# Connecting the dots: linking climate change resilience to human capital

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# Connecting the dots: linking climate change resilience to human capital

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This thematic review has been produced as part of a series of preliminary papers to guide the long-term research agenda of the Pathways to Resilience in Semi-arid Economies (PRISE) project. PRISE is a five-year, multi-country research project that generates new knowledge about how economic development in semi-arid regions can be made more equitable and resilient to climate change.

**Front cover image:**
A person securing water for his household in Pakistan.

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# Acronyms

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ADB | Asian Development Bank |
| BIS | Department of Business Innovation and Skills |
| COP | Conference of the Parties |
| CRED | Centre for Research on the Epidemiology of Disasters |
| CRI | Climate Risk index |
| DRR | Disaster Risk Reduction |
| ECLAC | Economic Commission for Latin America and the Caribbean |
| EDI | Educational Development Index |
| EFA | Education For All |
| EM-DAT | Emergency Disasters Database FAO |

Food and Agriculture Organization GDI

Gender-Related Development Index GDP

Gross Domestic Product

| | |
|---|---|
| GEM | Gender Empowerment Measure |
| GNP | Gross National Product |
| HDI | Human Development Index |
| HDR | Human Development Report |
| IDMC | Internal Displacement Monitoring Centre |
| IDRC | International Development Research Centre |
| IFRC | International Federation of the Red Cross and Red Crescent Societies |
| IISD | International Institute for Sustainable Development |
| IMF | International Monetary Fund |
| IPCC | Intergovernmental Panel on Climate Change |
| IFRC | International Federation of Red Cross and Red Crescent Societies |
| ILO | International Labour Organization |
| IOM | International Organization for Migration |

| | |
|---|---|
| IUCN | International Union for the Conservation of Nature |
| KNBS | Kenya National Bureau of Statistics |
| MDG | Millennium Development Goal |
| MPI | Multidimensional Poverty Index |
| NCAR | National Centre for Atmospheric Research |
| NDMA | National Disaster Management Authority |
| NGO | Non-Governmental Organisation |
| ODI | Overseas Development Institute |
| OECD | Organisation for Economic Co-operation and Development |
| PMD | Pakistan Meteorology Department |
| PRISE | Pathways to Resilience in Semi-Arid Economies |
| SAL | Semi-Arid Land |
| SDG | Sustainable Development Goal |
| UN | United Nations |
| UNAIDS | Joint UN Programme on HIV/AIDS |
| UNCTAD | UN Conference on Trade and Development |
| UNDP | UN Development Programme |
| UNESCO | UN Educational, Scientific and Cultural Organization |
| UNEP | UN Environment Programme |
| UNFCCC | UN Framework Convention on Climate Change |
| UNFPA | UN Population Fund |
| UNICEF | UN Children's Fund |
| UNU-IAS | UN University Institute for Advanced Study of Sustainability |
| URT | United Republic of Tanzania |
| WCDRR | World Conference on Disaster Risk Reduction |
| WEDO | Women's Empowerment and Development Organisation |
| WEF | World Economic Forum |
| WFP | World Food Programme |
| WHO | World Health Organization |
| WMO | World Meteorological Organization |

# Executive summary

From the perspective of human capital within the purview of climate change, this thematic review aims to assess the existing knowledge base on the risks and opportunities created by the interlinks between the two. There is a myriad of evidence on the deteriorating impact of climate change on human welfare in these regions, yet it also has the potential to introduce opportunities for a better future.

This review document is an output produced as part of a multi-country project, 'Pathways to Resilience in Semi-Arid Economies' (PRISE). The contextual focus of it is based on the semi-arid lands (SALs). 'PRISE' is a five-year project with the ambition of generating knowledge about climate-resilient and inclusive growth. Based on a development-first approach, it aims to engage stakeholders and researchers in identifying the prospects and challenges posed by climate variability that hinder the development process in semi-arid regions. The PRISE countries constitute Pakistan, Tajikistan, Burkina Faso, Senegal, Tanzania and Kenya. Lessons drawn from these target areas will then be generalised for SALs globally.

## Climate change and human capital in SALs

A significant proportion of the area, ranging from 40 to 80%, in PRISE countries is classified into 'arid and semi-arid' categories. Owing to their geographical characteristics, these areas are extremely sensitive to climate change stimuli and their effects, with impacts ranging from increased temperatures, erratic rainfalls, declining quality and quantity of water and extreme weather events like floods and droughts. These impacts are not only threatening the natural ecosystems, but also introducing grave concerns for the human systems.

Human Development Index (HDI) of the PRISE countries ranges from 0.388 to 0.607, indicating the low situation of socio-economic development in these countries, particularly in terms of education, health, and incomes. Poverty rates in these countries, especially in case of some African countries, are also considerably high. In addition, majority of the population of these areas is engaged in agricultural, livestock and forest sector for their livelihoods. High population growth rates (above 2%) and even higher urbanisation rates (as high as 6% in Burkina Faso) are creating serious policy and development concerns. All these factors indicate the low resilience of population to external shocks, making them highly vulnerable to scenarios like climate change and its impact.

This review discusses the concept of human capital as well as the mechanism for resilience-building in the context of risks introduced by climate change and their impacts. The idea of human capital is approached in the context of health, education, livelihoods, migration and the disproportionate impacts on gender and the marginalised. A thorough assessment of literature indicates that the interplay of human capital and climate change is twofold: climate change impacts are observed to be detrimental to existing human systems, and at the same time, a stronger human capital base is vital to adapt to the changing climatic scenario and is imperative for climate-resilient and inclusive development.

## Climate change and health

Health indicators of the PRISE countries show that the status of health in these countries is poor. Infant mortality rate is as high as 69 deaths in 1000 births in Pakistan, with the rest of the countries ranging close-by. Food insecurity is highest in Tanzania with 38.8% of population experiencing undernourishment whereas lowest in Pakistan with 19.9% incidence of undernourishment according to FAO reports. The occurrence of malaria is particularly high in Burkina Faso with 7,963 deaths from the disease only in the year 2012. Health expenditure in some countries, like Pakistan, is as low as 2.7% of the GDP. The health situation of these countries is worsening by the ramifications of climate change. Evidence suggests that climate change is responsible for spreading the geographical range of certain diseases like malaria, meningitis, gastrointestinal infections, etc. Through its toll on agricultural production, climate change is further worsening the food insecurity situation by making food accessibility all the more difficult for the poorest population.

However, the most serious health concerns caused by climate change are evident at times of extreme weather events like floods and droughts when cases of mortality, injury and severe health disorders rise in frequency. Investing in water and sanitation, especially in urban slums and rural areas can reduce the risk of diseases like malaria, eye and skin infections, gastrointestinal diseases, etc. In addition, pro-poor health investments, especially in the less-developed SALs would greatly increase the adaptive capacity of the most vulnerable populations, making them more resilient to climate-induced health risks.

## Climate change and education

Another factor that increases the vulnerability of population of PRISE countries is the low educational status there. While the literacy rates of some of the PRISE countries are comparatively high (100% in Tajikistan and 72% in Kenya), literature indicates that quality factor is lacking in the education system of these countries, with millions of school-aged children out of school. Lower secondary level education attainment, which is considered essential for developing productive skills in individuals is quite low, particularly in West African countries (Senegal has 24.4% and Burkina Faso 14%). Owing to the low status of education in the PRISE countries, most people are involved in low paying climate-sensitive jobs which increase their vulnerability.

Education and awareness has great potential to enhance the resilience of populations to climate effects. Education can help build risk-assessing and problem-solving skills in people. It also has close affinity to the earning capacity of individuals, as educated people are generally involved in highly paying jobs and thus have more adaptive capacity to external risks. A number of studies also indicate that people of SALs are practicing certain adaptation measures using indigenous knowledge. There is a great potential for enhancing the risk-bearing capacities of people by consolidating this indigenous knowledge with modern methods, technology and education.

## Climate change and migration

Migration, which is used both as an adaptation strategy and coping mechanism, is a common phenomenon in most of the PRISE countries. Existing literature on climate-induced migration gives snapshots of distress migration occurring in times of extreme events, however, the statistical data for the slow onset of climate change migration is more difficult to report. In the slow onset of migration, it is difficult to extract the influence of climate and environment from a variety of other push factors related to economic, social and political determinants. Seasonal migration is adopted in Pakistan, Tajikistan, Kenya, and Tanzania to diversify livelihoods in dry weather. Drought and flood-induced displacements are often accounted for in African countries and most recently in Thar district of Pakistan. Such movements of people can alter the demographic trends like urbanisation that may spur growth of urban slums and diaspora, putting further pressure on cities' strained resources. There are approximations that due to environmental reasons, about 50 million people move towards urban areas annually.

There is a great potential to use migration as an effective adaptation strategy to reduce the risks of climate change impact. However, the efficacy of this strategy depends upon the state's response and proactive approach to minimize the risks and uncertainties associated with migration. With the availability of better climate-induced migration data, planning to systemize the migration procedure may improve, thereby enhancing its ability to increase the adaptive capacity of people.

## Climate change and livelihoods

Majority of the people in the SALs of PRISE countries are directly or indirectly engaged in agriculture, livestock, forestry and pastoral activities. Climate change has introduced a number of livelihood insecurities for these people, especially for the poor. Even slight shifts in average temperature and rainfall patterns may greatly affect crop productivity, adversely affecting the incomes and livelihoods of many. Extreme events like floods and droughts can disrupt complete supply chains with the loss of crops, livestock, and physical infrastructure.

To deal with the impacts of changing climate, people in these areas are taking a number of adaptive measures. Some people are changing their crops and cropping patterns; others are shifting away from farming to water resources, forestry, etc.; and some are engaging themselves in petty trade or daily wage activities. However, climate change has also introduced tremendous opportunities for livelihoods. Investments in renewable energy sector, water management sector, low-carbon industries, climate-resilient agricultural research, etc. are some of the thriving opportunities that climate change has created. PRISE countries have the potential to tap these opportunities to create climate-resilient livelihood options.

## Climate change and the marginalised

The Fifth IPCC report confirms that climate change has been observed to have disproportionate effects on the socially, economically and culturally vulnerable populations. In the PRISE countries, these groups include the poor, women, children and the elderly, indigenous people, and minorities, on which the adverse effect of climate change is more pronounced. The poor have fewer assets and they are heavily reliant on agriculture and livestock for their livelihoods, thus their sensitivity to climate change impact is greater. By its nature, poverty has other embedded social adversities like food insecurity, health issues, less education, etc. that increases the vulnerability of the poor.

Climate change is also known to have disproportionate effects on women due to the socially structured gender roles in PRISE countries. In most PRISE countries, especially in the rural areas, women are responsible for collecting water, fuel, and food. With pressures on these resources due to climate change, their work becomes more difficult. Children and the elderly, due to their fragile bodies and less adaptive capacity to extreme temperatures and disasters, are particularly vulnerable to the effects of climate change. Similarly, indigenous groups and minorities in many PRISE countries also experience more pronounced effects of climate change as a result of their social exclusion, geographical remoteness and habitation in climate-sensitive locations.

## Conclusion

A thorough literature review indicates the existence of a strong correlation between climate change resilience and human capital accumulation. Socio-economic development of the population in terms of health, education, and livelihoods is crucial for increasing their capacities to face external shocks like those caused due to climate change. The review identifies certain policy gaps suggesting that the development paradigm of the PRISE countries needs to be changed by considering climate change as more of a development issue rather than an environmental one. Policy planning needs to consider the detrimental impact of climate change on human security and at the same time devise strategies to benefit from the opportunities introduced by it. In addition, this thematic review identifies that more investment needs to be directed towards data documentation for climate-induced migration. Conceptual frameworks also need to be established for a deeper understanding of how health and education endowments can be used to enhance climate resilience. Moreover, research is warranted to analyse the potential of renewable energy jobs to reduce poverty and inequality leading to less vulnerability of the marginalised. Lastly, a deeper insight is needed to assess as to how the climate change affects labour productivity.

Children in a flood affected IDP settlement near Rawalpindi, Pakistan. © Ayesha Qaisrani

# 1. Introduction

The six-country research project Pathways to Resilience in Semi-Arid Economies (PRISE) considers efforts to achieve sustainable development in semi-arid regions in Asia and Africa. This thematic report has been produced at a time when development discourse is bringing three different streams of global narrative–on sustainable development, climate change and disaster risk reduction (DRR) – into a single thread – that is, building resilience to ensure climate change and climate-induced disasters do not reverse development gains.

Building the resilience of people and communities translates into building human capital that is ultimately better able to adapt to climate risks. It is important to consider the human dimension of climate change, given the direct and indirect effects of the latter on well-being, security and long-term development. Climate change disrupts equity, efficiency, empowerment and sustainability, and its implications are visited on communities through disruptions in productivity, livelihood losses, general discomfort, infrastructure deterioration, displacement and migration, education discontinuation, health issues and heightened mortality. Moreover, communities that rely heavily on natural resources, such as the semi-arid lands (SALs) of Asia and Africa, are more affected by climate change (IPCC, 2014). Along with this, if the human development levels of such communities are low, the adverse effects of climate change will be more pronounced, as low capabilities and human development endowments make it harder to cope with shocks that threaten health, livelihoods and social stability (Juneja, 2008).

Climate change has exposed countries all around the globe to a new set of threats. While most literature on responses to climate change has tended to be framed around mitigation or adaptation strategies[1], there is growing body of work that ties climate change actions to poverty reduction, inequality and sustainable development[2]. Bowen et al. (2012) put forward a framework for sustainable development in the face of climate change, according to which what is necessary is investment in natural capital, infrastructure, human capital, macroeconomic stability, the institutional and regulatory framework, access to markets and capital and firm performance.

More recently, the prevalent global discourse[3] of building synergies among climate change, DRR and sustainable development, and taking into consideration communities and people's resilience, matches the PRISE project's research focus on building human capital as a core element in achieving the goal of climate-resilient sustainable development growth in the SALS of Asia and Africa. PRISE is a five-year, multi-country research project that aims to deliver quality information and knowledge, keeping in mind the changing climatic landscape, on inclusive, climate-resilient, growth. It is based on a policy- and development-first approach, engaging stakeholders and researchers to map out threats and opportunities posed by climate variability in relation to the development of semi-arid regions. Such a development-first approach can help identify the areas and gaps that need immediate attention and investment instead of depending on scientific projections before action. It engages business leaders, regional economic communities, academia, civil society and researchers to enable PRISE to cater to demand-specific policy gaps in semi-arid regions with sound research backing. The project focuses on the semi-arid regions of Pakistan, Tajikistan, Burkina Faso, Senegal, Kenya and Tanzania. Lessons drawn from project countries will then be generalised for global SALs.

The six PRISE countries share similar socioeconomic characteristics, with high poverty rates, low institutional capacity and low health and education statuses (except Tajikistan, which enjoys better education levels). Primarily agrarian societies[4], these countries are particularly sensitive to changes in climate, which may cause impacts such as degradation of the natural resource base; disasters and natural catastrophes; governance and institutional issues; disruptions in investment flows and market mechanisms; loss of livelihoods; food shortage; migration and displacement; and discrepancies in health and educational standards. Impacts may also be different depending on gender, marginalisation and exclusion. All of this results in compromised human well-being, which endangers sustainable growth.

[1] Ngigi, 2009; OECD, 2008;Tubiello, 2012; Venton and Trobe, 2008.
[2] Gupta, 2014; Kates et al., 2006; Skoufias et al., 2011).
[3] The Sustainable Development Goals (SDGs); COP (Conference of the Parties) 21; World Conference on DRR.
[4] Although the share of agriculture towards national gross domestic product (GDP) is declining in these countries, agriculture remains the major employment sector, absorbing more than 60% of the labour force in PRISE countries.

The purpose of this report is to carry out an extensive review of the literature to provide an evidence base on how climate volatility erodes human capabilities and increases the vulnerability of people living in climate-sensitive, semi-arid zones. It also aims to explore potential facets of human capital that can be focused on in order to build resilience in the population against climatic change. Besides the traditional components of human capital (health, education and livelihoods), the report studies the mobility and migration patterns of people that result from the changing climatic scenario and analyses their relevance in terms of building the adaptive capacity of vulnerable populations. The report also addresses existing deficits in human capital dimensions in PRISE countries, which climate change exacerbates and which expose people to climate-induced vulnerability. In addition, the report is based on the understanding that social inclusion, social rights and addressing differences in human capacity are crucial for improving climate resilience and inclusive growth.

This report is based on the assumption that achieving inclusive, climate-resilient, growth means addressing holistically the interlinked issues of access to services, demographic transformation and marginalisation. It can contribute to local, national and international policy planning by furnishing information on the need to build human capital in order to improve resilience and adaptive capacity. It also lays out research agendas relevant to human capital-building for the PRISE countries to be carried out in the implementation phase in the coming years of the project. More specifically, the report aims to answer the following questions:

1. How are human systems and endowments vulnerable to climate impact and what development opportunities can enhance resilience?
2. How does climate change exacerbate transformation in demography, migration, urbanisation and gender issues and how does this transformation affect climate resilience?
3. How can communities with rapidly changing demographics be better enabled to cope with climate stress and how can policy support planned migration as effective adaptation?
4. How are livelihoods affected by the impact of climate change and climate-induced disasters and what sort of livelihood opportunities arise out of the changing climatic scenario?

To set the scene, Section 2 reviews the evolution of the human development paradigm for broad-based economic growth and development. It also identifies links between different concepts that come under the umbrella of human development and throws light on different indices that attempt to quantify human development. Section 3 discusses climate change impacts on human capital in SALs in the context of vulnerability and resilience. Section 4 provides a detailed response to the above-mentioned PRISE research questions. Section 5 sums up the analysis, draws out policy implications and directs attention towards research gaps.

# 2. Conceptualising human capital, human security and human development

"People are the real wealth of a nation." (UNDP, 1990)

In economic terms, human capital is the capacity and capability of human beings to contribute to socioeconomic growth. In comparison, human development, human security and the protection of human rights are the processes that strengthen this capacity through the provision of structured choices for health care, education, food, civic amenities, a decent standard of living with freedom and dignity and safety and protection of life and livelihoods from all shocks, including social, physical, economic and environmental shocks (Slaus, 2012). The more adequately resourced the human security and development processes, the better the quality of the human capital to produce the desired results.

Initially, quantity of labour inputs[5] was the primary way of determining economic development. After the 1960s, significant consideration began to be given to the quality of 'human capital'.[6] However, growth theories (such as the neo-classical and the Solow–Swan growth theories) did not incorporate the quality of human capital in their growth framework. Contributions of economists such as Paul Romer (1986) and Lucas (1988) and the introduction of endogenous growth models broadened the concept of 'capital 'to include 'human capital', synonymous with educated and skilled labour.

The idea of 'human development' resonates with that of 'human capital'. More recently, advocacy on the 'livelihoods approach', which is a subset of the human development paradigm, has coincided with the notion of human capital. Both these approaches are people-centric: human development concentrates on the capacities of people in relation to general human well-being; the livelihoods approach centres around facilitating people with access to the 'assets' that support their livelihood strategies. These assets include physical, natural, social, financial and human components. The sustainable livelihood approach also talks about the enabling environment necessary to turn these assets into productive activities by tapping the opportunities and removing the constraints people face in terms of economic, social and institutional conditions (Chambers and Conway, 1992).

The following sub-sections discuss the evolution of the concept of human capital, including its links with other people-centred approaches developed to achieve sustainable development.

## 2.1. Evolution of the human development paradigm

The UN Development Programme (UNDP) mainstreamed the concept of 'human development' through its 1990 Human Development Report. Prior to that, development was defined narrowly in terms of economic growth and was perceived to improve on its own through policies that promoted growth (Sant'Ana, 2008). Growth was considered inherently beneficial to all spheres of a society through its trickle-down effect. Little attention was given to the evolution of other factors (along with growth) such as inequality, poverty, social injustice, well-being and empowerment.

Mahbub ul Haq introduced the idea of human development into the UN agenda in 1990s inspired by the capability approach of Sen (1980).[7] The concept of human development promotes the idea that development, in the perception of accumulating wealth, is not an end in itself, rather just a means; the real end of development is human well-being. Human well-being is reflected as the process of acquiring capabilities and the freedom to use them. It can be considered a development *of* the people, *for* the people and *by* the people (UNDP, 1990). It advocates for social progress (better access to and quality of knowledge and health services), economics (more growth to promote human development and reduce inequality), efficiency (to enhance productivity),

[5] Labour inputs have been seen as part of the production process since the time of Adam Smith (1776). Together with physical capital and technological advancements, increases in labour input have indicated greater growth. In this scenario, labour specialisation dominated the perception of human capital.

[6] The works of Barro (1991), Becker (1975), Jones (1996), Lucas (1988), Romer (1986) and Schultz (1961) were ground-breaking in introducing the importance of human capital, through investment in the health and education of people, in the long-run development of countries.

[7] Sen in "the Equality of What?" 1980. The capability approach of Sen was more on the philosophical than the economic side, but later works of Sen did include an economic dimension as well. Sen's approach was, in itself, motivated by the 'basic needs approach', which focused on limited domains for the poor, the economics of human need and the inter-linkages between governments, markets and institutions in the supply and demand of these needs (Doyal and Gough, 1991; Streeten and World Bank, 1981).

cultural liberty and political empowerment (particularly for the marginalised, in terms of gender, ethnic group and age), sustainability (in terms of environment and social and economic development) and human security (against unforeseen adverse situations such as conflicts, disasters, droughts, hunger and violence). These elements were developed in subsequent UN Human Development Reports (HDRs) over the years.[8] Nevertheless, the focus of human development is on enhancing people's standards of living and their capabilities to contribute towards development. In other words, development must revolve around people, not people around development.

## 2.2. Connectivity between human capital, human development, human security and human rights

The concepts of human capital, human development, human security and human rights are guided by the same overall agenda of improving people's lives. The difference lies in the primary audience and the literature guiding the dominant paradigms within each concept (Alkire, 2010). Table 1 compares these concepts in summarised form. The concept of human development was formulated for development economists and policymakers to help them shift the focus of development from a purely economic growth perspective to one that also covers people-centric factors.

There are profound similarities between human development and human rights. The idea behind human rights is 'the possession of certain rights by virtue of humanity to live a life of freedom and dignity' (UNDP, 2000). These rights guide the morals and behaviours of individuals and are universal in nature, promoting equality for all. Human development is guided by the human rights agenda, which predates the formulation of the human development paradigm. The primary audience for human rights, meanwhile, includes the legal and the political and activist communities (Alkire, 2010). The two concepts are now converging and both complement each other (ibid.).

Human security also has a logical relationship with human development. According to the Commission on Human Security (2003), it aims 'to protect the vital cores of all human life in ways that enhance human freedoms and human fulfilments'. The concept has evolved from a single core focus on national or territorial security to cover a variety of dimensions, including life, livelihoods, dignity, food, health and environment (Alkire, 2010). Intrinsically a subset of human development, it concentrates on empowering people with at least the minimum set of capabilities to enable them to live a decent life. Human security contributes to human development and the level of human development reflects the degree of human security.

**"The idea behind human rights is 'the possession of certain rights by virtue of humanity to live a life of freedom and dignity' (UNDP, 2000). These rights guide the morals and behaviours of individuals and are universal in nature, promoting equality for all."**

[8]The HDRs of 1990, 1991 and 1992 defined the concept of human development; HDR 1993 focused on people's participation; HDR 1994 looked at human security; HDR 1995 focused on gender; HDR 1996 linked economic growth and human development, HDR 1997 focused on the eradication of poverty, HDR 1999 addressed globalisation; HDR 2000 looked at human rights and human security; HDR 2001 looked at technological advancements; HDR 2002 focused on democracy; HDR 2003 introduced the Millennium Development Goals; HDR 2004 considered cultural liberty; HDR 2005 covered international cooperation; HDR 2006 focused on water scarcity; HDR 2007 dealt with climate change; HDR 2009 addressed migration, etc.

Table 1: Definitions and concepts

| Concept | Definition | Focus | Dimensions |
|---|---|---|---|
| Human development | Human development is a process of enlarging people's choices. The most critical ones are to lead a long and healthy life, to be educated and to enjoy a decent standard of living (UNDP, 1990) | Process of achieving human well-being and levels of achieved outcomes of well-being | 1. Material well-being<br>2. Bodily well-being<br>3. Social well-being<br>4. Security<br>5. Freedom of choice and action<br>6. Psychological well-being |
| Human capital | Human capital is the capacity of the population to drive economic growth (Human Capital Report, 2013.) | Increasing the productivity of people | 1. Education<br>2. Health<br>3. Innate abilities<br>4. On-the-job trainings<br>5. Migration |
| Human security | The objective of human security is to safeguard the vital core of all human lives from critical pervasive threats, in a way that is consistent with long term human fulfilment (Alkire, 2003) | Freedom from fear, freedom from want and freedom to live in dignity | 1. Economic<br>2. Health<br>3. Personal<br>4. Political<br>5. Food<br>6. Environmental<br>7. Community |
| Human rights | The possession of certain rights by virtue of humanity to live a life of freedom and dignity (UNDP, 2010) | Promotion and protection of certain fundamental freedoms of individuals and groups | 1. Security rights<br>2. Legal rights<br>3. Liberty rights<br>4. Political rights<br>5. Social rights |

Sources: UNDP, 1990, 2012; Alkire, 2013; Human Capital Report, 2013.

Similarly, human capital and human development also have a cyclical, reinforcing relationship. Both can be considered the means and ends of each other. From the economic point of view, human development leads to human capital formation, which then contributes to economic growth. On the other hand, if we look through the lens of development, the concept of human capital formation is considered an underlying factor in the agenda of human development. Thus, both concepts focus on enhancing human welfare by instilling different capabilities in people so they can live a healthy, safe, knowledgeable and productive life.

Human capital is used in economic theory in the sense that it considers the use of an acquired set of capabilities, through human development, as a resource in the growth process. It relates to the stock of knowledge and characteristics of a person that increases his or her productivity. Schultz, in 1961, defined human capital as an investment in the *quality* of human beings, which can then be used to enhance growth and development. He defined human capital as the capacity to adapt to disequilibrium or a changing environment. Using a multi-pronged strategy for strengthening human capital, he advocated investments in health services, education and training. Moreover, he also highlighted the importance of migration in response to varying opportunities of better livelihoods.

Becker (1975) defined human capital as the stock of knowledge and skills that increases the productivity of a person and considers the contributions of human capital directly in the production process. In a sense, then, this view is rather one-dimensional. Gardener (1989), on the other hand, focusing on multiple intelligences, saw human capital as the potential of people that results from the unique blend of capabilities and skills of individuals. The concept of multiple intelligences entails the overall personality, preferences and strengths that increase the productivity of a person.

What followed these theoretical underpinnings was empirical evaluation of endogenous growth theories involving specific dimensions of human capital, most commonly education and health in relation to economic growth. Among these, the works of Lucas (1988), Becker and Murphy (1988), Romer (1989), Barro (1989), the International Monetary Fund (IMF) (1998), Schultz (2003), Wilson and Briscoe (2004) and Howitt (2005) deserve special mention. The Organisation for Economic Co-operation and Development (OECD) (2001) explains the concept of

human capital as 'the knowledge, skills and competencies embodied in individuals that facilitate the creation of personal, social and economic wellbeing'.

The Human Capital Report (WEF, 2013) mentions that human capital is not the traditional function of education and skills; it holds a bigger meaning in which the health, physical, social and economic context of a society are fundamental. All these components relate to human development and increase people's productivity in the growth process through strengthening their capabilities. Thus, the broad-based definition of human capital now includes the knowledge, skills, attitudes and capacities of individuals in addition to the social and cultural endowment of communities to enable them to live a decent and productive life (Dae-Bong, 2009; Heitor, 2012; Marzzuchi and Montresor, 2012; WEF, 2013). In line with this definition, we have tried to understand strengthening of human capital in SALs in the context of climate change through five parameters: education, health, livelihoods, migration and marginalisation.

## 2.3. Measuring welfare

With perspectives on the rationale of development changing, hard-core economic indicators such as GDP and per capita income are no longer sufficient to cover the issue. As Robert Kennedy said (in Haq, 1995):

*The gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages; the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to country; it measures everything, in short, except that which makes life worthwhile.*

The need for a new measure was clear and searches were in progress from the start of the 1990s. Mahbub ul Haq (1999, in UNDP, 1999) suggested it should be a single number, with the 'same level of vulgarity as the GNP [gross national product] – but a measure that is not blind to social aspects of human lives as the GNP is'. This laid the foundations for the Human Development Index (HDI), which aspired to be both robust and attractive enough to draw the attention of policymakers (Jahan, 2002). The HDI focuses on three main dimensions –health, education and a decent standard of living – with a set of indicators for each.

The index measures the average achievements of people in relation to these dimensions. Measurement is weighted on indicators that comprise life expectancy at birth for health; the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schooling for education; and GDP per capita for standard of living (UNDP, 1990). But while the HDI is a strong measure of human development across nations, it does not and cannot capture all human development entails. It is a summary measure, not comprehensive enough to include aspects like human security, participation, political freedom and inequality (Anand and Sen, 1994).

With the introduction of the HDI and recognition of certain aspects it does not cover, other indices and measurements started developing. This does not mean the HDI became redundant; rather, other indices complemented it by serving to address other dimensions of human development the HDI could not entail. In 1995, the Gender-Related Development Index (GDI) and the Gender Empowerment Measure (GEM) were formulated. These measures focused on gender inequalities in basic capabilities and inequalities in participation in the economic and political arenas (Jahan, 1999).Following the emergence of these gender indices, an index was formulated in 1997 that aimed to capture multidimensional deprivations, named the Multidimensional Poverty Index (MPI). The MPI is centred on the same dimensions as the HDI (health, education and standard of living) but it takes these in terms of their deprivations and measures the intensity of severity of poverty within them. The MPI provides a holistic approach to poverty and considers it as going beyond a simple lack of economic resources.

All these indices, though not comprehensive enough to include human development to its complete definition, indicate levels of human development in its basic dimensions. They do not aim to replace the economic measures of GDP and per capita incomes, but rather to complement them by giving an indication of countries' socioeconomic aspects (Haq, 2007). Though open to much improvement in terms of indicators and data, these indices guide the human development journey by indicating where countries are lacking and where they perform well. Box 1 uses these indices to describe the socioeconomic landscape of PRISE countries.

## Box 1: Human development in PRISE countries

Various indices indicate that the countries that are part of the PRISE project rank generally low in terms of human development. Some countries, like Burkina Faso, Tajikistan and Tanzania have shown remarkable performances in terms of GDP growth but their levels of human development do not show the same optimistic picture. By not focusing solely on economic values, these indices explain that these countries are deprived on various dimensions of human development, resulting in low levels of capabilities in their population.

In terms of the HDI, it is evident that Asian countries perform better than African countries in terms of human development. Gender disparity is most evident in Pakistan and Senegal[1]. Multidimensional poverty is more intense in Africa, with a particularly dismal scenario in Burkina Faso, where 50% of the population is deprived in one dimension or another.

Human development levels in PRISE countries

| Country | GDP growth (%) | HDI[2] | GDI | MPI[3] |
|---|---|---|---|---|
| Pakistan | 4 | 0.537 | 0.750 | 0.237 |
| Tajikistan | 7.5 | 0.607 | 0.952 | 0.031 |
| Burkina Faso | 6.5 | 0.388 | 0.924 | 0.508 |
| Kenya | 4.6 | 0.535 | 0.908 | 0.226 |
| Senegal | 3.5 | 0.485 | 0.864 | 0.390 |
| Tanzania | 6.9 | 0.488 | 0.916 | 0.335 |

Source: UNDP (2014); World Bank (2014).

Looking at the above table we can discern each country's human development. For the sake of understanding, the HDI is broken down into its component indicators for each PRISE country. In the table below Tajikistan's progress on the HDI is a product of its remarkable performance in education and its better performance than that of the rest of the countries in health. Kenya also shows good performance in education but low performance in health means its HDI ranking is lower than that of Pakistan. Burkina Faso has the lowest values for all indicators and thus has the lowest HDI ranking.

Components of the HDI

| Country | Life expectancy at birth (years) | Mean years of schooling (years) | Expected years of schooling (years) | Gross national income per capita ($) | HDI |
|---|---|---|---|---|---|
| Pakistan | 66.6 | 4.7 | 7.7 | 4652 | 0.537 |
| Tajikistan | 67.2 | 9.9 | 11.2 | 2424 | 0.607 |
| Burkina Faso | 56.3 | 1.3 | 7.5 | 1602 | 0.388 |
| Kenya | 61.7 | 6.3 | 11.0 | 2158 | 0.535 |
| Senegal | 63.5 | 4.5 | 7.9 | 2169 | 0.485 |
| Tanzania | 61.5 | 5.1 | 9.2 | 1702 | 0.488 |

Source: UNDP, 2014.

[1] The higher the GDI value, the lower gender disparity is.
[2] The higher the HDI value, the higher the human development level.
[3] The higher the MPI value, the higher the multidimensional poverty level.

Poverty rates in PRISE countries

| Country | Rural population (%) | Poverty headcount ratio at $1.25 | Poverty headcount ratio at $2 |
|---|---|---|---|
| Pakistan | 62.14 | 12.74 | 60.19 |
| Tajikistan | 73.38 | 5.92 | 27.69 |
| Burkina Faso | 71.81 | 44.46 | 72.56 |
| Kenya | 75.22 | 43.37 | 67.21 |
| Senegal | 59.92 | 34.06 | 55.22 |
| Tanzania | 69.80 | 43.48 | 87.87 |

Source: World Bank database (World Development Indicators) for latest years available for countries.

On the basis of these indices, the globe has been divided into roughly three groups. The first, which performs well in almost all dimensions and thus has high HDI and low GDI, GEM and MPI values, comprises high-performing and developed countries. These countries have a good standing in health, education and living conditions and have predominantly less gender inequality. The second group of countries has relatively mediocre levels of achievement in the dimensions included and is thus named the 'medium development group'. The third group of countries includes the low development countries, in which performance is relatively quite low in all or some of the dimensions included in the indices. All PRISE countries, except Tajikistan, are in this group; Tajikistan, given its better performance on the HDI, particularly because of higher educational levels, is in the middle group. However, a closer look indicates that its per capita income is actually less than that of Pakistan's. This reinforces the notion that development goes beyond just economic measures. The human development situation is particularly bleak in Burkina Faso with extremely low performance in terms of education, health and economic empowerment.

As with human development, the literature looks at human capital along three broad lines:

1. Education: Indicators include school enrolment ratios (Romer, 1990), expenditure on education (Ljungberg, 2002; Nunes, 2003), average years of schooling (Barro and Salai-Martin, 1995; Krueger and Lindahl, 2001) and adult literacy ratios (Azariadis and Drazen, 1990).
2. Cost-based: Indicators involving costs of generating human capital, for example Schultz (1961) and Machlup (1962) used the cost of rearing a child as an approximation for human capital. Kendrick (1976) used a similar measure and included the tangible as well as the intangible costs of raising a child to age 14 years.
3. Future income approach: This relies on future incomes as a proxy for human capital levels, for example earnings per worker (Macklem, 1997).

A number of weaknesses and demerits exist in these measures of human capital.[9] For the measures of human capital to be more comprehensive, there is a need to adhere to the framework of human development (OECD, 2009), as it considers not only the quantitative aspect of human capital but also the qualitative aspect. In the sense that it aims to conceptualise human capital in relation to climate change, the notion of human capital used in this report harmonises with the notion of the livelihoods approach, which links capacities and vulnerabilities with the environment. Since the project countries are largely semi-arid in nature, and are thus exposed to a variety of climate risks, this analysis focuses on interlinks between climate variability impacts and human capital. The report looks at the impacts of climate change in the specific context of education, health, climate-induced migration, livelihoods and marginalisation of the people at risk and identifies opportunities that can be tapped in the face of climate change to lead to climate-resilient sustainable development. By analysing these risks and opportunities, the review highlights certain areas and gaps that warrant special attention, which could be the focus of PRISE research in the coming years.

[9] see Dae-Bong, 2009, for details.

## 2.4. Human development within the climate change context

The world has entered 2015 with three new global initiatives, which have a keen climate-resilient development focus: the SDGs (formulated by the UN General Assembly), the climate-focused COP21 (to be held in December 2015 in Paris with the objective of

reaching a universal legally binding agreement on climate) and the Post-Hyogo Framework of Action (to be adopted at the World Conference on Disaster Risk Reduction (WCDRR) in Sendai, Japan, in 2015). These initiatives provide an opportunity for researchers and policy analysts to conceptualise frameworks that guide the resilience-building of human beings against a variety of shocks through the lens of 'human capital'.

The gravity of the challenge climate change poses can be judged from the fact that, despite the existence of a UN legal mechanism to deal with climate change,[10] the global community has adopted an independent goal (Goal 13), under the SDGs, with a pledge to 'take urgent action to combat climate change and its impacts'. Goal 13 posits that sustainable development cannot be ensured without addressing the overarching impacts of climate change. While UNFCCC provides a legal framework, the SDGs provide aspirational targets that harmonise all actors around common goals.

Like climate change, DRR and resilience have both received significant consideration in the SDGs. Goal 9 on resilient infrastructure and Goal 11 on resilient cities provide political visibility for resilience, which is a key pillar in building human capital. A key resilience target under the poverty goal (Target 1.5) reflects how shocks push people into poverty. The target requires states to reduce the exposure and vulnerability of poor and deprived people, thereby reducing their risks relating to economic, social and environmental shocks. A key DRR target under the cities and human settlements goal (Target 11.5) requires states to reduce social and economic losses resulting from disasters for all populations equally. A further set of targets help support resilience-building, relating to social protection, land, incomes of small-scale food producers, food price volatility, preventable deaths of under fives, management of health risks, safe education facilities, safe housing, upgrading of slums, ecosystem management, desertification, violence and rule of law.

Similarly, the 5th Assessment Report (AR5) (2014) of the Intergovernmental Panel on Climate Change (IPCC) shows human influence on the climate system is clear and growing, with impacts observed on all continents. If left unchecked, climate change will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. However, options are available to adapt to climate change, and implementing stringent mitigation activities can ensure the impacts of climate change remain within a manageable range, creating a brighter and more sustainable future.

On release of the report in 2014, R.K.Pachauri, Chair of the IPCC, said, 'We have the means to limit climate change. The solutions are many and allow for continued economic and human development. All we need is the will to change, which we trust will be motivated by knowledge and an understanding of the science of climate change.' The IPCC report says risks may constitute certain challenges for many countries (including the PRISE project countries) and vulnerable communities, given their limited or non-existent ability to cope with them. Those who are marginalised socially, economically, culturally, politically, institutionally and otherwise are especially vulnerable to climate change. Such marginalised people and communities could be protected against this vulnerability if they are made resilient through continued economic and human development, as suggested by Dr Pachauri.

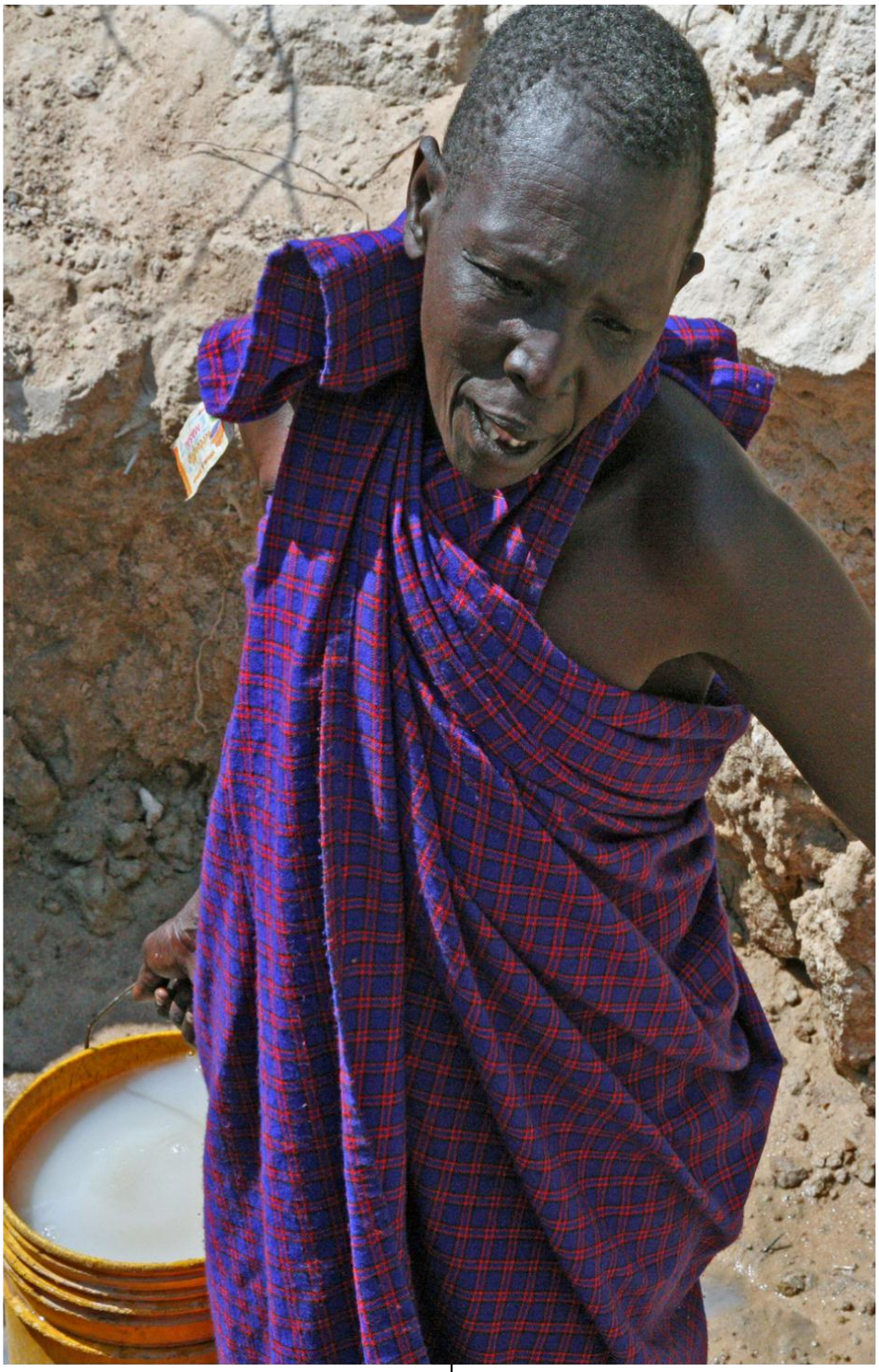
Dr Pachauri, in his analysis based on AR5, also talks about limiting the impacts of climate change by focusing on human development. Giving climate change debate a 'human face' has become extremely important, as it may be one of the greatest challenges to human development (UNDP, 2009). Climate change in fact poses a direct threat to a wide spectrum of human rights, including the rights to life, food, water and housing. On top of this, access to information, social facilities, justice and decision-making may also be affected, making climate change highly problematic for human development.[11]

The global discourses on sustainable development, climate change and DRR continuously warn of the reversal of development gains through climate-induced disasters, with negative impacts on lives, livelihoods, employment, education, health and shelter facilities. They point to the need for resilience-building and investing in people to strengthen human capital. Incorporation of standalone targets on climate change and DRR in the global SDGs indicates that the global community is convinced that development has a climate dimension and, similarly, climate has a development dimension.

Countries around the globe vary in their levels of human development, which affects their sustainable development outcomes. Among other challenges facing nations in the current era, including natural, financial and territorial crises, climate change is steadily changing from being a scientific speculation to being a harsh reality (IPCC, 2007). By influencing the capabilities of people through a

[10] The UN Framework Convention on Climate Change (UNFCCC), an intergovernmental forum for negotiating the global response to climate change.

[11] http://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=200andLangID=E#sthash.X7oE9VRs.dpuf



Bahi woman gets water from the well.

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number of channels, discussed at length in this report, climate change is gradually becoming one of the greatest threats to humanity.

Human capital and climate change are related through the concept of vulnerability, which involves the destruction of the capabilities of human beings (Medalye, 2012). The AR5 defines vulnerability as 'sensitivity or susceptibility to harm or lack of capacity to cope and adapt' (IPCC, 2014). According to Elliot (2012), vulnerability is a dynamic concept, one that relies on present as well as future inequities that carve out people's risk-related coping and adaptive measures. People experience varied types and levels of vulnerability depending on different socioeconomic and demographic factors. Vulnerability is not necessarily synonymous with poverty; rather, it is about insecurities, exposure to risks and shocks and the situational characteristics of people depending on the historical, cultural, social, political and environmental setting of an area (Cardona et al., 2012; Chambers, 2006). IPCC (2014) states that vulnerability to climate change is a function of a population's exposure, sensitivity and capacity to adapt.[12]

Characteristics that determine vulnerability are defined by a population's internal and external socioeconomic and biophysical conditions, such as household income, social networks, access to information, topography, environmental conditions, land cover, economic setting and policies and incidence of natural hazards (Fussel, 2009). Exposure to climate change refers to the degree of climate variability a population experiences; sensitivity to climate change refers to the amount of impact climate variability has on a population; and adaptive capacity is related to the ability of a population to manage change and take advantage of any opportunities that come along (IPCC, 2001).

Box 2 discusses the vulnerability ranking of PRISE countries as a result of climate change with respect to numbers of lives affected as well losses in economic terms.

[12] The studies of O'Brien et al. (2008), Fussel and Klein (2006) and McCarthy et al. (2001) supported this view.

## Box 2: Vulnerability assessment and indices

The Climate Risk Index (CRI) is a global measurement of the degree to which climate-related extreme events have affected different countries. These events may include storms, floods, droughts, heat waves, etc. The index exhibits the degree of exposure and vulnerability to extreme events. It is based on both, fatalities resulting from the event as well as the economic loss associated with it. The lower the value of the index, the higher the climate risk of that country.

From the table, it is evident that Pakistan is the most vulnerable country in the wake of extreme events, among the project countries. It is also the third most sensitive country to climate risk in the global list. Recent data shows the average death toll of Pakistan in a disaster is 469.95. The country also experiences the greatest economic loss associated with extreme events: as much as $2,400 million, or about 0.743% of GDP. The physical, economic and human losses incurred in the recurrent floods since 2010 occurring throughout the country and frequent droughts in Sindh (Tharparkar) not only depict the exposure and vulnerability of people of these areas to disasters but also indicate the low levels of coping capacities and resilience of these people to such destructive aftermaths of climate change impacts.

Tajikistan is the most vulnerable country to climate risk in the Central Asian States. Marked by glacier melt and irregular rainfall patterns, it is often subject to natural calamities. Economic losses associated with climate change are considerable, accounting for about 1.78% of GDP. Senegal is the least sensitive to climate change among the project countries, with a score of 128.5 and an average death toll of 4.5 people. Losses associated with climate risk as a percentage of GDP are at 0.052%.

Climate Risk Index 2014

| Country | CRI score | Average death toll | Deaths per 100,000 inhabitants | Losses ($USm) | Losses (GDP %) |
|---|---|---|---|---|---|
| Pakistan | 31.83 | 469.95 | 0.32 | 2394.93 | 0.743 |
| Tajikistan | 44.5 | 17.7 | 0.27 | 207.53 | 1.78 |
| Burkina Faso | 95.83 | 6.55 | 0.05 | 36.14 | 0.255 |
| Kenya | 80.17 | 45.05 | 0.14 | 71.89 | 0.143 |
| Senegal | 128.5 | 4.5 | 0.04 | 9 | 0.052 |
| Tanzania | 94.17 | 21.95 | 0.06 | 50.47 | 0.137 |

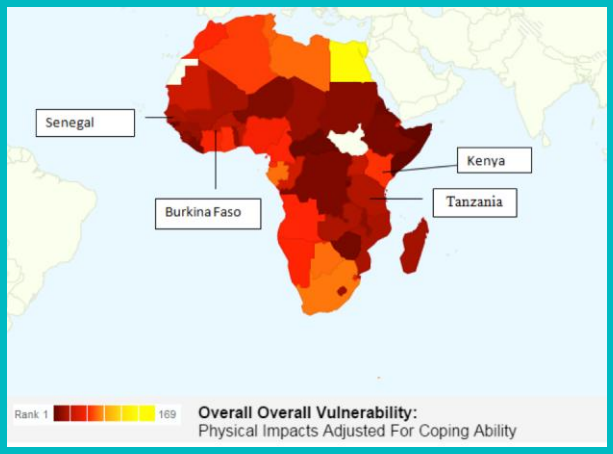
Source: Kreft and Eckstein 2014.

According to the above table, Kenya is the most climate-sensitive African country in the group. Its geographic location makes it prone to cyclical droughts and floods. Tanzania has been receiving heavy rainfall and flash floods recently. The flood in January affected over 10,000 people, with a significant number of casualties. Health issues associated with contaminated water usage have been on the rise, leading to high fatalities. The key climate risks in Tanzania and Kenya are floods and severe droughts. Over the past four decades, these two countries have experienced frequent, severe and prolonged droughts, with severe socioeconomic impacts. The frequency and magnitudes of floods events have also been increasing across the region (Kijazi et al., 2009). Analysis of recent climatological data has revealed a significant positive temperature trend and a slight negative rainfall trend in meteorological stations in Tanzania (Matari et al., 2008) and Kenya (Shongwe et al., 2011).

The increase in minimum temperature is much faster than that in maximum temperature, leading to a reduction in the diurnal temperature range in most of the stations. Late rainfall onset and early withdrawal (cessation) are becoming more common in most parts of Tanzania and Kenya, particularly in arid and semi-arid lands. Observational evidence from local communities in most parts of Tanzania suggests seasonal shifts in rainfall patterns, a decrease in rainfall amount and an increase in temperature (Kijazi et al., 2013).

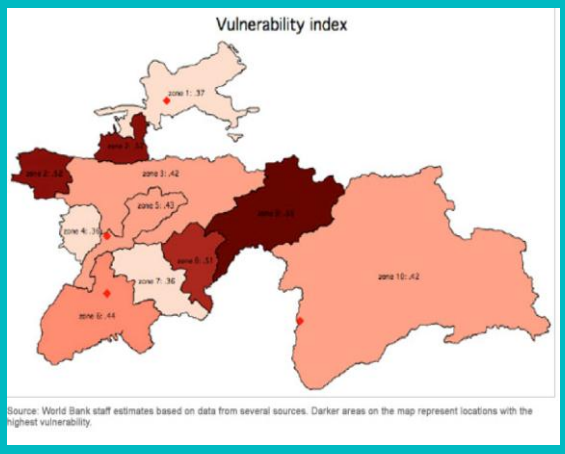
The vulnerability of Burkina Faso has been accounted for by the limited attention paid to the health sector, exposing the population to climate risks. Water shortage in the country is also one of the reasons for its extreme vulnerability to climate change. This is associated with a number of issues related to health care and agricultural production, and has impacts on the livelihoods of vulnerable people in the country.

Vulnerability mapping of Africa




Source: Wheeler (2011).

Vulnerability mapping of Tajikistan




Source: Wheeler (2011).

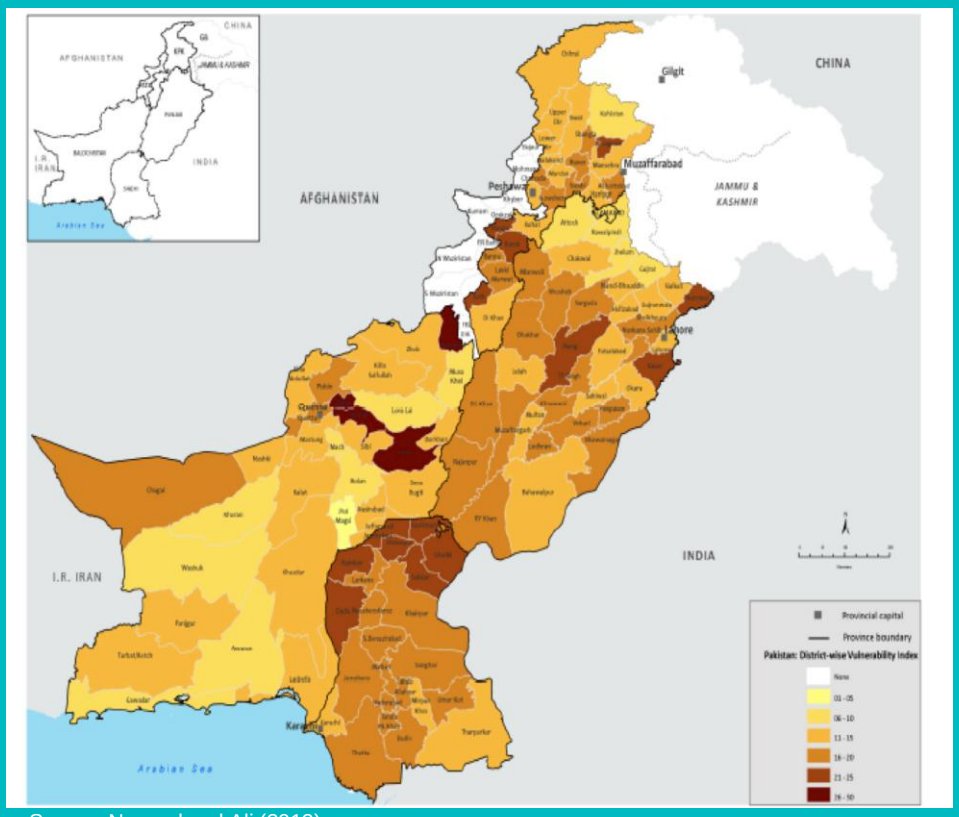
The map of Africa (above left) depicts the overall vulnerability of the continent with regard to extreme weather events, rises in the sea level and losses in agricultural productivity. The map is taken from the Centre for Global Development and is based on a dataset of risk indicators from Wheeler's (2011) work.

Regions of Tajikistan (above right) with greater dependence on agriculture and lower socioeconomic indicators, particularly the eastern mountain Region of Republican Subordination, the Southern Sughd Hills and the Khatlon Hills and Lowlands, are most vulnerable to climate change. Rural areas of Tajikistan, which cover about two-thirds of the country, are more prone to climate risks than the urban centres.

## Vulnerability mapping of Pakistan

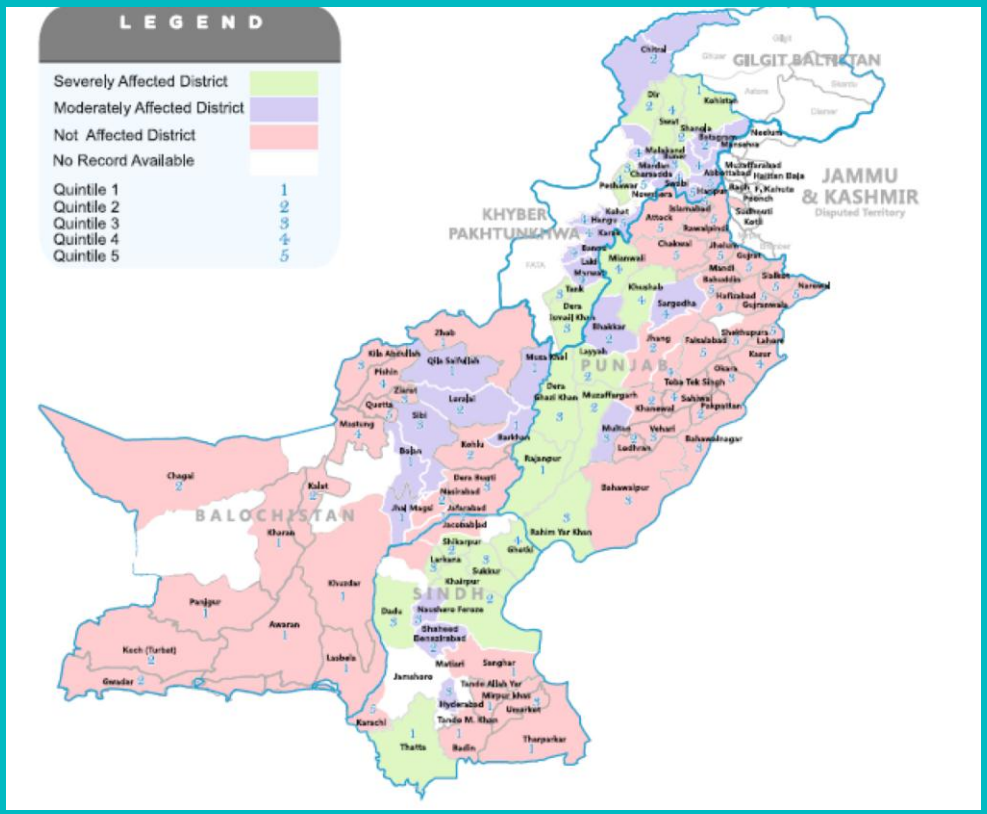
The ramifications of the 2010 floods of Pakistan were widespread. They devastated livelihoods, created food insecurity and destroyed the core gateways for transport and communication. Health, energy and institutional systems on which the population depended heavily, suffered. The whole country experienced a setback of decades, but the effects were disproportionately high for poor and deprived districts, particularly in the rural Sindh, southern Punjab and eastern Balochistan. Naveed and Ali (2012) mapped vulnerability to multidimensional poverty in their study on Pakistan. In the same year, Khan and Salman conducted a spatial mapping of the impact of the floods of 2010. The interesting part is that, in the maps, those districts that were more vulnerable to multidimensional poverty (based on health, education and standard of living) were also among those most affected by the floods, showing that climate change events are harsher for populations that do not have sufficient human development endowments. Since they lack resources and assets to cope with disasters and could not built back their lives and livelihoods in the aftermath of the 2010 floods, they have suffered the most in subsequent floods every year since 2010.

Spatial mapping of vulnerability to multidimensional poverty




Source: Naveed and Ali (2012).

Spatial mapping of the impact of the 2010 floods




Source: Khan and Salman (2012).

Malik et al. (2012) developed a Climate Change Vulnerability Index for Pakistan based on sets of indicators on exposure, sensitivity and adaptive capacity of the population. The findings supported the notion that overall vulnerability to climate change depends on the socioeconomic status and the institutional develop-

ment of the region. The study found that, irrespective of the degree of exposure, those areas that were the most sensitive and had the least adaptive capacity were most vulnerable to the effects of climate change. These areas include Balochistan, southern Punjab, rural Sindh (the cotton-wheat belt) and Khyber Pakhtunkhwa. These regions are highlighted as the most deprived regions of the country in terms of human development endowments, reinforcing the idea that climate change has more severe impacts on those who are not resilient.

The depth of the effects of climate change harming human development depends on people's abilities to cope, often termed as human resilience (UNDP, 2014). The IPCC approaches resilience as a 'capacity for positive adaptation despite adversity' (Lavell et al. 2012). It constitutes a capacity to buffer disturbances, ability to self-organise and adapt to disturbance and a capacity to learn (Tompkins et al., 2005). It is conceptualised as the 'ability of a system and its components to anticipate, absorb, accommodate or recover from the effects of a potentially hazardous event in an efficient manner' (Lavell et al., 2012). Resilience and vulnerability seem to be two ends of the same spectrum, where resilience implies the ability to cope and vulnerability the inability to cope.

There seems to be a two-way link between climate change and human capital. On the one hand, stronger (weaker) human capital means more (less) resilience and capabilities to address natural disasters and climatic change; on the other hand, climatic change can reduce endowment levels of human capital through devastating effects on the capabilities of human beings, making them vulnerable (Heltberg and Bonch-Osmolovskiy, 2010). For instance, in the 1990s, climatic disasters reportedly took 1,000 lives per disaster in countries with low human development; countries with high levels of human development suffered the loss of only 22 people from the same intensity of disasters (Medalye, 2012).

Insecurity breeds insecurity (Suleri, 2013). The hazardous impacts of climate change lead to human development insecurities in terms of causing crop failures, droughts, famine, floods and storms, resulting in food insecurity and hunger and increased poverty. This state of affairs then reverses the development gains and takes us off-track from achieving the Millennium Development Goals (MDGs) and other development targets. Global warming can reduce crop production in Sub-Saharan Africa by 20%, contributing further to malnourishment and hunger in the area (Sarr, 2012). Climate change has also been observed to cause certain other health concerns. Diseases such as malaria, yellow fever, cholera, dengue and respiratory and cardiovascular disorders have become common with weather changes in dry and hot areas, including semi-arid regions (Parry et al., 2007; UNDP, 2014).

In semi-arid regions, such a scenario has led to an increase in infant mortality and prenatal deaths (Tusneem, 2008). Variability in climate can also have long-term health impacts: Haines et al. (2006) report the occurrence of common mental disorders resulting from extreme temperatures and heat waves. The International Development Research Centre (IDRC) (2012) carried out research in Tunisia focusing on the health impacts of climate change and found prevalence of a disease called zoonotic cutaneous leishmaniasis, spread by irrigation practices adopted by local communities.

The impacts of climate change are closely related to a nation's demography. IDRC reports that with rapid urbanisation has come a lag in the provision of facilities for the increasing population. Havoc brought by natural disasters is determined by the population density of the area along with the human, material and environmental situation of households, which gauges the degree of ability to cope with the incident (Sarr, 2012). Nonetheless, it seems clear that households with fewer resources and capabilities, and that are located in disaster-prone areas, are the most vulnerable. Availability of safe drinking water, which is already a huge issue in developing countries, becomes all the more difficult (UNDP, 2010). IPCC (2014) reports that urban areas are more vulnerable to climate-induced diseases if there is congestion and settlements are poorly managed. This shows the need for climate-resilient infrastructure and provision of basic amenities to the population to enhance their resilience.

Furthermore, it has also been noted that the adverse effects of weather-related crises are worse for marginalised groups, which include ethnic minorities, women, children, the elderly and the disabled.[13] Human capital accumulation of such communities is more at threat owing to their low scores on social indicators, thereby exposing them to greater climatic risk (UNU-IAS, 2011). Research in the 1990s shows that, in the event of a disaster, fierce competition is created among people over access to limited resources, and the most marginalised group suffers the most in dealing with the scenario (Peacock and Ragsdale, 1997;

[13] ADB, 2010; Drabo and Mbaye, 2011; Kemp, 2007; OECD, 2009.

Yelvington, 1997) given their limited capabilities to survive a catastrophe and to come out of it (Mileti et al., 1991).

Dislocations and distress migrations in the face of climatic catastrophes are another problem, for the migrants as well as for the civil administration of the locations they migrate to (IFRC, 2012). In addition to loss of life and property in the face of a disaster, such groups are forced to move to an entirely different location to start their life from scratch (Drabo and Mbaye, 2011; UNDP, 2014). The source of earning remains unsustainable for quite a few in such situations, with trickle-down effects in terms of their vulnerability (Elliot, 2012).

The aforementioned effects have affected the capabilities of vulnerable communities and affected their ability to earn a decent living. The combined effects of climate change, ecosystem disruptions and human capital deterioration, among other factors, have plunged the populations of disaster-prone areas of low human development countries into vulnerability traps.

## 2.5. Determinants of vulnerability and resilience to climate risk

In accordance with the livelihoods approach, a number of factors may support or constrain a sustainable living, particularly in times of climate-induced extreme events. The literature points to the adverse effects of extreme weather events on poor people, and the idea that being poor itself implies being at risk (Juneja, 2008; ODI, 2013). Asset entitlement is a predominant factor in determining people's vulnerability, as it shapes their capacity to manage their responses to disproportionate events.[14] People with greater asset entitlement are less vulnerable to climate change, although evidence of increased vulnerability in the case of extreme events is also cited when wealth is greater (Mitchell, 1998). Generally, poverty plays a major role in vulnerability levels (Sen, 1980; World Bank, 1990). Climate change invokes a vicious cycle of poverty trap for poor households, as they have insufficient resources to fall back on. The long-term effects on the poor are also bleak, as they suffer far greater setbacks in the process of accumulating wealth (Skoufias et al., 2011). Box 3 throws some light on the economic losses associated with climate change-induced disasters on a macroeconomic scale.

Besides asset endowment, existence of personal associations, characterised as 'social capital', stands as a significant factor determining people's risk-surviving abilities. Dynes and Quarentelli (1973) note that family and the community act as mediating bodies in the case of calamities, including climate-induced calamities. Generally, people with strong kinship have been observed to survive and rebuild their lives in a much better way (Tobin and Whiteford, 2002), and a decline in family ties and support is associated with more socioeconomic vulnerability (Chambers, 1989).

Dealing with disasters and climate change requires not only strong asset-holding and kinship but also approaches to sustain livelihoods, with strong coping strategies necessary in order to reduce risk and loss. Examples of livelihood diversification and seasonal migration can be observed in the developing world, which help alleviate the adverse effects and improve access to new opportunities (Carraro et al., 2009). In anticipation of climate-related disasters, people in India aim to reduce their risk through the diversification of incomes, planned migration, drawing on household, communal, social and informal credit resources and mitigating consumption patterns, etc. (Agarwal, 1990). Increasing the opportunities available to vulnerable people and providing them with material goods is not the answer post-climate hazards (Skoufias et al. 2011). The most important is to develop sustainable livelihoods – which is a major challenge for the world in this era of financial and economic crises.

The importance of education in reducing vulnerability to climate change is well established.[15] Resilience and adaptation to natural hazards can be inculcated through knowledge- and experience-sharing, including of technical and scientific know-how. Chandra et al. (2011) suggest that, with the help of trained community partners, information flow towards individuals in a community can be a building block in terms of the social infrastructure of a resilient society. Schnell-Anzola et al. (2005) and Muttarak and Lutz (2014) found through comprehensive review that more educated and aware societies were more empowered to recover from climate risks and disasters, as education instils in individuals the skills of problem-solving. With more know-how and information regarding risks and risk management strategies, communities are in a better position to minimise the adverse effects of climate change (Ainuddin et al., 2013).

Besides these direct impacts, education can indirectly influence resilience through higher earnings (Psacharopoulos and Patrinos, 2002), better communication mechanisms (Wen et al., 2011) and more access to social networks (BIS, 2013), which can all contribute to mitigating and avoiding risk. These findings make it plausible to accept that more

[14] Juneja, 2008; Lal et al., 2009; Philip and Rayhan, 2004.

[15] Mileti and Sorencon, 1990; Nisbett, 2009; Reynolds et al., 2010.

education means higher resilience towards climate change.

Besides these direct impacts, education can indirectly influence resilience through higher earnings (Psacharopoulos and Patrinos, 2002), better communication mechanisms (Wen et al., 2011) and more access to social networks (BIS, 2013), which can all contribute to mitigating and avoiding risk. These findings make it plausible to accept that more education means higher resilience towards climate change.

Low health endowment levels can also expose populations to more risk of vulnerability to climate change. The interplay of good nutrition, little exposure to the risk of disease, immunisation and access to health centres determines peoples' health endowment (Malone, 2009).When this endowment is low, people are at the risk of falling prey to climate change-induced adversities, in which their ill health interferes with their resilience.

Climate change research is deeply intertwined with the capacity of human systems to respond to climate change impacts. In this context, the above determinants of vulnerability and resilience (health, education, social capital, sustainable livelihoods) provide conceptual frameworks for analysing socio-environmental systems. Investment needs to be made so these determinants act to strengthen resilience to climate risks.

## Box 3: Economic losses from disasters

Disasters, both natural and man-made, also have an economic perspective to them, and their effects may linger on in the long run. Barro (2009) states that rare ('black swan') events in terms of climate-induced disasters are more costly to economic development than other macroeconomic fluctuations. The UN Economic Commission for Latin America and the Caribbean (ECLAC) (2003) defines these as direct and indirect costs. Direct damages involve loss of life, property and infrastructure as a result of a disaster. These impacts have subsequent impacts on income, employment production and inflation, which are evident in the short as well as the long run (Cavallo and Noy, 2010). The indirect costs are caused by losses in investment and production activities and, most importantly, the shift of resources away from development projects to reconstruction and rehabilitation (Hallegate and Przyluski, 2010). This shift is actually at the cost of social sector development, ultimately bringing social indicators down. Such cuts in public sector development expenditure may further impede human development, leading to more human insecurity in the long run (Suleri, 2013).

Mustard field in Punjab, Pakistan.
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# 3. Climate change in semi-arid regions

The IPCC defined climate change in 2001 as 'the variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes etc.) of climate on all temporal or spatial scales beyond that of individual weather events'. Climate change is no longer a scientific speculation. According to AR5 (IPCC, 2014), since the 1850s the Earth has gradually been getting warmer. The global rise in atmospheric temperature between 1880 and 2012 has been observed to be 0.85°C. To be more specific, the Earth has never been warmer than it was between 1983 and 2012. Ocean warming is also significant, particularly near the surface, and the rate of precipitation has increased significantly since the 1950s.The IPCC describes climate change as being 'unequivocal', with the most pronounced effects being the warming of atmosphere and oceans, rising sea levels and melting snow and ice cover.

Increasing temperatures and industrial activity have led to increased ocean salinity and acidification: acidity in the oceans has increased by as much as 26%. Snow-caps and glaciers have been melting at a much faster rate since 2002 then they ever have in the past and average sea levels have risen significantly in the past century. The alarming fact is that these changes are on an upward spiral, and the IPCC warns that atmospheric temperatures are most likely to continue to rise for decades to come, even if greenhouse gas emissions stop overnight. Uncertainties associated with the emission of greenhouse gases in the future are dependent on socioeconomic development, which may expose natural and human ecosystems to risk and may even create new risks.

What is causing all these changes in the environment and climate is anthropogenic greenhouse gas emission, which has increased the amount of carbon dioxide, methane and nitrous oxide in the atmosphere. These emissions are largely a result of increased industrial and human activity, including population and economic growth. Together with industrial activity, fossil fuel combustion is the largest contributor to these emissions, which have the nature of retaining heat, so that, when their quantity increases, heat held by the atmosphere rises, resulting in an increase in the Earth's average temperature. Changes in the use of land, for example, deforestation also have a profound effect on the atmosphere, by influencing the amount of light being reflected back into the atmosphere and changing the rates of evapotranspiration (WMO, 2014a).

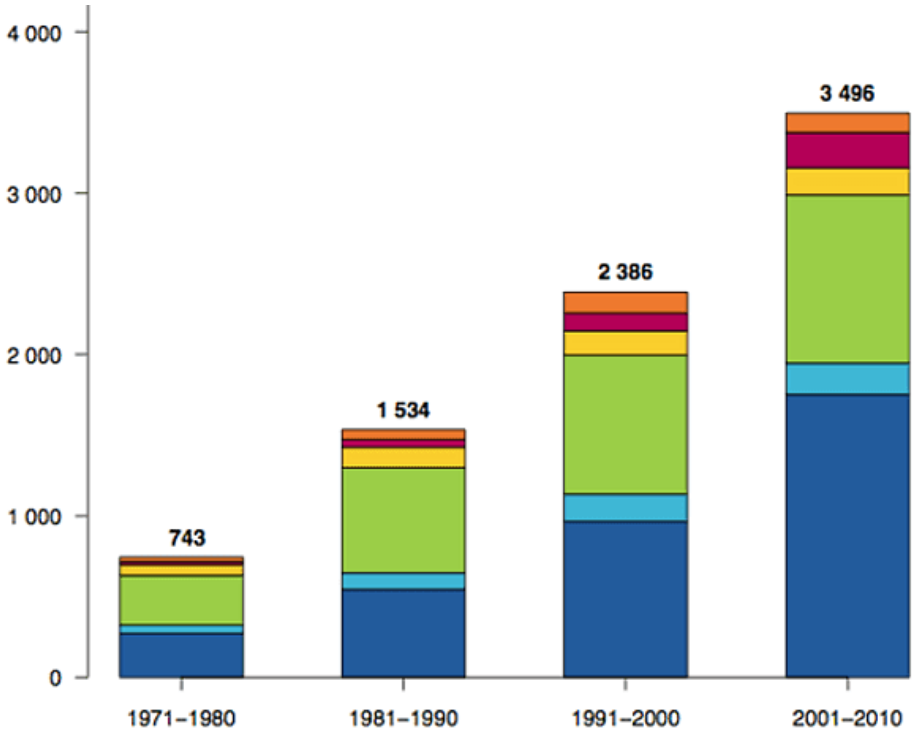
The gravity of the situation lies in the fact that these changes are profoundly affecting natural and human ecosystems and transforming life. In the natural system, such changes in the atmosphere have been found to alter the quality and quantity of water resources and the nature and quality of soil (IPCC, 2014). Volatility in rainfall patterns, impacts on agricultural production, loss of biodiversity, shifts in habitats, effects on human health, changes in forests and ecosystems, implications for energy supply, etc., are some of the consequences of climate change that have been observed globally.

Apart from changes to average temperatures, another consequence is the effect of climate change on extreme temperatures. Such changes increase the probability of weather-related natural disasters. The IPCC (2014) confirms a considerable increase in the incidence of heat waves in the past decade. According to the World Meteorological Organization(WMO) (2014b), together with extreme variability in temperatures, water cycling between the oceans, atmosphere and land is picking up pace, which is causing more intensified rains and droughts simultaneously across the globe. Intense rains have increased the incidence of floods and storms (IPCC, 2007). These rains are occurring as a result of the higher rate of evaporation from the seas because of higher temperatures. At the same time, rising temperatures have doubled the Earth's drought-ridden area since the 1970s as the speed of drying up of land increases (NCAR, 2014). The most severe climate change-induced extreme events are related to water, through either flooding or drought. The water issue has been labelled the biggest environmental issue of the 21st century.

According to recent research,[16] incidence of climate-related disasters has gradually increased in the past few decades. Both hydrological events (floods, landslides, etc.) and meteorological events (heat- and cold-waves, droughts, storms, wildfires, etc.) are on the rise. Figure 1 shows the rising trend in natural disasters occurring because of climate change impacts.

[16] AccuWeather, 2013; IPCC, 2014; WMO, 2014b.

Figure 1: Number of reported disasters by decade and hazard type (1971-2010)




Note: Dark blue= floods; light blue= mass movement wet; green= storms; yellow= droughts; magenta= extreme temperature; orange= wildfires

Source: WMO (2014b).

Extreme weather events and disasters are related through their impacts on the population. Such events translate into disasters depending on a number of factors, which include the risk or hazard of an extreme weather event, the exposure of people to that event and the capacity of communities to tolerate the event, which reinforces our earlier discussion on vulnerability and resilience. Recurrence of disasters can be attributed to increases in the incidence and intensity of extreme weather events, rising population growth rates and the more infrastructure there is that is exposed to risk, causing more damage and thereby resulting in worse 'disasters' (McNeall and Wiltshire, 2014).

Although climate change is a global phenomenon, it affects some areas more than others. The irony of this is that the countries that are least responsible for causing global warming and inputs into climate change are facing its maximum wrath, owing to their geographical, climatic, institutional and socioeconomic setting. According to the Centre for Research on the Epidemiology of Disasters (CRED) (2012), Asia was the worst hit continent by climate-induced disasters in 2012, with 64.5% of total disaster victims, followed by Africa, with 30.4%. Droughts and food crises hit about a million people in Africa in 2012. Asia suffered from 14 disasters in total in 2012, a mix of floods, typhoons, droughts and food shortages, affecting about 72.7 million people in total, out of whom 6.3% were from Pakistan.

The focus of PRISE research is on semi-arid regions. This means we need to define what we mean by 'semi-arid'. According to the 2011 UN Environment Management Group definition, drylands (including semi arid lands) are 'conceptually easy to grasp, but difficult to define precisely'. SALs are a subtype of drylands, with an aridity index[17] of 0.20-0.50, that receive an average annual rainfall of 300-700mm and that cover a global area of 15.2% with a population of 14.4%.

Quite a significant proportion of the total land in PRISE countries is characterized as 'semi-arid'. Tanzania has 45.1% area characterized as arid and semi arid (Sarwatt and Mollel, 2006); Pakistan has 70% (Chaudhry and Rasul, 2004); Kenya has 80% (WFP, 2015) and 60% of land in Senegal and Burkina Faso is arid and semi-arid (Lewis and Berry, 2011). Following the general characteristics of the semi-arid regions of the world, the semi-arid regions of PRISE countries are characterised by low, erratic rainfall patterns, averaging below 700mm per year, periodic droughts and the varying nature of vegetation cover and soil. Covered mostly by thorny grass species that are often cleared

[17] The aridity index is the ratio between average annual precipitation and total annual potential evapotranspiration.

for vegetation, farming and livestock, semi-arid regions are some of the most unevenly populated areas of the world: some areas are densely populated and others sparsely. The majority of these regions are in the continents of Asia and Africa. In some countries, like Pakistan, such regions have extensive irrigation systems along the regional rivers that are used to farm the surrounding lands. Comprising both rural and urban settings, people of semi-arid regions are heavily dependent, directly or indirectly, on their natural ecosystems as well as being employed in the thriving urban areas of the region.

People of SALs have, to a large extent, accepted the risk and unpredictability of their environment and therefore have developed certain adaptive skills in their lives and livelihoods, carried down from generations and through interaction with the environment. Apart from agriculture, the rural populations of semi-arid regions in many of these countries are involved in pastoralism and livestock-rearing, often as an adaptation strategy to counter the changing environmental conditions (Thornton, 2010). Many households, both rural and urban, are known to derive income from more than one source.

Many SALs of PRISE countries display rapidly rising patterns of urbanisation, migration and population growth (the next chapter delineates these trends). The prospects of economic opportunities in the cities and towns of semi-arid areas are pulling people out of rural agriculture sectors, resulting in some of the highest urbanisation rates in the world (e.g. Pakistan has the highest urban growth rate, of 3%, in South Asia). Such high rates of urbanisation introduce new opportunities and challenges for the socioeconomic development of the SAL populations of these countries, influencing the nature of risks and vulnerabilities. The services sectors of these countries are improving, but still a large portion of the economy depends on industry and agriculture, which are highly sensitive to climate variability through its impact on natural resources.

Even without considering the change in climate, semi-arid regions are characterised by water scarcity. With the onset of climate change, rainfall has become highly erratic, sometimes coming down in torrents and other times not all for the whole season (UN Environment Management Group, 2011) (see Box 4 for the impacts of climate change on Pakistan's waterways). In view of the current changes in climate, temperatures in African countries like Kenya and Tanzania are projected to rise by 1.4°C by 2050 (IPCC, 1997). Eastern Africa has experienced tremendous precipitation extremes over the past 30-60 years (Williams and Funk, 2011). Climate change is expected to result in increasing desertification, rises in soil salinity and chronic levels of water scarcity in Asia and Africa (IPCC, 2007).The most serious concern arising out of climate change in semi-arid regions is the exacerbation of existing threats and vulnerabilities through the incidence of more extreme weather events with high intensity (UN Environment Management Group, 2011). Their agriculture and food sectors are expected to be threatened by more challenges, with declining crop yields and water shortages, especially in those areas that are rain-fed, increasing the threat of food insecurity (Parry et al., 2009). Together with the changing nature of climate, ill management of land and water in most SALs is causing degradation of the environment and affecting day-to-day human life through direct and indirect pathways.

The rationale for focusing on human capital to deal with climate change in the semi-arid regions of PRISE countries is to inculcate adaptation measures in communities. Adaptation requires the development of human capital along with the proper management of natural capital and public finances and a sound institutional structure (Adger et al., 2003). Expanding people's capacities by focusing on the core facets of human capital, like health, education and livelihoods, can help them respond better to stresses and shocks in their lives, including climate stresses. Owing to the sensitivity of semi-arid regions to climate change, given their geographic nature combined with low national socioeconomic development levels, people's capacities to cope with and respond to climatic stresses are low in this region and vulnerabilities are exacerbated, particularly in the marginalised community.

## Box 4: Climate change and economic activity in the SALS of Pakistan

The agriculture sector of the semi-arid region of Pakistan derives its lifeblood from the Indus River, which is fed by glaciers in the Hindu Kush and Karakoram Mountain ranges up in the north. Besides agriculture, the mighty Indus River supports the hydro-power facilities of the country, producing about 50% of total electricity. According to the Pakistan Meteorological Department (PMD), the semi-arid regions of Pakistan are often subjected to alternative periods of droughts and floods owing to highly erratic weather patterns, with a dried-up Indus in some years (1999-2002 being a major example) and over-flows in others (intense monsoons from 2010 onwards). The torrential monsoon of 2010 and the subsequent flash-floods that recurred every year thereafter are in line with the IPCC's projections of extreme rainfall events related to monsoons, reinforcing the atrocities of climate change on this side of the world.

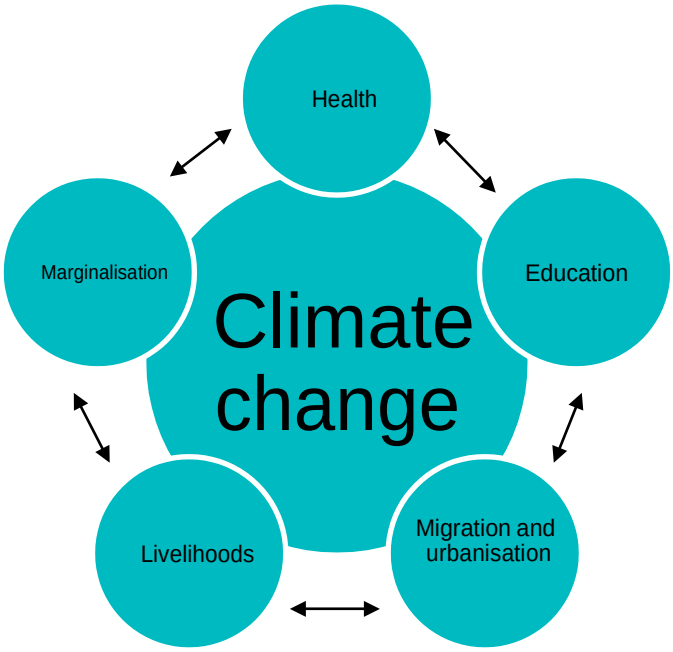
Studies by PMD show the Indus Delta has experienced a rise in heat-waves and temperatures over recent years. Such erratic weather behaviour is detrimental to the health of the economy. Cotton production, which is the source of the previously thriving textile industry of Pakistan, is already being affected by changes in the average temperature, which could have an impact on prices of cotton worldwide. With the main subsistence sector, the power sector and the main export industry in jeopardy as a result of climate change, the prosperity of the nation is at stake. Impacts on these sectors are easily seen in other facets of life in Pakistan: for example, decreases in income can further lower the socioeconomic status of the region.

Source: Cooke (2013).

# 4. Effects of climate change on human capital

A review of the available literature not only highlights the impacts of climate change on social indicators and the people living in SALS but also suggests how to make use of climate change opportunities to increase the adaptive capacity of the vulnerable population. This section discusses in detail the interrelated concepts of adaptation measures as a means of developing human capital and human capital-building as a means of increasing people's resilience in PRISE countries. The five key areas that are our reference points for the analysis of the vulnerability/resilience of human capital are health, education, livelihoods, migration and marginalisation (see Figure 2).

Figure 2: Dynamics of climate change impacts on human capital




Source: Author.

## 4.1. Climate change and health

Many of the adverse implications of climate change on human capital are observed through exposure of human beings to new health issues and worsening of existing ones. Climate change is regarded as a significant contributor to the spread of certain diseases, and climate-induced disasters increase the risk of injuries, disabilities and deaths. Particular health issues related to climate change include heat stress, malnutrition, food- and water-borne diseases such as diarrhoea, vector-borne diseases like malaria and dengue and fatalities in the case of extreme events (Heltberg et al., 2008).

The underlying determinants of sound health that are clean air, clean water, proper sanitation, food security and secure shelter, are negatively impacted through climate change (Fritz and Samenow, 2014). The existing health situation of the PRISE countries on its own is quite precarious, making the population extremely vulnerable to further health risks associated with climate change (see Table 3 for an overview of health indicators for PRISE countries).

Global warming has increased the range of certain diseases, especially air- and water-borne diseases, meaning the spread of such diseases has widened. For instance, cholera is a water-borne disease that thrives in warm temperatures, so the warming of the sea surface has greatly increased cholera incidence (Fritz and Samenow, 2014). Other diseases, like malaria, dengue fever, lyme disease, etc., are all expected to rise in incidence as well as in geographical area as a result of climate change (IPCC, 2007). Table 2 presents a list of number of deaths caused by malaria in the PRISE countries as per 2012 data.

Table 2: Number of deaths from malaria, 2012

| Country | No. of deaths |
|---|---|
| Pakistan | 260 |
| Tajikistan | 0 |
| Burkina Faso | 7,963 |
| Kenya | 785 |
| Senegal | 649 |
| Tanzania | 7,820 |

Source: WHO database (2012).

With already low levels of health status in PRISE countries, further socioeconomic vulnerabilities are exacerbated, pushing the poor into further traps of poverty. Alderman (2010) reports that more than half of the adverse shocks inflicted on the poor are related to health, which opens up avenues for further issues, including food shortages, loss of wages and jobs and absenteeism from school.

Besides the direct effects of climate change on health, there are indirect pathways through which the health of individuals is affected. For instance, in the case of extreme events, destruction of health institutions and medical services may worsen certain diseases not induced by climate (Schmid et al., 2005), and lead to rises in anxiety, stress and depression as a result of displacement or separation from family members (Fritze et al., 2008), as well as reductions in food production, leading to malnutrition and infant mortality (Haines et al., 2006). Health issues, including physical and psychosocial disorders, are common when disasters hit. These need to be researched according to the particular perspective (see Box 5 for case studies).

## Box 5: Implications of climate change for health

### Pakistan

In the aftermath of the 2010 flood, as a result of heavier-than-usual rainfall in the monsoon season, over 6 million people in the flood-hit areas were reported to have suffered from acute diarrhoea, respiratory infections, skin diseases and malaria. An outbreak of cholera in these areas was also reported. A slight increase in polio and measles in children and pregnant women was observed.

Source: Kronstadt et al. (2010).

### Kenya

Recurring droughts in the Horn of Africa have threatened the lives of many. Kenya has also experienced frequent periods of drought, the cycle of which has shrunk from ten to three-five years. Prevalence of malaria and cholera has prominently increased in Kenya as a result of climate change. A malaria outbreak in the western highlands of Kenya took its toll on thousands. Pregnant women and children constituted a large percentage of the victims of the malaria outbreak, which greatly reduced their ability to cope with the changing climate.

Source: UNICEF (2007).

Table 3: Health indicators of PRISE countries

| Country | Life expectancy at birth (years) | Health expenditure in GDP (%) | Infant mortality (per 1,000 births) | Child malnutrition (% of children under 5) |
|---|---|---|---|---|
| Pakistan | 66 | 2.7 | 69 | 31 |
| Tajikistan | 67 | 5.8 | 49 | 15 |
| Burkina Faso | 56 | 6.2 | 66 | 26 |
| Kenya | 61 | 4.7 | 49 | 16 |
| Senegal | 63 | 5 | 45 | 14 |
| Tanzania | 61 | 7.3 | 38 | 16 |

Note: Latest years for which data for all countries were available on each indicator.

Source: World Bank.

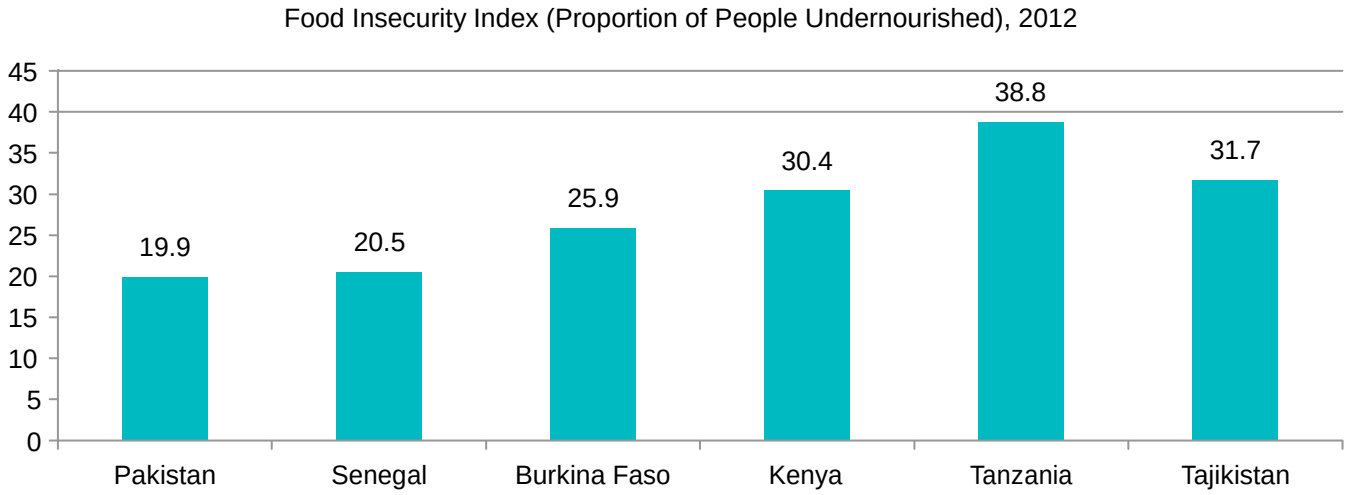
If we consider the six PRISE countries according to their health indicators, we can see these countries are already low in terms of health endowments (Table 3).

The situation of health is particularly discouraging in Pakistan, which has the highest infant mortality and child malnutrition yet the lowest investment in the sector. Respiratory diseases like asthma are common implications of climate change. Moreover, because of extreme weather conditions, pneumonia, heatstroke, cholera and heart attacks are becoming common (Noor and Fatima, 2011).

Increase in average temperatures are promoting the spread of certain diseases in areas previously free of them. Kenya and Tanzania are reporting increased numbers of cases of meningitis, a disease that was not common earlier but that is spreading as a result of increasingly hot and dry conditions in these countries (McMichael et al., 2003). Water contamination and increased temperatures are causing gastrointestinal infections in Tajikistan (Heltberg et al., 2013). Diseases like malaria, dengue and yellow fever are claiming the lives of hundreds of African children, where diseases like AIDS are multiplying as a result of the destruction of health facilities because of extreme climate events (UNEP and UNAIDS,2008).

Rising temperatures are also linked to the decline in agricultural production in most African countries. An alarming number of more than 300 million people are hungry in Africa (UNCTAD, 2009). A major reason for this is the burgeoning food prices as a result of decreases in yield (ibid.). Food shortages and malnutrition as a result of extreme events or high temperatures are taking 1.7 million lives per year in Africa (Patz et al., 2005). This figure is the largest contributor to climate-induced deaths. Figure 3 presents the situation of food insecurity in the PRISE countries.

Figure 3: Food insecurity index for PRISE countries (proportion of people undernourished), 2012




Source: The State of Food Insecurity in the World, FAO (2013).

While the rest of the world is meeting its targets on reducing the undernourished population, the percentage is increasing in Central and South Asia and Africa (Tubiello, 2012). This rise can be associated with decreases in agricultural production and/or rises in food prices. Both factors reduce the ability of the poor to feed themselves properly, thus leading to malnutrition. The cases of Tanzania and Tajikistan are alarming: even with high growth rates, of 6.9% and 7.5%, respectively, both countries have the highest percentage of malnourished population in the consortium. In Tanzania, one in every twelve households is food-insecure, with rural households more food-insecure than urban households (WFP, 2012). In Tajikistan, 1.4 million people do not receive a sufficient amount of food, because of droughts and declines in yield, the effects of which linger on for a couple of years (Oxfam International, 2010).

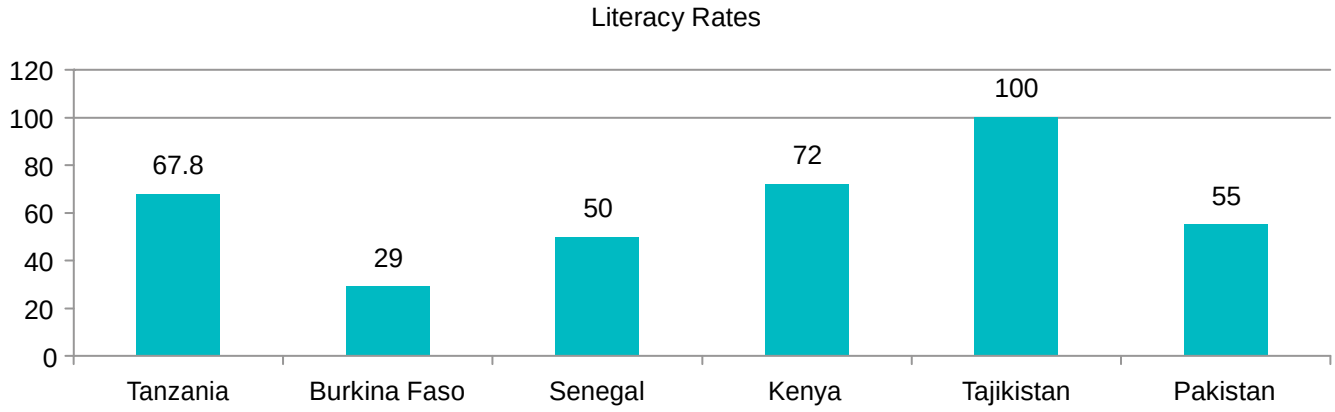
There is a dire need to assess particular health vulnerabilities in the most-climate sensitive spots in the SALs of PRISE countries. Improving the existing situation of sanitation, water and food availability can mitigate the harmful health impacts of climate change to a large extent. Availability of clean air and water can reduce the risk of vector infections that obtain a favourable breeding environment as a result of rising temperatures. Access to health facilities in underdeveloped SALs should be made easier in order to be able to provide proper treatment for climate-induced or other diseases. When a population is sufficiently endowed in health, the risk of falling prey to climate-induced diseases is greatly reduced.

## 4.2. Climate change and education

Education is an integral part of human capital. It contributes to the stock of knowledge and information and is vital for development to be sustainable (UNESCO, 2014). Its importance is evident from the fact that it not only is a development goal in itself but also helps in achieving other development goals, such as gender equality, social inclusion, reducing poverty, better health, economic growth and environmental sustainability (Rose and Steer, 2013). By contributing to the achievement of all these goals, good quality education promotes an inclusive approach to sustainability (Nevin, 2008).

Among the PRISE countries, Tajikistan is the only country with a 100% literacy rate. Kenya has improved, with a literacy rate of 72%, and Tanzania is close figure at 67.8%. The rest of the consortium, on the other hand, shows dismal performance, with only about half of the populations literate (Figure 4).

Figure 4: Literacy rates in PRISE countries, 2010




Source: World Development Indicators, World Bank, 2010.

The UN Educational, Scientific and Cultural Organization (UNESCO) Education for All Monitoring Report (2012b) states that, despite progress in Kenya's educational landscape, about 1 million children are still out of school. Pakistan and Tanzania have about 5.1 and 3.2 million children out of school, respectively. Where countries like Kenya and Tanzania are investing more than ever in education, Pakistan is going backwards, with only 2.3% allotted to education sector in 2010 against 2.6% in 1999.Meanwhile, the quality of education in most of the consortium countries is not up to par. High public spending in some countries (Kenya, Tanzania, etc.) has not been able to improve quality. Many of the youth in these countries have less than secondary school education and have little-skills or everyday competencies (UNESCO, 2012a). Box 6 provides insights into PRISE countries' educational status.

## Box 6: Education and climate change

Lack of knowledge and education can severely affect vulnerability to climate change. Schooling is a great way of informing children and their families regarding the changing nature of the climate and its implications for their environment (UNESCO, 2011). The ability to read and write and language skills can improve access to information that is especially useful in the case of adverse events like disasters. With access to information, a literate population may prepare in advance for any severe climate changes and be in a better position to cope. Educated populations are more efficiently responsive to early warning systems for storms and floods and seasonal predictions for droughts. Education gives them empowerment to self-help in the case of unforeseen events. Studies have found improvements in education levels have been translated into increases in adaptive capacities (van der Land and Hummel, 2013; Striessnig et al., 2013, etc.).

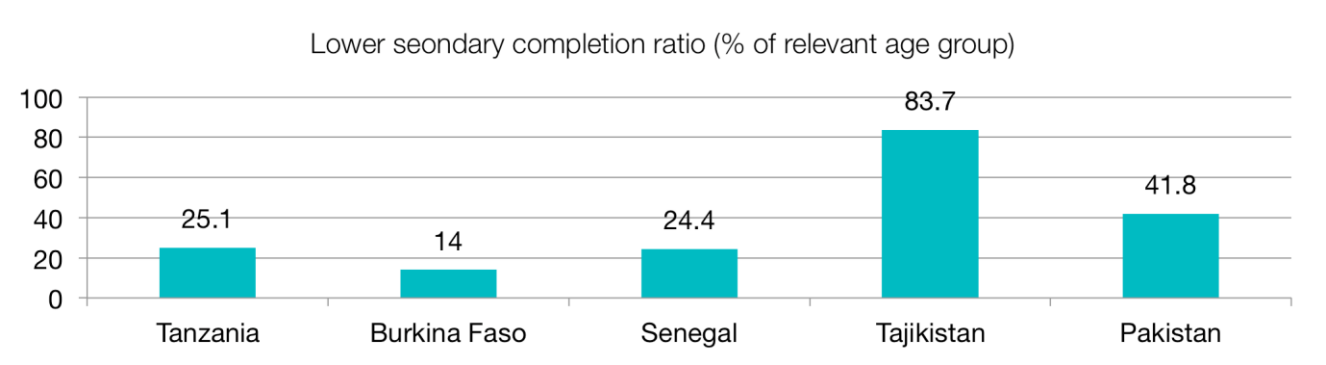
The PRISE countries, except Tajikistan, are generally characterised by low levels of education (see table below). Low educational levels may be considered as one of the factors causing their low adaptive capacity to external and internal shocks like climate change. People with no education are generally observed to be less responsive in preparing for unforeseen events than educated people. It is said that at least secondary level schooling is must for developing skills in individuals that enable them to engage in sustainable livelihoods (UNESCO, 2006). PRISE countries, however, have unimpressive performance on the scale of lower-secondary education completion (see figure below). Amid the growing impacts of climate change, people in the PRISE countries need appropriate knowledge and life skills to understand, adapt to and cope with changing climatic conditions.

The Educational Development Index (EDI) and its components

| Country | Ranking according to level of EDI | Standard EDI and its components (2010) | | | | |
|---|---|---|---|---|---|---|
| | | EDI | Primary adjusted enrolment ratio | Adult literacy rate | Gender-specific EFA Index | Survival rate to Grade 5 |
| Pakistan | 110 | 0.627 | 0.721 | 0.549 | 0.715 | 0.522 |
| Tajikistan | 30 | 0.977 | 0.976 | 0.997 | 0.944 | 0.989 |
| Burkina Faso | 111 | 0.622 | 0.632 | 0.287 | 0.765 | 0.803 |
| Kenya | 96 | 0.839 | 0.870 | 0.736 | 0.922 | 0.829 |
| Senegal | 102 | 0.707 | 0.789 | 0.497 | 0.827 | 0.718 |
| Tanzania | - | - | 0.978 | 0.678 | - | 0.932 |

Source: UNESCO (2014).

Lower secondary school completion rate in PRISE countries (% of relevant age group)




Source: World Development Indicators, World Bank (2012).

Data for Kenya was not available.

The discourse and research on the significance of education as an agent in instilling adaptive capacity against climate change are gaining importance. Disasters not only have impacts on the education system, when social sector development funds are diverted for disaster management, but at times may also cause losses to existing educational infrastructure (UNICEF, 2008). Moreover, these institutions are often used as relief camps for displaced populations, resulting in interruptions in educational activities. Even in the absence of extreme events, intense heat, for example in some regions of Africa, prevents children from regular attendance of school (Thacker, 2013). Flash-floods also block access, and can cause electricity failure or other facilitative problems, leading to disruptions in educational attainment. There is little account of aggregate damage as a result of such disturbances, but the general understanding is that these are detrimental to the educational process (ibid.).

There are other indirect pathways through which climate change influences the process of attaining education. Implications through health issues are a major channel. The spread of certain diseases, exacerbated as a result of climate change means children often fall sick and have to miss school. Malnutrition and water scarcity are also posing a great threat to the well-being of children in the SALs of Africa and Asia (Patz et al., 2005). When climate puts children's health at stake, their ability to participate in education and learn may suffer because of physical, social and mental vulnerability.

Children may also be withdrawn from schools as a result of losses of income households face in times of natural disaster. Crunches in resources may make schools unaffordable for many households, resulting in a large number of school dropouts (Das, 2010). Similarly, displacements and disaster-induced migration act as another disturbance to education attainment. Disaster-affected communities may shift to areas where there are few or no educational facilities or, as a result of resource losses, households may involve children in child labour or trafficking (ibid.). Gender equality is also an issue: UNESCO (2010) reports that, in Pakistan and Uganda, after climate shocks more girls are taken out of school than boys.

However, the important feature here is that education is also a part of the solution, to cope with the risks caused by climate change[18] (see Box 6). Not only is a negative relationship between formal education and deaths from climate-induced mortality reported (IPCC, 2014) but also education is considered the most important element to reduce vulnerability to climate hazards (Striessnig et al.,2013). These claims are supported by findings from Senegal (van der Land and Hummel, 2013) that educated individuals earn more and are mostly involved in non-traditional occupations, which are less vulnerable to environmental pressures.

Muttarak and Lutz (2014) present a theoretical framework about how education can reduce vulnerability to climate change. They map out certain direct and indirect pathways for the process. Acquisition of knowledge, information and competencies can directly instil adaptive capacities in people. Although the people of SALs are well aware of the erratic behaviour of the weather in their region and have developed certain response mechanisms, formal education can equip them with cognitive skills and better understandings, which can enable them to process risk information more efficiently and instil the ability to perceive and

[18] K.C, 2013; Thacker, 2013;van der Land and Hummel, 2013; Wamsler et al., 2012

anticipate events and threats (Mileti and Sorenson, 1990; Paul and Bhuiyan, 2010). In addition to risk understanding, education can develop problem-solving techniques in individuals.[19]

Education informs people about measures to reduce risk and safer places to move to in the event of any climate emergency and gives people details of sources and methods of receiving institutional support. For instant, Wamsler (2012) found from a detailed study that individuals who had no formal education had little knowledge on how to improve their situation in the face of climate risks, and were also less aware of the institutional sources that could assist them in times of climatic emergency. Education can also help people prioritise and allocate resources wisely in anticipation of the future and particularly for unforeseen events, including climate aberrations.

There are certain indirect pathways through which education can help in vulnerability reduction and capacity enhancement. By improving the socioeconomic situation of the household through higher earnings, education gives it control over its resources to reduce risk. This may include getting insurance against unforeseen events, living in low-risk areas and better housing quality (Muttarak and Lutz, 2014). Moreover, more educated individuals have stronger social connections and communication linkages that prove to be vital in times of any type of risk.[20] These social networks help in informal dissemination of news and updates about potential risks and also support in emergency dislocations and migration etc. (Airriess et al., 2008).

In addition to these benefits attained through generic formal or informal education, targeted information dissemination regarding climate change through various channels is also helpful in preparing people for adaptation. For example, awareness of new and heat-resilient seeds and use of innovative technology for increased production is useful for the farming community and natural resource-related sector in SALs. Creating public awareness about the risks they are facing is an important strategy being pursued by major agencies working on climate change adaptation and risk mitigation (UNESCO, 2014). What climate-sensitive communities need is the inclusion of climate change and global warming information in school curricula and knowledge about the societal implications of climate change (Kagawa and Selbi, 2012). UNESCO has initiated a project on Climate Change Education for Sustainable Development, which aims to impart climate change knowledge to children from a young age in order to instil in them the awareness of the risk climate change posits as well as help them devise ways to adapt to them in their local contexts (see Box 7 for more information). A dedicated environmental impact study unit can help identify the vulnerabilities and risks people of a certain area are exposed to and can help devise mechanisms to prepare for it (MacEwan, 2010).

In semi-arid areas like those in the PRISE countries, the potential of education to contribute to adaptation to environmental risks has not been fully utilised. The curriculum imparted at primary and secondary levels needs to incorporate an environmental aspect to prepare children for adaption efforts. Another facet to focus on is awareness of the impacts of climate change at state level: unless policymakers are well aware of the changes the environment is undergoing and impacts on their people, they will not be able to conceive well-designed and holistic policies that recognise the impacts of climate change on local people.

In addition to advocacy on imparting climate change-related education to the people of SALs, we should also recognise the existence of indigenous or traditional knowledge. Even formally uneducated people in SALs are responding quite creatively to climate change and its impacts (Egeru, 2011). For example, people in the SALs of Tanzania predict rainfall by using temperatures, animals and plants as indicators (Chang'a et al., 2010). Instead of a one-way trajectory of information dissemination – from the state or other development entities to the local people–policymakers and people involved in the climate change discourse should ensure they also have an understanding of indigenous coping practices. The idea of incorporating traditional knowledge and locally adopted coping mechanisms into new and innovative technologies is already being propagated in the literature. For example, Galloway-McLean (2010) reports that several projects at the grassroots level are dedicated to revitalising traditional soil and water conservation methods and cropping and harvesting systems with innovative knowledge to improve the livelihoods of local people. Hence, in the SALs of PRISE countries, there is a need to investigate the indigenous knowledge the populations are using in response to climate change and to assess how well these responses are helping them adapt to the situation. Formal education should also be given due consideration in order to promote awareness of new technologies and problem-solving techniques.

[19] See also Ishikawa and Ryan (2002) and Schnell-Anzola et al. (2005).
[20] BIS, 2013; Cotten and Gupta, 2004; Wen et al., 2011

## Box 7: UNESCO Climate Change Education for Sustainable Development

Realising the serious threats climate change is exposing the world to, UNESCO launched its Climate Change Initiative in 2009, driven by the agenda to inculcate coping and adaptation capacities in people against damages brought by climate change. It follows a four-pillar policy to achieve this goal:

- Climate science and knowledge: This involves development of a climate change adaptation forum that aims to impart climate change knowledge to stakeholders, especially targeting those most vulnerable to its impacts. It informs on longer-term climate projections, their impacts and ways to adapt to climate change by proposing certain response strategies.
- Climate change, cultural and biological diversity and cultural heritage: This aims to develop a Global Climate Change Field Observatory at UNESCO World Heritage Sites in order to observe the mechanism through which climate change influences human societies, culture, biodiversity and ecosystems. By doing so, it aims to inform on potential adaptation and mitigation strategies.
- Climate change education in the overall context of education for sustainable development: This programme aspires to educate and instil awareness in communities, especially targeting youth, in order to make them understand, adapt and mitigate the challenges induced by climate change. It targets sustainable development in the wake of climate change through mainstreaming quality climate change education to citizens.
- Climate change, ethics, social and human sciences dimensions: This aims to develop a research initiative that is action-oriented and addresses the varied ethical issues highlighted in climate change impacts, like gender issues and inequalities.

## 4.3. Climate change and migration

Since ancient times, human settlements have agglomerated in areas where the environment encourages human survival and ambitions for sustainability. Historical patterns of migrations in response to climate change state that all types of migration, internal, external, temporary and permanent, have been used as a coping mechanism against environmental shocks and cyclical changes in the climate (Warner et al., 2010). However, mobility patterns as a result of climate change have not been quantitatively recorded in the past properly, which is a deep challenge to policymaking in recent times. Hugo (1996) identifies that different countries have achieved different levels of capacity to react to external changes. In this regard, he carves out potential patterns of the people moving out from developing countries to developed countries to avoid environmental stresses.

It is important to understand the definition and mechanisms of environmental migration. The International Organization for Migration (IOM) (2008) defines environmental migrants as 'Persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.'

Migration, as a response to climate change or extreme events, can act as an adaptive or maladaptive strategy, depending on the characteristics of out-migration and in-migration regions and the vulnerability and capacities of the migrants (Ober, 2014). Richmond (1993), in his book, *Global Apartheid*, carved out a conceptual framework for environment-induced migration. According to him, factors causing vulnerability to environmental change may be important in determining migration. Certain 'pre-disposing conditions' exist that are aggravated as a result of an environmental shock or 'precipitating event'. In this stage, certain constraining or facilitating factors existing in the area of impact play an influential role to determine people's migration decisions. For instance, some families may be facilitated by kinship or entitlement, which can ease their movement and give them a destination to move to. This signifies the role of social networks or human systems, which support migrants in their process to migrate and resettlement afterwards (Hugo, 1996).

Vulnerability increases as a consequence of weather extremes and shifts in climatic paradigms that

Boy carrying his goat in a flood affected IDP settlement.

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threaten livelihoods and derail human security. Frequent incidences of disasters and climate change have generated a large percentage of distress migration (Sattar, 2014; Warner and Sherbinin, 2009), and it has been estimated that climate change will drive about 250 million people out of their homes by 2050 (Orach, 2009). The term 'distress migration' has been used, as this migration is not pre-planned for economic or social reasons but is opted for as a means of escaping the wrath of sudden adverse events like disasters (Hunter, 2005; Raleigh et al., 2008). This type of migration has many social and economic consequences associated with it, the most significant of which is inequities generated along the process of resettlement (Fussel and Elliot, 2009). For instance, in the case of male out-migration, women have to take up more work as a shift in the gender division of labour (Lambrou and Piana, 2006).

One reason why the patterns of environmental migration are difficult to identify is that climate change-induced migration is prominent only in times of sudden catastrophes like floods, etc.; in the case of slow changes in climate, like temperature increases, water scarcity, etc., human mobility is not well documented (Sattar, 2014). A major quandary exists in terms of recognising the motivation behind the migration of families, which may be driven by an amalgam of environmental stress, demographic pressures, social, economical or political reasons, etc. In the event of disasters, whole families dislocate to find relief and generally move to areas where government and humanitarian aid is available. But in the case of slow-onset environmental changes, the movements are not that clear. In some cases, only some members of the family move out to diversify their livelihood opportunities.

Members of some households migrate as a coping mechanism for adverse situations like droughts or food shortages (Ellis, 2000); others migrate when they fear the occurrence of a bad harvest or crop failure (Cannon and Muller-Mahn, 2010). In Central and South Asia and Africa, north–south migration during extreme winters has been common since ancient times, with migration making up for the dearth of economic opportunities in the dry/extreme season, lowering demand for household food stock and presenting an opportunity to send home remittances (Ober, 2014; Schulz et al., 2013).

With drying river basins in the southern and eastern areas of Africa, and rising sea levels in western Africa, a large percentage of the population has been forced to leave their homes in search of livelihood opportunities in safer environments (Lisk, 2008). For instance, pastoralist communities of northern Kenya have been migrating to other parts of the country after being stricken by both floods and droughts several times (Mitchell and Tanner, 2006). In Tajikistan, recurrent spells of droughts and floods have forced a huge percentage of people to migrate to Russia to seek sustenance (Oxfam International, 2010). An earlier study by Oxfam (2007) indicates that, in 2006, about 1 million male members of families moved to Russia to earn a living. This number is likely to increase further with increasing climate variation and related extreme events. In Thar, Pakistan, droughts are recurrent, responsible for driving 25% of inhabitants out of the area (Suleri, 2014).

Lueck and Meyer (2011) state that distress migration as a result of climate changes is a social issue, as the most vulnerable population is forced to temporarily or permanently migrate. This displacement thereby causes hurdles in achieving resilience owing to losses of social network and social structures that rural people relied on in their villages. Human systems are disrupted as a result of both displacement and communication failures as an aftermath of a natural calamity. From another perspective, it has come to light that, even among the affected, only the less vulnerable can afford to migrate to urban hubs: the extremely marginalised rely on internal circular migration (Mallah, 2013). The ultra-poor and marginalised have no means to bear the cost of migration (Deshingkar, 2006). This indicates that even an escape from disasters needs some entitlement at the back, as proposed by Sen's (1980) theory of entitlement.

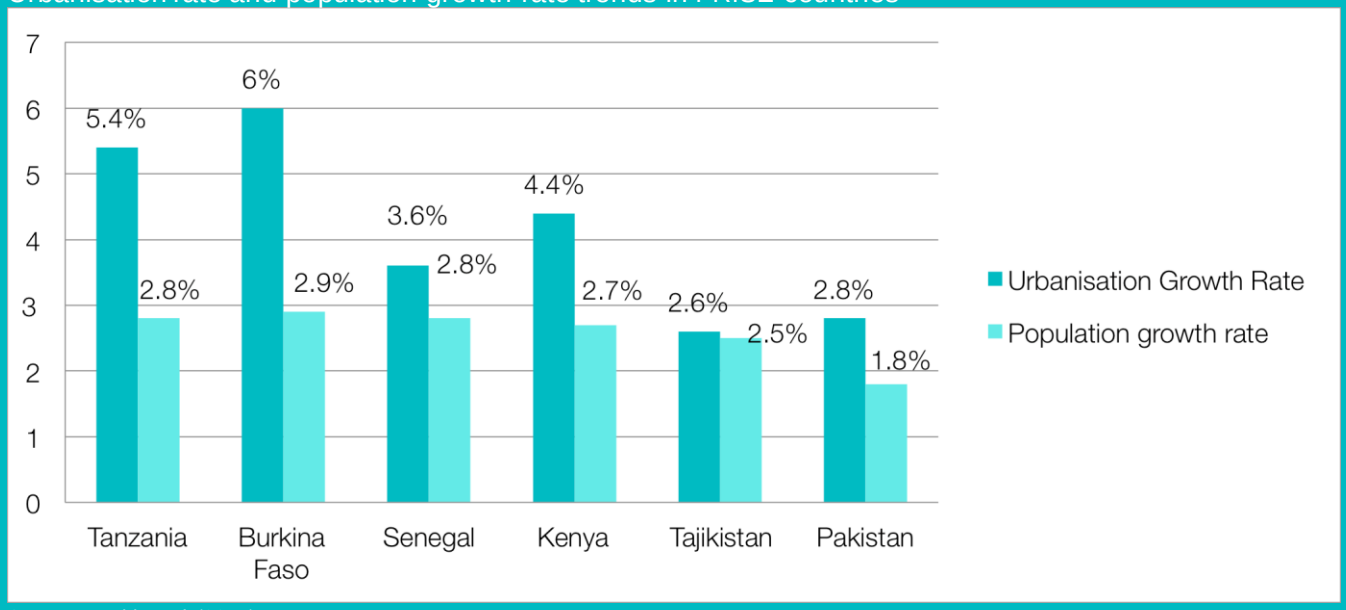
Climate change can be seen as one of the factors affecting the rapid urbanisation common in most developing countries that are sensitive to the impacts of climate change (see Box 8 for information on climate change and urbanisation in PRISE countries). Of the types of migration that occur during times of disaster, droughts and rising temperatures push permanent and planned migrations towards milder areas, whereas storms, cyclones and floods lead to more temporary and unplanned displacement in search of immediate relief (Mallah, 2013).

## Box 8: Climate change and urbanisation

According to a rough estimate, around 50 million people move towards urban canters for environmental reasons annually (Warner et al., 2010). A rise in rural to urban migration has been observed in Pakistan in recent years (Daniel, 2011). The general direction of migration from people of arid and semi-arid lands in times of climatic distress is towards Karachi and Lahore and other urban areas, where the majority of them are settled in slums.

Such a trend of urbanisation is also observed in certain areas of Africa (Besada and Sewankambo, 2008). In Tanzania, about 30%of the total population lives in urban areas. Notable concentrations of people and activities are in Dar es Salaam, Mwanza, Mbeya and Arusha, the four main urban centres. For instance, Dar es Salaam accommodates about 10%of the total national population and slightly more than 40%of the national urban population (URT, 2012).People living in informal settlements form substantial proportions of populations in five major urban centres in Kenya; in Nairobi 60%, Mombasa 80% (covering over 90% of the land area), Kisumu 60%, Eldoret 30% and Nakuru close to 40% (KNBS, 2006).Rising urbanisation in all PRISE countries is of great detriment to their journey of development. East African countries are showing the fastest rates and, if they continue this way, their urban population will reach 50% of the total population by 2030 (Cilliers, 2009).

Urbanisation rate and population growth rate trends in PRISE countries




Source: World Bank (2014).

Rising urbanisation does not always uplift migrants. This is because urban slums and diasporas are not always maintained with basic provisions and poor living conditions, coupled with high rates of unemployment, lead to urban poverty, inequality and crime (Abbasi, 2014; Dixon and Schaffer, 2010; Noor and Fatima, 2011). The current physical and social infrastructure in the urban centres of developing countries, and especially in PRISE countries, is not adequate for absorbing large influxes of people from rural areas. Many urban areas in PRISE countries have poor drainage systems and sanitation, lack of access to roads and poor housing and spatial conditions. The high rate of urbanisation means urban poverty rates are also grave, with 66% of urban dwellers living in slums. The state capacity of most of the countries is not sufficient to facilitate the rising number of informal settlements across cities. Moreover, a large percentage of these migrants are youth, most of them with little or no education or skills. Youth unemployment is already high in the region, and this trend is worsening the labour market scenario (Cilliers, 2009). Urbanisation is generally associated with progress and poverty reduction but, unless there is access to basic services, proper management and robust social and physical infrastructure, it will lead instead to the 'urbanisation of poverty'.

Cities are facing the dual complexities of rising urbanisation and the threat of climate change effects. These trends are putting under pressure the ability of cites to provide basic services to the citizens (DePaul, 2012). In addition, many cities are themselves vulnerable to climate volatility, making it more difficult for the state to build resilience and accommodate the large inflows of climate migrants. Inflows of migrants are leading to the expansion of cities, with a large proportion of people in lower-income group settling down in areas that are environmentally hazardous (ibid.).

Urbanisation itself must take a great deal of responsibility for exacerbating climate change. Urban areas are hubs of economic activity. In addition to an abundance of heat-emitting vehicles and air-conditioners, city infrastructure holds a considerable amount of heat-absorbing materials (Rizwan et al., 2008), meaning cities face more complicated environmental challenges.

Migration can also give rise to conflict, as more people struggle to obtain access to scarce resources. Environmental scarcity, and competition generated as a consequence, may create or breed inequalities leading to conflicts (Barnett, 2003; Sattar, 2014). Dwindling water sources and the declining ratio of fertile land have deepened competition with the influx of migrants and the displaced in some parts of Africa (Lisk, 2008). Land entitlements and access to and rights over water sources create contestation for resources, putting pressure on resilience in South Asia. Urban development projects may disrupt many settlements, particularly peri-urban settlements or diasporas. Often, the elite take over the water resources of peri-urban areas, which makes water availability either short or too expensive for the people living in these areas (Khan, 2013).

Research on climate-induced migration and its resulting impacts on human development and policy issues are still in its infancy. In light of increasing urbanisation and risks associated with climate change in cities, special attention needs to be directed towards climate-resilient infrastructure planning. Since many climate refugees flee from vulnerable rural areas to settle in even more risky peri-urban areas or urban slums, there is a need for 'smart growth' policies in which governments help migrants relocate to environmentally safer locations.

Climate-induced migration is steadily becoming a policy challenge for governments in the semi-arid and arid areas that are the most climate-sensitive. A vacuum exists in understanding the spatial development strategies governments adopting out-migration as well as in-migration regions. Emergency evacuations and dislocations are easier to track and some data can be found on them (Internal Displacement Monitoring Centre (IDMC), National Disaster Management Authority (NDMA), the Emergency Disasters Database (EM-DAT), etc.), but the slow onset of migration, induced primarily by environmental stresses, is hard to analyse because of a paucity of data.

There is a need to evaluate the positive effects of migration as an adaptive strategy more thoroughly from a policy point of view (Ober, 2014). If migration proves an effective strategy for adaption to climate change, then dealing with those who do not even have the resources and networks to opt for migration becomes a major concern.

## 4.4. Climate change and livelihood/employment patterns

Human systems around the globe, and particularly in developing countries, are closely knit with ecosystems. These ecosystems function as the capital base for human systems (Thapa et al., 2010). With the onset of new threats that climate variability is posing to human systems and ecosystems equally, livelihoods, especially rural livelihoods of the poor, have come under great pressure (Sacramento, 2009).

Defined as the 'set of capabilities, assets and activities that are required to make a living' (Chambers and Conway, 1992), livelihoods are a function of the natural, physical, human, financial, social and cultural assets that people make use of to expand their assets by investing their skills and capabilities in order to sustain and improve their living conditions (Bebbington, 1999). Universal in nature, both rich and poor engage in different sets of livelihoods to earn a living. The irony is, however, that the poor suffer the most from climate change, as they are mostly dependent on climate-sensitive sectors for a living, for example small-scale agriculture, livestock, fishing, poultry and pastoral work in rural settings, and informal wage labour in urban areas (UNDP, 2007).

Countries with a predominantly agricultural base, like the PRISE countries, have a great deal at stake given the growing impacts of climate change on natural and human capital. Most people in

SALs are engaged in agriculture and natural resource base activities for sustenance. Working through direct and indirect pathways, even subtle shifts in climate have an intense correlation with the livelihood patterns of people living in climate-sensitive areas.[21] The rich have a strong resource backing in the event of external stressors like environmental or climate variability, but the poor pay a high price as they are forced to erode their assets (Tanner and Mitchell, 2008). Decline in crop yields, food insecurities, death of livestock, destruction of infrastructure and transportation and communication mechanisms, etc., are only some of the channels through which livelihoods suffer (Hassan et al., 2011; Orach, 2009).

Declines in capacities and skills owing to health issues also interrupt livelihood activity. Health problems result in double trouble for the poor: livelihood contributions from productive household members are lost, and are compounded by the health expenses that follow ill-health (IUCN and IISD, 2003). Through the effects of climate change on natural systems and livelihoods, food shortages become a major concern. Food prices rise with food shortages, devastating not only the rural poor but also wage-earning urban dwellers (IPCC, 2014; Olsson et al., 2014). Thus, a vicious cycle of poverty and deprivation is created.

Rising temperatures in Central and South Asia are expected to reduce agricultural production by 15-50% in the coming years (WHO, 2013). Simulations from household data in Tajikistan show a 20% decline in the agricultural yield would prop up poverty by 13%; a 20% increase in food prices would propel poverty by 16%; and a 20% reduction in agricultural wages would increase poverty by 2% (Heltberg et al., 2013). Temperature increases would result in degradation of land productivity by 14-27% in Africa (Iglesias et al., 2011).

In addition to agriculture, livelihoods based on water resource are also in grave danger, given changing climate patterns. Rising temperatures, declining precipitation rates and erratic wind patterns combined with increased population demands may result in the dwindling of water resources (Tekken and Kropp, 2012). Sowers et al. (2011) predict that, by 2025, water availability per person will have declined by almost 30-70%. Besada and Sewankambo (2008) state that 45% of the population of Africa relies on water sources for its livelihoods from five river basins passing through the continent, namely, the Nile, Chad, Congo, Zambezi and Niger. These rivers are gradually drying up as a result of harsh temperatures and climate shifts, disrupting the lifeblood of many. In Pakistan, sea intrusion on the Indus basin has wreaked havoc on the livelihoods of the people of Thatta and Badin (NDMA, 2008).

Besides the natural resource base erosion, climate change and extreme events are also associated with losses in physical and financial assets, disrupting livelihoods associated with them. Increasing frequencies of flash-floods and torrential rains have deteriorated infrastructure and roads (Sudmeier-Rieux et al., 2012). In some cases, such events result in loss of income and jobs, especially in informal urban settlements and rural areas, eroding financial assets (Alderman, 2010). Climate-induced income losses, especially in agricultural livelihoods, translate to less money for investment in inputs and other daily household expenditures on health, education, food, etc. (Thomas et al., 2007).

Climate change is also associated with disrupting complete supply chains, especially those that are agricultural-based. With rising temperatures, increasing soil salinity, soil degradation and extreme weather events, both the quality and the quantity of crop production is adversely affected, which, in turn, makes decisions regarding sowing and harvesting difficult (Thorpe and Fennell, 2012). Agricultural production serves as raw material for sectors beyond food, like textiles, cosmetics, retail, etc. Changes in weather patterns can curtail production, leading to a domino effect in associated sectors.

Besides the direct impact on the livelihoods of farmers, transport routes may be destroyed in extreme events, affecting the employment of transporters or middlemen. These disruptions in supply may affect further manufacturing operations, affecting the employment of those not directly involved in climate-sensitive sectors. Furthermore, the impacts can spread out to users or buyers of the end product through a rise in the price of the final product as a result of supply shortfalls or disruptions. The effect of climate change in this scenario, thus, surpasses boundaries. For instance, the floods of 2010 have enormously affected the cotton production of Pakistan, which is the fifth largest cotton producer in the world. The stress on supply hiked up the prices of cotton and textile items. Besides floods, cotton production in Pakistan is unstable as a result of water scarcity and poor water management. Along with the rising costs of cotton, energy shortages have crippled many textile mills and garment manufacturers, resulting in a loss of livelihood for many farmers, middlemen, factory workers and garment makers.

As a response to climate change and extreme events, people may abandon climate-sensitive livelihood sources (like agriculture) and opt for other means of earning, or they might adapt their livelihoods to changing climatic patterns (Olsson et al., 2014). For example, Oxfam International (2012) carried out a

[21] Bryan et al., 2013; Douglas et al., 2008; Olsson et al., 2014.

survey in late 2010 focusing on the flood-displaced people of Sindh. Out of 318,000 individuals in the sample, some 80% were involved in agriculture prior to the flood. However, only 23% showed willingness to return to agriculture after. The report further noted that the majority of the displaced people became involved in scanty casual labour after the floods, relying on daily labour wages.

Some communities in Africa have been observed to rely on asset-selling, social networks, petty trade or migration in times of drought (Osbahr et al., 2010). Many farmers in Tanzania opt for other natural resource bases like forestry for fuel wood, timber, charcoal, etc., in cases of drought (Paavola, 2004).

On the other hand, Kurukulasuriya and Mendelsohn (2007) report that farmers may change their crops and cropping patterns rather than dumping farming, or they might opt for diversifying their income base. For example, in Southern Africa farmers are diversifying their income base from purely crops to livestock and poultry (Thomas et al., 2007) and agro-pastoralism, combining both farming and livestock breeding to mitigate climate uncertainties (UNEP, 2011). In Tanzania, practices like agricultural intensification (applying more inputs on land units), agricultural extensification (cultivating more units of land) and livelihood diversification are common in response to climate change, but they are mostly affordable for the wealthier population of the community (Paavola, 2004). Crop switching is also a strategy common to farmer communities in climate-sensitive areas (O'Brien et al., 2000). Olsson et al. (2014) note that, in most SALs, adapting to a changing climate by shifting from agriculture is difficult owing to high poverty, marginalisation and low skills. Most people rely on strategies like early or late sowing or using heat-resistant crops, but that too depends on affordability and the resources at hand.

The literature notes that it is not just climate change that explains disruptions in natural resource-based livelihoods.[22] A variety of stressors and factors act in unison to affect livelihoods; therefore, adaptation is not so straightforward. Livelihoods can be affected by socio-political factors, such as the networks and connections a specific livelihood has for operational activities;[23] human capital, comprising the skills, knowledge and expertise of the people involved in the livelihood activity; and physical capital, including infrastructure, transport, communications and productive capital and financial resources[24] (IUCN and IISD, 2003).

When seeking adaptation measures to climate change, all these factors jointly determine the strategy, but for the poor the natural capital base remains the most important. According to Rennie and Singh (1996), 'predominantly the poor of the world depend directly on natural resources, through cultivation, herding, collecting or hunting for their livelihoods. Therefore, for the livelihoods to be sustainable, natural resources must be sustained.'

Olsson et al. (2004) stress that, for livelihood resilience and adaptability, the ability to self-organise is vital. It needs both individual and collective efforts, in collaboration with formal or informal institutions (Pelling et al., 2008). No single policy prescription for adapting agriculture livelihoods to climate change can work for all; rather, policy frameworks need to have a participatory nature, drawing from existing local risk management techniques (Osbahr et al., 2008). A community-based adaptation approach is warranted as it provides a comprehensive understanding of the localised nature of impacts of climate change and integrates indigenous knowledge with modern techniques.

Meanwhile, although climate change has negative impacts on businesses, employment and other means of making a livelihood, mostly connected to land use and agriculture, it can open up new employment opportunities in emerging sectors such as environment-friendly technology, solar energy and use of information technology in agriculture and other sectors, thus helping ensure climate-resilient livelihoods.

As the world struggles to mitigate and adapt to climate change, new employment prospects are coming onto the horizon (Fankhauser et al., 2008). Investment in building preparedness for climate change is generating enhanced economic activity. As countries shift from high-to low-carbon activities, labour-intensive industries, such as the wind and solar energy sector and exploration of technologies for the efficient use of scarce resources, are gaining in popularity.

With rising pressure on water demand amid scarcity, investments in water management technologies are also gaining momentum, creating new value chains such as in purification, desalination, water filtration and water reuse (Oxfam America, 2009). In this scenario, employment opportunities arise for engineers, architects, construction workers, storage house owners, etc. Similarly, new opportunities have been generated for those who are exploring climate-resistant agricultural adaptation such as drought-resistant seeds, pesticides and irrigation systems. This has increased the demand for crop scientists, researchers, agricultural economists and installers.

Work in renewable energy solutions sectors like wind and solar energy has increased the demand for wind turbines and solar panels, which

[22] IUCN and IISD, 2003; Kurukulasuriya and Mendelsohn, 2007; Thomas et al., 2007
[23] Access to markets, credit, government institutions, etc.
[24] For investment, productive use, etc.

has opened up opportunities for designers, manufacturers and installers of renewable systems (see Box 9 for examples). Similarly, learning from the experience of countries like China, which created more than 1.7 million jobs in renewable energy in 2012 (Figueres and Ryder, 2014), the PRISE countries can generate new employment avenues for their people.

The renewable energy potential in PRISE countries offers a great opportunity to generate green jobs and mitigate climate change effects. However, a major skills gap exists in terms of taking full advantage of this source of energy. Lack of knowledge, exposure and experience to water, wind and solar technology, grid integration, troubleshooting in installation and maintenance need to be addressed through technical workshops, trainings and proper degree courses to fully harness this resource.

The biggest challenge to livelihoods occurs after extreme weather events such as floods. In such a situation, it is better if government, humanitarian agencies and donor organisations aim to catalyse employment instead of continuing cash and in-kind transfers. The need to mobilise people is paramount in order to help them rebuild their lives. For instance, the International Labour Organization (ILO) created cash-for-work opportunities for the 2010 flood-affected communities of two districts of Pakistan (Peshawar and Nowshehra). The programme especially targeted the marginalised–women, ultra-poor men and the disabled – and engaged them in rehabilitation work such as rebuilding houses and repairing roads and workplaces. Youth were engaged in cleaning and fumigating shelter houses. In this way, disaster-affected people can be involved and mobilised in rebuilding their lives with overall rehabilitation of the community as well.

The climate-sensitive semi-arid regions of PRISE countries need concrete policies that generate jobs in the process of preparing for climate change by initiating labour-intensive projects. In the most affected areas, construction jobs such as building of coastal defences, flood protection and drainage containment should be promoted to engage people in sustainable livelihoods and at the same time build a climate-resilient society (ILO, 2010).

A detailed review of literature shows that most research on the effects of climate change on livelihoods offers snapshots of experiences and incidents. A comprehensive analysis of the dynamics and mechanisms involved in adapting livelihoods to climate change is missing. Also, there is a need to identify the barriers that get in the way of adaptation process and make poor people's livelihoods more susceptible to climate vulnerabilities. Research is needed to highlight the types of livelihood and livelihood assets that need support through public investment

## Box 9: Renewable energy initiatives

### Employment in the renewable sector in Tanzania

In Tanzania, Solar Company 'A' has initiated installation and maintenance of solar photovoltaic systems for households and health centres in rural and urban Tanzania. The company has two offices: a headquarters in Dar es Salam and a regional office in Arusha. It serves many districts in the vicinity of these offices. In addition to the permanent managerial and support staff, the company hires construction workers and installation staff. Tanzania currently does not have a reliable recycling infrastructure, which, if built, can be used to provide additional employment.

Other than the company's directly created employment, it helps fulfil the energy requirements of small businesses, especially in rural areas, which keeps livelihoods running for the owners. Barbershops, mobile charging stations, small inns and bars are fulfilling cost-effective energy requirements by using photovoltaic systems.

### Solar energy systems in Tharparkar, Pakistan

The introduction of solar energy technologies in Tharparkar, a drought-ridden district of Pakistan, is a ray of hope for people who could not fetch underground water for their crops. Now, many of them are benefiting from solar energy to irrigate their crops. One of beneficiaries, Mohabbat Khan, has revitalised his failing crops by cultivating his 6acresof land by means of a solar energy irrigation system. He earns Rs. 300 ($3) daily by selling vegetables. Similarly, in another village, Singharo, solar energy is being used to quench the thirst of about 2,000 residents, and is also used to pump enough water to irrigate the lands on which villagers depend for their livelihoods.

to enable the poor to adapt to climate change and its effects. More efforts need to be directed to the rebuilding of livelihoods after extreme events.

## 4.5. Climate change and the marginalised

Vulnerability to climate change varies within countries, communities and households depending on the geographic, economic, socio-political and demographic characteristics; their access to and control over resources; and their adaptive capacities (UNDP, 2011). Within societies, climate change is, however, known to take a particular toll on the disadvantaged, vulnerable or marginalised groups, with disproportionate effects. According to the IPCC(2007), 'Impacts of climate change are likely to be felt most acutely not only by the poor, but also certain segments of the population, such as the elderly, the very young, the powerless, the indigenous people, and recent immigrants, particularly if they are linguistically isolated i.e. those most dependent upon public support. Impacts will also differ according to gender.'

Marginalisation is the central notion of exclusion from attaining and fulfilling a full social and economic life at individual, community and social level as a result of less access to assets, opportunities and social resources to make productive social contributions (Burton and Kagan, 2003). Generally, ountries in the PRISE consortium have social dynamics that discriminate against certain groups of individuals or communities based on their economic status, ethnicity, religion, language, geographical distribution or age, etc., often subjecting them to inequality and injustice.

The course of cultural and social devaluation often affects the economic dynamics of such groups (Kabeer, 2006). This can be illustrated by the World Bank (2001) finding that, while development and growth are compromised by inequalities in land distribution, excluded and marginalised groups perform ineffectively in land distribution not only because of their inability to afford land but also because the structure of society does not permit them to do so. In most cases, social exclusion and marginalisation like poverty and discrimination against certain ethnic groups transfer across generations. For instance, children from marginalised groups often follow parental patterns of illiteracy and occupational choices (ibid.). Moreover, the economic marginalisation of people in certain areas is reinforced by the provision of basic services by the state, which is often discriminatory for different groups (Betancourt and Gleason, 2000). Such groups, with limited social, economic and political backing, are more sensitive to external changes and shocks, like climate change, which interrupt the regular course of life.

The following short review considers the differential impacts of climate change on diverse groups. It generates glimpses of the implications of climate change for the poor, children, the elderly and indigenous and minority groups. It also discusses the gender dimension.

### The poor

*'Climate change is regressive – awful for the rich, catastrophic for the poor' (Busch, 2014).*

Climate change and poverty reinforce each other (UNDP, 2014). The most pronounced effects of climate change are evident among the poorest proportions of the population, particularly those living in developing countries, as the poorest proportion of people in these countries have the least control over natural, physical, financial, political and human resources and are less endowed in social capital (Mitchell and Tanner, 2006). According to the World Bank International Poverty Line, individuals with less than $1.25 (at 2005 purchasing power parity) and those who consume less than 2,350 calories a day are categorised as 'poor'. However, countries vary in their approaches to poverty and its measurement. The International Poverty Line gives a quantitative measure of income- or consumption-based poverty. On the other hand, international development discourse is now inclined towards evaluating and using social indicators to analyse people's deprivations (see the literature on multidimensional poverty, mentioned in Section 2 of this review).

Heavily reliant on the natural resource base (e.g. agricultural and livestock livelihoods), the livelihoods and food security of the poor suffer from the brunt of climate change, with recovery difficult, thrusting them deeper into poverty and vulnerability (McGuigan et al., 2002; UNDP, 2011). IPCC (2014) reports that, with lower agricultural productivity and dwindling water sources for irrigation, impoverished farmers and pastoralists with little capital in semi-arid regions will suffer particularly. Lack of information and a dearth of resources prevent them from adapting to climate change by building climate-resistant houses and sowing heat-resistant crops. With the climate taking a toll on their agricultural resource base, they are often observed to be adopting more environmentally offsetting activities like deforestation, which further wrecks the climate (FAO, 2011). Mitchell et al. (2008) state that coping strategies employed by the very poor in

Cattle herders in semi-arid regions of Tanzania.

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disasters include distress selling of productive assets, often resulting in them being forced further into poverty traps. Rising food prices are particularly burdensome for poor urban and rural wage labour-dependent households (IPCC, 2014).

Moreover, the social structure of most of the PRISE countries is majorly inclined in favour of the rich rather than the poor, which further increases their vulnerability to external shocks like climate change and may even result in the exploitation of the poor by the rich. Major loopholes in policies regarding agriculture, land tenure, urban planning, etc., constrain the poor from getting involved in sustainable livelihoods that are less sensitive to climate change. The result is that most of the poor in SALs are forced to work on degraded farms, under precarious environmental conditions, and have limited decision-making authority to improve their resilience in the face of climate shocks.

The poorest and the marginalised are also more prone to health issues. According to Tajikistan Living Standard Survey data (Republic of Tajikistan 2007), incidence of diarrhoea is 1.4 times greater in the poorest than in the rich population, and children from the poorest quintile have twice the probability of being malnourished and underweight.

Malnutrition and food insecurity in Pakistan is highest in regions that have predominantly poor living conditions owing to a lack of resources and facilities, and these are the areas that are worst hit by calamities like floods. Insecurities related to basic needs like food mean these areas are lagging far behind on other parameters as well, and are thus insecure in terms of health, education and livelihoods. Such inequalities and insecurities breed negative sentiments among the poor that may fuel violent and criminal activities (Suleri, 2013).

With the rising heat stress in the summers, the greatest economic difficulty people in SALs experience relates to rising utility bills, which most cannot afford to pay. Poor household that are already in a tight situation in terms of fighting against and adapting to climate change may divert their resources from other priorities, for example withdrawing children from school, mostly likely with biases against women and girls (Brock, 2012). Such activities have unfavourable impacts on the future prospects and capabilities of children and ultimately their livelihoods.

## Gender inequality

Climate-induced effects are not gender-neutral. By being more socially, economically and politically deprived, women generally have limited access to resources, information and technology (Gandhi, 2011). Socially structured gender roles and differential access to resources leave poor women most susceptible to the risks related to climate change. Activities like water collection, collecting food and fuel for cooking and managing livestock are predominantly women's responsibilities, and these areas face the most impacts of climate change (UNDP, 2011).

Climate change may also disrupt these roles and may mean responsibility for additional roles for tribal and poor rural women, particularly if the males of the household migrate in search of livelihoods (Nellemann et al., 2011).

Women are particularly disproportionately affected in South and Central Asia and Africa, with disparities in education, earnings and empowerment (Box 10) (UNESCO, 2012a). For example, the UN Population Fund (UNFPA) (2011) reports that, in post-disaster settings, when trauma, distress and malnutrition are all around, gender-based violence has been observed to rise as social systems collapse.

## Box 10: Gender inequality issues

### Burkina Faso

In Burkina Faso, the status of education and health for women lags far behind that of men. Gender Inequality Index (GII) of 2012 indicates that the maternal mortality ratio of Burkina Faso is as high as 300 and females with atleat secondary school education comprise only 0.9%.

Discrimination against girls starts at home, when families prioritise sending male children to school while girls are supposed to stay at home and help with the household chores. Early marriage for girls is also very common. While the majority of women are involved in agriculture, a large percentage of them do not have access to training opportunities in farming to make them efficient in their work. The result is a low level of rewards or earnings for women. Only on a small scale do women have access to training through various non-governmental organisation (NGO) programmes. Women also face the brunt of food insecurity, as they generally eat less and save more for their children.

### Senegal

In the rural region of Keur Moussa lies the plateau of Ndiass, which has a maximum height of 120m.Steep slopes mean the village has fast-running surface water. But climate change has made water erosion a serious threat, with dire implications for the environment. Some of the consequences are resource degradation and increasing soil salinity.. It has even affected human life, through deadly accidents, house collapses and resource inaccessibility. The women in this village are responsible for fetching water and taking care of the farms. Production is suffering because of soil erosion and salinity, with a heavy toll on earnings. Meanwhile, most of the men and young people migrate to other areas, leaving behind the women to fend for themselves. The intensity of this can be gauged by the fact that, in the village of Landou, there are only about 20 men but 118 women. Thus, women in this area face the brunt of climate change effects.

Source: WEDO (2008).

### Pakistan

Recurrent drought has devastated the lives of thousands of people living in Thar district of Pakistan. With the majority of population living way below the national poverty line, Thar is considered one of the most vulnerable districts in the country. Every year, the intensity of the drought increases and leads to many deaths, most of which are avoidable. Most deaths are of women and children, and result from malnutrition and starvation. There have also been many cases of suicides of women, who have taken their lives out of desperation, unable to provide food for their children. A total of 24 suicide cases of women were reported in 2011 and 35 in 2012. 2014 alone has witnessed 31 suicide cases of women as a result of poverty.

Source: Baloch (2014).

The impacts of climate change on biodiversity also affect women. Climate change has aggravated deforestation and water availability, meaning wood and water can only be found further away from where people live. Since in most poor African and Asian communities collection of wood for fuel and water is the responsibility of women and girls, a considerable amount of their time is taken up by this activity. This leaves little time for them to be involved in other activities, such as earning, decision-making, fulfilling domestic responsibilities and acquiring skills and education (UN Women, 2009). Furthermore, carrying heavy loads for long distances is particularly harsh on the health and can often result in injury (Lambrou and Piana, 2006).

With male members of households migrating to other areas in pursuit of livelihood options, in both South and Central Asia and Africa, the percentage of female-headed households is increasing (Oxfam International, 2007). The majority of

these women are involved in agriculture or the informal sector, where they receive a meagre reward. Such households are among the poorest and therefore most vulnerable to external factors like climate variations.

For adaptation to climate change, all members of a society need to be involved. It has been documented that, during calamities like natural hazards, communities show better resilience when women are well aware, have control over resources and play leadership roles (UN Women, 2009). Women display strength and capacity to adapt to new livelihoods, ensuring food and water security (Ariyabandu, 2000). They are also more capable of mobilising communities in times of emergencies (Carvajal-Escobar, 2008).

The dearth of gender-segregated data for livelihoods and disaster preparedness is hindering comprehensive and thorough research in this area. Without proper documentation and statistics, climate change policies risk being gender-neutral. Gender-distinct needs, priorities and roles need to be analysed and considered to reduce the acute vulnerability of women to climate change effects.

## Children and the elderly

Climate change is particularly harsh on children and the elderly, as they are more sensitive to the rising temperatures. Children's fragile state and limited capacity to cope with deprivation, stress and shocks means they are more likely to perish in natural disasters (UNICEF, 2008). Their weak immune system also means they are more likely to fall victim to diseases that spread as a result of climate changes, like malaria, diarrhoea, etc.

When climate hazards like droughts hit already impoverished communities, the consequences are acute in the form of 'barren fields, drying cattle, skeletal children and empty classrooms' (UNICEF, 2007). Moreover, the physical and psychological health of children suffers greatly after extreme events, undermining educational attainment and, at times, endangering survival (Bartlett, 2008; D'Allesandro, 2013). Food insecurity ends up hitting children the most, putting their health and nutrition at stake. For instance, infant mortality in Thar (Pakistan) in the cold dry season is so high that locals have named the area as Marussthali (Land of the Dead).

The elderly also face the brunt of climate change. Filiberto et al. (2011) state that age is not the sole factor making the elderly vulnerable to climate change; rather, a combination of physiological and social factors associated with ageing nurtures this vulnerability. Old people have little resilience to changing climatic patterns like intense temperature shifts and drastic events (Haines et al., 2006). They also face a greater risk of morbidity during extreme events (Filiberto et al., 2011). In most climate-sensitive and disaster-ridden SALs, access to health institutions is difficult. In such areas, it is particularly hard for the elderly, particularly those who suffer from pre-existing health conditions, to get healthcare in the case of illness or disease (Brody et al., 2008; McGeehin and Mirabelli, 2001). On top of this, if the elderly are socially isolated and have little income, the ramifications of climate change will be more pronounced (Haq et al., 2008).

Although links between climate change and its effects on children and the elderly are quite prominent, more research is required to identify the mechanisms through which these links work. Insight is needed to improve adaptation strategies for these groups, considering their limitations in terms of strength and ability.

## Indigenous groups and minorities

Indigenous populations and minorities are likely to suffer more at the hands of climate change than other groups. They tend to live in the areas most likely to be hit by the adverse impacts of climate change, and are more involved in natural resource-based livelihoods (Baird, 2008). Biodiversity degradation resulting from climate change affects their food sources and livelihood opportunities. For example, the pastoralists of Kenya, involved in herding animals in the dry and hot environment, were hit severely by the drought of 2006/07, which took away about 70% of their animals. About 80% of these pastoralists were then forced to live on food donations from the international community, and many of them had to move out in search of water. Most of those who migrated gave up their remaining animals and took up labour work for petty wages (Kimenye, 2006).

One important factor in their vulnerability is these communities' geographic remoteness, which can amplify health risks (Green, 2006) and make social facilities of health, education and relief hard to reach. Their social exclusion and isolation from the rest of the community makes coping with climate change difficult. Even after extreme events, these groups are the last to get hold of any aid, as stronger groups of a society dominate (Wapmuk, 2010).

Although there is some scattered literature available on the disproportionate effects of climate change on minorities and the indigenous, there is a need for further comprehensive investigation on this aspect to draw out mechanisms to improve their resilience to the onslaught of climate change.

Building the resilience of marginalised groups against external shocks like climate change

requires concentration on their social and human development. Programmes formulated to increase their well-being would be fruitful if such groups are participating in programme design and decision-making and have a collective or community approach. Their access to productive resources and opportunities should be ensured in order to enable them to improve their well-being.

# 5. Gaps between theory and reality

By reviewing the existing literature, this report has aimed to analyse the links and mechanisms between how climate change impacts human capital and how human capital-building can increase the resilience of SALs in PRISE countries to climate change. To build the context, it first defined the evolution of multi-pronged dimensions of human capital under the umbrella concept of human development. It briefly mentioned ways to quantify human capital using different indices and presented a global overview of the effects of climate change on human capital in the context of vulnerability and resilience. This broad-based approach helps us analyse the dimensions through which climate change and human capital are linked.

The report then zoomed in on five major dimensions where the ramifications of climate change are most pronounced – health, education, livelihoods, migration and marginalisation – and explored the opportunities to build human capital climate change provides. It related empirical evidence to theoretical backing in linking the dimensions with climate change effects and threw some light on the prospects for turning communities' vulnerabilities in these dimensions into resilience.

In this section, the paper summarises some of the major lessons drawn out of the detailed review, gives policy recommendations based on the arguments provided in the literature and highlights some research gaps that can be bridged in the upcoming research phase of the PRISE project.

## 5.1. Major lessons

Climate change has wide-ranging consequences in relation to human capital. These consequences, working through a number of different channels, are all interconnected and reinforce each other. Climate change can expose people to a number of infectious, vector-borne and temperature-related health issues. It can also disrupt the process of attainment of education through its direct and indirect effects. Livelihoods are also affected as a result of the direct toll climate change takes on natural resources. Poverty exacerbates it. People tend to move to other areas as a result of slow-onset environmental changes, or to be displaced in extreme events. Above all, all these effects work disproportionately against the most vulnerable groups: the poor, women, children, the elderly, indigenous groups and minorities.

However, improvements on all of these dimensions, generally for developing countries and particularly for SALs, can work towards adaptation to climate change. Improved sanitation and the use of clean drinking water can help stop many diseases from spreading more rampantly as a result of climate change. Targeted climate-specific information can be disseminated among those most vulnerable to climate change and also among the main stakeholders, which may include the state, NGOs and policymakers, etc., regarding the nature of climate change and its potential impacts on society. Traditional knowledge should be given due consideration in designing adaptation strategies for better resilience. Investing in formal education would result in more enlightened societies that are in a better position to make their livelihoods sustainable through diversification or use of better inputs. Climate change is also presenting new opportunities for different livelihood options, such as in the solar energy sector. With timely availability of information, migration could be well planned and used as an effective adaptation strategy. Moreover, there should be more of a policy focus on the marginalised in terms of coping and adaptation strategies framed by governments.

## 5.2. Policy implications

The unprecedented challenge climate change has introduced requires governments to transform their approach to development policy. In light of the above arguments, we need to consider both the direct and the indirect impacts of climate change on human capital in order to be able to devise specific adaptation strategies for building resilience and moving towards sustainable growth. PRISE countries face numerous human capital challenges, as we have seen. Environmental issues like climate change are aggravating these challenges and posing threats to human security. The state, NGOs, policymakers, development partners and the private sector, etc., need to make a holistic assessment of how climate change is exacerbating human capital deprivations in PRISE countries and look for opportunities to build resilience as a result of the climate variations currently unrolling.

The trans-boundary nature of climate change offers opportunities for certain social benefits that policymakers can employ, for example community participation in reconstruction and provision and access to safe drinking water, health, etc., resulting in social mobilisation. A stronger human

capital can help in responding to climate change more efficiently; unless the focus is people-centred, no adaptation or mitigation strategy can ensure sustainable and inclusive development. There is a need to analyse the broader agenda of how different social, economic, financial and political aspects interrelate with environmental stressors to put pressure on human well-being. Considering the disproportionate effects of climate change on certain groups, adaptive policies should be inclusive.

Mobility and migration can be utilised as adaptation strategies to mitigate the risks associated with climate change. In arid and semi-arid lands, where climate change effects are most evident, the process of migration should be well considered by the government, which should provide resettlement facilities to the displaced. Moreover, the affected and displaced should be given information to help them restart their lives in the areas they have migrated to. They should be guided in terms of livelihood opportunities and productive activities. Policy action should be guided by equity concerns and socioeconomic dynamics of the displaced/migrated population with special concern for gender, the impoverished and the marginalised. They should have the core aim of improving human welfare and development in a sustainable manner.

## 5.3. Research gaps

This detailed review also helps identify certain areas that need research attention. The literature is full of anecdotal evidence of the consequences of climate change for the dimensions of human capital mentioned in this report. What it lacks is robust conceptual frameworks of direct and indirect channels through which these consequences occur. The implications of climate change for education and health are well documented; what is needed is a clear understanding as to how endowments in health and education work to make societies resilient to climate change in SALs. There is a dire need to assess what demographic characteristics make households more vulnerable to climate shocks. Empirical studies need to be carried out on this research question to discover what household dynamics create resilient or vulnerable environments.

Moreover, insights are needed to identify natural resource-based livelihoods that are sustainable to climate change and ways of adapting existing livelihoods to climate variability. There is a dearth of data and information on climate-induced migration, although some evidence of distress migration is available. In order to analyse the prospects of using migration as an adaptation strategy, availability of robust and reliable data is a must. Lastly, a comprehensive conceptual framework analysis of the uneven effects of climate change on vulnerable and marginalised groups is warranted, with a special focus on minorities and indigenous people who have not received appropriate and due consideration in the literature.

Potential research questions that emerge from the analysis are:

1. How can investments in basic service provision, particularly in health and education, most effectively strengthen climate-resilient economic development in semi-arid regions?
2. How best can social policy support migration as an adaptation measure for those living in semi-arid areas?
3. To what extent do renewable energy technologies have the potential to reduce poverty and inequality and ensure climate-resilient economic development in semi-arid regions?
4. To what extent will climate change alter the employment and livelihood mix in SALs?
5. How does climate change impact the prevalence and nature of inequality in semi-arid areas as disaggregated by age, sex, disability and ethnicity?
6. How do extreme heat and other climate change-related extreme events impact labour productivity in SALs? What can be done to maintain labour productivity under such conditions?

Farmer reaping millet corn, Pakistan.

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# References


Abbasi, Z.F. (2014) 'The Challenge of Urbanization'. Urbanization Perspective 1. Islamabad: IDI.

AccuWeather (2013) 'Steady Increase in Climate Related Natural Disasters'. http://www.accuweather.com/en/weather-blogs/climatechange/steady-increase-in-climate-rel/19974069

ADB (Asian Development Bank) (2010) *Climate Change in Southeast Asia: Focused Actions on the Frontlines of Climate Change*. Manila: ADB.

ADB (Asian Development Bank) (2013) *Investing in Resilience: Ensuring a Disaster-Resistant Future.* Manila: ADB.

Adger, W., Khan, S.R. and Brooks, N. (2003) 'Measuring and Enhancing Adaptive Capacity'. Adaptation Policy Framework Technical Paper 7. New York: UNDP.

Agarwal, B. (1990) 'Social Security and Family in Rural India: Coping with Seasonality and Calamity'. *Journal of Peasant Studies* 17(3): 341-412.

Airriess, C.A., Li, W., Leong, K.J. and Keith, V.M. (2008) 'Church-Based Social Capital, Networks and Geographical Scale: Katrina Evacuation, Relocation, and Recovery in a New Orleans Vietnamese American Community'. *Geoforum* 39(3): 1333-1346.

Ainuddin, S., Routray, K. and Ainuddin, S. (2013) 'People's Risk Perception in Earthquake Prone Quetta City of Baluchistan'. *International Journal of Disaster Risk Reduction* 11.

Alderman, H. (2010) 'Safety Nets Can Help Address the Risks to Nutrition from Increasing Climate Variability'. *The Journal of Nutrition* 140(1): 148S-152S.

Alkire, S. (2003) 'A Conceptual Framework for Human Security'. CRISE Working Paper 2. Oxford: QEH.

Alkire, S. (2010) *Human Development: Definitions, Critiques, and Related Concepts*. New York: UNDP.

Anand, S. and Sen, A. (1994) *Human Development Index: Methodology and Measurement.* New York: Human Development Report Office, UNDP.

Ariyabandu, M.M. (2000) 'Impacts of Hazards on Women and Children: Situation in South Asia'. Gender and Disaster Network.

Azariadis, C. and Drazen, A. (1990) 'Threshold Externalities in Economic Development'. *Quarterly Journal of Economics* 105(2): 501-526.

Baird, R. (2008) *The Impact of Climate Change on Minorities and Indigenous Peoples.* London: Minority Rights Group International.

Baloch, S. (2014) 'Poverty Causing People to Kill Themselves'. *The Dawn*, 2 September.

Barnett, J. (2003) 'Security and Climate Change'. *Global Environmental Change* 13: 7-17.

Barro, R.J (1989) 'Economic Growth in a Cross Section of Countries'. Working Paper. Cambridge, MA: Harvard University.

Barro, R.J (1991) 'Economic Growth in a Cross-Section of Countries'. *Quarterly Journal of Economics* 106, pp. 407-443.

Barro, R.J. (2009) 'Rare Disasters, Asset Prices and Welfare Costs'. *American Economic Review* 99(1): 243-264.

Barro, R.J. and Salai-Martin, X. (1995) *Economic Growth.* Cambridge, MA: MIT Press.

Bartlett, S. (2008) 'Climate Change and Urban Children'. Human Settlements Discussion Paper. London: IIED.

Bebbington, A. (1999) 'Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty'. *World Development* 27(12): 2021-2044.

Becker, G. (1975) 'Human Capital: A Theoretical and Empirical Analysis, with Speical Reference to Education'. Cambridge, MA: NBER.

Becker, G. and Murphy, K. (1988) *Economic Growth, Human Capital and Population* Growth. Chicago, IL: University of Chicago.

Besada, H. and Sewankambo, N. (2008) *Climate Change in Africa: Adaptation, Mitigation and Governance Challenges.* Waterloo: CIGI.

Betancourt, R. and Gleason, S. (2000) 'The Allocation of Publicly Provided Goods to Rural Households in India: On Some Consequences of Caste, Religion and Democracy'. *World Development* 28(12): 2169-2182.

BIS (Department of Business Innovation and Skills) (2013) 'The Benefits of Higher Education Participation for Individuals and Society: Key Findings and Reports'. The Quadrants Research Paper 146. London: BIS.

Bosher, L.S. (2007) *Social and Institutional Elements of Disaster Vulnerability: The Case of South India*. New Delhi: Academica Press.

Bowen, A., Cochrane, S. and Fankhauser, S. (2012) 'Climate Change, Adaptation and Economic Growth'. *Climate Change* 113: 95-106.

Brock, H. (2012) 'Climate Change: Drivers of Insecurity and the Global South'.

http://www.oxfordresearchgroup.org.uk/publications/briefing_papers_and_reports/climate_change_drivers_insecurity_and_global_south

Brody, A., Demetriades, J. and Esplen, E. (2008) *Gender and Climate Change: Mapping the Linkages – A Scoping Study on Knowledge and Gaps.* Brighton: IDS.

Bryan, E., Ringler, C. et al. (2013) 'Adapting Agriculture to Climate Change in Kenya: Household Strategies and Determinants'. *Journal of Environmental Management* 114: 26-35.

Burton, M. and Kagan, C. (2003) *Community Psychology: In Pursuit of Wellness and Liberation*. London: MacMillan Palgrave.

Busch, J. (2014) 'Climate Change Is Regressive'. http://www.cgdev.org/blog/climate-change-regressive

Cannon, T. and Muller-Mahn, D. (2010) 'Vulnerability, Resilience and Development Discourses in Context of Climate Change'. *Natural Hazards* 55: 621-635.

Cardona, O.D, van Aalst, M.K. et al. (2012) 'Determinants of Risk: Exposure and Vulnerability', in IPCC *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Special Report of Working Groups I and II. Cambridge and New York: Cambridge University Press.

Carraro, C., Eyckmans, J. and Finus, M. (2009) 'Optimal Transfers and Participation Decisions in International Environment Agreements'. *Review of International Organizations* 1(4): 379-396.

Carvajal-Escobar, Y., Quintero-Angel, M. and Garcia-Vargas, M. (2008) 'Women's Role in Adapting to Climate Change and Variability'. *Advances in Geo Sciences* 14: 27-280.

Cavallo, E. and Noy, I. (2010) 'The Economics of Natural Disasters: A Survey'. Working Paper 124. Washington, DC: IADB.

Chambers, R. (1989) 'Vulnerability, Coping and Policy'. *IDS Bulletin* 20(2): 1-7.

Chambers, R. (2006) 'Vulnerability, Coping and Policy: Editorial Introduction'. *IDS Bulletin* 37(4): 33-40.

Chambers, R. and Conway, G. (1992) 'Sustainable Rural Livelihoods: Practical Concepts for the 21st Century'. Brighton: IDS.

Chandra, A., Acosta, J. and Stern, S. (2011) *Building Community Resilience to Disasters: A Way Forward to Enhance National Health Security.* Santa Monica, CA: RAND.

Chang'a, L.B, Yanda, P.Z, and Nagana, J. (2010) 'Indigenous Knowledge in Seasonal Rainfall Prediction in Tanzania: A Case-Study of the South-Western Highland of Tanzania'. *Journal of Geography and Regional Planning* 2(3): 66-72

Chaudhry, Q.Z. and Rasul, G. (2004) 'Agro-Climatic Classification of Pakistan'. *Science Vision* 9(1-2): 59-66.

Cilliers, J. (2009) 'Climate Change, Population Pressure and Conflict in Africa'. Paper 178. Pretoria: ISS.

Commission on Human Security (2003) *Human Security Now.* New York: Commission on Human Security.

Cooke, K. (2013) 'Climate Change: One More Problem for Pakistan'. Climate News Network, 30 March, www.climatecentral.org/news/climate-change-one-more-problem-for-pakistan-15780

Cotten, S.R. and Gupta, S. (2004) 'Characteristics of Online and Offline Health Information Seekers and Factors that Discriminate between Them'. *Social Science and Medicine* 59(9): 1795-1806.

CRED (Centre for Research on the Epidemiology of Disasters) (2012) *Annual Disaster Statistical Review 2012: The Numbers and Trends.* Brussels: CRED.

Cruz, R.V., Harasawa, H. et al. (2007) 'Asia', in IPCC *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution to Working Group II to AR4. Cambridge: Cambridge University Press.

D'Alessandaro, N. (2013) 'How Climate Change Impacts Children'. http://ecowatch.com/2013/07/31/climate-change-impacts-children

Dae-Bong, K. (2009) 'Human Capital and Its Measurement'. Third OECD Conference on Statistics, Knowledge and Policy, Busan, 27-30 October.

Daniel, H. (2011) 'Floods and Displacements in Rural Sindh Pakistan – People's Perspectives'. Bielefield: Communicating Disaster Centre for Interdisciplinary Research

Das, P.K. (2010) *Climate Change and Education, Bangladesh.* Dhaka: BDRC.

DePaul, M. (2012) 'Climate Change, Migration and Megacities: Addressing the Dual Stresses of Mass Urbanization and Climate Vulnerability'. *Paterson Review of International Affairs* 12: 145-162.

Deshingkar, P. (2005) 'Internal Migration, Poverty and Development in Asia'. New York: IOM.

Dixon, R. and Schaffer, T. (2010) 'Pakistan Floods: Internally Displaced persons and the Human Impact'. Islamabad: CSIS.

Douglas, I., Alam, K. et al. (2008) 'Unjust Waters: Climate Change, Flooding and the Urban Poor in Africa'. *Environment and Urbanization* 20(1): 187-205.

Doyal, L. and Gough, I. (1991) *A Theory of Human Need*. New York: Macmillian.

Drabo, A. and Mbaye, L.M. (2011) 'Climate Change, Natural Disasters

and Migration: An Empirical Analysis of Developing Countries'. Discussion Paper 5927. Bonn: IZA.

Dynes, R. and Quarantelli, E.L. (1973) *The Family and Community Context of Individual Reactions to Disaster*. Washington, DC: Disaster Research Center.

ECLAC (UN Economic Commission for Latin America and the Caribbean) (2003) *Handbook for Estimating Socioeconomic and Environmental Effects of Disasters*. Santiago de Chile: ECLAC.

Egeru, A. (2011) 'Role of Indigenous Knowledge in Climate Change Adaptation: A Case-Study of the Teso Sub-Region, Eastern Uganda'. School of Forestry and Environmental Sciences, Kampalla: Uganda

Elliot, L. (2012) *Climate Change, Migration and Human Security in South East Asia.* Singapore: RSIS.

Ellis, F. (2000) *Rural Livelihoods and Diversity in Developing Countries.* Oxford: Oxford University Press.

Ellis, F., Kutengule, M and Nyasulu, A. (2003) 'Livelihoods and Rural Poverty Reduction in Malawi', *World Development*, 31(9), 1495-1510.

Fankhauser, S., Sehllieirier, F. and Stern, N. (2008) *Climate Change, Innovation and Jobs.* London: Climate Policy, London School of Economics.

FAO (Food and Agricultural Organisation) (2011) *Framework Programme on Climate Change Adaptation.* Rome: FAO.

FAO (Food and Agricultural Organisation) (2013) *the State of Food Insecurity in the World: The Multiple Dimensions of Food Insecurity.* Rome: FAO

Figueres, C. and Ryder, G. (2014) 'How to Create Jobs by Tackling Climate Change'. https://forumblog.org/2014/09/climate-change-unemployment-clean-jobs/

Filiberto, D., Wethington, E. et al. (2011) 'Older People and Climate Change: Vulnerability and Health Effects'. http://www.asaging.org/blog/older-people-and-climate-change-vulnerability-and-health-effects

Foskett, N. and Helmsely-Brown, J. (2001) *Choosing Futures: Young People's Decision Making in Education, Training and Career Markets.* London: Routledge Falmer.

Fritz, A. and Samenow, J. (2014) 'Will Climate Change Worsen Ebola Outbreaks?' *The Washington Post*, 5 August.

Fritze, J.G., Blashki, G.A., Burke, S. and Wiseman, J. (2008) 'Hope, Despair and Transformation: Climate Change and Promotion of Mental Health and Well-Being'. *International Journal of Mental Health Systems* 2(13).

Fussel, E. and Elliot, J. (2009) 'Social Organisation of Demographic Responses to Disaster: Studying Population'. *Organisation and Environment* 22(4): 379-394.

Fussel, H.M. (2009) 'Development and Climate change: Review and Quantitative Analysis of Indices of Climate Change Exposure, Adaptive Capacity, Sensitivity, and Impacts'. Potsdam: Potsdam Institute for Climate.

Fussel, H.M. and Klein, R.J.T. (2006) 'Climate Change Vulnerability Assessments: An Evolution of Conceptual Thinking'. *Climate Change* 75: 301-329.

Galloway-McLean, K. (2010) 'Advance Guard: Climate Change Impacts, Adaptation, Mitigation and Indigenous Peoples – A Compendium of Case Studies'. Darwin: UNU Traditional Knowledge Initiative.

Gandhi, S. (2011) 'Women as Agents of Change'. Commonwealth Lecture, London, 17 March.

Gardner, H. (1989) 'Multiple Intelligences Go to School: Educational Implications of the Theory of Multiple Intelligences'. *American Educational Research Association* 18(8): 4-10.

Gemmell, N. (1996) 'Evaluating the Impacts of Human Capital Stocks and Accumulation on Economic Growth'. *Oxford Bulletin of Economics and Statistics* 58; 9-28.

Green, D. (2006) *Climate Change and Health – Impacts on Remote Indigenous Communities in Northern Australia.* Melbourne: CSIRO.

Guernier, V., Hochberg, M. and Guegan, J. (2004) *Ecology Drives the Worldwide Distribution of Human Diseases.* Oxford: Oxford University Press.

Gupta, M.D. (2014) 'Population, Poverty, and Climate Change'. *World Bank Research Observer* 29(1): 83-108.

Haines, A., Kovatz, R.S., Campbell-Lendrum, D. and Corvolan, C. (2006) 'Climate Change and Human Health: Impacts, Vulnerability and Public Health'. *Journal of Royal Institute of Public Health*: 585-596.

Hallegate, S. and Przyluski, V. (2010) 'The Economics of Natural Disasters: Concepts and Methods'. Policy Research Working Paper 5507. Washington, DC: World Bank.

Hamid, A. and Ahmed, A.M. (2011) 'An Analysis of Multidimensional Gender Inequality in Pakistan'. *Asian Journal of Business Management* 3(3): 166-177.

Haq, G., Whitelegg, J. and Kohler, M. (2008) *Growing Old in a Changing Climate: Meeting the Challenges of an Ageing Population and Climate Change.* Stockholm: Stockholm Environment Institute.

Haq, K. (2007) 'Human Development Index and Its Relevance for Developing Countries'. Washington, DC: Foreign Service Academy.

Haq, M.U. (1990) 'Human Development Paradigm'. New York:

Human Development Report Office, UNDP.

Haq, M.U. (1995) *Reflections on Human Development.* New York: Oxford University Press.

Hassan, R. and Nhemachena, C. (2008) 'Determinants of African Farmers' Strategies for Adapting to Climate Change: Multinomial Choice Analysis'. *African Journal of Agriculture and Resource Economics* 2(1): 83-104.

Hassan, S., Khan, M.A., Hussain, A. and Mehmood, I. (2011) 'Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience in Semi Arid Zones of Pakistan'. *Pakistan Journal of AgricultureRegions* 24: 1-4.

Heitor, M. (2012) *Developing Human Capital and Research Policies: Science Policies Promoting Brain Gain.Technological Forecasting and Social Change* 82: 6-22.

Helberg, R. and Bonch-Osmolovskiy, M. (2010) *Mapping Vulnerability to Climate Change*. Washington, DC: World Bank.

Heltberg, R., Seigal, R.S. and Jorgenson, P.B. (2008) 'Climate Change, Human Vulnerability and Social Risk Management'. Cambridge, MA: MIT.

Heltberg, R., Zaidi, A. and Reva, S. (2013) 'Tajikistan: Economic and Distributional Impact of Climate Change'. Cambridge, MA: MIT.

Howitt, P. (2005) *Health, Human Capital and Economic Growth: A Schumupeterian Perspective*. Cambridge, MA: MIT Press.

Hugo, G. (1996) 'Environmental Concerns and International Migration'. *International Migration Reviews* 30(1): 105-131.

Hunter, L.M. (2005) 'Migration and Environmental Hazards'. *Population and Environment* 26(4): 273-302.

Hussain, S. (2014) 'A Ray of Hope'. *The News*, 9 December.

IDRC (International Development Research Centre) (2012) *New Pathways to Resilience: Outcomes of the Climate Change Adaptation in Africa.* Ottawa: IDRC.

IFRC (International Federation of the Red Cross and Red Crescent Societies) (2012) *World Disaster Report – Focused on Forced Migration and Displacement*. Geneva: IFRC.

Iglesias, A., Quiroga, S. and Diz, A. (2011) 'Looking into the Future of Agriculture in a Changing Climate'. *European Review of Agricultural Economics* 38(3): 427-447.

ILO (International Labour Organization) (2010) 'Climate Change and Labour: The Need for a "Just Transition"'. *International Journal of Labour Research* 2(2).

IMF (International Monetary Fund) (1998) 'The Impact of Human Capital on Growth: Evidence from West Africa'. Working Paper. Washington, DC: IMF.

IOM (International Organisation for Migration) (2008) *Migration and Climate Change.* Geneva: IOM.

IPCC (Intergovernmental Panel on Climate Change) (1995) *Climate Change 1995*. IPCC AR2. Geneva: AR2.

IPCC (Intergovernmental Panel on Climate Change) (1997) *The Regional Impacts of Climate Change: An Assessment of Vulnerability*. Cambridge: Cambridge University Press.

IPCC (Intergovernmental Panel on Climate Change) (2001) *Climate Change 2001*. IPCC AR3. Geneva: IPCC.

IPCC (Intergovernmental Panel on Climate Change) (2007) *Climate Change 2007.* IPCC AR4. Geneva: IPCC.

IPCC (Intergovernmental Panel on Climate Change) (2014) 'Climate Change 2014, Impacts, Adaptation and Vulnerability'. Working Group II Report IPCC AR5. Geneva: IPCC.

Iqbal, M.M., Sheikh, M.M., Ali, G. and Khan, A.M. (2010) 'Climate Change and Vulnerability of Pakistan'. *Journal of Himalayan Earth Sciences* 43: 32-33.

Ishikawa, M. and Ryan, D. (2002) 'Schooling, Basic Skills and Economic Outcomes'. *Economics of Education Review* 21(3): 231–243.

IUCN (International Union for the Conservation of Nature) and IISD (International Institute for Sustainable Development) (2003) *Livelihoods and Climate Change*. London: Task Force on Climate Change Vulnerable Communities and Adaptation.

Jahan, S. (1999) 'Gender Equality Indices in the Human Development Reports: Concepts, Measurements and Impacts'.

Jahan, S. (2002) 'Measuring Living Standard and Poverty: Human Development Index as an Alternate Measure'. Boston, MA: University of Massachusetts.

Jones, C.I. (1996) 'Human Capital, Ideas, and Economic Growth'. Stanford, CA: Department of Economics, Stanford University.

Juneja, S. (2008) 'Disasters and Poverty: The Risk Nexus'. Geneva: UNISDR.

K.C., S. (2013) 'Community Vulnerability to Floods and Landslides in Nepal'. *Ecology and Society* 18(1): 8.

Kabeer, N. (2006) 'Poverty, Social Exclusion and the MDGs: The Challenge of "Durable Inequalities" in the Asian Context'. *IDS Bulletin* 37(7): 64-78.

Kagawa, F., & Selby, D. (2012). *Education and Climate Change: Living and Learning in Interesting Times.*

Kates, R.W., Cotten, C.E., Laska, S. and Leatherman, S.P. (2006) 'Reconstruction of New Orleans Following Hurricane Katrina'. *Proceedings of National Academy of Science* 104(43): 14653-14660.

Kemp, R. (2007) 'Classifying Marginalized People, Focusing on Natural Disasters Survivors'. *Proceedings of North American Symposium on Knowledge Organisation*. Seattle, WA: North American Symposium on Knowledge Organisation.

Kendrick, J.W. (1976) 'The Formation and Stocks of Total Capital'. Cambridge, MA: NBER.

KNBS (Kenya National Bureau of Statistics) (2006) 'Kenya Integrated Household Budget Survey 2006, Basic Report'. Nairobi: KNBS.

Khan, F.A. and Salman, A. (2012) 'A Simple Human Vulnerability Index to Climate Change Hazards for Pakistan'. *International Journal of Disaster Risk Science* 3: 163-176.

Khan, M. (2013) 'Adapting to Peri Urban Water Insecurity Induced by Urbanization and Climate Change: Insights from South Asia'. Dhaka: IWFM.

Kijazi, A.L. and Reason, C.I.C. (2009) 'Analysis of 2006 Floods over Northern Tanzania'. *International Journal of Climatology* 29: 955-970.

Kimenye, D. (2006) 'Climatic Changes in the Mandera District of Kenya'. Unpublished report.

Kreft, S and Eckstein, D (2014) *Global Climate Risk Index 2014.* Germanwatch: Bonn.

Kronstadt, K.A., Sheikh, P.A. and Vaughn, B. (2010) 'Flooding in Pakistan: Overview and Issues for Congress'. Washington, DC: CRS.

Krueger, A.B. and Lindahl, M. (2001) 'Education for Growth: Why and for Whom?' *Journal of Economic Literature* 39(4): 1101-1136.

Kurukulasuriya, P. and Mendelsohn, R. (2007) 'Crop Selection: Adapting to Climate Change in Africa'. Policy Research Working Paper 4307. Washington, DC: World Bank.

Lal, P.N., Singh, R. and Holland, P. (2009) 'Relationship between Natural Disasters and Poverty: A Fiji Case Study'. Miscellaneous Report. Suva: SOPAC.

Lambrou, Y. and Piana, G. (2006) *Energy and Gender: In Rural Sustainable Development.* Rome: FAO.

Laoroche, M. (1998) 'On the Concept and Dimensions of Human Capital in Knowledge Based-Economy Context'. Ottawa: University of Ottawa.

Lavell, A., Oppenheimer, M. et al. (2012) 'Climate Change: New Dimensions in Disaster Risk, Exposure, Vulnerability, and Resilience', in IPCC *Managing the Risks of Extreme Events and Disasters to Advance*. Special Report of Working Group I and II. Geneva: IPCC.

Lewis, LA. and Berry, L. (2011) 'African Environments and Resources'. Routledge Library Editions: Development, New York.

Lisk, F. (2008) 'Overview: The Current Climate Change Situation in Africa', in H. Besada and N. Sewankambo (eds) *Adaptation, Mitigation and Governance Challenges*. Waterloo: CIGI.

Ljunberg, J. (2002) 'About the Role of Education in Swedish Economic Growth'. *Historical Social Research* 27: 125-139.

Lucas, R.E. (1988) 'On the Mechanics of Economic Development'. *Journal of Monetary Economics* 22(1): 3-42.

Lueck, M. and Meyer, A. (2011) 'United States Environmental Migration Vulnerability: Vulnerability, Resilience and Policy Options for Internally Displaced Persons'. *SOURCE* 15/11.

MacEwen, L., Choudhuri, S. and Bird, L. (2011) 'Education Sector Planning: Working to Mitigate the Risk of Violent Conflict'. Paper commissioned for the Global EFA Report.

Machlup, F. (1962) *The Production and Distribution of Knowledge in the United States*. Princeton, NJ: Princeton University Press.

Macklem, R.T. (1997) 'Aggregate Wealth in Canada'. *Canadian Journal of Economics* 30(1): 152-168.

Malik, S.M., Awan, H. and Khan, N. (2012) 'Mapping Vulnerability to Climate Change and Its Repercussions on Human Health in Pakistan'. *Globalization and Health*: 8-31.

Mallah, R. (2013) 'Social Inequalities and Environmental Threats in Indus Delta Villages: Pakistan'. Working Paper. Islamabad: COMCAD.

Malone, E.L. (2009) *Vulnerability and Resilience in the Face of Climate Change: Current Research and Needs for Population Information.* Battelle, WA: Pacific Northwest Division.

Marzzuchi, A. and Montresor, S. (2012) 'Absorptive Capacity, Innovation, Cooperation and Human Capital: Evidence from 3 European Countries'. Technical Report. Brussels: JRC.

Matari, E.R., Chang'a, L.B., Chikojo, G.E. and Hyerea, T. (2008) 'Climate Change Scenario Development for Second National Communication – Tanzania'. *TMA Research Journal* 1: 40-64.

McCarthy, M.P., Best, M.J. and Betts, R.A. (2010) 'Climate Change in Cities Due to Global Warming and Urban Effects'. *Geophysical Research Letters* 37.

McGeehin, M.A. and Mirabelli, M. (2001) 'The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States'. *Environmental Health Perspectives* 109: 185-189.

McGuigan, C., Reynolds, R. and Wiedmer, D. (2002) Poverty and Climate Change: Assessing Impacts in Developing Countries and the Initiatives of the International Community. London: ODI.

McMichael, A., Campbell-Lendrum, D.H. et al. (2003) Climate Change and Human Health: Risks and Responses. Geneva: WHO.

McNeall, D. and Wiltshire, A. (2014) 'Climate Change Is Far from the Only Cause of a Rapid Rise in Disasters'. The Guardian,21 July.

Medalye, J. (2012) 'Human Development and Climate Change'. The Encyclopaedia of Earth, 27 July.

Mileti, D.S. and Sorensen, J.H. (1990) 'Communication of Emergency Public Warnings: A Social Science Perspective and State-of-the-Art Assessment'. Oak Ridge, TN: Federal Emergency Management Agency.

Mileti, D.S., Bolton, P.A., Fernandez, G. and Updike, R.G. (1991) The Eruption of Nevado del Ruiz Volcano, South America. Washington, DC: National Academica Press.

Mitchell, J.K. (1998) The Long Road to Recovery: Community Responses to Industrial Disaster. Tokyo' UN.

Mitchell, T. and Tanner, T. (2006) 'Adapting to Climate Change: Challenges and Opportunities for the Development Community'. Teddington: IDS and Tearfund.

Mitchell, T., Sabates-Wheeler, R. et al. (2008) 'Rural Disaster Risk – Poverty Interface'. Prepared for Global Assessment Report on Disaster Reduction.

Murali, J. and Afifi, T. (2014) 'Rainfall Variability, Food Security and Human Mobility in the Janjgir-Champa District of Chhattisgarh State'. Climate and Development, India 6(1): 28-37.

Muttarak, R. and Lutz, W. (2014) 'Is Education a Key to Reducing Vulnerability to Natural Disasters and Hence Unavoidable Climate Change?' Ecology and Society 19(1).

Naveed, A. and Ali, K. (2012) 'Clustered Deprivations: District Profile of Poverty in Pakistan'. Islamabad: SDPI.

NCAR (National Center for Atmospheric Research) (2014) 'Climate Change'. http://ncar.ucar.edu/learn-more-about/climate

NDMA (National Disaster Management Authority) (2008) 'Disaster Risk Management Plan: District Thatta, Government of Sindh'.Annual Report. Islamabad: NDMA.

Nellemann, C., Verma, R. and Hishlop, L. (2011) Women at the Frontline of Climate Change: Gender Risks and Hopes. Geneva: UNEP.

Nevin, E. (2008) 'Education and Sustainable Development: Policy and Practice'. Development Education Review 6.

Ngigi, S.N. (2009) 'Climate Change Adaptation Strategies: Water Resources Management Options for Smallholder Farming Systems in Sub-Saharan Africa'. New York: Earth Institute.

Nisbett, R.E. (2009) Intelligence and How to Get It: Why Schools and Cultures Count? New York: W.W. Norton.

Noor, S. and Fatima, M. (2011) 'Impacts of Climate Change on the Human Settlements and Their Possible Adaptive Measures: An Overview from Pakistan'. Rajshahi University Journal of Environment Sciences 1: 62-72.

Nunes, A. (2003) 'Government Expenditure on Education, Economics Growth and Long Waves: The Case of Portugal'. Paedagogica Historica 39(5): 559-581.

O'Brien, K., Sygna, L. et al. (2000) Is Information Enough?: User Responses to Seasonal Climate Forecasts in Southern Africa, Oslo: CICERO, University of Oslo.

Ober, K. (2014) 'How the IPCC Views Migration: An Assessment of Migration', in IPCC (2014) AR5 WGII Report. Geneva: IPCC.

ODI (Overseas Development Institute) (2013) The Geography of Poverty, Disasters and Climate Extremes in 2030. London: ODI.

OECD (Organisation for Economic Co-operation and Development) (2001) Poverty and Climate Change: Reducing Vulnerability of the Poor Through Adaptation. Paris: OECD.

OECD (Organisation for Economic Co-operation and Development) (2008) Climate Change Mitigation: What Do We Do? Paris: OECD.

OECD (Organisation for Economic Co-operation and Development) (2009) Statistics, Knowledge and Policy. OECD World Forum, Busan, 27-30 October.

Olsson, P., Folke, C. and Berkes, F. (2004) 'Adaptive Co-Management for Building Resilience in Social-Ecological Systems'. Environmental Management 34(1): 75-90.

Orach, C. (2009) 'Climate Change in Africa: Adaptation, Mitigation and Governance'. Special Report. Winnipeg: CIGI.

Oreggia, E., Fuente, R. and Torre, E. (2010) 'The Impact of Natural Disasters on Human Development and Poverty at the Municipal Level in Mexico'. Working Paper. New York: UNDP.

Osbahr, H., Twyman, C., Adger, W.N. and Thomas, D.S.G. (2008) 'Effective Livelihood Adaptation to Climate Change Disturbance: Scale Dimensions of Practice in Mozambique' Geoforum 39(6): 1799-2132.

Osbahr, H., Twyman, C., Adger, W.N. and Thomas, D.S.G. (2010) 'Evaluating Successful Livelihood Adaptation to Climate Variability and Change in Southern Africa'. Ecology and Society 15(2): 27.

Oxfam America (2009) 'The New Adaptation Marketplace: Climate Change and Opportunities for

Green Economic Growth'. New York: Oxfam America.

Oxfam International (2007) 'Adapting to Climate Change: What's Needed in Poor Countries, and Who Should Pay?' Briefing Paper. Oxford: Oxfam International.

Oxfam International (2010) Reaching Tipping Point? Climate Change and Poverty in Tajikistan. Oxford: Oxford International.

Oxfam International (2012) 'Restoring Livelihoods after Floods'. Programme Insight. Oxford: Oxford International.

Paavola, J. (2004) 'Livelihoods, Vulnerability and Adaptation to Climate Change in the Morogoro Region, Tanzania'. Working Paper EDM 04-12. Norwich: CSERGE.

Parry, M., Canziani, O. and Palutikof, J. (2007) Climate Change 2007: Impacts, Adaptations and Vulnerability. Cambridge: Cambridge University Press.

Parry, M., Evans, A., Rosegrant, M.W. and Wheeler, T. (2009) Climate Change and Hunger: Responding to the Challenge. Rome: World Food Programme.

Patz, J.A., Campbell-Lendrum, D., Holloway, T. and Foley, J.A. (2005) 'Impact of Regional Climate Change on Human Health'. Nature 438: 310-317.

Paul, B.K. and Bhuiyan, R.H. (2010) 'Urban Earthquake Hazard: Perceived Seismic Risk and Preparedness in Dhaka City, Bangladesh'. Disasters 34: 337-359.

Peacock, W.G. and Ragsdale, A.K. (1997) Social Systems, Ecological Networks and Disasters: Towards a Socio-Political Ecology of Disasters. London: Routledge.

Pelling, M., High, C., Dearing, J. and Smith, D. (2008) 'Shadow Spaces for Social Learning: A Relational Understanding of Adaptive Capacity to Climate Change within Organisations'. Environment and Planning 40(4): 867-884.

Phillip, D. and Rayhan, M.I. (2004) Vulnerability and Poverty: What Are the Causes and How Are They Related? Bonn: ZEF.

Psacharapoulos, G. and Patrinos, H.A. (2002) 'Returns to Investment in Education: A Further Update'. Policy Research Working Paper 2881. Washington, DC: World Bank.

Raleigh, C., Jordon, L. and Saleyhan, I. (2008) Assessing the Impact of Climate Change on Migration and Conflict. Washington, DC: World Bank.

Rennie, J.K. and Singh, N. (1996) Participatory Research for Sustainable Livelihoods. Winnipeg: IISD.

Republic of Tajikistan (2007) 'Living Standard Survey of Tajikistan'. Dushanbe: Republic of Tajikistan.

Reynolds, A.J., Temple, J.A. and Ou, S.R. (2010) 'Preschool Education, Educational Attainment and Crime Prevention: Contributions of Cognitive and Non-Cognitive Skills'. Children and Youth Services Review 32(8): 1054-1063.

Richmond, A. (1993) Global Apartheid: Refugees, Racism, and the New World Order. Toronto: Oxford University Press.

Rizwan, A.M., Liu, L. and Dennis, C. (2008) 'A Review on the Generation, Determination, and Mitigation of Urban Heat Island'. Journal of Environmental Sciences 20(1): 120-128.

Romer, P.M. (1986) 'Increasing Returns and Long-Run Growth'. Journal of Political Economy 94(5):1002-1037.

Romer, P.M. (1989) Human Capital and Growth: Theory and Evidence. Cambridge, MA: NBER.

Romer, P.M. (1990) 'The Origins of Endogenous Growth'. Journal of Economic Perspectives 8(1): 1-22.

Rose, P. and Steer, L. (2013) Financing for Global Education: Opportunities for Multilateral Action. Paris: UNESCO.

Sacramento, A., Alberto, M., Basilio, M. and Bila, S. (2009) 'Climate Change Impacts and Coping Strategies in Chicualacuala District, Gaza Province, Mozambique'. Geneva: UNEP.

Sant'Ana, M. (2008) 'The Evolution of the Concept of Development: from Economic Growth to Human Development'.

Sarwatt, S. And Mollel, E. (2006) 'Country Pasture/Forage Resource Profiles', United Republic of Tanzania.

Sarr, B. (2012) 'Present and Future Climate Change in the Semi Arid Region of West Africa: A Crucial Input for Practical Adaptation in Agriculture'. Atmospheric Science Letters 13(8): 108-112.

Sattar, A. (2014) 'Climate Change and Migration: Exploring the Linkage and What Needs to Be Done in the Context of Pakistan'. Vulnerability and Resilience Series. Islamabad: LEAD Pakistan.

Schmid, D., Lederer, L., Much, P., Pichler, A. and Allerberger, F. (2005) 'Outbreak of Nuruvirus Infection Associated with Contaminated Flood Water'. Salzburg: Eurosurveillance.

Schneider, R.O. (2011) 'Climate Change: An Emergency Management Perspective'. Disaster Prevention and Management 20: 53-62.

Schnell-Anzola, B., Rowe, L.M. and Levine, A.R. (2005) 'Literacy as a Pathway between Schooling and Health-Related Communication Skills: A Study of Venezuelan Mothers'. International Journal of Educational Development 25(1): 19-37.

Schultz, P.T. (1961) 'Investments in Human Capital'. American Economic Review 51: 1-17.

Schultz, P.T. (2003) 'Human Capital, Schooling and Health Returns'. Centre Discussion Paper 853. New Haven, CT: Yale University.

Schulz, C.R., Schraven, B. and Mahaman, E. (2013) 'Time Matters: Shifting Seasonal Migration in Northern Ghana in Response to Rainfall Variability and Food Insecurity, Climate and Development'. *Climate and Development* 37-41.

Sen, A. (1980) *The Equality of What?* in Sterling M. McMurrin (ed), The Tanner Lectures on Human Capital, Salt Lake City: University of Utah Press, pp. 195-220.

Sen, A. (1985) *Commodities and Capabilities.* New York: Elsevier Science Pub. Co.

Shongwe, M.E., Oldenborgh, G.J. and Hurk, B. (2011) 'Projected Changes in Mean and Extreme Precipitation in Africa Under Global Warming, Part II'. *East Africa Journal of Climate* 24: 3718-3731.

Skoufias, E., Rabassa, M., Olivieri, S. and Brahmbhatt, M. (2011) 'The Poverty Impacts of Climate Change'. Washington, DC: PREM, World Bank.

Slaus, I. (2012) 'Human Capital: Its Self-Augmenting Growth and Individuality A Simple, Possibly Naïve Approach'. http://eruditio.worldacademy.org/article/human-capital-its-self-augmenting-growth-individuality-simple-possibly-na%C3%AFve-approach

Sowers, J., Vengosh, A. and Weinthal, E. (2011) 'Climate Change, Water Resources, and the Politics of Adaptation in the Middle East and North Africa'. *Climatic Change* 104(3): 599-627.

Streeten, P. and World Bank (1981) *First Things First: Meeting Basic Human Needs in the Developing Countries.* New York: Oxford University Press.

Striessnig, E., Lutz, W. and Patt, A.G. (2013) 'Effects of Educational Attainment on Climate Risk Vulnerability'. *Ecology and Society* 18(1): 16.

Sudmeier-Rieux, K., Gaillard, J.C. et al. (2012) 'Floods, Landslides, and Adapting to Climate Change in Nepal: What Role for Climate Change Models?', in Sherpa, P.Y. (ed.) *Climate Change Modeling For Local Adaptation In The Hindu Kush-Himalayan Region*. Kathmandu: Emerald.

Suleri, A.Q. (2013) 'Insecurity Breeds Insecurity' in Weiss, A.M and Khattak, S.G. (ed) Development Challenges Confronting Pakistan. Boulder: Lynne Rienner Publishers.

Suleri, A.Q. (2014) 'Dealing with Food Insecurity'. *The Express Tribune*, 27 October.

Tanner, T. and Mitchell, T. (2008) 'Entrenchment or Enhancement: Could Climate Change Adaptation Help to Reduce Chronic Poverty?' Working Paper 106. Manchester: CPRC.

Tekken, V. and Kropp, J.P. (2012) 'Climate-Driven or Human-Induced: Indicating Severe Water Scarcity in the Moulouya River Basin (Morocco)'. *Water* 4(4): 959-982.

Thacker, S. (2013) 'Education and Climate Change in the Middle East and North Africa'. http://blogs.worldbank.org/arabvoices/education-and-climate-change-middle-east-and-north-africa

Thapa, S., Soussan, T. et al. (2010) 'Enhancing Adaptive Capacity in Bhutan and Nepal'. Kathmandu: Adaptation Knowledge Platform for Asia.

Thomas, D.S.G., Twyman, C., Osbahr, H. and Hewitson, B. (2007) 'Adaptation to Climate Change and Variability: Farmer Responses to Intra-Seasonal Precipitation Trends in South Africa'. *Climatic Change* 83: 3301-3322.

Thornton, P.K. (2010) 'Livestock Production: Recent Trends, Future Prospects'. *Philosophical Transactions of the Royal Society* 365: 2853-2868.

Thorpe, J. and Fennell, S. (2012) 'Climate Change Risks and Supply Chain Responsibility'. Discussion Paper. Oxford: Oxfam.

Tobin, G.A. and Whiteford, L.M. (2002) 'Community Resilience and Volcano Hazard: The Eruption of Tunguruhua and Evacuation of the Faldas in Ecuador'. *Disasters* 26(1): 28-48.

Tompkins, E.L. (2005) *Surviving Climate Change in Small Islands, A Guidebook*. Norwich: Tyndall Centre for Climate Change Research.

Tubiello, F. (2012) 'Climate Change Adaptation and Mitigation: Challenges and Opportunities in the Food Sector'. Special Report. Rome: Natural Resources Management and Environment Department, FAO.

Tusneem, M.E. (2008) 'Food Security in a Changing Climate'. *Pakistan Development Review* 47: 815-816.

UN Environment Management Group (2011) *Global Drylands: A UN System Wide Approach.* Geneva: UN.

UNCTAD (UN Conference on Trade and Development) (2009) *Food Security in Africa: Learning Lessons from the Food Crisis*. Geneva: UNCTAD

UNDP (UN Development Programme) (1990) *Concept and Measurement of Human Development: Human Development Report 1990.* New York: UNDP.

UNDP (UN Development Programme) (1999) *Globalisation with a Human Face: Human Development Report 1999).* New York: UNDP

UNDP (UN Development Programme) (2000) *Measurement of Human Development: Evolution of Indices and Indicators*. First Global Forum on Human Development. New York: UNDP.

UNDP (UN Development Programme) (2007) *Fighting Climate Change: Human Solidarity in a Divided World, Human Development Report 2007/8*. New York: UNDP.

UNDP (Un Development Programme) (2009) *Overcoming Barrier: Human Mobility and Development, Human Development Report 2009.* New York: UNDP.

UNDP (UN Development Programme) (2010) *Capacity Development for Disaster Risk Reduction.* New York: UNDP.

UNDP (UN Development Programme) (2011) *Overview of Linkages between Gender and Climate Change*. New York: UNDP.

UNDP (UN Development Programme) (2014) *Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience: Human Development Report 2014.* New York: UNDP.

UNEP (UN Environment Programme) (2011) *Livelihood Security Climate Change, Migration and Conflict in the Sahel.* Geneva: UNEP.

UNEP (UN Environment Programme) and UNAIDS (Joint UN Programme on HIV/AIDS) (2008) 'Climate Change and HIV/AIDS'. Joint Position Paper. Nairobi: UNEP and UNAIDS.

UNFPA (UN Population Fund) (2011) 'After the Flood: Emergency Response in Pakistan'.http://www.unfpa.org/public/pakistan

UNESCO (UN Educational, Scientific and Cultural Organisation) (2006) *Education for Sustainable Development Toolkit: Education for Sustainable Development Action,* Learning and Training Tools No.1

UNESCO (UN Educational, Scientific and Cultural Organisation) (2010) 'Report Highlights: Impact of Climate Change on Education'. Paris: UNESCO.

UNESCO (UN Educational, Scientific and Cultural Organisation) (2011) 'Climate Change Education for Sustainable Development in Small Island Developing States'. UNESCO Experts Meeting 21-23 September 2011, Nassau: Commonwealth of the Bahamas.

UNESCO (UN Educational, Scientific and Cultural Organisation) (2012a) *Youth and Skills: Putting Education to Work*. *Education for All Global Monitoring Report*. Paris: UNESCO.

UNESCO (UN Educational, Scientific and Cultural Organisation) (2012b) 'Education in Kenya'. Fact Sheet in Education for All Global Monitoring Report. Paris: UNESCO.

UNESCO (UN Educational, Scientific and Cultural Organisation) (2014) *Climate Change Education for Sustainable Development at UNESCO.* Paris: UNESCO.

UNFPA (UN Population Fund) (2011) 'After the Flood: Emergency Response in Pakistan'. http://www.unfpa.org/public/pakistan

UNICEF (UN Children's Fund) (2007) *Climate Change and Children.* New York: UNICEF.

UNICEF (UN Children's Fund) (2008) *Our Climate, Our Children, Our Responsibility: The Implications of Climate Change for the World's Children.* New York: UNICEF.

UNU-IAS (UN University Institute for Advanced Study of Sustainability) (2011) 'Indigenous Peoples , Marginalized Populations and Climate Change: Vulnerability, Adaptation and Tradition Knowledge'. http://www.unutki.org/default.php?doc_id=187

UN Women (2009) *Women, Gender Equality and Climate Change.* New York: UN Women.

URT (United Republic of Tanzania) (2012) 'National Report for the United Nations Conference on Sustainable Development Rio +20'. Arusha: Vice-President's Office.

Van der Land, V. and Hummel, D. (2013) 'Vulnerability and the Role of Education in Environmentally Induced Migration in Mali and Senegal'. *Ecology and Society* 18(4).

Venton, P. and Trobe, S.L. (2008) 'Linking Climate Change Adaptation and Disaster Risk Reduction'.*WMO Bulletin* 57: 118-125.

Wamsler, C., Brink, E. and Rantala, O. (2012) 'Climate Change, Adaptation, and Formal Education: The Role of Schooling for Increasing Societies' Adaptive Capacities in El Salvador and Brazil'. *Ecology and Society* 17(2).

Wapmuk, S. (2010) 'Climate Change and Environmental Degradation in Nigeria's Niger Delta: The Imperative for Environmental Justice as a Comprehensive Policy Framework'. Oxford: Oxford Research Group.

Warner, K. and Sherbinin, A. (2009) 'In Search of Shelter: Mapping the Effect of Climate Change on Human Migration and Displacement'. Columbia, SC: CARE International and UNHCR.

Warner, K., Hamza, M., Oliver-Smith, A., Renaud, F. and Julca, A. (2010) 'Climate Change, Environmental Degradation and Migration'. *Natural Hazards* 55(3): 689-715.

WEDO (Women's Empowerment and Development Organisation) (2008) *Gender, Climate Change and Human Security: Lessons from Bangladesh, Ghana and Senegal.* New York: WEDO.

WEF (World Economic Forum) (2013) *The Human Capital Report 2013*. Geneva: WEF.

Wen, L.M., Rissel, C. et al. (2011) 'Who Is NOT Likely to Access the Internet for Health Information? Findings from First Time Mothers in Southwest Sydney, Australia'.

*International Journal of Medical Informatics* 80: 406-411.

WFP (World Food Programme) (2012) Comprehensive Food Security and Vulnerability Analysis Tanzania. Rome: WFP.

WFP (World Food Programme) (2015) Protecting and Rebuilding Livelihoods in Arid and Semi Arid Areas. Rome: WFP

Wheeler, D. (2011) 'Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance'. Working Paper. Washington, DC: CGD.

WHO (World Health Organisation) (2013) Climate Change Already Affecting Health in Tajikistan. Geneva: WHO.

Wilson, R.A. and Briscoe, G. (2004) 'The Impact of Human Capital on Economic Growth: A Review'. Third Report on Vocational Training Research in Europe: Background Report. Luxembourg: Office for Official Publications of the European Communities.

Williams, P. and Funk, C. (2011) 'A Westward Extension of the Warm Pool Leads to a Westward Extension of the Walker Circulation, Drying Eastern Africa'.Climate Dynamics 37(11-12): 2417-2435.

WMO (World Meteorological Organisation) (2014a) 'Causes of Climate Change'. http://www.wmo.int/pages/themes/climate/causes_of_climate_change.php

WMO (World Meteorological Organisation) (2014b) Atlas of Mortality and Economic Losses From Weather, Climate and Weather Extremes. Geneva: WMO.

World Bank (1990) World Development Report 1990. Washington. DC: World Bank.

World Bank (2001) World Development Report 2000-2001: Attacking Poverty. Washington. DC: World Bank.

World Bank (2014) 'Pakistan: Empowering the Most Vulnerable and Marginalized'. www.worldbank.org/en/results/2014/04/11/pakistan-empowering-the-vulnerable-and-marginalized

Yelvington, K.A. (1997) 'Coping in a Temporary Way: The Tent Cities', in W.G. Peacock, H. Gladwin and B.H. Morrow (eds) Hurricane Andrew: Ethnicity, Gender, and the Sociology of Disasters. London: Palgrave.

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