METHODOLOGICAL CONSIDERATIONS FOR SURVEY RESEARCH ON CHILDREN, ADOLESCENTS AND YOUTH IN THE CONTEXT OF ENVIRONMENTAL CHANGE AND MIGRATION.

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Acronyms

CAY	Children, adolescents and youth
DHS	Demographic and Health Survey
EACH-FOR	Environmental Change and Forced Migration Scenarios
GFMD	Global Forum on Migration and Development
LSMS	Living Standards Measurement Survey
MICS	Multiple Indicator Cluster Survey
NAPA	National Adaptation Plans of Action
PRSP	Poverty Reduction Strategy Papers
UN	United Nations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

Content

Executive Summary

In recent years there has been increasing interest in the potential relation between migration and environmental change (i.e., sudden and slow-onset events of climatic change and environmental degradation). As the effects of climate change –in particular– are felt beyond coastal and dessert areas affecting an even larger percentage of the world's population, migration has become a fundamental strategy for adapting to climate change's adverse effects and for increasing families' and communities' social resilience. The UK government's Foresight report on *Migration and Global Environmental Change* represented a landmark in providing an analytical framework on the links between migration and environmental change. Among its conclusions the report noted that rather than being a direct driver of migration, environmental change – whether sudden or slow-onset – interacts with socioeconomic, cultural, political and demographic drivers of migration in complex ways. Climate change does not automatically lead to more migration, not least because there are also certain segments of the population including children, adolescents and youth who may lack the necessary resources to migrate. These 'trapped populations' bear the brunt of the adverse effects of environmental change.

Children, adolescents and youth are central to the environmental change-migration nexus. On the one hand, young people are among the most likely to migrate as families attempt to adapt to the adverse effects of environmental change by sending a member elsewhere to seek work and send back remittances. On the other, children and adolescents are more predisposed to experience the long-term effects of environmental change especially in low- and middle-income countries that are more likely to suffer them and simultaneously face a substantial 'youth bulge'. The role of children, adolescents and youth (CAY) in the context of environmental change and migration is thus vitally significant not only for their human development but also for the emerging post-2015 development agenda.

Within this context, it is becoming apparent that resilience, demographic change, the role of young people and equity will be important and partly cross-cutting elements of a new agenda for global development. The High-Level Panel of Eminent Persons on the Post-2015 Development Agenda, for instance, has emphasized that supporting people to enhance their resilience is of primary importance for inclusive and sustainable development. In addition, UNICEF has clearly identified climate change as a factor likely to increase the vulnerability of children, adolescents and youth in the foreseeable future. Consequently, environmental change and resilience play a major part in UNICEF's strategic planning. Evidence-based research is thus necessary for the formulation and implementation of policy initiatives and for monitoring programmes' performance. Such research will be necessary in order to make predictions about how climate change will impact the movements of people and to allow policymakers to prepare for different scenarios. Filling this knowledge gap with a special focus on children, adolescents and youth is the key purpose of this report.

While the Foresight report has pointed a way forward, much remains to be done in order to generate a deeper and empirically based understanding of the specific impacts of the interrelations between environmental change and migration on vulnerable populations in general and on children, adolescents and youth in particular. There is an urgent need for more systematic and comparative research in this sense, survey research is especially essential as it allows the specific levels of resilience and migration options of different population segments within geographical or otherwise defined units to be quantified. But survey research in this context also poses multiple methodological challenges. This is because climate related factors are usually highly intertwined with other factors, actors and institutions driving migration (e.g. social, demographic, political and cultural). These interactions make the identification of environmental change impacts a difficult task. Moreover,

relating environmental change and migration over time is a severe logistical and financial challenge; accordingly, many quantitative studies on the environment-migration nexus so far are lacking the crucial temporal dimension. Finally, selecting a suitable and, if possible, representative sample out of the relevant population as well as finding the right entry points are likewise important challenges for field research in the context of environmental change and migration. The report proposes several methodological and conceptual measures like the construction of a resilience composite measure and oversampling techniques (for contexts where for instance youth migrants are a so-called 'difficult-to-find population') to overcome these issues and to increase our knowledge on the mechanisms between environmental change, migration and resilience.

This report, however, is only the first step. The methodology outlined here requires validation in the field in order to adjust its breadth, applicability and relevance to different contexts in which migration and environmental change takes place. This validation process will require identifying research sites, test survey instruments, and sampling strategies in order to confirm the soundness of the methodology in general, and the quality of the data collected in particular. The next step will be to implement these procedures using UNICEF Country Offices and related research initiatives such as the (planned) UNICEF-led project on *Children, Adolescents, and Youth in the context of Migration and Environmental Change*.

Part one of the report provides a general introduction and discusses the significance of the environment-migration nexus, with particular reference to children, adolescents and youth, in the context of the UK Government-funded Foresight report. **Part two** examines, on a technical level, approaches to the methodological challenges of research in this field. In addition, it addresses operationalization issues and looks at an empirical application, illustrating how data collected through UNICEF's Multiple Indicator Cluster Survey can be utilized to gauge CAY's situation in the context of environmental degradation and resilience. The **annexes** provide further details and examples on survey research techniques.

Children, adolescents and youth are central to the environmental change-migration nexus

Environmental Chagne, Migration and Youth: Connecting the Dots

In the decades ahead, environmental change will adversely affect a large percentage of the world's population. The negative impacts of slow-onset events (e.g. increasing rainfall variability) or increasing sudden-onset events (e.g. floods) related to climate change as well as related or unrelated processes of environmental degradation (e.g. soil erosion) will be felt most acutely in less developed countries. Some of the poorest regions of the world, such as Sub-Saharan Africa, the Pacific, and South Asia will be particularly at risk. Compared with more developed regions of the globe, these areas are more likely to suffer from an increased frequency of droughts, coastal erosion, and rising sea levels. People affected by environmental change have limited options to confront its effects.[1] They can adapt their lifestyles to their new reality by increasing their resilience through -among other alternatives- migration (see Box 1). The relationship between environmental change and its potential impacts on migration, particularly among vulnerable populations, is of growing interest to national governments, policymakers and the international community. For example, the conclusions of the 2010 Global Forum on Migration and Development (GFMD) held in Mexico reflected this increasing awareness and underscored the need to enhance data, policy dialogue and legal and institutional frameworks in order to address the interconnections between environmental change, migration and development.[2]

Assesing the Link Between Migration and Environmental Change

Within the last few years, a growing number of research projects and initiatives have addressed the potential causal mechanisms linking environmental change and migration. An essential milestone in that regard was the UK Government-funded Foresight project on *Migration and Global Environmental Change*,[3] the findings of which were published in late 2011. An interdisciplinary cluster of 350 experts from around the world were involved

in this project which aimed to assess how the world's migration movements are affected by processes of global environmental change now and in the coming decades. The project came up with several notable findings.

First, it concluded that it is difficult to define climate -induced migration *per se*; instead, environmental change interacts with other -political, social, economic, cultural, demographic- drivers of migration in complex ways.

Furthermore, the Foresight report came to the conclusion that environmental change "is equally likely to make migration less possible as more probable".[4] This means that there is no automatic link between environmental change and migration in the sense that more environmental change will inevitably generate more migration. Some parts of the population may lack the necessary financial and non-financial capital to migrate. These population segments are "trapped" in precarious conditions and hit full on by the consequences of environmental change. It can be assumed that this trapped population is made up of the sick, the old, and the very poor. Within the latter group, often the very young in other words, children (0-9 years) and adolescents (10-14 years) may also constitute an important section of the trapped population.[5]

Despite media discourses focusing on catastrophic or humanitarian implications, Foresight clearly emphasized that migration in the context of environmental change cannot for the most part be classified as refuge-seeking or displacement in order to save lives or essential belongings. Often migration is a form of adaptation, which increases the short-, medium- and long-term resilience of households that are vulnerable to the effects of environmental change. Only in very rare situations do whole households or families move to another place. It is more often the responsibility of one or a few household members to support their families by migrating in order to mitigate the adverse

effects of environmental change. Due to their high working potential and relatively limited family responsibilities, youth (15-24 years) may form a majority of these migrants. In other words, it often falls to young people to enhance their families' resilience via adaptive migration, which in the context of environmental change is predominantly internal (see Box 1), but also international in some contexts.

When young people do migrate – whether internally or across international borders – they are likely to do so under socioeconomic, legal and political conditions that are highly precarious. Furthermore, Foresight finds that they are likely to migrate to destination areas, especially cities, which are either already characterized by ecological degradation or will be increasingly vulnerable to cliamte change and risks in the future.

Box 1. Internal Migration – A Neglected Dimension of Development?

The huge development potential of international migration – particularly the potential of financial remittances being sent by international migrants to their home countries – has become a new "mantra" in international development policies.[6] The same cannot be said about internal migration. But internal migrants' families also rely on financial remittances and these remittances have virtually the same potential for pro-poor growth, development and adaptation via investments in health, education or local economic activities. The global dimension of internal migration is certainly enormous; given the rates in large economies such as China or India alone, the global number of internal migrants is a multiple of the estimated number of 232 million international migrants. UNDP[7] estimates that about 740 million people around the world are internal migrants. An accurate estimate, however, is nearly impossible due to the overwhelming lack of data in many countries and the absence of comparative cross-national measures. It is quite likely that the number of internal migrants worldwide may even have exceeded the barrier of one billion people by now. The knowledge gaps concerning the magnitude, trends and social, economic and political significance of internal migration for communities, regions, countries and the global community remain dauntingly large.

Internal migrants, especially those who moved due to environment-related reasons, often face the same level of social, economic and political marginalization as international migrants. In many destination communities – which to an increasing degree are peri-urban areas and rural fringes of cities instead of inner-city areas – they face difficulties concerning access to public infrastructures and goods, social services and political participation. Moreover, when migrants end up in areas of high environmental risk, such as low-lying urban areas in mega-deltas or slums in water-insecure expanding cities, their vulnerability increases as these limitations worsen significantly their poor living conditions.

Many governments raise questions concerning the impacts and consequences of internal migration for urban infrastructure, transport infrastructure, planning or public services. Although in many places natural population increase in city areas contributes much more strongly to urban population growth rates than in-migration,[8] internal migration is still very much associated with urban sprawl, increasing crime rates or *slumification*. As a consequence, internal migration is hardly addressed politically. If it is, it is clearly influenced by a sedentary bias; the declared goal of such policies is to prevent further migration by eradicating the alleged root causes of migration, such as poverty. The positive impacts of internal migration and the difficulties migrants face are hardly recognized, let alone addressed by political measures.

Many children, adolescents and youth are significantly affected by internal migration worldwide. First of all, many internal migrants are under 18 years of age; in some countries, such as China, up to one tenth of the national child population are internal migrants. According to UNICEF's 2012 *State of the World's Children*, most of these children, adolescents and youth move with their families; but in some regions – especially in West Africa and South Asia – a high percentage of the underage internal migrant population also moves independently. Their motives for moving are mainly the same as those of international migrants, such as better income opportunities or the support of families back home. However, a change in the family structure, e.g. the loss of a parent, may also induce children and youth migration. Often, young people's educational aspirations cannot be met because of their work commitments. In particular, children, adolescents and youth who move without the company of their parents or adult legal guardians are vulnerable to exploitation, human trafficking or sexual abuse. But even if children do not move at all, they can be affected by (internal) migration. When their parents move, many children are left behind in the care of relatives, friends or other community members. For instance, approximately 55 million children in China alone were "left behind" in 2008. Children left behind are in danger of experiencing severe educational, psychosocial and even physical impairments as a consequence of being separated from their parents.

Despite Foresight's groundbreaking findings, there are important next steps to take in order to gain a deeper understanding of the environment-migration nexus and its specific impacts on vulnerable populations. **CAY are a crucial demographic group in this regard as they are, on the one hand, a key segment of the trapped population; and, on the other hand, they are the main responsible for increasing families' resilience** (see Box 2). It is most important to understand which factors increase the probability that vulnerable populations – and in particular children, adolescents and youth – will a) be trapped and unable to engage in adaptive migration; b) be able to migrate but increase their vulnerability by doing so; or c) be able to migrate and enhance their social resilience by doing so. Answers to these questions, including migration-related policies, will significantly help at-risk countries to develop comprehensive adaptation strategies, both in order to increase the resilience of communities and households most endangered by environmental change, and to effectively manage migration in the context of these processes. Such strategies must be developed for the wellbeing of both migrants and origin and destination communities. We must be able to predict how at-risk populations will respond to adverse environmental changes in order to effectively manage this process.

Foresight was mainly based on expert reports, state-of-the-art reviews in relevant sciences, and several models based on these. However, in order to gain a deeper and empirically-based understanding of the different degrees of specific impacts of the interrelations between environmental change and migration on vulnerable populations, there is a need to conduct systematic and comparative research. In particular survey research is essential as not only does it provide an insight into the issues cited above, but it also makes it possible to quantify the specific levels of resilience and the migration options of different – demographic, socioeconomic, ethnic or religious – population segments within geographical or otherwise defined units. Research initiatives such as EACH-FOR[14] or "Where the Rain Falls"[15] have made some important progress in this respect, as they have systematically analysed the specific role of, inter alia, gender, local geographical settings, or seasonality in the environment-migration nexus. What is still missing, however, is the systematic analysis of CAY in the context of environmental change and migration.

Box 2. (Social) Resilience

In the context of environmental change and its effects on people's livelihoods and their migration decisions, resilience and in particular social resilience has become a highly important concept and analytical tool. It is also the underlying conceptual approach for this report. Generally, social resilience can be understood as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change".[9] Thus, in this context social resilience is a multidimensional concept that helps to understand "how and why people are vulnerable to climate change, as well as examining the different strategies they develop to cope with (or adapt to) environmental stress – migration being one among other such strategies." [10]

Although social resilience is still a "concept in the making", it describes "the ability to anticipate, withstand and bounce back from external pressures and shocks – whether physical, emotional, economic or related to disaster or conflict – in ways to avoid a fundamental loss of identity and maintain core functions"[11] **in ways that promote the rights of every child, adolescent and women with special focus to the most vulnerable**.[12] Social resilience, in other words, includes social actors' capacities to cope with short-term stress (**coping capacities**) and their capacities to adapt to long-term changes (**adaptive capacities**). Resilience also includes individuals' capacities "to craft institutions that foster individual welfare and sustainable societal robustness in the event of present and future crisis (**transformative capacities**)"[13] . **It is an inclusive and multi-dimensional concept that incorporates not only social but also economic, political, and cultural dimensions and factors.**

CAY in the Context of Environmental Change, Migration and the Post-2015 Development Agenda

The issue of CAY in the context of environmental change and migration has nevertheless received increasing attention within the international community. For instance, the Mauritius 2012 GFMD recognized that the link between migration and the environment "implies challenges that go beyond migration, and discussions need to bring together migration, development and environment stakeholders" and suggested that "more practical tools, such as those proposed in the UK's Foresight report, need to be considered".[16]

The relationship between environmental change, young people and migration touches on core elements of the emerging post-2015 global development agenda. Recognizing the high potential of migration as an "enabler" of development processes and enhancing resilience, an increasing number of migration and development stakeholders, including international organizations and civil society, support the idea of integrating migration as an important component of the new global partnership for development. This new development partnership has been postulated as a core element of the post-2015 development agenda by the High-Level Panel of Eminent Persons, which highlights the importance of helping people to build resilience and to create livelihoods so as to make growth inclusive and sustainable - particularly for the benefit of excluded groups, women and young people.

Given the complex interactions between environmental change, migration, social, economic and political factors, a post-2015 development agenda would need to include more than just a merely "enabling" understanding of migration focused on aspects such as remittances, high-skilled migration, brain drain or even diaspora mobilization; it has to emphasize migrants' rights and the need to improve their living conditions.[17]

Furthermore, the High-Level Panel identified climate change, young people and inequality as fundamental cross-cutting issues, which cannot merely be addressed in single goals of a future post-2015 development agenda.[18] Besides, a growing number of voices on other international platforms and in other fora (e.g. the Global Platform for Disaster Risk Reduction[19]) have identified social, gender-based and also age-based inequalities as major barriers making some more vulnerable to the effects of environmental change than others. Accordingly, the question of equity is becoming an ever more crucial issue in the post-2015 debate, given today's population dynamics in which less developed countries are and will be experiencing higher birth rates and a significant "youth bulge". The majority of the next billion humans will be born in low- and middle-income countries, with those countries with the lowest per-capita incomes more likely to experience higher fertility rates if current trends continue.[20] They will also be the ones facing the most negative effects of climate change, which may threaten their future human development prospects and have severe implications for their migration options.

Thus, it will be essential that international as well as national adaptation planning take the specific and highly important role of CAY in the environment-migration nexus much more fully into consideration. So far, the existing National Adaptation Plans of Action (NAPAs), in particular, largely ignore the issue of (adaptive) migration.[21] In order to achieve a more profound understanding and to address the specific needs and functions of CAY in the context of environmental change and migration, adaptation planning is in severe need of results based on sound survey research.

Why this Report? UNICEF, Environmental Change, Migration and Programming for Resilience

The impacts of environmental change -whether sudden or slow-onset- are likely to be felt more and more keenly, especially at the local level, exacerbating the vulnerability of affected populations. CAY are recognized as a particularly vulnerable group as they suffer the greatest risk of acquiring climate-sensitive health problems, such as malaria, dengue and malnutrition, and the greatest harm from exposure to short-term and long-term impacts, such as reduced availability of water consumption or exposure to air pollution (see Box 3).

Noting the pace with which climate change and environmental degradation are projected to increase, and how these impacts are mediated by existing development conditions and resilience levels, suggests that a wide range of specific climate-related risks to CAY is likely to emerge. [22]

The end-of-cycle review of the UNICEF strategic plan 2006-2013 acknowledged the relevance of these challenges by: (1) calling "for increased attention to mainstreaming sensitivity to climate change and environmental degradation, to promoting resilience and to addressing the rights of children with disabilities and indigenous children; [and by] (2) underscoring the need to strengthen dedicated capacity on these issues" [§ 8]. As a result, climate change, environmental degradation and resilience play a major role within the structure of the 2014-2017 strategic plan.

Resilience is a relevant conceptual approach to understand and address the complex multi-risk issues that stem from climate change especially when reducing or minimising the exposure of children and families to climate change related shocks and stresses and by strengthening the capacities of CAY, their families and their communities. In this context it is imperative to support communities and families "to increase their resilience so that achievements for girls and boys can be sustained even when families are confronted with volatility and shocks, whether caused by economic shift, climate change, natural disaster, disease or violent conflict" [§ 2]. Moreover, it underscores that "UNICEF is also committed to strengthening its involvement in systematic reduction of vulnerability to disaster and conflicts through risk-informed country programmes that help build resilience" [§ 25].

Box 3. Emerging Issues Webinar on Climate Change
UNICEF
New York, NY, 23 May 2012

UNICEF Headquarters' interdivisional Climate Change Task Force identified some of the most pressing issues within the context of climate change that affect CAY resilience.[23]

Health: Child health is highly vulnerable to climate-sensitive diseases. Diarrhoeal diseases are expected to rise due to increased risk of temperature-accelerated transmission of water and food-borne illnesses, damages to water/sanitation infrastructure linked to disasters or sea-level rise, post-disaster outbreaks, and poor hygiene in water-stressed regions.

Water, Sanitation and Hygiene: Imminent negative impacts related to water are expected worldwide from climate-related changes in rainfall, surface water availability and quality, as well as ground water quality in coastal regions.

Nutrition: Acute and chronic under-nutrition, including micronutrient deficiencies are expected to rise along with long- and short-term food insecurity in the coming decades. Climate-induced flooding, drought, salinization and plant diseases threaten future food security, particularly in areas dependent on rain-fed agriculture in Africa.

Education: Children may be forced to miss or drop out of school as a result of destruction of schools or related infrastructure or to help their families recover from extreme climate/environment-related events.

Protection: Population displacement and stress are predicted outcomes that generate multiple challenges for child protection; in particular extreme changes in livelihoods can trigger negative coping mechanisms such as violence, child trafficking, child labour and early marriage.

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Migration is a key mechanism for development and resilience especially by reducing or minimising the impact of climate change related shocks and stresses and by strengthening CAY's coping capacities. However, it can also become a threat to their human development as displacement due to environmental change could expose CAY to more hazardous and risky regions, particularly urban areas. In order to understand whether migration could or could not become a strategy for social and economic resilience in the context of environmental change for CAY, it is necessary to understand the causal mechanisms that exist between climate change and environmental degradation, migration and resilience.

However, as has been reported by many UNICEF Country Offices, there is "inadequate research (almost non-existing) information on the vulnerability and impact of climate change on children."[24] Therefore, to properly respond to issues related to migration in the context of environmental change, there is a need for more systematic research to be conducted.

The Foresight report made great progress by providing useful guidelines for policymakers and suggesting what drives or prevents migration in the context of environmental change. But this is not enough. Evidence-based research is necessary for the formulation and implementation of policy initiatives and subsequently should form the cornerstone for monitoring programme performance. To achieve this, the collection of data must be reliable and valid in order to facilitate comparisons between countries. Evidence-based research is also needed to design policies aimed at increasing households' resilience. Such research will be necessary to make useful predictions about how global environmental changes will impact the movements of people and allow policymakers to prepare for different possible scenarios. Filling this gap in our knowledge with a special focus on CAY is the key purpose of this report, which considers the methodological challenges for survey research on CAY in the environment-migration nexus.

Methodological Challenges in Research on the Environment-Migration Nexus

In order to draw survey data-based conclusions on the specific roles and vulnerabilities of CAY within the context of environmental change and migration, it is necessary to address some methodological challenges affecting different aspects of survey research. A review of the scarce literature addressing research methodologies on environmental change and migration[25] indicates that these challenges comprise: 1) the multiplicity of factors, actors and institutions influencing migration decisions; 2) the (missing) time dimension; and 3) challenges related to population and sampling. Whereas the focus of the last challenge is on the selection of adequate and sufficient respondents, the first two challenges address the content-wise operationalization of surveys (design and selection of survey questions/variables) and the management of existing data sets, especially in terms of indicator construction. These methodological challenges -and possible solutions to them- will be discussed in the following section focusing on issues of operationalization and data gathering related to CAY.

Identifying the impact of environmental change on migration: a challenging endeavour for survey research.

Migration decisions are driven by a multiplicity of cultural and socio-economic factors.

Studying the process of environment-related migration is exceptionally difficult. Although migrations that result from an acute disaster such as an earthquake are relatively simple to quantify, migrations in the context of slow-onset processes, which include "sea level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity and desertification"[26] are much harder to measure. Despite the difficulty in accurately measuring these processes, their social consequences may be severe. Migrants moving in the context of slow-onset environmental change may not

even recognize the relationship between the environment and their migratory behaviour. As a result of climate change and a subsequent decrease in an area's agricultural output, a young person may abandon his/her village – at least for some time – and move to another area to find employment and support his/her family with financial or non-financial remittances. That being said, when asked to explain the reasons for migrating, the migrant may be unlikely to name environmental change as the primary cause. Most likely, he/she will instead mention decreasing harvests or a lack of jobs in the region of origin. This shows that environmental factors are usually highly intertwined with social, economic, demographic but also political or cultural factors impacting on migration decisions.[27] The isolation of environmental factors is almost impossible.

It is, however, possible to analyse the extent to which households are vulnerable to slow- and rapid-onset environmental hazards. A myriad of factors could potentially make households resilient to environmental change. Given that the level of environment-related vulnerability varies from region to region and that people do not have access to the same resources to cope or adapt to environmental change, it is necessary to include enough factors to help explain *how* and *why* people are vulnerable to environmental change.

Migration decisions are driven by a complex interplay of actors and institutions

In addition to the multiple factors influencing migration, decisions about migration are usually also the result of a complex interplay of different actors and institutions. Migration theories operate at distinct levels of aggregation and objectives. Individuals, for instance, engage in cost-benefit analysis, households attempt to minimize risk and overcome barriers to capital credit;[28] both individuals and households draw on social capital and family networks[29]

to facilitate movement, etc. Generally, temporary livelihood research has recognized that households are not simple unitary consumption units or unitary bodies of livelihood- and migration-related decision making; they are rather made up of different actors and individuals. Accordingly, migration decisions are also individually influenced by gender, age, orientation towards different individual goals or access to social networks, social protection and legal identity.[30] The bottom line for survey research is that these multiple factors surrounding a potential migrant need to be taken into consideration when it comes to designing a data-collection programme, as do the complex set of actors and institutions having a potential impact on the migration decisions and processes of individuals and households.

To capture the complex decision-making structures and processes behind households and individuals, survey research needs to be complemented by precise qualitative methods such as observational field research, which attempts to gauge and understand people's motives, values and beliefs by studying their actions within their daily lives. Ethnographic methods can add insights to the analysis that quantitative methods alone cannot achieve.

Focus group discussions also constitute a good qualitative tool not only to complement quantitative data but also to elicit in-depth insights into the impact that climate change may have on migration decisions and on actors' resilience. Also, focus groups can be helpful for reviewing the standards and content of the survey to confirm respondents' understanding of the questions and their different perceptions of environmental change. Previous research indicates that children are aware of how climate change is changing their local environment in a negative way. Lawler and Patel[31] conducted focus group discussions with children in Mongolia, Indonesia, Vanuatu, Kiribati and the Philippines. In Mongolia, children reported that winters had become harsher, in Kiribati they noted that coastal erosion had increased, and in Vanuatu they said saltwater intrusion was contaminating their drinking water. These kinds of studies can provide a useful starting point. However, as Lawler and Patel were careful to point out, it is difficult to derive generalizable findings from these kinds of qualitative studies. A sophisticated empirical study of environmental change and CAY migration is therefore long overdue. While this report primarily focuses on the migration of CAY, it is important to note that surveys of older people will be an important part of a future research agenda. Although CAY may be overrepresented among migrants, the decision to migrate will often be made by older family members or community leaders. Furthermore, in a qualitative study of northern Ghana, it was revealed that older community members were more likely to report environmental changes.[32] The insights of older respondents will be useful in determining both environmental changes and the drivers of environment-related migration.

Besides qualitative methods, survey research also needs to be complemented by other data sources; to further understand the relationship between environmental change and migration. It is equally important to measure environmental change and its results in small geographic areas. In order to demonstrate the relationship between environmental changes and migration, we must have highly accurate measures of those environmental changes. It will therefore be important to collect longitudinal data on environmental degradation such as desertification, changes in annual patterns of rainfall and flooding, changes in annual crop yields, and changes in sea levels and coastal erosion. *TerraPopulus* is a recent effort by a diverse number of academic institutions that is integrating population as well as environmental data across time, space and scientific domain to better understand the nexus between environmental change and population dynamics.[33]

Furthermore, to fully capture a complex household structure with regard to age, gender, educational structure or migration experience/history, it is highly advisable to obtain this information for every household member in a survey questionnaire via a so-called household roster (see Figure 1). The household roster allows every individual's information to be connected with other information (e.g. education and migration status).

The (Missing) Time Dimension

When studying the interrelations between environmental change and migration, especially those related to slow-onset changes (sea-level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity and desertification), the temporal dimension is extremely important.

To assess the full complexity of the links between environmental changes, social resilience levels and possible migration outcomes, an ideal research design would involve observing/researching the households of a particular community affected by processes of environmental change over an adequate period of time. Establishing such a research design implies a significant time and financial commitment, which in most cases is not feasible.

The cross-sectional cohort[34] study is an alternative research design that factors the temporal dimension by using a cohort in the present and assessing the timing of exposure and outcomes, respectively, while applying statistical methods. This design involves cross-sectional sampling in the present (t_1) to obtain a random sample of the study cohort and retrospectively assessing their history of exposure and outcomes – exposure to environmental change and migration – at each time point back from t_1 to the onset of that individual's period of exposure. The observation period

Figure 1. Example for a Household Roster (from MICS)

Member ID	Name	What is the relationship of (name) to the head of household?*	Is (name) Male or Female? 1 = Male 2 = Female		What is (name's) date of birth?		......
			M	F	Month	Year	
1		01	1	2	_ _	_ _	
2			1	2	_ _	_ _	
3			1	2	_ _	_ _	

* Codes for Relationship to the head of household

01 Head
02 Wife/Husband
03 Son/Daughter
04 Son-in-law/Daughter-in-law
05 Grandchild

06 Parent
07 Parent-in-law
08 Brother/Sister
09 Brother-in-law/Sister-in-law
10 Uncle/Aunt

11 Niece/Newphew
12 Other Relative
13 Adopter/Foster/Stepchild
14 Not Related
98 Don't Know

begins at the time point at which an individual in the cohort is exposed to environmental externalities (t_0). The cross-sectional cohort study might also be refined by selecting specific individuals who have migrated (cases) and a number of people who have not migrated (control) and investigating which factors differ between them.[35] If the cross-sectional cohort is not an option due to financial, logistical or time constraints, the integration of a migration history section in the survey questionnaire is useful. This section addresses retrospectively all kinds of migration-relevant household information (who went when, where and why; see Figure 2).

But the migration history section can be more than a simple retrospective household migration log book; it can for instance also be used to assess the regularity of temporally limited migration patterns or – obviously relevant for "trapped" households" – the reasons why no one has migrated. As this method requires respondents to remember the relevant information, the temporal range of a migration history section needs to be limited to a "manageable" time period.

Figure 2. Example for a Household's Migration History

Member ID	In the past 5 years, did (name) ever migrate to anotehr country, region or province for at least 3 months for work, to seek work or to live?	In which year was (name) most recent migration to another country, region or province for work, to seek work or to live?	To what country, region or province and city did (name) migrate the last time?	....
1				
2				
3				

Below are described some of the techniques and challenges associated with conducting survey research especially when the population of interest is difficult to find or is dispersed widely among the overall population.

Challenges related to population and sampling

Aggregate Methods

There are several methodological approaches to gauge the role of CAY in environmental change, social resilience and migration. Which of these researchers will take depends largely upon several factors such as data availability, budgetary constraints, type of climatic/environmental phenomenon and time.

As its name suggests, the aggregate method uses an aggregated geo-referenced outcome variable (i.e., migration rates) that is related to a number of predictors/covariates, which can be observed at different levels of aggregation.[36] Inferences about individual-level behaviour based on the results from aggregate-level

analysis should be done with extreme caution in order to avoid problems that arise due to the interaction between exposure to environmental events and socioeconomic confounders within the group.[37] Moreover, researchers should be cautious in establishing causal relationships between environmental change and migration solely relying on aggregate data.

Despite their methodological limitations there are several advantages to studying the effects of environmental change on the drivers of migration (or non-migration) at the aggregate level: [38]

1. **Lack of individual-level data.** Lack of specialized geo-referenced individual-level surveys and limitations of individual-level exposure to environmental change due to within-person variability makes measurement of relevant exposure-related issues an insurmountable enterprise especially when resources are limited.

2. **Exposure homogeneity.** Often there is little variation in exposure to climate/environmental phenomena at the individual level within a particular geo-referenced study area. Thus, individual-level studies may not provide additional information. Studies involving a wider area, however, may provide substantial variation in mean exposure across areas and groups.

3. **Low cost**. The use of secondary geo-referenced aggregate data with individual-level sources such as population registries, vital records, census and/or large surveys makes data collection efforts cheaper and more convenient.

Overall, aggregate methods seek to assess the group-level association between exposure level to environmental change-related phenomena and the rate of migration among a particular population across time. Usually, certain

statistical techniques (e.g. cross-sectional or hierarchical/multilevel techniques) are needed in order to estimate the spatiotemporal dimension of migration and climate/environmental change.

As will be noted in greater detail below, there are significant problems with relying solely on aggregate data such as censuses when, for instance, attempting to measure the migration patterns of CAY in the context of environmental change. For example, when such surveys ask respondents about their previous place of residence, sometimes only a broad region is coded – this will frequently be insufficient for our purposes. That being said, these aggregate data may allow us to discern important patterns that can inform our strategy for sampling difficult-to-sample populations. For example, by measuring urban population growth, we can better determine which communities are experiencing a significant influx of rural migrants. Thus, while aggregate data are too limited to answer the most important questions related to CAY migration, they provide a valuable starting point and will allow us to better allocate resources to our more sophisticated survey methods.

Probability and non-probability sampling

Survey research in this field is additionally challenging because the populations most likely to migrate for environmental reasons are not evenly distributed across a geographical region. In order to make the most of limited resources, researchers conducting surveys should target those geographical locations most likely to contain migrants and potential migrants.

To get a perfect picture of the specific role of CAY in the environment-migration nexus in a particular country, region, province or community, it would be necessary to collect information on the causal mechanisms relating to these phenomena for all CAY in these areas. Obviously,

the time, budgetary and logistical considerations would be enormous due to the number of CAY potentially affected by environmental change, their geographical dispersion and the practical difficulties involved in travelling to remote areas.

To overcome budgetary and logistical problems, it is necessary to select a subset of the population (a sample). Ideally, this is representative of the whole population (the universe or the target population) in the sense that the characteristics of interest in the population can be estimated from the sample with a certain degree of precision,[39] which allows the results to be extrapolated or generalized from the sample (summary statistics) to the overall population.

In an ideal world, the sampled population would be identical to the target population, but this is rarely the case especially when the target population is small or dispersed within the target population and in geographical terms. A good sample is one that is not biased, that is, one that reflects the composition of the target population as closely as possible, without omitting some of its members or privileging the inclusion of others (this is known as selection bias). A good sample, in addition, has accurate responses to the survey questions, in other words, the responses in the survey do not differ from the true value (this is known as measurement error).[40]

There are a wide number of different techniques to create a sample, but these can be grouped into two categories: probability and non-probability samples.[41]

Probability samples are those in which each element in the population (i.e., the entirety of CAY affected by environmental change in a particular geographical region) has a known probability of selection and a randomization mechanism is used to choose the specific elements to be included in the sample. There are four types of probability samples, which are applicable to different situations:

- **Simple Random Sample (SRS):** This is the simplest probability sample and the foundation of more complex designs. An SRS of a particular size n is taken when every possible subset of n units of that population has the same chance of being in that particular sample.

- **Stratified Random Sample:** The population is divided in subgroups that share similar characteristics called strata followed by taking an independent SRS from each stratum.

- **Cluster Sample:** Elements of the population are aggregated into larger sampling units called clusters, which can then be selected through an SRS and then all or some of the members of the selected clusters subsampled.

- **Systematic Sampling:** By using a random number a starting point is chosen from a list of the population, that unit and every kth unit after that one is chosen to be in the sample.

These sample types are virtually ideal types as in a real survey situation a mixture of the several types at different levels of selection is necessary; e.g. first-level cluster (e.g. a selected communities of a region affected by environmental change); second-level stratified (e.g. income groups, etc.) and third-level SRS. The estimation of the level of precision is quite a complicated process in these cases. Generally, in order to come up with a probability sample it is necessary both to have information about certain population characteristics and to have a randomized selection. Often, this is not given. Then researchers need to rely on non-probability samples. Non-probability or non-random samples are those in which the selection likelihood of any element of the population is unknown, given that certain population parameters (size, distribution measures, etc.) are also unknown. There are four types of non-random samples.

- **Availability or convenience sampling:** This is a technique in which the elements that are part of the sample are chosen based on their availability or because they are easy to find.

- **Quota sampling:** This method establishes quotas in order to ensure that the sample "represents" a group of predetermined characteristics in proportion to their prevalence in the population.

- **Purposive Sampling:** This method chooses the elements of the sample according to the purpose of the study.

- **Snowball Sampling:** This is a network-based sampling technique in which elements of the sample are chosen by referral. First, a researcher identifies one member of a population, then asks that person to identify others in the population, and so on.

Although it is (statistically) not possible to extrapolate the results of a survey that is based on a non-probability sample, this does not mean that these results have just a "value on their own". It is the task of the researcher to select a non-probability sample that shows some features (with regard to CAY migration in the context of environmental change, for instance) that can also be observed in a broader population.

Sampling Difficult-to-Sample Populations

Often in order to gauge the impact of environmental change on drivers of CAY migration or non-migration, it may be necessary to collect data from small groups (known as difficult-to-sample populations) in addition to those from the general population. The main difficulty in gathering data from difficult-to-sample populations is the limited data available for specific subgroups or groups not covered adequately by general survey data collection efforts, such as CAY. Every so often the survey data collected may be so inadequate that the only information available is from anecdotal studies or from small-scale surveys in a particular location other than the target area. As a result, methods for generalizing to the target area are tentative and plagued with very strong assumptions, which compromise the validity and reliability of the data.

A group or target population is considered difficult-to-sample or singular not because of its absolute size but due to its size relative to available sampling frames that cover it. For example, consider the population of children left behind by one or two migrant parents who have migrated due to environment-related factors in a particular community. If there were 50 children left behind in a population of 10,000, the population would be difficult-to-sample primarily because it forms less than 1 per cent of the total population.

When the subgroups are small, the need to create adequate sample sizes for analysis can create major logistical, budgetary and sample design challenges in addition to those already confronted by thematic household surveys. In designing a sampling strategy for difficult-to-sample subgroups, its size (relative to that of the total population) is a crucial consideration that needs to be taken into account for methodological, budgetary and logistical aspects.

- **Major subgroups** represent around 10 per cent or more of the total population.

- **Minor subgroups** represent between 1 to 10 per cent of the total population.

- **Mini-subgroups**, which comprise between 0.1 to 1 per cent of the population and require the use of particular statistical models.

- **Rare subgroups** encompass less than 0.01 per cent of the population, which cannot be handled by survey sampling methods.[42]

Traditional national household surveys (e.g., UNICEF's Multiple Indicator Cluster Survey (MICS), USAID's Demographic and Health Surveys (DHS), etc.) are sufficiently large that they can be expected to produce estimates of reasonable precision for major subgroups and there is generally[43] no need to employ the kind of oversampling procedures described in this report. The aim here is to provide a discussion for those interested in obtaining information on minor and mini-subgroups in general, and in particular of CAY in the environment-migration nexus.

International, and to some extent internal or inter-regional migration, is an atypical phenomenon; that is, most people do not migrate. Not all migrants, in addition, move due to environment-related reasons and not all migrants are young people. In order to study the impact of migration in the context of environmental change on a population that is inherently small in size, difficult to find and/or that is dispersed widely geographically and in the general population, it is necessary to utilize specific methods to estimate the prevalence of migration under conditions of environmental change and to estimate the indicators of interest.[44]

To gauge the impact of environment-related factors on CAY it is necessary to design a sampling frame that contains households where at least one member (who has migrated) is under 24 years of age, hereafter referred as migrant households, and households without such members, hereafter referred to as non-migrant households, in order to be better able to isolate the effects of CAY migration in contexts of climate/environmental change from other confounders (see Box 4 for definitions).

In order to understand the impact of environmental change on young people's migration decisions it is necessary to incorporate enough CAY, that is, it is necessary to increase the size of this special group by oversampling them. An oversample is an additional sample of a subgroup, deliberately constructed to sample a much higher proportion of elements of this subgroup than the rest of the general population.

The prevalence of migrant households within the target population as well as their geographical dispersion or concentration across a region or across the national territory will dictate which special cost-efficient sampling methods need to be adopted. When migrant households are part of a major subgroup, that is, when they represent around 10 per cent or more of the total population, the sample size

Box 4 Definition: Environmental Change and CAY Migration

Migrant household: A household with at least one member (0-24 years of age) who used to live and eat together and who is currently living in another province/department/state within their country of birth or in a country other than the one in which they were born.

Non-migrant household: A household with at least one member (0-24 years of age) in which no member of this age-group (who lives and eats together) has ever moved away from the current household.

determined by a representative household survey should be sufficient to produce estimates of reasonable precision. However, it is necessary to verify that the sampling frame chosen provides good coverage of the migrant population.

When migrant households are part of a minor or mini-subgroup the oversampling strategy will depend on the quality and amount of information available to identify migrant households. If there are data available either from a national representative survey, such as MICS, DHS, LSMS, or labour force survey that identifies migrant households or data from a recent census, the data can be used to allocate particular area clusters to strata based on the prevalence estimates for migrant households. If there are no data available, it may be possible to use local experts to help identify particular strata within the sampling frame, which may contain a high prevalence of migrant households. The next section discusses these alternatives in more detail; it is not intended, however, to be a comprehensive treatise on sampling difficult-to-sample populations.

Oversampling Migrant Households

Even though migrant households cannot be separated from the target population at the time of designing the sampling, in some countries migrant households tend to be heavily concentrated in certain parts of the population due to the inherent characteristics of climate/environmental change. When there is information about their concentration it can be beneficial to sample those parts with heavier concentrations of migrant households at higher proportions. In order to do so it is necessary to treat the various parts of the population as strata, with higher sampling fractions being used in the strata that have the higher concentrations of migrant households. This technique is known as disproportionate stratification since those strata with higher concentrations of migrant households are oversampled disproportionately.

To determine if disproportionate stratification is an effective strategy for sampling migrant households it is necessary to consider the following three factors:[45]

1. The prevalence of migrant households in each stratum

2. The proportion of migrant households in each stratum

3. The ratio of the full cost of data collection for migrant households to the screening cost involved in identifying members of that minor or mini-subgroup (see Appendix 1 for screening question examples).

When there are readily identifiable strata in which migrant households are much more prevalent and contain a high proportion of migrant households, that is, when factors 1 and 2 above are high, disproportionate stratification can be an efficient strategy and a cost-effective one, since less screening would be necessary to identify members of that minor or mini-subgroup.

The next step is to create strata based on the prevalence and proportion of migrant households. For example, the first stratum could comprise Primary Sampling Units (PSUs) where migrant households constitute less than 10 per cent of the PSU's total population. Further cut-points for defining the strata might be 30 per cent, and 60 per cent, yielding a total of four strata (0-10 per cent, 10-30 per cent, 30-60 per cent and 60-100 per cent). Generally speaking, more strata will create a more efficient design; however, it is necessary to consider the logistical complications and the budgetary restrictions of a large number of strata. A fairly small number of strata will achieve most of the gains pursued by stratification (see Appendix 2 for more details on oversampling).

Operationalizing secondary data collection efforts

Collecting this information can be taxing and in certain situations next to impossible. There are however, several existing data sources that allow for the creation of a resilience composite measure that could shed light on the specific factors that make CAY and their communities resilient. The index, furthermore, could be analysed by demographic and economic variables such as women-headed households, differences in ethnicities and wealth.

Several data sources such as UNICEF's Multiple Indicator Cluster Survey (MICS), Demographic and Health Surveys (DHS) and the Living Standards Measurement Study (LSMS) provide enough indicators to weigh households' coping and adaptive capacities. The data can be easily accessed and analysed using statistical techniques, such as principal components analysis, that provide methods for data simplification by combining many correlated indicators into a smaller number of latent dimensions.

MICS and the Resilience Index

To construct the resilience index the items selected need to reflect certain characteristics associated with households' coping and adaptive capacities to environmental change. It is necessary to assume that the items comprising it reflect some underlying, latent, unobservable stable characteristic (i.e., resilience). In other words, the items should be logically related to resilience (face validity), must adhere to this one topic only (unidimensionality) and should ensure to the extent possible a representative sample of all potential components of resilience (content validity).[46]

MICS is a unique dataset that allows researchers to construct a multidimensional, comparable resilience index to monitor the impacts of environmental change. The flexible, modular nature of MICS makes it easy to focus only on those modules that are relevant to the construction of the index and also to incorporate data from other sources. MICS has a significant advantage over other household surveys:

- First, the sampling strategy is designed to include children, adolescents and women.

- Second, it is a national-level household survey large enough to include populations affected by environmental change with reasonable precision.

- Third, MICS is a harmonized survey comparable, in particular, with the Demographic and Health Surveys (DHS), which increases the depth as well as the scope of the survey.

MICS, by its very nature, creates multivariate data structures that simplify the creation of a resilience index. To illustrate how MICS can be used to construct a resilience index and the statistical methods needed to do so this report uses MICS3 Thailand as a case study.

Thailand is a country of origin and destination of international migrants; however, over the past 30 years internal migration, especially from the Northeast to the Bangkok metropolitan area and surrounding provinces and more recently from the South, has played an important role in Thailand's economic transformation (see Figure 3).

Figure 7. Resilience Index Quintiles

Figure 1. Net Gain or Loss by Region from Five-Year Migration Census
1965-2000

Northeast

Bangkok   Central   North   South
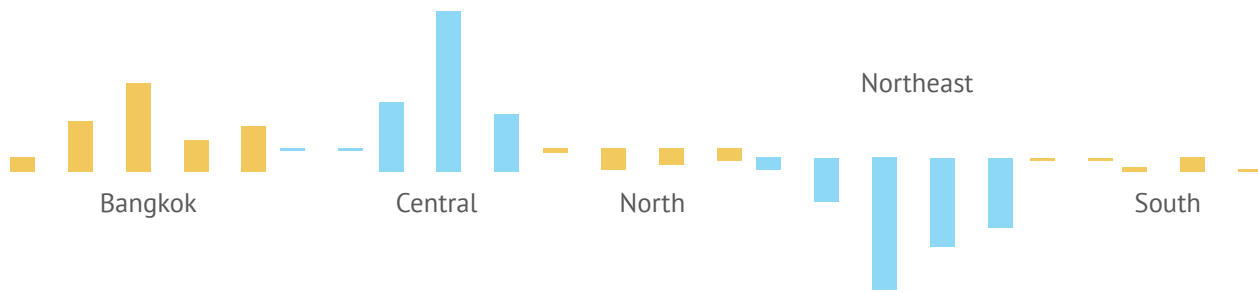
Source: National Statistics Office from Thailand Migration Report, IOM 2011.

Figure 1 shows a clear correlation between Bangkok's net migration gains and the Northeast's net migration losses (r = -0.82). On average, Bangkok gained 194,000 net migrants between 1965 and 2000, while the Northeast had a net loss of 288,000 migrants over the same period of time. Thailand, on the other hand is significantly impacted by climate events especially droughts and floods, which pose significant threats in the Central, Eastern and Southern regions (Center for Hazards and Risk Research, 2005) (see Figure 2).

Figure 5. National Disaster Risk Hotspots

Drought Hazard
Deciles
1st - 4th
5th - 7th
8th - 10th

Flood Hazard
Deciles
1st - 4th
5th - 7th
8th - 10th
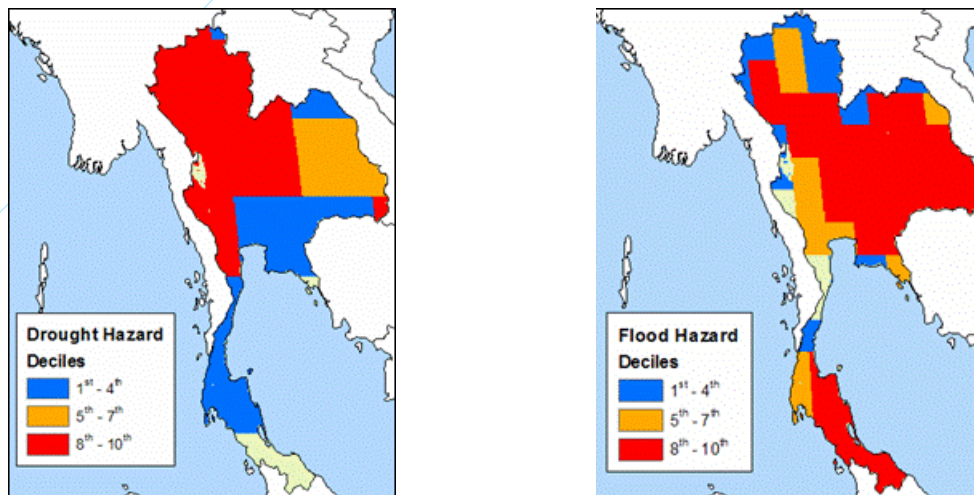
Source: Center for Hazards and Risk Research at Columbia University 2005

In terms of mortality and the proportion of GDP impacted by climate events, floods severely affect the whole country almost uniformly (see Figure 3), however, the Northeast and Central regions of the country seem to be affected at higher rates than the Southern and Northern regions of the country.
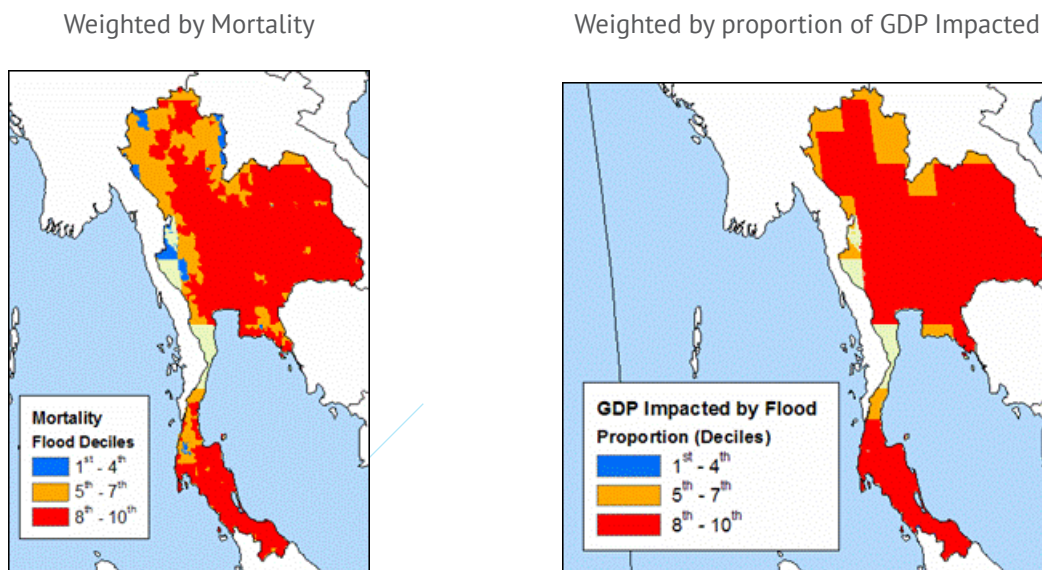
Figure 6. National Disaster Risk Hotspots

Weighted by Mortality

Weighted by proportion of GDP Impacted

Source: Center for Hazards and Risk Research at Columbia University 2005

So far the data show two clear patterns:

1. There is significant out-migration from the Northeast

2. The Northeast is one of the regions of the country that is significantly impacted by climate events in terms of mortality and proportion of GDP impacted.

Given the patterns depicted in Figures 1-3 – which may or may not be related[47] – are households residing in the Northeast more or less resilient than households residing in other regions of the country? To answer this question it is necessary to incorporate a number of items measuring households' coping and adaptive capacities to environmental change. Table 1 illustrates

a minimum set of indicators related to households' coping, adaptive and transformative capacities. Other indicators such as child-caring practices, school drop-out rates may be relevant in particular contexts.

Table 1. Coping, Adaptive and Transformative Capacities Indicators

Component	Indicator
Coping Capacities	• Sources of drinking water • Sanitation • Wealth index • Health infrastructure index
Adaptive/transformative capacitates	• Education level of head of household • Occupation

Coping Capacities

These indicators measure households' capabilities to manage short-term stress.

• **Source of drinking water:** This indicator is constructed from MICS's household module. The WS1 variable is recoded into three sources of drinking water: bottled water, piped water and other sources such as protected and unprotected wells, springs or rainwater collection.

• **Sanitation:** This indicator is constructed from MICS's household module. The WS7 item is recoded into three kinds of toilet facilities: sewer, septic tank and other such as flushing into a pit, to an unknown place, or there are no facilities.

• **Wealth Index:** This indicator is part of MICS's tabulation plan. It includes a number of variables that are related to households' living standards such as:

  • Ownership of certain types of household assets, such as refrigerator, television, car, truck, bicycle, motorcycle and so on;

  • Materials used in household construction, such as wood, bricks, rocks, cement and so on;

  • Having electricity in the household;

  • Access to drinking water and water for general usage;

  • Improved sanitation facilities.

The index is calculated through principal components analysis, where households are grouped together in continuum of comparative wealth. Wealth quintiles are subsequently created. Wealth index quintiles are useful in analysing economic inequality in accessibility to important health services and outcomes, such as childhood illness and fatality (see http://childinfo.org for details on the construction of this index).

• **Health Resource Index Quintiles:** This indicator comes from Thailand's health profile report 2001-2004 and measures the health resource infrastructure at the regional level. The following variables are used to construct the health resource index.

  • Number of hospital beds

  • Number of health centres

  • Number of doctors

  • Number of dentists

  • Number of pharmacists

  • Number of nurses

Health resource index quintiles are calculated by factor analysis similarly to the wealth index described above, where households are grouped into comparative health resources quintiles by region. Health index quintiles can be used to analyse the health infrastructure between regions in terms of human resources, beds and health facilities.

Adaptive and Transformative Capacities

These indicators work as proxy variables to measure households' and individuals' abilities to adapt to long-term changes and to foster societal robustness in the event of future crisis.

- **Education level of head of household:** This indicator comes directly from MICS helevel variable and measures household head's education in three levels: no education, primary education or secondary-plus education.

- **Occupation:** This variable comes from MICS and is constructed by recoding the hc1d variable into a new variable with three categories: government employee, private employee and agriculturist, labourer or other.

How to estimate a Resilience Index using MICS?

At the outset it is necessary to test the stability of the items, in other words how well they hold together. The stability of the items is determined by using Cronbach's alpha and the total inter-item correlations. Cronbach's alpha is an indicator of how well the different items complement each other in their measurement of different aspects of the same quality. In other words, Cronbach's alpha is a measure of the internal consistency of a set of items, and it ranges from zero (no internal stability/consistency) to one (perfect internal stability/consistency).

A Cronbach's alpha greater than 0.60 indicates that the items comprising the index can be considered as a function of a latent, unobserved theoretical construct, generally, we strive for indices with alphas of 0.70 or higher. [48]

To test if the items are valid—that is, if our items are actually measuring resilience—we need to test the relationship between the manifest variables and our latent variable. Confirmatory Factor Analysis (CFA) determines if the manifest variables, those that are observable to us, conform to what is expected on the basis of our predetermined conceptualization of resilience. The model is illustrated by the following path diagram (see Figure 4) with its individual standardized factor loading values.

Table 2. Reliability Analysis

Item	Obs.	Sign	Item-Test Correlation	Avg. Inter-Item Cov.	Cronbach's Alpha	Item
Drinking Water	40,358	+	0.69	0.50	0.17	0.54
Sanitation	40,358	+	0.21	0.12	0.28	0.65
Wealth Index	40,358	+	0.83	0.61	0.10	0.47
Health Index	40,358	+	0.58	0.23	0.21	0.68
Educ. Head of Household	40,358	+	0.55	0.42	0.22	0.59
Occup. Head of Household	40,358	+	0.65	0.50	0.19	0.56
Test Scale					0.20	0.64

Figure 6. Resilience Components
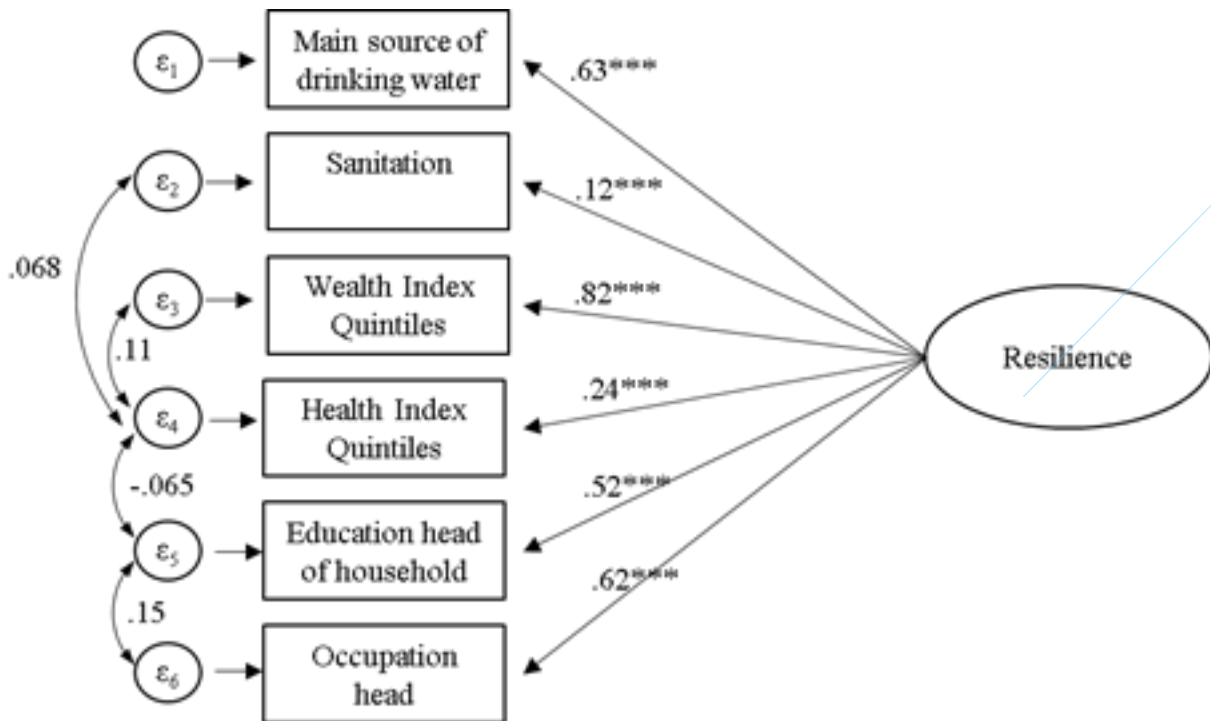
The summary statistics of the model, namely the Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Coefficient of Determination (CD), which provide information similar to the R^2 value of a linear regression, indicate that the fit of the model is adequate (see Table 3).

The model's goodness of fit indicates that the observed variables are indeed linked to their underlying latent factor. In other words, households' main sources of drinking water, sanitation (toilet facilities), wealth, health resources in the region, the education and the occupation of the head of household are associated with the household's resilience in a statistical and conceptually meaningful way.

Lastly once the reliability (Cronbach's alpha) and validity (CFA) of the items have been verified the resilience index can be constructed using principal components analysis following the same procedures to estimate the wealth and health resource index. In order to see how households'

resilience varies we can estimate the index by region, for example by comparing those more likely to be affected by environmental change with those who are less likely such as the Northeast and the North, respectively. Figure 5 shows that in the Northeast the proportion of households with poor resilience is larger than that of the North, while the proportion of households with high resilience is higher in the North than in the Northeast.

Figure 5. National Disaster Risk Hotspots

31

Table 6. Fit Statistics

Fit Statistic	Value	Description
Likelihood Ratio		
Chi2_ms(5)	157.728	Model vs. Saturated
P>chi2	0	
Chi2_bs(15)	41176.16	Baseline vs. Saturated
P>chi2	0	
Population Error		
RMSEA	0.028	Root mean squared error of approximation
90% CI, LB	0.024	
UB	0.031	Prob RMSEA < 0.05
pclose	1	
Information Criteria		
AIC	511252.105	Akaike's information criterion
BIC	511441.427	Bayesian information criterion
Baseline Comparison		
CFI	0.996	Comparative fit index
TLI	0.989	Tucker-Lewis index
Size of Residuals		
SRMR	0.009	Standarized RMSR
CD	0.785	Coefficient of determination

Figure 7. Resilience Index Quintiles

32% 26% 28% 25% 19% 22% 13% 15% 9% 12%

Poor   Medium   Rich
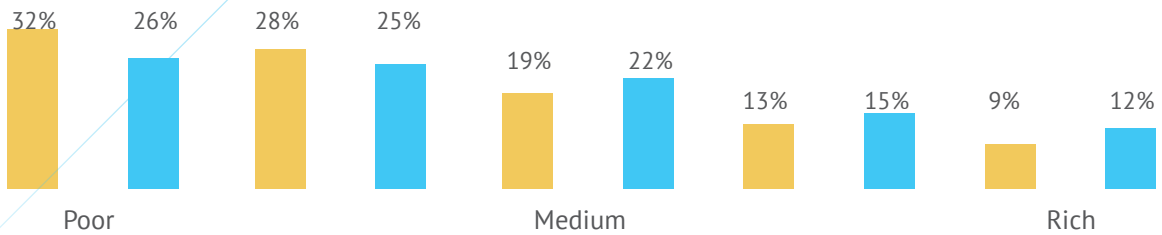
Some Caveats

The procedures described in this section only illustrate how it is possible to construct a social resilience index using MICS as the main data source. In order to make the index more robust in terms of items included it is necessary to utilize other relevant information such as households' migration histories. The social resilience index could be then used as an independent variable to predict migration under certain climate/environment-related events. Researchers implementing these methods, however, have to be careful in terms of the generalizations that the limited data allow us. MICS, as mentioned above, is an excellent source to study households with children, adolescents and women due to its size, geographic coverage and comparability with other household surveys.

Conclusion

Resilience and Migration as Key Components for the Post-2015 UN Development Agenda

For many of today's children, who will become adults in the post-2015 world, dealing with environmental change will be a fact of life. The increasing exposure to sudden and slow-onset environmental hazards, coupled with the levels of resilience and the adaptive capacity of individuals and communities to cope with these, has become a priority concern in the field of international development. Accordingly, resilience will certainly become a key factor in delivering the post-2015 development agenda. Tools and strategies that allow households, communities including children, adolescents and youth to adapt better to stressful environmental conditions and to increase their resilience will be of fundamental importance in the post-2015 world.

Migration due to its important role for development and its potential for adaptation strategies among vulnerable populations is expected to be an important element of the new post-2015 development agenda. So far, however, policies addressing migration and development are still heavily dominated by a purely functionalist approach focusing primarily on the economic role of remittances and largely excluding migration as an adaptation strategy to environmental change.

Investigating the scope of migration as an adaptation strategy has been a major challenge thus far. For instance, insufficient research and policy work has been done to assess the linkages between climate change and environmental degradation and their impacts on migration and vulnerable populations, in particular, on children, adolescents and youth. As many countries affected by climate change and environmental degradation are also characterised by a youth bulge, young people are a key segment in the context of environmental change and migration. CAY in less developed countries are particularly at risk of being trapped in locations where environmental change will likely have negative consequences for their families' livelihoods. On the other hand, it is youth who take on the burden to migrate in order to help their families to cope with the adverse effects of environmental change. In order to address the challenge of enhancing the social resilience of people whose livelihoods are severely affected by environmental change and to better integrate the issue of migration in the adaptation discourse, a better understanding of the role and the specific vulnerabilities of CAY in the environment-migration nexus is fundamental. This not only affects the efforts of governments, civil society and international organizations, such as UNICEF but also the breadth and scope of debate on the post-2015 development agenda. Survey research plays a key role in this regard as it provides a base for quantifying several issues related to the role of environmental change and CAY migration.

This initiative aims to begin filling the existing knowledge

gaps in this regard. The methodology that is being proposed is an initial step, first, to address a lack of statistical data and rigorous research on the impact of environmental change on CAY drivers and patterns of migration; and, second, to develop targeted policy recommendations to minimize the costs associated with migration while enhancing the effectiveness of environmental change adaptation strategies.

Assessing Environmental Change and Migration Linkages

Conducting research on the linkages between environmental change and CAY migration should be a dynamic enterprise that needs to take into consideration the distinct contextual variables that local communities affected by environmental change confront. Researchers need to apply indicators that gauge households' adaptive, coping and transformative capacities in order to produce comparable data. Research in this area also needs to take into account the size of the target population and its distribution in the overall population in order to choose relevant research designs. Only by having sound research designs producing reliable and comparable data policies can be informed during the implementation and monitoring processes.

Examining the particular role of CAY in the context of environmental change and migration poses a number of methodological challenges including: the multiplicity of factors, actors and institutions influencing migration decisions, the (missing) time dimension and several challenges related to population and sampling. Several methodological solutions to these challenges like oversampling techniques or the adding of migration histories have been described. The next step will be to implement these procedures using UNICEF field offices and related research initiatives such as the (planned) UNICEF-led project on "Children, Adolescents, and Youth in the context of Migration and Environmental Change

The Policy Connection

The Fifth Assessment Report (AR5) by the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) highlights resilience and adaptation strategies as necessary activities to manage future environmental risks. In this context, the AR5 calls to further explore the "future vulnerability, exposure and responses of interlinked human and natural systems." From a policy perspective the methodology presented in this report provides policymakers and stakeholders with a toolset to assess the risks and opportunities that arise from the complex interactions between environmental change and migration. Specifically the methodology could help policymakers to assess CAY's risks, vulnerabilities and resilience to environmental change as well as determining the viable adaptation strategies at their disposal.

Coping with the risks of environmental change and environmental degradation necessitates adaptation and mitigation strategies with direct implications for future generations.[49] This report provides a way to design, implement and evaluate evidence-based policies within NAPAs in certain policy sectors vital to increase CAY's resilience and potential adaptation to environmental change such as water and sanitation, wealth maintenance and creation, health infrastructure and future job market prospects.

Appendix 1: Examples for screening questions

We are from XXXXXX. We are working on a project concerned with environmental degradation and migration. I would like to talk to you about this and initially I would like to ask you a few questions, if you agree. Some of them are for instance related to the economic situation of your household.

Screening questions for migrant households

S1.   May I speak with the father, mother or person in charge of the household?
RESPONDENT AVAILABLE ….. CONTINUE ….. 1
RESPONDENT IS NOT AVAILABLE ….. APPOINTMENT SCHEDULED ….. 2
DON'T KNOW (DK)/REFUSED TO ANSWER (RF) ….. TERMINATE ….. 98

S2.   Are there any children, adolescents or young people between 0 and 24 years of age who live in the household?
Yes ….. CONTINUE ….. 1
No ….. TERMINATE ….. 2
DK/RF ….. TERMINATE ….. 98

S3.   Are there any persons between the ages of 0 and 24 years who are still considered to be a part of this household moved to live either in another province or in a foreign country?
Yes, within country ….. CONTINUE ….. 1
Yes, foreign country ….. CONTINUE ….. 2
No ….. TERMINATE ….. 3
DK/RF ….. TERMINATE ….. 98

S4.   [PROBE] Are the persons who moved to live in [INSERT ANSWER FROM S3] currently living there?
Yes ….. CONTINUE TO MAIN SURVEY ….. 1
No ….. TERMINATE ….. 2
DK/RF ….. TERMINATE ….. 98

We are from XXXXXX. We are working on a project concerned with environmental degradation and migration. I would like to talk to you about this and initially I would like to ask you a few questions.

Screening questions for non-migrant households

S1.   May I speak with the father, mother or person in charge of the household?
RESPONDENT AVAILABLE ….. CONTINUE ….. 1
RESPONDENT IS NOT AVAILABLE ….. APPOINTMENT SCHEDULED ….. 2
DON'T KNOW (DK)/REFUSED TO ANSWER (RF) ….. TERMINATE ….. 9

S2.   Are there any children, adolescents or young people between 0 and 24 years of age who live in the household?
Yes ….. CONTINUE ….. 1
No ….. TERMINATE …..2
DK/RF ….. TERMINATE ….. 98

S3.   Are there any persons between the ages of 0 and 24 years who are still considered to be a part of this household ever moved away from the household?
Yes ….. TERMINATE ….. 1
No ….. CONTINUE TO MAIN SURVEY….. 2
DK/RF ….. TERMINATE ….. 98

Appendix 2: Stratified Sampling

In order to determine the optimal allocation of a stratified sample we need to assume that the costs (c) are constant across all strata (h), even though this might not be very accurate for some countries in which migrants are primarily located in areas affected by distinct environment-related effects.

- The cost of screening out a member of the non-migrant population is the same for all strata, $c_{Sh} = c_S$
- The cost of collecting data for a member of the difficult-to-sample population is the same for all strata, such that, $c_{Rh} = c_R$

We also assume that the distribution of our variable of interest (Y) that could be migration rate, income, inequality, etc., is constant:

- The population mean of variable y in stratum h ($\bar{Y}_h$) is the same for all strata, that is, $\bar{Y}_h = \bar{Y}$ for all h
- The variance of y in stratum h, S^2_h, is the same for all strata, so that $S^2_h = S^2$

Given these assumptions, with simple random sampling within the strata, the *optimum sampling fraction* in stratum h is:

$$f_h \propto \sqrt{\frac{P_h}{P_h(c-1)+1}}$$

where $P_h = \frac{M_h}{N_h}$ is the prevalence or proportion of the households in stratum h that are migrant households (Mh is the number of migrant households in stratum *h* and N_h is the size of the total population in stratum h and $c = \frac{c_R}{c_S}$ is the ratio of the cost of a full interview to the cost of screening an interview. In most cases the cost of collecting data (c_R) is greater than the cost of screening (c_S), and thus the ratio of the cost of a full interview to the cost of screening an interview is greater than 1 (ie.,c>>1); however, when the cost of screening and interviewing is practically the same (c = 1), the optimum sampling fraction is reduced to $f_h \propto \sqrt{P_h}$

Example:
Suppose that you have two strata, with 64 per cent of migrant households in one stratum and 4 per cent in the other being migrant households. Then, with c = 1, the first stratum should be sampled at a rate 4 times as large as the second stratum.

$$f_1 \propto \sqrt{.64} = .80$$
$$f_2 \propto \sqrt{.04} = .20$$
$$f_1 / f_2 = 4$$

With c = 4, the first stratum should be sampled at a rate only 2.35 times larger than the second stratum.

$$f_1 \propto \sqrt{\frac{.64}{.64(4-1)+1}} = .47$$
$$f_2 \propto \sqrt{\frac{.04}{.04(4-1)+1}} = .20$$
$$f_1 / f_2 = 2.35$$

In order to determine if disproportionate stratification is an efficient strategy it is necessary to estimate the gain in precision from using disproportionate stratification over proportionate stratification. For the case when r = 1 the gain in precision is given by:

$$R = \frac{\left[\sum A_h \sqrt{P(c-1) + P/P_h}\right]^2}{P(c-1)+1}$$

Where Ah is the proportion of the difficult-to-sample population in stratum h and P is the prevalence of migrant households in the full population. This formula shows the need for the distributions of migrant households and of the total population to differ across strata if a reduction in variance is to be obtained from disproportionate allocation. As c increases, the gains in precision decline, so if the data collection is onerous (c_r) or the cost of screening is very low (c_s), then disproportionate stratification may result in only minor gains in precision. When $c = 1$ the gain in precision is given by $R = \left(\sum \sqrt{A_h W_h}\right)^2$, where W_h is the proportion of the total population in stratum h.

Forming the Strata with Area Sampling

Most national surveys employ area sampling. For the case of sampling migrant populations within specific regions affected by environmental degradation, area sampling could also be used as an efficient and cost-effective strategy. There are three situations that need to be distinguished in order to fashion an effective design.

1. Migrant households are evenly spread through the population

2. Migrant households are unevenly spread, with higher concentrations in some areas.

3. Migrant households are unevenly spread, with many areas containing no members of the difficult-to-sample population.

Evenly Spread Migrant Population

From a two-stage sample consider an a equal-sized PSUs selected by random sampling and b Secondary Sampling Units (SSUs) selected by simple random sampling within PSUs. Also assume that the cost is given by $C = {}_a C_a + abc$ where C_a is the cost of including a PSU in the sample and c is cost per selected SSU. The optimum value for b is given by:

$$b_r = \sqrt{\frac{C_a}{c} \frac{1-\rho}{\rho}}$$

where p is the intra-class correlation of the y-values in the PSUs, and the subscript T denotes that it is an estimate of the mean for the total population. The above formula can be adjusted for an evenly spread migrant population with the value of c changed to $c'=c_R+c_S$ $(P^{-1}-1)$ where $P= M/N$. In this situation the relationship between bR and bT depend on the cost ratio. So if $c_S = 0$, then $b_R = b_T$. If $c_R = c_S$, $c'= P^{-1}_{cR}$ and hence $b_R = \sqrt{Pb_T}$ it follows then that:

$$\sqrt{Pb_T} < b_R < b_T$$

Example:

Suppose that P = 10% and b_T=200, $\sqrt{.10} \times 200 < b_R < 200$. The PSU screening sample size to generate such a sample size is $63 < n_T < 200$.

The example suggests that it is good practice to select large subsamples from selected clusters when sampling migrant households, but the optimum subsample is not as large as would occur by equating b_R and b_T.

Unevenly Spread Migrant Population[51]

In some countries, migrant households may be heavily concentrated in certain geographical regions affected by distinct environmental deterioration events. Under this situation, disproportionate stratification may be employed with the strata being defined geographically as follows:

1. Choose study regions within the country that are affected by slow-onset environmental change-related phenomena.
2. Choose sub-regions within the region that contain known/expected high proportions of migrant households.
3. Classify geographical areas within each sub-region according to the estimated prevalence of households with migration experience (use available quantitative data, or if absent, estimate the relative prevalence of migrant and non-migrant households based on expert opinion, using key informants).
4. Create strata to classify areas according to the (relative) prevalence of households with migration experience.
5. Sample areas from each "prevalence rate" stratum, whereby areas with a higher expected prevalence of migrant households are oversampled as previously discussed.
6. Screen households in areas selected in step 5; that is, briefly visit all households with a short screening questionnaire and prepare a list identifying all households as migrant or non-migrant.
7. Create strata of migrant and non-migrant households for each sample area.
8. Allocate a disproportionate share of the sample for each area to the stratum of migrant households (i.e., oversample migrant households).
9. Following predetermined criteria, interview clusters of non-migrant households in each area, as needed, to economize on fieldwork time and costs.

Unevenly Spread Migrant Population with Areas Containing No Migrants

If there are areas in which migrants may be under-represented for whatever reason and if those clusters can be identified in advance of the survey, they can simply be removed or ignored for the oversampling purposes. If they cannot be identified in advance then c_s would increase substantially and the fieldwork involved would become drastically onerous.

Weighting Scheme

Given that migrant households are oversampled, it is necessary to compensate for their disproportionately high selection probabilities. The weight for each element is the inverse of its selection probability. The elements are scaled to the relative frequency of the elements in the population from which these elements were sampled. The values of the weights are computed from the data collected on the population from which the samples were drawn. In general a sample design weight can be defined as the ratio between the probability proportional to estimated size selection (PPES) divided by the actual selection probability.

$$\frac{P(x)^{PPES}}{P(x)^{actual}}$$

where $P(x)^{actual}$ is the actual selection probability of a household and those of all higher order sampling units under which the household is subsumed (e.g. EA, census block, district, region, etc.); and $P(x)^{PPES}$ is the PPES selection probability of the household if the PPES sampling were to be used for all higher order sampling units under which the household is subsumed.

Example:

The following table illustrates the effect of oversampling in a particular country and in its regions. Column (a) shows the name of the particular region, column (b) depicts the migration status of households within regions. Columns (c) and (d) show the result of the actual sample design, which used higher selection probabilities for migrant-sending households and the actual selection probability $P(x)^{actual}$ respectively, whereas columns (e) and (f) show the number of households that would be selected in a sample based on PPES (equal probability sampling) and its selection probability $P(x)^{PPES}$. Finally, column (g) shows the weights for the different types of household in the regions; these weights are used to weight the data for each group so as to make the total representative of the four regions together in this particular country.

Region (a)	Migration Staus of Households (b)	Disproportion-ate Sampling Households (c)	$P(x)^{actual}$	Proportionate Sampling Households (e)	$P(x)^{PPES}$	$\frac{P(x)^{PPES}}{P(x)^{actual}}$
Region 1	High Migration	365	0.13	152	0.05	0.42
	Null Migration	210	0.07	463	0.16	2.20
Region 2	High Migration	415	0.14	225	0.08	0.54
	Null Migration	148	0.05	459	0.16	3.10
Region 3	High Migration	658	0.23	244	0.09	0.37
	Null Migration	426	0.15	614	0.21	1.44
Region 4	High Migration	378	0.13	134	0.05	0.35
	Null Migration	269	0.09	578	0.20	2.15
Total	High Migration	1,816	0.63	755	0.26	0.42
	Null Migration	1,053	0.37	2,114	0.74	2.01
	Total	2,869		2,869		1.00

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METHODOLOGICAL CONSIDERATIONS FOR SURVEY RESEARCH
ON CHILDREN, ADOLESCENTS AND YOUTH IN THE CONTEXT OF
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