges relating to economic integration, social cohesion and increased tension/conflict. It is estimated that *1.5–2 million Zimbabweans have migrated to South Africa since 2000, and in May 2008 a spate of xenophobic attacks took place on migrants, leading to 65 deaths and the further displacement of 150,000 people.*
- *Displacement posing operational challenges:* Environmental change is likely to increase the occurrence of human displacement, where individuals have little or no option to remain where they are in the short or long term. For example,
  - *17 million were displaced by natural hazards in 2009*
  - *42 million were displaced by natural hazards in 2010*[3]

  This kind of displacement has significant impacts on economic growth, human security and social protection, but, if it occurs within the borders of a country, is short term and not involved with existing conflict, it poses *relatively* routine operational challenges that can be managed through emergency planning, for example the provision of emergency and humanitarian relief such as food, water, health care and shelter.
- *Displacement posing geopolitical challenges*: Some impacts of environmental change may give rise to significant permanent displacement of whole populations as a consequence of existing settlements being rendered uninhabitable. This movement may be long term and sometimes across international borders, presenting geopolitical challenges. *For example, the potential displacement of entire islands represents significant implications for sovereignty and citizenship of those displaced.* Evidence suggests that political leadership is critical in the successful management of mass displacements.

3 This definition of natural hazards includes geophysical events such as earthquakes and tsunamis.

- *Choosing to stay*: The opportunity to stay in a location represents a positive outcome in many respects, but there are important issues concerning the provision of services and protection to potentially vulnerable populations, and whether people want to stay because of certain obligations. Furthermore, a community's ability to stay may depend on opportunities for voluntary migration. ***For example, in small island states, reduced options for migration may cut off important forms of income support, such as remittances, and in the long run lead to a larger migration of whole households or communities in an unplanned and unpredictable way.***
- *The challenges of 'trapped' populations unable to leave*: The challenges associated with those who remain may become more severe and more geopolitical in nature if these people become trapped in vulnerable locations.
    - ***For example, in Somalia, armed conflict hinders both the movement of pastoralists, who would otherwise relocate in the face of drought, and the access of humanitarian organisations to those who are drought affected.***
    - ***There are likely to be between 472 and 552 million people directly or indirectly affected by floods in rural areas in Africa, Asia and Latin America and the Caribbean by 2060.***

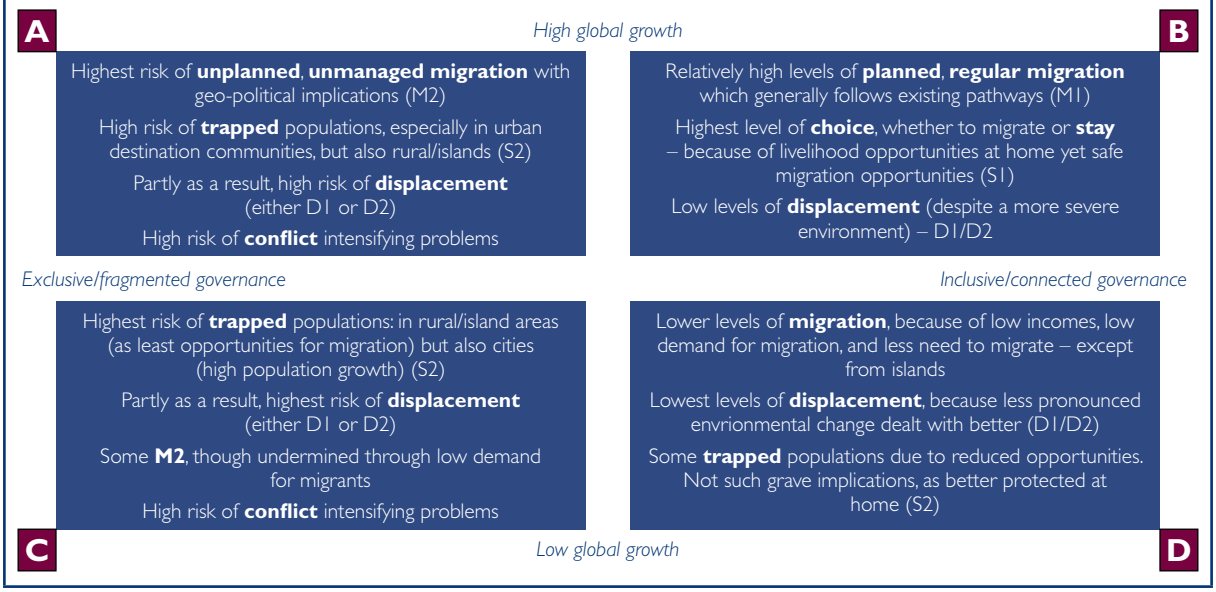
  People who are trapped may become more prone to humanitarian emergencies and possibly even displacement if their situation worsens, or if extreme events occur. In such cases, human survival may depend upon unplanned and problematic displacement.

None of the future scenarios offer a 'no risk' situation for policy makers.

Figure ES.4 is a synthesis of the human mobility outcomes resulting from environmental change, taken across the three ecological regions, and based on an analysis of the trends in the drivers of migration in the four future scenarios. ***This synthesis reveals that 'no migration' is not an option in the context of future environmental change: migration will continue to occur in the future and can either be well managed and regular, or, if efforts are made to prevent it, unmanaged, unplanned and forced.*** Furthermore:

- The existence of trapped populations is a significant risk in three of the four scenarios.
- There are high risks of displacement influenced by environmental change in two of the scenarios.
- Unplanned, unmanaged migration with geopolitical challenges is driven by a combination of high growth and exclusive, fragmented governance.

Figure ES.4: Synthesis of the likelihood of human mobility outcomes across drylands, low-elevation coastal zones and mountain regions for the project's four future scenarios



The evidence from this report shows that some migration in the context of global environmental change is inevitable in the future, even if its nature is uncertain. This has two important implications for policy makers:

1. The most future-resilient policies are those that move households and communities from situations in which they are trapped, or from where they are in vulnerable circumstances where displacement may occur.
2. Proactively facilitated and managed migration should lead to improvements in each of the future scenarios, as it will reduce the chances of populations being trapped and/or being displaced in circumstances which raise wider geopolitical challenges. A proactive approach can also capitalise on and maximise the benefits from migration, building resilience and transforming adaptive capacity.

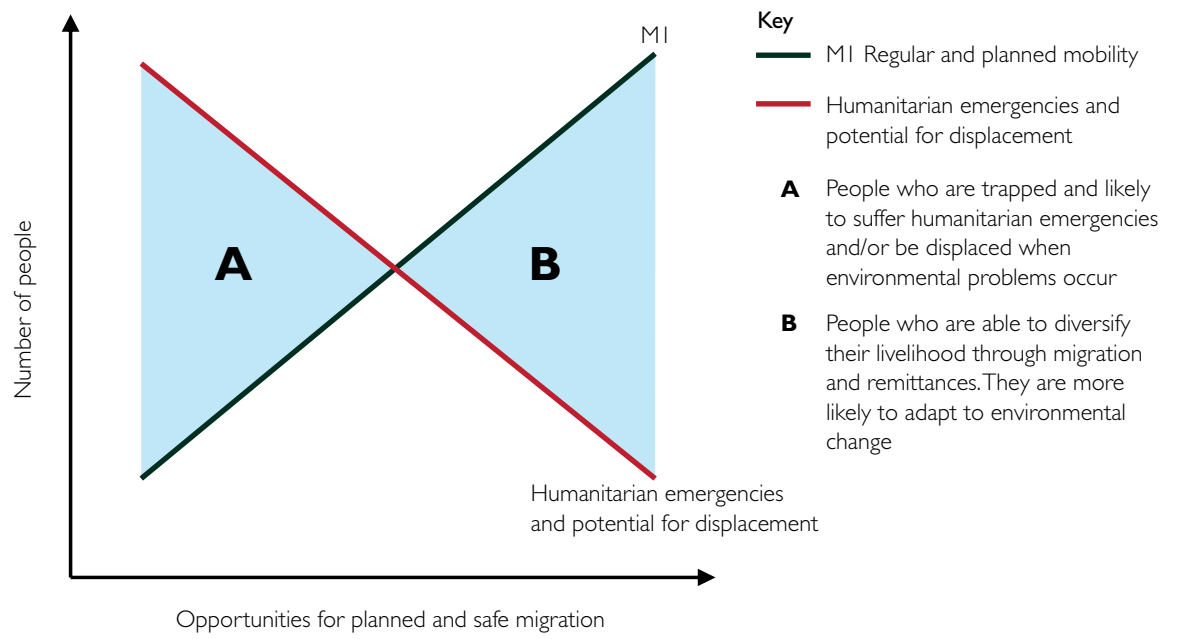
5. A strategic policy approach which plans for some forms of migration and recognises its long-term potential to build resilience

Whilst a policy approach focused on preventing migration would address certain policy challenges, it would risk worse outcomes in other areas. A more strategic approach is required.

Evidence shows that policies to prevent migration can be ineffective: for example, rural development intended to curb rural–urban migration in Africa has either had only a minimal effect on migration or has even encouraged it; there is evidence that migration policies in certain parts of the world have been unsuccessful because of underlying structural economic drivers. However, a more important reason why preventing migration is not an appropriate long-term solution in many circumstances, is that there are powerful links between different mobility outcomes, which means that trying to prevent migration may lead to worse longer-term outcomes:

- Migration is often an important method for households to diversify their incomes, and may be even more important if global environmental change affects other income streams.
- Reduced options for migration may cut off important forms of income support, such as remittances, and in the long run may make it unsustainable for households and communities to remain *in situ*, ultimately leading to a much larger migration at a later point, potentially in an unplanned and vulnerable way.
- Alternatively, the consequence of preventing migration may be for even more people to be trapped in situations where they have few alternatives to sustain their livelihood and thus are more vulnerable to environmental change. This may ultimately result in humanitarian risks, including displacement, a relationship shown in Figure ES.5.

Figure ES.5: Schematic representation of the relationship between well managed migration and those who are trapped and more likely to suffer humanitarian emergencies and problematic displacement



A more strategic approach to policy in relation to migration in the context of global environmental change is required, which operates on three parallel levels.

Policy makers need to follow these different strategies simultaneously, and in coordination:

1. *Reducing the influence of global environmental change on migration*: This approach includes policies to arrest the long-term rate of change (including climate policy), policies focused on reducing the impact of environmental change and policies to build resilience to environmental change in communities.

2. *Planning for and responding to migration influenced by environmental change (and non-migration, as appropriate)*: This approach includes closing protection gaps for those displaced, planning for urban growth and adaptation and dealing with tensions and conflicts associated with migration and non-migration influenced by environmental change.

3. *Recognising the opportunities inherent in migration in the context of environmental change*: This approach includes relocation as adaptation, building new cities and making migration work as adaptation.

Policy makers may be tempted to try and focus their efforts on just one of these three approaches; in particular, there may be a temptation to focus all efforts on reducing migration influenced by environmental change so as to eliminate the need for policies in the second and third categories. However, it is important to emphasise that policies in the first group are unlikely to ever fully eliminate the impact of environmental change on the drivers of migration. For example, the full impact of climate policy is likely to be felt most towards the second half of the century; forecasting and warning policies require effective governance and coordination of emergency responses, which is highly dependent on the sociopolitical context; and institutions in low-income countries may have limited financial and human capital to fully implement infrastructural measures such as flood defences and non-structural measures such as different crop varieties. For this reason, it is essential that policy makers consider all three approaches in parallel.

6. There is a need for global policy makers to focus on the vulnerability of growing urban populations

Migration in the context of environmental change is likely to lead to increased rural–urban migration and city expansion. Cities will face a 'double jeopardy' future, in which this challenge is multiplied by increasing threats from environmental change. Yet the third challenge is perhaps the most critical, the fate of the new migrant arrival to the city, who will often be in the most vulnerable situation.

Cities will face compound future challenges, which will reinforce each other or 'multiply' the consequences. These challenges are:

1. *Cities are growing in terms of their populations as a result of natural population growth and increased rural–urban migration.* For example, Dhaka's population increased from 1.4 million in 1970 to 14 million in 2010, and is expected to rise to 21 million in 2025; similarly, Shanghai's population increased from just over 6 million in 1970 to over 16 million in 2010 and is expected to rise to just over 20 million in 2025. In a 'business as usual' scenario this expansion alone would represent a huge set of operational challenges for cities, including housing provision and land-use planning, particularly for those in low-income countries.

2. *Cities are extremely vulnerable to future environmental change, particularly those located in vulnerable areas, such as drylands, low-elevation coastal zones or mountain regions, where inundation, reduced availability of water resources and threats to health will variously be experienced.* For example, the populations living in urban floodplains in Asia may rise from 30 million in 2000 to between 83 and 91 million in 2030, and then to 119–188 million in 2060 according to different scenarios of the future. The future expansion of cities needs to be understood in the context of this increasing risk.

3. *Migrants are particularly vulnerable, as they tend to live in high-density settlements in areas prone to environmental risks, and may not have the human, social or financial capital to protect themselves from these risks. For example:*

    - In Dakar, Senegal, 40% of new migrants arriving in the past decade have moved to zones with high flood potential.
    - Immigrant populations in Mombasa, Kenya, and Estelí, Nicaragua, suffer disproportionate impacts from localised hazards, such as flooding and winds.
    - Around 20% of the population of Rio de Janeiro live in favelas, which are susceptible to landslides and floods, with a significant proportion of those being migrants coming from dryland areas in north-eastern Brazil.

The urgency of the issue in respect of cities needs to be emphasised. Whilst trends in population growth and environmental change are likely to multiply the challenges faced by cities in the future, it is important to recognise that these challenges will add to *existing* fragilities. Many cities in low-income countries are already failing in several respects, and citizens, especially low-income groups such as migrants, are already vulnerable. For example:

- There are already 150 million people living in cities with significant water shortages.
- The number of African urban poor is expected to exceed 400 million by 2015, compared with 240 million in 1990.

Future trends will exacerbate these challenges, and action is required now.

Urban strategic planning must focus on these increasing environmental threats in the context of growing populations, with a focus on the vulnerability of migrants. Cities require much more strategic decision making about long-term location and protection.

- *Much greater emphasis now needs to be given to planning for long-term environmental change in expanding cities.* Planning for sustainability and for resilience to global environmental change requires addressing critical issues of water availability and quality in growing cities, long term land loss, more frequent hazards, waste, mobility and congestion.

- *Migrants moving to cities present particular policy challenges, as they are often the most vulnerable yet also have inadequate voice and representation.* Migrants are often low-skilled, and, especially in cities in low-income countries, are often concentrated in dense and new housing, and in informal settlements with low levels of health, water and other services. Robust urban planning and policies specifically focused on the welfare of new city migrants are required.
- *Environmental change and urban population growth require national and subnational planners to take a much more strategic and long-term approach to city planning.* When urban areas are protected, 'they have to be protected forever' as development occurs and populations grow in protected areas. Agglomeration effects, moral hazard and path dependency effects will make it ever more difficult to abandon or shift urban developments, particularly because protection in the short run induces new migrants into these areas. Urban planning should take into account future changes in climate risks (and sea level for coastal cities) and the likelihood of continuing rural–urban migration, and recognise in particular the irreversibility of defending areas, as well as the indirect and social costs.

7. Protection gaps for those displaced by environmental change

There are protection gaps for populations who experience displacement influenced by global environmental change. Yet this report argues that a global framework for 'environmental migrants' is highly unlikely to be a 'silver bullet', and moreover would neglect key populations at risk.

There have been recent arguments made by academics and advocates for the creation of a new category of 'climate refugee'. However, this report has shown that migration is a multi-causal phenomenon, that environmental change will affect migration through its effects on drivers, and that each migrant is likely to have a multitude of drivers and motivations behind migrating, some of which may be influenced by environmental change and some of which may not. For this reason a global framework for 'environmental refugees' is considered inappropriate.

There is a multitude of existing international relationships, legal agreements and institutions involved in governance which can and should be built on in the first instance. For example, 'soft law' approaches, such as the Guiding Principles on Internal Displacement and, potentially, the recently proposed Nansen Principles[4], are 'bottom-up' approaches which build consensus and allow for adaptable and tailored adoption by states.

A particular challenge relates to small island states. Here, there is the clearest case for reassessing the scope for new definitions and structures within the framework for international climate governance. In this instance, as in others, *the array of existing governance fora and processes should be utilised to address humanitarian needs relating to those displaced by environmental change. Where protection gaps are identified, these are the appropriate places to address them, and ultimately the discussion should be widened to migration more generally.*

8. Managing social tensions and conflicts associated with migration influenced by environmental change

There is little evidence available to support the theoretical notion that environmentally induced conflict will cause migration, or that migration influenced by environmental change will cause conflict. However, there are two linkages between migration, environmental change and conflict which are particularly important:

1. *Migration, including that influenced by environmental change, can amplify political or geopolitical problems, and in particular can raise tensions and interact in problematic ways with conflict in destination areas.* This is more likely to be the case if the migration is long term, across international borders, illegal/irregular, concentrated in particular source destinations and/or is unexpected. In low-income countries, the majority of such problematic migration in the future is expected to be to cities, but in some circumstances may be rural to rural. Displacement influenced by environmental change may also pose geopolitical tensions if it results in large numbers of people arriving in specific locations over a short duration, with an absence of political leadership to manage these tensions.

4 For more discussion on the Guiding Principles on Internal Displacement and the Nansen Principles see Chapters 7 and 9 of the main report, respectively.

2. *Global environmental change can contribute to impoverishment, and can raise the exposure and vulnerability of individuals to conflict, ecological disasters and economic hardship.* An associated reduction in financial assets can reduce the ability of individuals to move in a planned, safe way and lead to them effectively becoming trapped (see Figure ES.2). The implications, in particular the reduced ability to move in a planned and safe way in the context of high levels of vulnerability, means that there is a greater chance of humanitarian emergencies and potentially unmanaged and highly problematic displacement.

Strategic policy responses to these challenges include:

- *Policies and plans to reduce tension and avoid conflict in growing cities.* In turn, these include (a) policies which may be considered part of 'normal development practice', but are likely to reduce social unrest and tension by addressing material deprivation and social and economic inequality associated with rapid urban growth and major rural–urban migration; and (b) bespoke policies to address the particular challenges of tension and conflict, which are often built on collaboration among local agencies, criminal justice systems and civil society, and which often embrace the informal sector.
- *Policies to avoid populations being trapped in conflict situations, where they are in turn vulnerable to environmental change.* Where there is an endogenous and cyclical relationship between poverty, resources, conflict and the inability for people to move voluntarily (with humanitarian emergencies and displacement a likely outcome), an important set of policies should focus on reducing conflict and tension associated with natural resources. Environmental change is likely to affect these natural resources, potentially reinforcing this endogenous cycle; there is thus a clear requirement for policies to address the impact of environmental change on the resource–conflict relationship. Policies may also include ensuring that conflict 'early-warning systems' are adapted to assess the risk of vulnerable populations being trapped in situations where they are exposed to environmental events such as droughts or floods.

9. There is a need for adaptation planning and funding to recognise the role of migration in building long-term resilience

Policies to build long-term resilience are essential in the context of future global environmental change. Migration can represent a 'transformational adaptation' to environmental change, and in many cases is an effective means to build long-term resilience.

Environmental and development policy makers need to implement a wide range of policies in light of future global environmental change. There is no single solution, and a wide range of measures are required. Measures to slow the rate of environmental change are important, as are measures to reduce the impact of environmental events. However, equal priority should be given to policies that promote the long-term resilience of communities and households to environmental change. They include:

- measures to enhance livelihoods;
- the provision of insurance;
- social protection schemes.

There is evidence to suggest that migration is often the most effective approach to enhancing livelihoods and thus securing resilience. For example, a study in Ghana found that income diversification through non-farm activities such as trading and handicrafts was the second most widely used measure for enhancing livelihoods after the option of outmigration. Indeed, migration, and in particular the tools, such as training and skills, to make migration successful, can be considered a transformational adaptation strategy, as opposed to just 'improving' the coping of a community in particular vulnerable areas.

Furthermore, many poor households engage in migration of some family members as part of an income diversification and insurance strategy, with remittances flowing in response to shocks. For example, the relevance of the insurance strategy has been found for international migration from Mexico and Nigeria to the USA, and for internal migration in Botswana and Thailand. This is also reflected in the growth of international remittances in the aftermath of major climate-induced disasters. For example, international remittances increased after Hurricane Gilbert in Jamaica, whilst remittances increased in response to rainfall shock-related income losses in the Philippines.

Policies to achieve these benefits can focus on source areas or destination areas. In particular, future demographic deficits in some countries suggest that a 'win–win' solution may in some cases be found where there are opportunities for planned, circular migration from countries which are likely to be vulnerable to environmental change.

Relevant policies to promote and facilitate migration as an adaptation strategy to build long-term resilience can be focused on source areas, for example, building human capital and increasing skills, or destination areas, for example making cities more attractive for in-country migrants and guaranteeing rights to migrants.

However, regional or international circular migration schemes may offer benefits in the context of countries which are facing demographic deficits. For example, by 2050, the number of persons of working age for each citizen aged 65 or above in the EU will have dropped from four to only two; Europe's fertility rate is 1.5[5], while Japan, Korea and countries in Eastern Europe have fertility rates of below 1.3; the UN projects that the populations of both Japan and Russia will shrink by 25 million between 2010 and 2050. Particular schemes of temporary and circular migration could enable international migrants with a wide variety of skills to play a role in countries with demographic deficits. This could be most effective where opportunities and thus movement are within regional groupings of countries.

Critically, funding to address and deal with a changing environment is being agreed at an international level imminently, for example through negotiations at the UNFCCC, the development of the Cancun Adaptation Fund, and the Green Climate Fund. It is imperative that these important, long-term initiatives recognise the links between global environmental change and migration, and avoid a missed opportunity: indeed, many of the objectives of these initiatives may be realised through harnessing the positive outcomes of migration.

Yet, perhaps more significant is that people will increasingly be trapped in vulnerable situations, where there are few safe migration options but staying also represents a danger because of the environment. The sooner action is taken, the sooner human suffering will be alleviated.

5 This is the average fertility rate for the EU, and masks significant regional variation. For example, for 2005-10, UK, Sweden and France had fertility rates between 1.84-1.89, whilst Slovakia, Germany and Romania had fertility rates between 1.28-1.32.

Annex

Executive Summary

Final report

Scenarios

Driver Reviews

- DR1: Migration drivers and destination countries
- DR2: Urbanisation in Africa and environmental change
- DR3: Labour market and environmental change
- DR5: Environmental change, conflict and human migration
- DR6: Drivers of migration in drylands
- DR7a: Environmental drivers in LECZs
- DR7b: Non-environmental drivers in LECZs
- DR8a: Environmental drivers in the Mediterranean
- DR8b: Non-environmental drivers in the Mediteranean
- DR9: Drivers of migration in mountains
- DR10: Quantitative analysis of determinants of international migration
- DR11: Demographic change, environmental change and migration
- DR12: Drivers of UK internal migration
- DR13: International legal and political frameworks
- DR14: Social drivers of migration, vulnerability and resilience
- DR15 Low-carbon policy and migration
- DR16: Drivers of migration in islands

State of Science Reviews

- SR1: Frequency, location and severity of extreme events
- SR2: Impact on ecosystems services of singular climatic events
- SR3: Changing variabililty in climates
- SR4a: Early warning systems (EWS) for environmental shocks
- SR4b: Role of EWS in migration flows and human displacement
- SR5: Mechanisms to react to environmental shocks
- SR6: Seasonal and decadal forecasting
- SR8: Likelihood of high levels of climate change and implications for migration
- SR10: Wildfires and environmental change
- SR11: Wildfires: impact on migration
- SR12: Links between environmental change and conflict
- SR13: Use of remittances to build resilience to environmental change
- SR14: Microinsurance and climate-related disasters
- SR15: Macroeconomic management of extreme events
- SR16: Tracking, recording and managing migration
- SR17: Economic growth impact of sea level rise
- SR18: Returns from migration for destination countries
- SR19: Economic growth impacts of extreme events
- SR20: Impact of the Colombo process on migration

Policy Development Reviews

- PD1: Improving urban living conditions in low-income communities
- PD4: Mitigating conflict and violence in Africa's growing cities
- PD6: UK experience of arrival of displaced populations
- PD7: Migration and ageing populations
- PD11: Conflict management in resource-constrained Africa
- PD12: Efficacy of migration and non-migration policies
- PD13: International migration in the Mashriq
- PD15: Options available for low-lying islands
- PD16: Global environmental governance and migration
- PD17: Environmental migration governance and the European Union
- PD18: European Union: coordinating environnment and migration policies?
- PD19: Future of EU governance of migration
- PD21: Financial instruments for vulnerable locations
- PD23: Cancun adaptation framework and migration

Case Studies

- CS1: New Orleans and Hurricane Katrina
- CS2: Indian Ocean Tsunami
- CS4: Bangladesh disaster preparedness
- CS6: Zimbabwe and conflict
- CS8: The EU neighbourhood
- CS10: Nepal and the Gulf States
- CS11: New urban spaces in India
- CS12: Water, conflict and migration in the Mediterranean

Case Study Reviews

- CR1: Abandonment of settlements
- CR2: Review of case studies in Burkina Faso, Ecuador, Ghana and Nepal

Modelling Reviews

- MR2 Agent-Based Model: Burkina Faso and the Sahel
- MR3: Economic drivers of international and internal migration
- MR4: Net migration flows by ecosystem
- MR5: Attitudes to migration and the environment
- MR6: Relative importance of migration drivers
- MR7: Review of existing estimates of environmental migration
- MR8: Bayesian forecasts of environmental migration
- MR9: Populations in low elevation coastal zones in 2030 and 2060

Workshop reports

- WR1: Mountains
- WR2: Drylands
- WR3: Low-elevation coastal zones
- WR4: The Mediterranean

Working papers

- WP1: USA and the global migration system
- WP2: Lessons to learn from Curitiba
- WP3: Climate change adaptation and migration; implications for migration
- WP4: The stated motivations for migration across household surveys

Project reports and papers can be found on the Project's CD and are freely available to download at http://www.bis.gov.uk/Foresight

Note: some report numbers were initially allocated but were not subsequently used.

Printed in the UK on recycled paper with a minimum HMSO score of 75
First published October 2011.
The Government Office for Science.
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