An Examination of the Least Developed Countries in the IPCC AR5 WGII

Clare Stott

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About the authors

Clare Stott, Researcher, International Centre For Climate Change and Development

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Photo caption: Farmer Nimale Maribu Saidi at work in his maize field (2010) Meceburi Forest Reserve, near Nampula, Mozambique.

Photo credit: Mike Goldwater

International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
email: info@iied.org
www.iied.org

@iied
www.facebook.com/theIIED

The Fifth Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change was released in 2014. It examines the impacts of climate change, inherent vulnerabilities and adaptation responses across the globe. The Least Developed Countries (LDCs) are identified as being particularly vulnerable to climate change due to economic and capacity barriers. This paper examines the LDCs within the IPCC report to highlight how climatic impacts, vulnerabilities and adaptation are portrayed for these countries. It illuminates a need for a greater focus on the LDCs by the IPCC and for further research concentrated on the LDCs in general, in order to enhance the state of knowledge on LDCs and appropriately guide related policy.

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Executive summary

The Fifth Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change (IPCC AR5 WGII), on *Impacts, Adaptation and Vulnerability*, was released in March 2014. In providing the latest available knowledge on climate change, the report is of much significance to informing practice and policy for countries around the world, including the Least Developed Countries (LDCs). The LDCs are low-income countries that are subject to growth barriers and, as such, are acknowledged as being particularly vulnerable to climate change. In response to this, certain institutional arrangements and procedures are designed to support the LDCs financially and otherwise. While the IPCC AR5 WGII refers to the LDCs both as a group and individually, references are dispersed throughout the report, rather than the LDCs being discussed as a point of focus in themselves. As such, this review serves to highlight these references, indicating how the LDCs are framed within the IPCC AR5 WGII.

Where the LDCs are discussed as a group, references tend to focus on the vulnerability of this group of countries determined by their socio-economic status, alongside the plans and processes that are in place to support national-level adaptation mechanisms. The necessity of being attentive to the situation in the LDCs is indicated by the huge and growing populations living in the rural and urban areas of these countries. Acknowledging the need to support these countries, the United Nations Framework Convention on Climate Change (UNFCCC) assist in the development of National Adaptation Programmes of Action (NAPAs) and National Action Plans (NAPs). Moreover, global agreements highlight that the need for providing financial assistance has become central to the UNFCCC agenda and various mechanisms for public financing assistance for the LDCs are in place to support programmes that contribute to a response to climate change in the LDCs.

There are 34 LDCs within Africa, of which thirty are cited in the IPCC AR5 WGII. Drying, precipitation and sea level rise are indicated as the main impacts for the African region, which can be responded to via a range of adaptation activities. The African LDCs are referred to much more in the rural and terrestrial context than the urban or marine contexts and, while impacts are highlighted as being connected across regions, responses are highlighted to most often be on the local and national levels. In examining the African LDCs individually, a range of shared vulnerabilities are highlighted, including increased malaria rates, landslides and major flooding, vegetation shifts and fishery vulnerability. Adaptive responses within African LDCs are found to be subject to certain biophysical, infrastructural, institutional, technological, political, informational and financial barriers. For example, in general, the African LDCs have received little funding support for their adaptation endeavours to date.

There are nine LDCs within the Asia region. Among these are some adaptation leaders, namely Bangladesh and Nepal, while Timor-Leste is the only Asian LDC not cited in the IPCC AR5 WGII. A much more varied situation is presented for Asia, with impacts of high precipitation, sea-level rise and extreme events being emphasised alongside drying. This variation in impacts reflects the varied geographical contexts of the Asian LDCs, some being mountainous, while others being floodplain or coastal areas. This dictates that they face differential issues and as such have varied responses. Bangladesh is the most cited LDC in the report, and while it is indicated as being a particularly vulnerable country to the impacts of climate change, references also reflect that it has several successful and advanced response systems in comparison to other LDCs, exemplified through its disaster response mechanisms and community based adaptation programmes. Both the success and failures of Bangladesh provide lessons for other countries in the region and beyond. Nepal is also highlighted as a leader through the introduction of their Local Adaptation Plans for Action.

The Small Island LDCs are highlighted as places that exemplify much diversity in their specific geomorphology, culture, ecosystems and populations, though in terms of climate change impacts, there are some clear similarities. As a group, the Small Islands are viewed as being particularly vulnerable to climate change impacts. Four of the LDCs can be found among the Small Islands. Each of these is critically affected by the impacts of climate change on their marine resources. While risks and vulnerabilities are much discussed, little successful adaptation experience is cited. What is clear from these countries is that communities are a central focus of much of the research being done. Cultural impacts differ between islands, both helping and hindering adaptive responses, and giving an indication of the diversity highlighted for these countries.

Haiti is the only LDC in the Americas region. It is little discussed within the IPCC AR5 WGII, though where it is cited, severe limitations in coping capacity are indicated.

This examination of the LDCs in the IPCC AR5 WGII provides an indication of the current state of knowledge of the exposure of these countries to climate impacts, alongside the vulnerabilities this presents and the adaptation approaches being applied, yet it is clear that the detail and extent to which the LDCs are discussed, highlighted and prioritised, is limited. It is fair to say that the IPCC report does not comprehensively depict the situation for each individual LDC. To address this, it may be beneficial to examine the knowledge available about each country, determined by research trends and researcher ability to work within the often unstable context of these countries. Importantly, shortfalls in research availability can give a distorted understanding of the situation for each country, and as such, for LDCs as a whole. This can lead to a misleading basis for inclusion or exclusion in institutional support processes. Lessons can be shared between LDCs in order to highlight areas of potential concern. Considering the heightened exposure of LDCs to climate change, reflection upon how the needs of the LDCs are addressed is crucial. More direct and comprehensive information about each LDC in future IPCC reports can assist this.

Introduction

1

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 to provide a policy-neutral assessment of current knowledge on climate change, centred on principles of scientific integrity, objectivity, openness and transparency (IPCC, 2010). The first assessment report was released in 1990, with subsequent reports released in 1995, 2001 and 2007, and the latest Fifth Assessment Report (AR5) released in 2014. The reports of the IPCC are authored and reviewed by thousands of experts from across the globe who contribute to the three working groups of the IPCC: Working Group I on the Physical Science Basis; Working Group II (WGII) on Climate Change Impacts, Adaptation and Vulnerability; and Working Group III on the Mitigation of Climate Change (IPCC, 2010). The analysis here focuses on the content of the IPCC's Fifth Assessment Report of Working Group II, *Climate Change Impacts, Adaptation and Vulnerability*. Specifically, it examines the content referring to the Least Developed Countries (LDCs).

The LDC category comprises low-income developing countries that are subject to growth barriers, including economic vulnerability and low levels of human capital (UN, 2008). The categorisation of LDCs was introduced by the United Nations in 1971, since when the number of countries included has increased from 25 to 49 (UN, 2008), and now stands at 48. LDCs are categorised dependant on their Gross National Income (GNI) per capita, human assets, and economic vulnerability to external shocks. Acknowledgement of vulnerability caused by climate change is highlighted by the addition of the indicator, 'Share of population living in low elevated coastal zones', in 2012, and the adaptation of the indicator, 'Homelessness caused by natural disasters', to 'Victims of natural disasters', in order to include impacts of drought and extreme temperatures (UN, 2013). Categorisation as an LDC qualifies a nation for certain external support, primarily in the form of trade preferences and development assistance (UN, 2008). Several multi-lateral organisations have also devised programmes specifically to benefit LDCs. In the context of climate change, these include the Global Environment Facility (GEF), which manages the Least Developed Countries Fund (LDCF) of the United Nations Framework Convention on Climate Change (UNFCCC); and the World Meteorological Organisation (WMO), which aims to enhance the national-capacity of LDCs to meet weather, climate and water related needs (UN, 2008). Moreover, the UNFCCC provides financial assistance for LDCs to participate in their processes, prioritising the LDCs and small island states in particular (UN, 2008) and as such developing the capacity of these countries to be recognised in international negotiations and decision making.

WGII of the IPCC does not specifically address LDCs. Instead their mention is dispersed throughout the report. Within the analysis given here, 'impacts' are interpreted as consequences suffered and expected, 'vulnerability' as the socio-economic risks that populations are and will be exposed to and 'adaptation' as the response processes of a community, country or alternative stakeholder group to such impacts and vulnerabilities, including the discussion around these responses. Impacts are often discussed at an aggregate or regional scale. Here, LDCs are sometimes grouped into multi-country analyses meaning that results are broadly applied to a few countries rather than being specific to one place. Examples of multi-country studies are highlighted in boxed text throughout this report. None of these studies includes all of the LDCs, at least in part due to limitations in the scope of research aims and the availability of data. Conversely, vulnerabilities and adaptation actions are often described on a country-specific basis. Certain LDCs are more prominent than others, for example, Tanzania is the most cited African LDC, while Bangladesh is the most cited Asian LDC and, in fact, the LDC that is cited most regularly throughout the entire report. The LDCs in these two regions also have much more mention than Haiti or those in the Small Island States. This disparity in citations means much more information can be collated with regard to some LDCs than others. This report first discusses the specific references to LDCs as a category in the IPCC AR5 WGII. It then moves on to discussions of each individual LDC, based wholly on the specific referrals made to each country in the IPCC report. Here, countries are ordered by region. In examining the LDCs as a category and individually, a lack of direct and comprehensive attention to the LDCs in the IPCC report is highlighted. Information gaps are apparent for some nations more than others. The need for examination of impacts on a country-specific basis alongside the lack of reliable scientific information available for many LDCs, are suggested as issues that need to be addressed.

The 'Least Developed Countries'

2

An examination of the references to LDCs on aggregate was conducted. It revealed that LDCs are discussed in reference to vulnerability determined by their socio-economic status, alongside the plans and processes contributing to national-level adaptation mechanisms.

Within the IPCC report, the categorisation of 'Least Developed Countries' reflects those countries that fall under the criteria defined by the United Nations, relating to GNI per capita, human assets and economic vulnerability to external shocks. There are variations in how some of the LDCs are categorised in alternative data sets cited in the IPCC report. For instance, the Wheeler data set (2011) categorises countries according to income levels, with countries defined as low, lower middle, middle or high income countries. Within this, the LDCs are not all defined as low income countries and instead some fall into the low to middle income category (e.g. Djibouti). Table 2.1 indicates the countries currently defined as LDCs, which are discussed in this report.

Population figures for rural and urban populations in the LDCs indicate that the overwhelming majority of

Table 2.1. LDCs According to Continent

AFRICA	ASIA
Angola	Afghanistan
Benin	Bangladesh
Burkina Faso	Bhutan
Burundi	Cambodia
Central African Republic (CAR)	Timor-Leste
Chad	Laos
Comoros	Myanmar
Democratic Republic of Congo (DRC)	Nepal
Djibouti	Yemen
Equatorial Guinea	**SMALL ISLANDS**
Ethiopia	Kiribati
Eritrea	Solomon Islands
The Gambia	Tuvalu
Guinea	Vanuatu
Guinea-Bissau	**AMERICAS**
Liberia	Haiti
Lesotho	
Madagascar	
Malawi	
Mali	
Mauritania	
Niger	
Rwanda	
São Tomé and Príncipe	
Senegal	
Sierra Leone	
Somalia	
South Sudan	
Sudan	
Togo	
Tanzania	
Uganda	
Zambia	

Table 2.2. Urban population and projection of urban populations in the LDCs

YEAR	POPULATION IN URBAN AREAS	% OF URBAN POPULATION	% OF WORLD POPULATION
1950	15 million	7.4%	2%
1960	41 million	13%	3%
1990	107 million	21%	4.7%
2010	234 million	28.1%	6.6%
2030	477 million	38%	9.6%
2050	860 million	49.8%	13.8%

Source: Adapted from: IPCC, 2014a

the world's rural population (92 per cent) and nearly half of the world's total population (44 per cent) live in less developed or least developed countries (UN-DESA Population Division, 2013). In the LDCs, the rural population accounts for 72 per cent of people compared to 50 per cent in other less developed countries. Urban populations and projections indicate that by 2030, over a third of the world's urban population and a tenth of the entire world's population is expected to be concentrated in urban centres within the LDCs. By 2050, these numbers are expected to have risen to half of the world's urban population being in the urban centres of the LDC's, which corresponds to nearly one seventh of the world's population (see Table 2.2).

LDCs are often discussed with regard to the activities of the United Nations Framework Convention on Climate Change (UNFCCC). These countries are supported by the UNFCCC through their assistance in the process of National Adaptation Programmes of Action (NAPAs) and, more recently, National Action Plans (NAPs). As of 2013, 49 LDCs produced and submitted NAPAs to the UNFCCC. NAPAs are the principal process through which national bodies are organising adaptation priorities and linking local-level adaptation and development (Agrawal, 2008; Agrawal and Perrin, 2008; Stringer *et al*., 2009; Ciplet *et al*., in press). They have been designed as flexible, action inducing and nationally defined vehicles through which to communicate adaptation needs. Yet related research reveals that lack of coordination between government sectors, lack of technical capacity and discrepancies between long-term development goals and short-term adaptation interventions constrain intended mainstreaming efforts (Saito, 2013).

At the international level, agreements such as the Bali Action Plan (UNFCCC, 2007a) and Cancun Adaptation Framework (UNFCCC, 2011b) indicate that deliberation over how the adaptation needs of LDCs will be financed has become central to the UNFCCC policy agenda (Ayers and Huq, 2009; Dellink *et al*., 2009; Flåm and Skjærseth, 2009; Denton, 2010; Patt *et al*., 2010a). Public financing for adaptation includes contributions from national budgets, multilateral and bilateral development funds, and UNFCCC operational funds. Examples include the Adaptation Fund, the Special Climate Change Fund and the LDCF (Christiansen *et al*., 2012; Haites and Mwape, 2013; Romani and Stern, 2013), which was established to assist developing nations in developing NAPAs. Further funding mechanisms are associated with the GEF adaptation funds support for the Pilot Program for Climate Resilience (PPCR) (see Box 3.6).

In reference to internal response options in the LDCs, the report indicates that domestic insurance markets are rare, yet specific measures are more often discussed on a country-by-country basis rather than with reference to LDCs as a whole.

The LDCs – Country-by-Country

3

There is much differentiation in the extent to which each LDC is referred to in the IPCC report. Whilst some feature widely, others are not specifically mentioned in any part of the report. Some countries are used to exemplify a particular issue meaning that, while the country name is cited often, these references are confined to a small part of the report. The differentiation in references is likely to be reflective of the availability of quality research data for each country. It suggests that while much research is occurring in some countries, very little is occurring in others, or if it is, it is not being published in quality and internationally accessible documents. This section of the report summarises the content of the IPCC AR5 WGII references for each LDC. The countries are ordered region by region and a brief overview of the regional analysis according to the IPCC report is also provided.

3.1 LDCs in Africa

The climate risks and adaptation options for the Africa region have been summarised in the IPCC WGII AR5 *Summary for Policy Makers*. This indicates that temperature rise causes drying, precipitation and sea level rise (SLR), and that these are the main experienced and expected impacts for the region. A range of adaptation approaches for the region in general is also summarised (see Figure 3.1)

There are 34 countries among Africa's LDCs. Eritrea, Liberia, São Tomé and Príncipe, and Sierra Leone are not referred to in the IPCC report (see Table 3.1) and as such are not discussed in this analysis. The report highlights that, though African LDCs have developed NAPAs to support their adaptation processes, little funding has been received and, as such, the implementation of adaptation actions is lacking. Despite this barrier to progress, it is stated that the integration of adaptation with economic and development planning is growing. The remainder of this section discusses, in turn, the African LDCs referred to in the IPCC AR5 WGII.

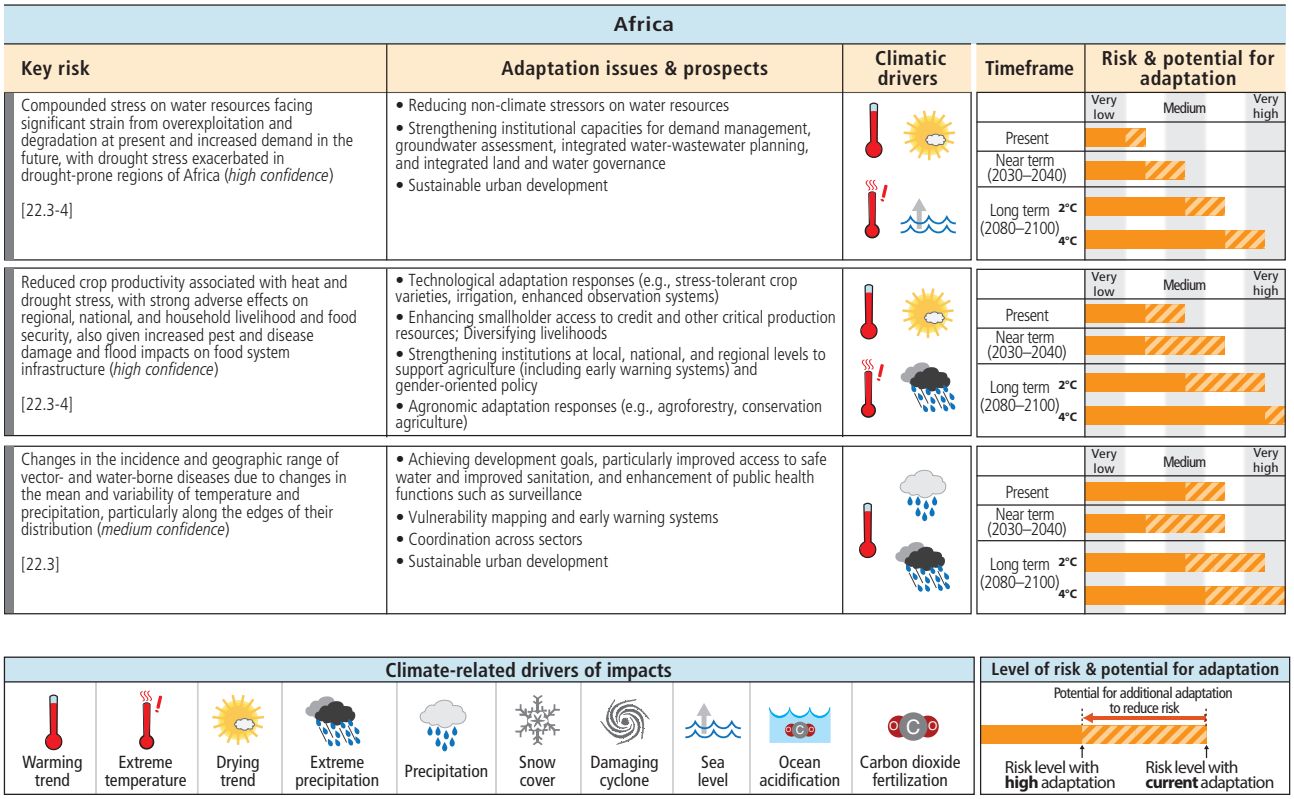
3.1.1 Angola

The report reveals that Angola experiences late precipitation in the summer (Hoerling *et al.*, 2006; New *et al.*, 2006). Vulnerability of crops is exemplified through the anticipated expansion of Black Leaf Streak disease by 2020, which will further affect banana crops (Ramirez et al., 2012). Moreover, the vulnerability of fisheries will be particularly pronounced (see Box 3.5).

3.1.2 Benin

Dense urban populations in Benin are affected by floods and future protection against such climatic impacts is expected to be a multi-faceted challenge.

Figure 3.1. Climate Change Risks and Potential for Reducing Risks for Africa Region



Source: IPCC, 2014b

Table 3.1. African LDCs and Regularity of Citation throughout the IPCC AR5 WGII

REGULARLY CITED	OFTEN CITED	SOMETIMES CITED	RARELY CITED	NOT CITED
Ethiopia	Burkina Faso	Benin	Angola	Eritrea
Malawi	Mali	Burundi	CAR	Liberia
Tanzania	Mozambique	Madagascar	Chad	São Tomé and Príncipe
	Uganda	Niger	Comoros	Sierra Leone
	Zambia	Rwanda	DRC	
		Senegal	Djibouti	
		Somalia	Equatorial Guinea	
		Sudan	The Gambia	
			Guinea	
			Guinea-Bissau	
			Lesotho	
			Mauritania	
			South Sudan	
			Togo	

For example, in Cotonou, property, infrastructure, water sources, industries, businesses and livelihood options will be negatively affected (Dossou and Glehouenou-Dossou, 2007). Disease rates in urban areas are also expected to grow. Country-wide, malaria incidences and treatment costs are expected to increase (see Box 3.1). Health insurance has been proposed as a potential response to SLR and flood induced disease increases (Dossou and Glehouenou-Dossou, 2007). Despite good practice at project level, adaptation in the agricultural sector is limited by a lack of coordination in planning and policy, accompanied by a lack of integration between research and extension systems, and climate planning. This limits local agricultural stakeholder adaptation learning, including the transfer of information on adaptation technologies (Moumouni and Idrissou, 2013a; Moumouni and Idrissou, 2013b).

3.1.3 Burkina Faso

In Burkina Faso, changes in temperature and precipitation are causing a range of impacts on ecology and, subsequently, health, local livelihoods and vulnerability. Vegetation cover is shifting (see Box 3.3) and there have been negative impacts on crops and livestock production (Molua *et al.*, 2010), including those incurred due to soil degradation (Zougmoré *et al.*, 2010). Health impacts include changes in malaria incidences (see Box 3.1) and increased mortality. Adaptation in Burkina Faso is found to rely on cultural, social and individual drivers, which can both enable and hinder effective action (Nielsen and Reenberg, 2010). Responses may be driven by growing land scarcity or new market opportunities, rather than directly by climate impacts (Barbier *et al.*, 2009). Traditional approaches are exemplified by the selection and protection of Shea Butter trees, which has expanded and enhanced areas of growth in locations with favourable soil types (Gijsbers *et al.*, 1994; Larwanou and Saadou, 2011). Agricultural adaptation approaches include rotation of cultivation areas, conservation agriculture, crop diversification, water harvesting and irrigation techniques (Hertsgaard, 2011; Barbier *et al.*, 2009). Local-level economic response strategies are used, with wealthier households selling assets and maximising on increasing market values through sales of produce (Roncoli *et al.*, 2001) and poorer houses reducing consumption (Carter and Lybbert, 2012). Smallholders largely rely on increasing off-farm labour (Kazianga and Udry, 2006). Decreases in rainfall have been indicated to increase migration between rural areas (Kniveton *et al.*, 2011; Kniveton *et al.*, 2012), while long distance or international migration occurs in years of high agricultural productivity (Henry *et al.*, 2004).

3.1.4 Burundi

Burundi provides an example of the complex interaction between climate change, disaster, conflict, displacement, and migration (Kolmannskog, 2010). Floods and mudslides have led to huge displacement and concerns of future flood risks in urban centres (see Box 3.2). Human health will be vulnerable to increased incidences of Malaria (see Box 3.1). In addition, rising temperatures are expected to affect coffee production by 2050 (Jaramillo *et al.* 2011).

BOX 3.1. CLIMATE IMPACTS ON MALARIA RATES AND TREATMENT COSTS

Data from 25 African countries was analysed to examine the relationship between climatic factors and malaria cases. Temperature and precipitation projections were used to estimate likely changes in malaria incidences and treatment costs. Of the countries examined, 18 LDCs are represented, including Benin, Burkina Faso, Burundi, Central African Republic (CAR), Chad, Djibouti, Ethiopia, Guinea, Malawi, Mali, Mauritania, Niger, Rwanda, Sudan, Togo, Tanzania, Uganda and Zimbabwe. The results are summarised in the table below, indicating experienced and expected increases and decreases in malaria rates for these LDCs.

These impacts are expected even with minor changes in temperature and precipitation, with those countries that currently have a high number of malaria cases being most at risk to rising numbers. With such increases in malaria cases also comes an increase in treatment costs for both outpatients, in terms of medication, and inpatients, in terms of hospitalisation costs. Such costs could reduce the coping capacity of LDCs.

Table 3.2. Changes in Malaria Rates and Treatment Costs [↑= increase; ↓= decrease; ↑= particularly large increase]

COUNTRY	EXPERIENCED RATE (1900–2000)	EXPECTED RATE (BY 2100)	OUTPATIENT TREATMENT COSTS	INPATIENT TREATMENT COSTS
Benin	↓	↑	↑	↑
Burkina Faso	↓	↑	↑	↑
Burundi	↑	↑	↑	↑
CAR	↑	↓	↓	↓
Chad	↓	↑	↑	↑
Djibouti	↑	↑	↑	↑
Ethiopia	↓	↓	↑	↑
Guinea	↓	↓	↑	↑
Malawi	↑	↑	↑	↑
Mali	↑	↑	↑	↑
Mauritania	↑	↑	↑	↑
Niger	↑	↑	↑	↑
Rwanda	↑	↑	↑	↑
Sudan	↓	↑	↑	↑
Togo	↓	↑	↑	↑
Tanzania	↑	↑	↑	↑
Uganda	↑	↑	↑	↑
Zimbabwe	↑	↑	↑	↑

Source: Egbendewe-Mondzozo et al. 2011

3.1.5 Central African Republic

In the CAR, a decrease in malaria rates and treatment costs is predicted, despite recorded increases in the period 1990–2000 (see Box 3.1).

3.1.6 Chad

Multi-country studies that include analyses of Chad indicate vegetation changes (see Box 3.3) and changes in malaria rates and treatment costs (see Box 3.1) for this LDC.

BOX 3.2. CASE STUDY: FLOODS IN URBAN CENTRES

In 2002, heavy rains caused floods and mudslides in many East African countries, including Rwanda, Kenya, Burundi, Tanzania and Uganda. This event killed 112 people and thousands were forced to flee their homes. In Rwanda, landslides caused the death of more than 50 people in 10 days. Huge losses to homes and livestock were also incurred. In Tanzania, food security was threatened by crop damage and hundreds of families in urban areas were left homeless. Such events exert considerable impacts on both rural and urban areas, resulting in concern about urban security in the face of future climatic events.

Source: Douglas et al. 2008

BOX 3.3. CHANGES IN VEGETATION COVER IN AFRICAN LDCS

In this multi-country study, biome shifts derived from research completed throughout the twentieth century that examined the influence of climate on vegetation, are collated and analysed (see Table 3.3). The LDCs referred to include those in the Sahelian region and Guinea zones, alongside Sudan, Senegal, Burkina Faso, Chad, Mali, Mauritania and Niger. In all of these countries, a latitudinal shift in retracting tropical woodland and expanding tropical grassland has been recorded.

The locations of the observed biome shifts recorded in published field research are indicated in Figure 3.2. The bottom halves of the circles indicate retracting tropical woodland, while the top halves of the circles indicate expanding tropical grassland.

Figure 3.2: Locations of Biome Shifts in some African LDCs (Adapted from IPCC, 2014a, Figure 4-1)

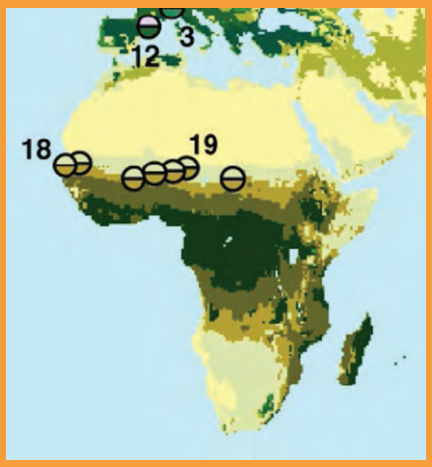


Table 3.3. Biome shifts for some African LDCs [* rate significant at P ≤ 0.05] (Source: Adapted from IPCC, 2014a, Table 4-1)

Location	Time Period	Shift Type	Retracting Biome	Expanding Biome	Temperature Change (°c/century)	Precipitation Change (%/century)
Sahel, Sudan, Guinea zones; Senegal	1945–1993				0.4*	–48*
Sahel, Burkina Faso, Chad, Mali, Mauritania, Niger	1960–2000	Latitudinal	Tropical woodland	Tropical grassland	–0.01* to 0.8*	–31*to 9

Source: Gonzalez, 2001; Gonzalez et al., 2012

3.1.7 Comoros

The resilience of corals off the coast of Comoros is indicated, those in the south-western Indian Ocean being found to be more resilient than those in eastern locations. Country-specific impacts, vulnerabilities and adaptation are not otherwise cited.

3.1.8 Democratic Republic of the Congo

The DRC is noted to be an emerging hunger hotspot, leading to predictions of future poverty crises in the country (Liu *et al.*, 2008). Moreover, impacts on fisheries will have significant consequences (see Box 3.5). 'REDD readiness' initiatives have resulted

in community conflict with conservationists and governments (Brown *et al.*, 2011a). Such experiences are used to exemplify the potential of financial resource provision through payment for ecosystem services projects to stimulate conflict over resources and property rights (Melick, 2010).

3.1.9 Djibouti

A rise in national risk in Djibouti from 2008–2015 has been attributed to climate change above income or urbanization rates (Wheeler, 2011). Extreme events are expected to result in heightened poverty and less severe changes will increase malaria rates and related treatment costs (see Box 3.1). Adaptation efforts cited for the country largely focus on combating the impacts of flooding through dike construction and mangrove restoration. The former is expected to protect against flooding while also enhancing the effectiveness of road and transportation infrastructure (UNFCCC, 2007b; Urquhart, 2009). Mangrove restoration efforts are being instigated via the country's NAPA programme, which seeks to achieve adaptation through linking biodiversity, developmental and social goals (Pramova *et al.*, 2012).

3.1.10 Equatorial Guinea

Vegetation shifts for the Guinea zones are indicated (see Box 3.3), yet no specific references to Equatorial Guinea are made.

3.1.11 Ethiopia

Despite increasing biomass in Ethiopia (Angassa and Oba, 2008), climatic impacts in the agricultural sector have led to a 10 per cent decline in Gross Domestic Product (GDP) (Mideksa, 2010) and rainfall and temperature changes are expected to have negative consequences (Müller *et al.*, 2011). For example, the distribution of the Coffee Berry Borer is predicted to decrease coffee yields (Jaramillo *et al.,* 2011). Long-term vulnerability reduction is sought through "low regrets" measures (Conway and Schipper, 2011), with adaptation practices including conservation agriculture, water control mechanisms, shading and wind breaks (Bryan *et al.*, 2009). There are several initiatives under the African Green Growth Strategy, reflected by the Climate Resilient Green Economy Facility (Corsi *et al.*, 2012) and a Community-Based Adaptation (CBA) project in Humbo, which achieves adaptation and mitigation co-benefits through natural forest regeneration (Brown *et al.*, 2011b). Good practices have been developed through the United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserves initiative (German Commission for UNESCO, 2011). Insurance programmes employed in response to climate stressors include a scheme that grants insurance premiums to farmers engaging in disaster risk reduction (DRR) projects (WFP, 2011) and a government-led drought-index-based scheme. The government also engages through urban capacity development programmes that involve integrating CBA and DRR into local development planning (Madzwamuse, 2010; Castán Broto *et al.*, 2013). Social protection approaches, highlighted as more effective than relief interventions, buffer against shocks by building assets and increasing household resilience (Brown *et al.*, 2007; Heltberg *et al.*, 2009). Yet external interventions have been indicated as having a complex array of effects on the coping mechanisms of local and indigenous institutions (Debsu, 2012). In fact, limitations to adaptation are found in financial, biophysical, infrastructural, institutional, technological, political and informational barriers (Bryan *et al.*, 2009, 2011; Deressa *et al.*, 2009). In the adaptation of food systems, lack of adaptive capacity, cultural acceptability, functioning markets and insurance systems also pose challenges (Deressa *et al.*, 2009).

3.1.12 The Gambia

The Gambia is cited as an example of the costs and negative economic impacts that can result from adaptation (see Box 3.4).

3.1.13 Guinea

Multi-country analyses indicate changing vegetation (see Box 3.3), vulnerable fisheries (see Box 3.5) and changes in malaria cases and treatment costs (see Box 3.1) in Guinea. It is also predicted that increasing minimum temperatures will expand Black Leaf Streak disease in banana by 2020 (Ramirez *et al.*, 2011).

3.1.14 Guinea-Bissau

Though vegetation shifts for the Guinea zones suggest impacts in Guinea-Bissau (see Box 3.3), no specific references to this LDC are made in the IPCC AR5 WGII.

3.1.15 Lesotho

At the national-level, Lesotho provides evidence of the evolution from NAPAs and National Climate Change Response Strategies (NCCRS) to a multi-level and multi-sector approach to adaptation planning, through a co-ordinated policy framework, while at the local-level, youth ambassadors develop capacity and raise awareness, aiming to engender behavioural change (Corsi *et al.,* 2012).

3.1.16 Madagascar

Madagascar is indicated as a low-income country at much risk to poverty as a result of climate change (Warner *et al.*, 2012). Climate change will increase favourable conditions for cassava pests (Bellotti *et al.*, 2012) while also decreasing availability of arable

BOX 3.4. LOSS AND DAMAGE IN THE GAMBIA

Research conducted in the North Bank region of The Gambia (see Figure 3.3) indicated climate related losses and coping strategies for the area. Agricultural activities undertaken include crop cultivation, livestock keeping and off-farm economic activities. The majority of households cultivate crops on their own land, most of which are for personal consumption, though a small percentage of households also cultivate crops to sell. A severe drought in 2011 incurred a decrease in crop production for 90 per cent of the participants and livestock losses for 74 per cent. Coping strategies included seeking alternative sources of income, temporary migration, selling personal assets, seeking support from friends and family and reliance on relief donations. Despite these strategies, 63 per cent of households were forced to modify their food consumption patterns, reflecting a lack of coping capacity for such climatic incidences.

Figure 3.3. Location of loss and damage research in The Gambia (Warner et al., 2012)

Source: Warner et al., 2012

BOX 3.5. VULNERABILITY OF LDC CAPTURE FISHERIES

Several of the LDCs have been identified as among the most vulnerable to the effects of climate change on their fisheries. An indicator-based analysis was employed to measure the relative vulnerabilities of 132 national economies to climate change impacts on fisheries by 2050. Here, vulnerability was determined as a result of exposure to climatic impacts, sensitivity to the impact on fisheries and national adaptive capacity. Seven LDCs were among the nations identified as being highly dependent on fisheries, including Bangladesh, Cambodia, DRC, Madagascar, Sierra Leone, Tanzania, and Uganda. Finally, among the 33 national economies whose fisheries were listed as highly vulnerable, 19 were LDCs. In order of the most vulnerable, these included Angola, DRC, Mauritania, Senegal, Mali, Sierra Leone, Mozambique, Niger, Bangladesh, Zambia, Malawi, Uganda, Yemen, Burundi, Guinea, Guinea-Bissau, Cambodia, Tanzania and The Gambia.

Source: Allison et al. 2009

land (Lambin and Meyfroidt, 2011). On the other hand, corals appear to be more resilient in Madagascan seas. Adaptation to increased flooding includes urban agriculture and submersible roads (UNFCCC, 2007b; Urquhart, 2009), while further infrastructural approaches include the adoption of cyclone-resistant standards for public buildings (AfDB, 2011). The latter exemplifies the necessity for soft measures to complement hard infrastructure in order to achieve affordable and feasible improvements (Chigwada, 2005; Siegel, 2011).

3.1.17 Malawi

In Malawi, climate change threatens the freshwater ecosystem and enhances the unpredictability of rainfall (Wellard *et al.*, 2012). This accentuates rural livelihood pressures relating to economic policy, globalization, environmental degradation and health issues, such as HIV/AIDS (Casale *et al.*, 2010) and malaria (see Box 3.1). The economy is further vulnerable to impacts upon capture fisheries (see Box 3.5). Anthropogenic actions exacerbate climatic impacts. For instance, the

use and consequent depletion of forest resources heightens flood vulnerability (Fisher *et al.*, 2010). Women are subject to greater vulnerability in terms of food insecurity (Nelson and Stathers, 2009; Kakota *et al.*, 2011), economic drivers and, for female tea pickers, heat stress (Renton, 2009). Heightened vulnerability of children is reflected by intensified pressure on their transfer to the labour market (UNDP, 2007). Extreme drought is expected to cause disparate impacts in urban and rural areas due to those in rural areas responding through asset liquefaction (Ahmed *et al.*, 2009). Local adaptation includes conservation agriculture (Ngwira *et al.*, 2012), the use of appropriate crop varieties, rainwater harvesting, early warning and trialled and tested insurance schemes (Hellmuth *et al.*, 2009; Linnerooth-Bayer and Mechler, 2011). Moreover, success in co-beneficial mitigation and adaptation strategies is exemplified through integrated soil replenishment that doubles maize yields leading to heightened security (Garrity *et al.*, 2010). Social protection buffers against shocks by building assets and increasing household resilience (Brown *et al.*, 2007; Heltberg *et al.*, 2009). Yet institutional, financial, biophysical, infrastructural, technological, political and informational barriers are reported (Clover and Eriksen, 2009; Vincent *et al.*, 2011a), institutional constraints being exemplified through synergies between CBA and Community Based Natural Resource Management experiences (Chishakwe *et al.*, 2012), the limitations of national agricultural extension policies (Liwenda *et al.*, 2012) and conflicting urban policy and planning approaches for funding, land use and infrastructure. Nevertheless, success has been exemplified through a major government initiative that promoted jatropha cultivation as a livelihood opportunity (Dyer *et al.*, 2012).

3.1.18 Mali

Changing vegetation cover in Mali is reflected by an increase in tropical grassland (see Box 3.3) and drought is expected to decrease agriculturally-productive land, and hence, food security, by 2025 (Jankowska *et al.*, 2012). Livelihood shifts from water-based to agro-sylvo-pastoral systems as a result of increased drought is exemplified around Lake Faguibine (Brockhaus and Djoudi, 2008). Moreover, food price increases since 2006 have increased the incidence of child food poverty from 41 to 52 per cent (Bibi *et al.*, 2010). Further exacerbation in child under-nutrition is predicted due to climatic changes alongside population increase and greater livestock reliance (Jankowska *et al.*, 2012). Malaria rates and treatment costs will also be affected (see Box 3.1). The 1980's drought increased cyclical migration by heightening economic hardship (Findley, 1994). Detrimental social consequences resulting from such mobility are exemplified by the increased workload borne by the remaining family when men migrate, which has been found to lead to a reduction in children's school attendance (Brockhaus *et al.*, 2013). Pressures on crop production are also responded to through forest resource use (Robledo *et al.*, 2012) and modified crop practices, including increased plot size, water control mechanisms and conservation agriculture approaches (Adepetu and Berthe, 2007), such as water harvesting practices that improve soil quality and agricultural yields (Fatondji *et al.*, 2009; Vohland and Barry, 2009). Pressures on livestock are addressed through ensuring supplemental feeding, modified grazing patterns and optimal herd size (Adepetu and Berthe, 2007). At the national-level, integration of adaptation into multiple sectors exemplifies evolution from NAPAs and the NCCRS to a more integrated approach to adaptation planning (Fröde *et al.*, 2013).

3.1.19 Mauritania

Climatic impacts in Mauritania affect vegetation change (see Box 3.3), health (see Box 3.1) and capture fisheries (see Box 3.5). Temperature changes may result in positive impacts due to the increasing suitability of Mauritania's waters for certain fish species.

3.1.20 Mozambique

Though there has been a decrease in tropical cyclones in the Mozambique Channel over the last 50 years, climatic disasters have already led to huge impacts on the population. In 2007, flooding resulted in the mass displacement of over 100,000 people (Artur and Hilhorst, 2012; Foley, 2007). This led to the development of emergency response plans alongside dam construction, which encouraged increased and seemingly permanent settlement in the Zambezi flood plain (Cosgrave *et al.*, 2007; Foley, 2007; Jäger *et al.*, 2009; Warner *et al.*, 2010). Projections of costs indicate 1 per cent of national GDP in the event of one metre of Global Mean SLR (Anthoff *et al.*, 2010) and climate-induced poverty is likely due to the country's status as an emerging hunger hotspot (Liu *et al.*, 2008): rural food security is sensitive to food spikes (Jayne *et al.*, 2006), shortages in arable land are apparent and the freshwater ecosystem is particularly at risk (Lambin and Meyfroidt, 2011). It has been found that the use of agricultural technologies has not had a significant impact upon household income and market integration can reduce the capacity of indigenous systems for dealing with climate risk (Eriksen and Silva, 2009; Silva *et al.*, 2010). Instead, adaptation through social protection can address slow-onset impacts through buffering against shocks. Local-level approaches to adaptation, in the form of CBA, have been implemented through the Adaptation Learning Program (CARE International, 2012). National-level efforts are exemplified via the PPCR (see Box 3.6) and through infrastructural adaptation such as the construction

BOX 3.6. THE PILOT PROGRAMME FOR CLIMATE RESILIENCE

Initiated in 2009, the Pilot Programme for Climate Resilience (PPCR) aims to demonstrate multi-stakeholder participatory approaches for mainstreaming climate resilience into long-term national-level development planning. Eight LDCs were selected for the undertaking and implementation of this process, including Bangladesh, Cambodia, Niger, Mozambique, Nepal, Tajikistan, Zambia and Yemen, with the objectives of strengthening national capacity and leveraging funding for integrating climate risk and resilience into development policies and planning throughout a process of lesson learning at multiple levels. This was planned via a two phase approach. Phase 1 aimed to develop a Strategic Program for Climate Resilience, while Phase 2 sought to achieve increased integration of climate resilience into development. Phase 1 activities included analysing climate risk, conducting institutional analyses, building knowledge and raising awareness, capacity building, consulting stakeholders, and defining and prioritising action points. Phase 2 activities include engagement of stakeholders, strengthening of analytical capacity, provision of information, strengthening of institutions, revision of relevant policies and plans, investment in support of climate resilience and concessional financing to attract private sector investments. As such the PPCR exemplifies the potential of these LDCs to gain much assistance in adaptation planning, while also becoming leaders in such strategies, from which other countries can learn.

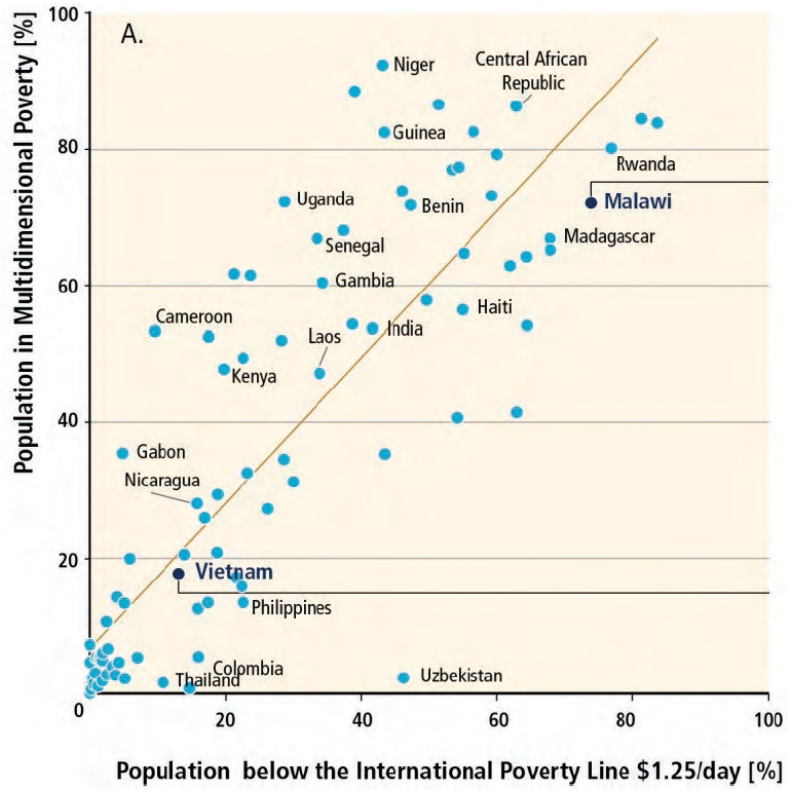
Source: Climate Investment Fund, 2009

of low cost, flood proof roads (Halsnæs and Trarup, 2009). Yet institutional, financial, biophysical, infrastructural, technological, political and informational barriers have been identified (Clover and Eriksen, 2009; Vincent *et al*., 2011a; Chishakwe *et al*., 2012). Looking forward, it is suggested that there is potential for bio-fuels to boost investment, employment, and economic growth (Arndt *et al.,* 2009).

3.1.21 Niger

Temperature and precipitation changes in Niger have affected vegetation and malaria rates (see Boxes 3.3 and 3.1, respectively) and continued changes are expected to cause future impacts. Vulnerability in Niger is enhanced by the country's poverty level, with a high percentage of the population living in multi-dimensional poverty (see Figure 3.4).

Figure 3.4. Liner Regression Relationship between Multi-Dimensional Poverty and Income-Based Poverty



Source: Adapted from IPCC, 2014a; Figure 13-2; UNDP, 2011b.

Agricultural adaptation is addressed through water harvesting practices (Fatondji *et al.*, 2009; Vohland and Barry, 2009; Larwanou and Saadou, 2011) and traditional natural regeneration efforts (Reij *et al.*, 2009; Tougiani *et al.,* 2009; Sendzimir *et al.*, 2011; Larwanou and Saadou, 2011). Male migration is increasing, but this leaves women with no labour support (Goh, 2012). A national approach to climate resilience is found in the PPCR (see Box 3.6). Moreover, the new Economic and Social Investment Plan in Niger sees climate resilience being mainstreamed into economic planning documents (Corsi *et al.*, 2012). It is indicated that measures to promote foreign direct investment and industrial competitiveness can undercut the adaptive capacity of poor people (Madzwamuse, 2010), while simultaneously, poor business environments impede both foreign direct investment and adaptation (Collier *et al.*, 2008).

3.1.22 Rwanda

Climatic impacts noted for Rwanda include increasing malaria incidences (see Box 3.1), reduction in coffee production due to expansion of the Coffee Berry Borer distribution (Jaramillo *et al.*, 2011) and displacement due to heavy rainfall (see Box 3.2). At the local-level, social protection in order to better prepare for slow-onset shocks is increasing, while at the national level resilience is sought through the 2012 National Strategy on Climate Change and Low Carbon Development (Climate Investment Fund, 2009).

3.1.23 Senegal

In Senegal's rural areas, climate variability affects existing livelihood pressures through economic policy, globalization, environmental degradation and HIV/AIDS (Mbow *et al.*, 2008). A change in vegetation cover is noted (see Box 3.3), while projections of increased rainfall variability indicate a reduction in the optimal livestock stocking density (Hein *et al.*, 2009). Moreover, the country's fishery economy is vulnerable to climatic changes (see Box 3.5). In terms of health impacts, heavy rainfall and El Niño Southern Oscillation is expected to cause cholera outbreaks (de Magny *et al.*, 2007). In the urban context, cities such as Dakar and Saint-Louis are vulnerable to flooding impacts upon infrastructure, industry and tourism, and increased in-migration (Wang *et al.*, 2009). Local-level adaptation approaches include natural selection, which has resulted in extensive parks of Acacia Albida (Lericollais, 1989). Formal projects are exemplified by the UNESCO Biosphere Reserves initiative, wherein good CBA practices were developed (German Commission for UNESCO, 2011), and carbon sequestration projects, which have enabled reduced losses of soil fertility. Yet, only marginal impacts on poverty reduction have been observed and benefits for poor farmers are further limited due to their reduced ability to participate (Antle and Stoorvogel, 2009).

3.1.24 Somalia

Somalia's climatic susceptibility has increased since the 2011 drought, which highlighted the need for increased donor support to the disaster resilience-building agenda (Haan *et al.*, 2012). An expected rise in national risk in Somalia is also attributed to climate change, with the country being vulnerable to resultant poverty and conflict. Failures in appropriate governance contribute to this, reducing communities coping and adaptation ability (Ahrens and Rudolph, 2006; Menkhaus, 2010).

3.1.25 South Sudan

The mean seasonal temperature in South Sudan has increased over the last 50 years (Funk *et al.*, 2011, 2012) and regional climate models suggest continued drying over most parts of the country by the end of the 21st Century (Patricola and Cook, 2011).

3.1.26 Sudan

Vegetation cover has changed in Sudan (see Box 3.3) and a shortage of arable land could put pressure on sensitive landscapes (Lambin and Meyfroidt, 2011). Migration and urbanization patterns are shaped by climate change (Morton, 1989) with rapid return significantly outweighing permanent migration following dry season movements (McLeman and Hunter, 2010). Such mobility patterns reflect those of pastoralists after the 1990's drought. Pastoralist mobility habits indicate the importance of migration and trade over subsistence agriculture, however, though these approaches are considered fundamental to addressing risk (Goldstone, 2002; Urdal, 2005; Reuveny, 2007; Fox and Hoelscher, 2010), lifestyles are threatened by a changing climate (Mertz *et al.*, 2011). The breakdown of pastoralism is also impacted by policies that limit mobility, alongside asset stripping and escalating violence (Young *et al.*, 2009). More formal adaptation practices are exemplified by the Community-Based Adaptation in Africa (CBAA) project, the use of rural finance and micro-credit for resilience-building activities by women (Osman-Elasha et al., 2008), and insurance schemes. Access to one agricultural insurance scheme was granted to farmers on the basis of their adoption of resilient farming practices (Oxfam, 2009). More recently, index-based insurance has been introduced and piloted.

3.1.27 Togo

Togo is vulnerable to increased malaria incidences despite a decline in the disease between 1990 and 2000 (see Box 3.1). Adaptation to rising temperatures in Togo is exemplified by the use of dense green foliage on buildings in hot and humid areas to enable a cooling effect (Hodo-Abalo *et al.*, 2012).

3.1.28 Tanzania

In Tanzania, climatic changes include changes in temperature and rainfall patterns (Cook and Vizy, 2013; Nakaegawa *et al*., 2012), which alter vegetation cover (Lambin and Meyfroidt, 2011) and cause losses to coastal areas due to inundation. Heavy rains have impacted urban areas (see Box 3.2), while in rural areas, climate variability affects existing livelihood pressures, including those stemming from economic policy, globalization, environmental degradation and HIV/AIDS (Hamisi *et al*., 2012). Health will be further impacted by increased malaria rates (see Box 3.1), cholera incidences (Luque Fernández *et al*., 2009; Reyburn *et al*., 2011) and mortality (Egondi *et al*., 2012; Mrema *et al*., 2012). Food security will be much impacted due to heavy reliance on agriculture for produce and employment (Thurlow and Wobst, 2003). Women are disproportionally affected by food insecurity due to low prioritisation in family food distribution (Nelson and Stathers, 2009; Kakota *et al*., 2011). Moreover, Tanzania's emergence as a hunger hotspot means that future poverty traps are likely (Liu *et al*., 2008; Ahmed *et al*., 2011). Local-level adaptation approaches include diversified farming systems (Paavola, 2008) and the use of forest resources (Robledo *et al*., 2012). Societal responses are led by community-based organizations (Corsi *et al*., 2012; McClanahan *et al*., 2009), alongside reactive adaptive approaches at the micro-level (Muthoni and Wangui, 2013). Yet some coping and reactive adaptation strategies have caused maladaptation, for example due to over-intensive farming (Hamisi *et al*., 2012) and CBA approaches have highlighted institutional and other constraints (Chishakwe *et al*., 2012). Simultaneously, national-level 'REDD readiness' responses have been found to stimulate conflict and contestation between communities and conservationists (Beymer-Farris and Bassett, 2012, 2013; Burgess *et al*., 2013; Melick, 2010). Moreover, national policies are limited. For instance, those that support agricultural extension to farmer groups do not ensure that peri-urban farmers receive benefits (Liwenda *et al*., 2012).

3.1.29 Uganda

High temperatures and floods impact vulnerability and adaptation needs in Uganda (Funk *et al*., 2011, 2012; Patricola and Cook, 2011). Temperature increases will affect tea and coffee production, in the latter case by expanding the Coffee Berry Borer distribution (Jaramillo *et al*., 2011). Fisheries are also vulnerable (see Box 3.5) and health is likely to be impacted by increased malaria incidences (see Box 3.1). Concerns over urban vulnerability have resulted from past heavy rainfall events (see Box 3.2). Differentiated gender impacts are also indicated. For instance, women's non-land assets are reduced by drought and men are more able to amass land after floods (Quisumbing *et al*., 2011). Local-level initiatives are found in CBA programmes, exemplified by the CBAA project and the Karamoja Productive Assets Programme, which shows how food security, nutrition-related safety nets and social protection mechanisms can be mutually reinforcing and promote adaptation (Government of Uganda and WFP, 2010; WFP, 2011). Migration responses are varied and patterns difficult to discern, yet it is indicated that high soil quality marginally increases migration, particularly permanent, non-labour migration (Gray, 2011).

3.1.30 Zambia

Climate change threatens Zambia's freshwater ecosystem. The country's population is one of the most at risk from climate-induced poverty and it is estimated that, by 2016, the poverty headcount could increase up to 650,000 (Thurlow *et al*., 2009). It is predicted that an extreme dry event could have disparate impacts on urban and rural households, with urban poverty being exacerbated by income reductions due to declines in agricultural productivity (Thurlow *et al*., 2012), and rural poverty being reduced through consolidation of assets (Ahmed *et al*., 2009). Health will be impacted by increases in the number of cholera cases (Luque Fernández *et al*., 2009; Reyburn *et al*., 2011). Technological change is deemed necessary for agricultural adaptation (Langyintuo and Mungoma, 2008) but appropriate approaches are crucial. For example, profitability can be negatively affected by high production costs incurred by expensive technologies, such as high-yield maize. Conversely, soil replenishment and the use of natural forest resources can enable livelihood adaptation, if appropriate management techniques are applied (Garrity *et al*., 2010; Robledo *et al*., 2012). CBA projects, exemplified by the CBAA project have highlighted institutional constraints to adaptation. Further adaptation constraints include financial, biophysical, infrastructural, institutional, technological, political and informational barriers (Clover and Eriksen, 2009; Mandleni and Anim, 2011; Nyanga *et al*., 2011; Vincent *et al*., 2011a). Zambia's National Climate Change Response Strategy and Policy (Corsi *et al*., 2012) represents the transition to an integrated approach to adaptation planning including the creation of enabling policy environments. The country's Sixth National Development Plan 2011–2015 reflects mainstreaming of climate resilience into economic planning, while the PPCR (see Box 3.6) has enabled leverage of co-financing from the Nordic Development Fund. It is noted, however, that measures to promote foreign direct investment and industrial competitiveness can undercut the adaptive capacity of poor people (Madzwamuse, 2010), while poor business environments can impede both foreign direct investment and adaptation (Collier *et al*., 2008).

3.2 LDCs in Asia

The risks presented by climate change for Asia and related adaptation options are summarised in Figure 3.5. This indicates increased temperatures causing drying at one end of the scale, accompanied by a rise in precipitation, cyclones and sea-level at the other end of the scale. The adaptation practices highlighted revolve around infrastructural improvements, early warning systems, diversification of economic practices and resource management. There are nine countries in Asia that fit into the LDC category. Timor-Leste does not specifically feature in the IPCC AR5 WGII report (see Table 3.4), however a summary of the references to the remaining Asian LDCs follows below.

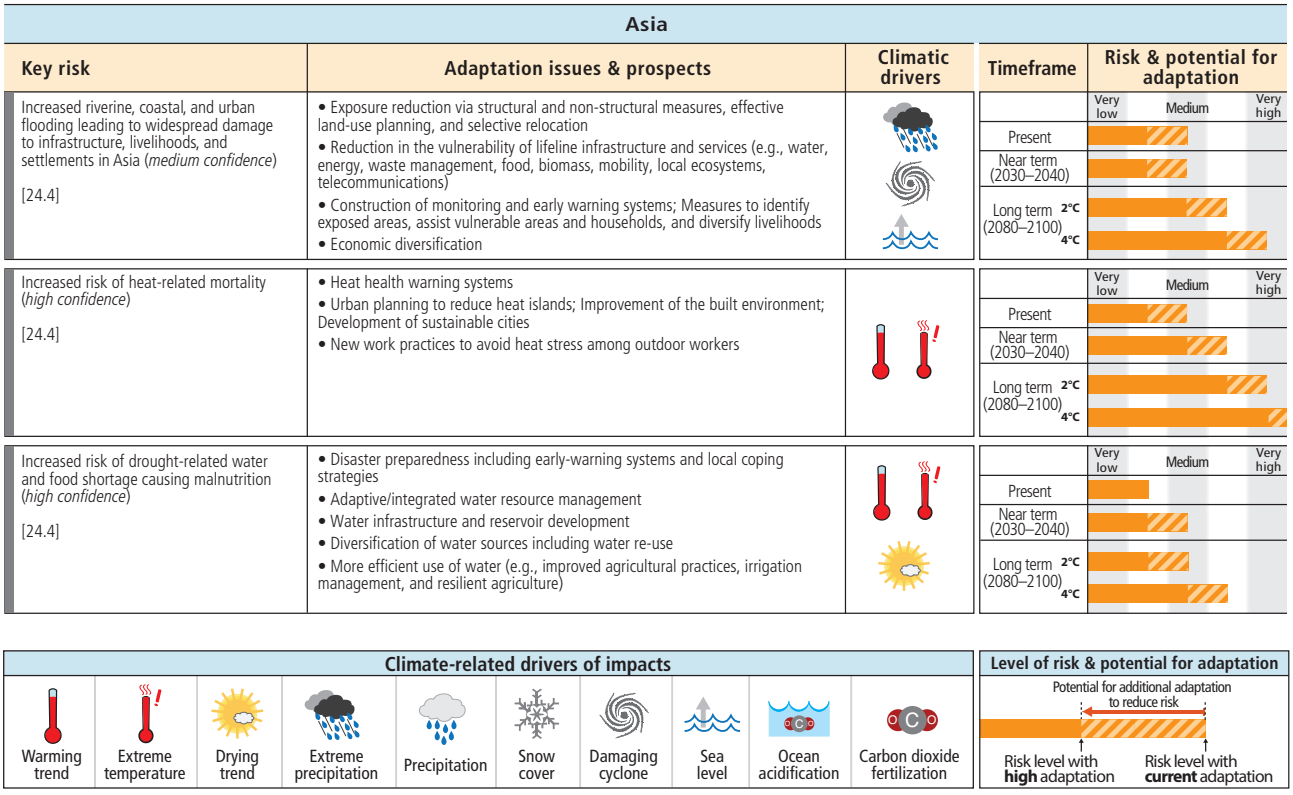
3.2.1 Afghanistan

Afghanistan is highlighted as having the lowest life expectancy, at 50 years (CIA, 2013), alongside a low GDP per capita of USD620 (World Bank, 2013). This situation is exacerbated by climate change, which affects the population's immediate basic needs, longer-term capabilities and assets, the latter being exemplified by losses to household assets caused by the 1999–2004 drought (de Weijer, 2007). Vulnerability is further discussed in the context of conflict, with severe failure of governance, including violent conflicts, exacerbating the risks of climate change, due to pre-existing exposure to complex emergency situations dictating limited coping and risk management capacities (Ahrens and Rudolph, 2006; Menkhaus, 2010).

3.2.2 Bhutan

Bhutan's coping measures include Clean Development Mechanism projects, such as micro-hydro projects, which achieve co-benefits of mitigation and adaptation, while also generating livelihood benefits and employment, and reducing poverty (UNFCCC, 2011a; UNFCCC, 2013). In addressing health, early warning models for use in malaria prevention are being tested (Wangdi *et al.*, 2010). Yet adaptation measures do not benefit all. An analysis of responses to changing monsoon patterns revealed that 87 per cent of households that adopted coping measures in the Punakha district of Bhutan were still experiencing adverse effects (Kusters and Wangdi, 2013).

Figure 3.5: Climate Change Risks and Potential for Reducing Risks for Africa Region



Source: IPCC, 2014b

Table 3.4: Asian LDCs and Regularity of Citation throughout the IPCC AR5 WGII

REGULARLY CITED	OFTEN CITED	SOMETIMES CITED	RARELY CITED	NOT CITED
Bangladesh	Myanmar Nepal	Afghanistan Bhutan Cambodia	Laos Yemen	Timor-Leste

3.2.3 Bangladesh

As a low-lying country, Bangladesh is expected to face very high impacts, including from cyclones and SLR, which will incur increased poverty and high annual costs (Ahmed *et al*., 2009; Karim and Mimura, 2008; Dasgupta *et al*., 2010). The country is particularly vulnerable to tropical cyclones and high rates of mortality are associated with such events (Ali, 1999; Mallick and Rahman, 2013; Murray *et al*., 2012). Vulnerability to SLR is pronounced due to low-elevation coastal zones, storm surge zones and population density, with major impacts expected by 2050, affecting a range of economic activities undertaken by coastal communities (McGranahan *et al*., 2007; Smith, 2011). Cyclones and SLR contribute to greater flooding, incurring increased mortality (Milojevic *et al*., 2012), displacement (Paul, 2005) and agricultural impacts, the latter resulting in increased crop prices and shifts to shrimp farming (Pouliotte *et al*., 2009). It has been found that vulnerability to floods is reduced by increases in income and income sources and greater reliance on natural resources (Brouwer *et al*., 2007). Moreover, urban transformational resilience has resulted from floods (Pelling, 2011) despite insufficient infrastructure exacerbating vulnerabilities (Rahman *et al*., 2010). Beyond flood impacts, vulnerabilities are also apparent for capture fisheries (see Box 3.5) and tiger populations (Loucks *et al*., 2010), while human health impacts include increased rates of cholera (Lobitz *et al*., 2000; Lipp *et al*., 2002; Pascual *et al*., 2000), dengue (Hashizume and Dewan, 2012) and heat stress (Burkart *et al.,* 2011). Climate-induced stress, grief and disrupted safety nets have increased domestic violence (Pouliotte *et al*., 2009). More broadly, climate events differentially impact women due to gender differences in poverty, nutrition, exposure to water-logged environments (Neelormi *et al*., 2009; Röhr, 2006) and mobility (Saito, 2009; Bradshaw, 2010).

The adaptation deficit with respect to cyclones in Bangladesh is estimated at USD 25 billion (World Bank, 2011) and it is reported that by 2050 Bangladesh will face extreme initial and recurring costs for flood protection alone (Dasgupta *et al*., 2010). The country is among one of the largest recipients of overseas financial assistance for adaptation, yet finance delivery is limited by the inadequacy of planning strategies (Hedger, 2011). Large-scale structural efforts for adaptation have proved problematic. For instance, coastal protection measures have led to unwanted development (Grothmann and Patt, 2005; National Research Council, 2010; Repetto, 2008), erosion and maladaptation (Huq and Khan, 2006; Masozera *et al*., 2007; Pouliotte *et al*., 2009) and the construction of cyclone shelters has not met capacity needs (Bern *et al*., 1993; Chowdhury *et al*., 1993). Conversely, Bangladesh offers successful local-level adaptation experience, providing successful examples of awareness raising, protective building measures and DRR (Martinez *et al*., 2011, Murray *et al*., 2012), yet financial barriers are apparent, for example in terms of credit access for fishing communities (Islam *et al*., 2014). Mortality rates have been found to be reduced by multi-stakeholder collaboration (Khan, 2008), yet institutional restrictions hinder progress (Christensen *et al*., 2012). Examples of collaboration come from the PPCR (see Box 3.6) and CBA approaches. Technologies have achieved co-benefits of mitigation, adaptation and development via waste-to-compost projects that reduce methane emissions, improve soil quality and preserve ecosystem services (Ayers and Huq, 2009). In applying agricultural technologies, patents and other intellectual property protection have presented barriers to transfer. Migration is reflected by responses to cyclone Aila, yet variation among groups in attitudes and capabilities regarding migration is apparent and preferences have been found to depend on exposure and social conditions (Saroar and Routray, 2010). The effective distribution of aid following the 2004 tornado seemed to curb out-migration, however where male out-migration has occurred, women are left to face unsafe working conditions, exploitation and loss of respect (Pouliotte *et al*., 2009).

3.2.4 Cambodia

The Lower Mekong River Basin running through Cambodia provides a crucial resource for the population (MRC, 2009; Dugan *et al.,* 2010), yet the country now suffers a range of climate impacts, which have contributed to a shift in income generation patterns (Resurreccion, 2011). Intense floods and droughts have heavily impacted agricultural output, causing almost

90 per cent of rice production losses between 1996 and 2001 (Brooks and Adger, 2003; MRC, 2009) and, for some communities, inducing perpetual vulnerability (Nuorteva *et al.*, 2010; Keskinen *et al.*, 2010). Rising temperatures are increasing vulnerability of fisheries (see Box 3.5) and rice crops (Wassmann *et al.*, 2009a, Wassmann *et al.*, 2009b) and a shift in rice cropping patterns in reaction to the latter has shifted perceptions of income-generating activities (Resurreccion, 2011). Technology Needs Assessments reflect the application of technology to agricultural adaptation (Christiansen et al., 2011), while funding for adaptation has been secured from the International Fund for Agricultural Development through the PPCR (see Box 3.6).

3.2.5 Laos

The Lower Mekong River Basin running through Laos provides the population with crucial agriculture and fishery resources (MRC, 2009; Dugan *et al.*, 2010), yet agriculture is threatened by the impacts of increasing heat stress on rice crops (Wassmann *et al.*, 2009a, Wassmann *et al.*, 2009b).

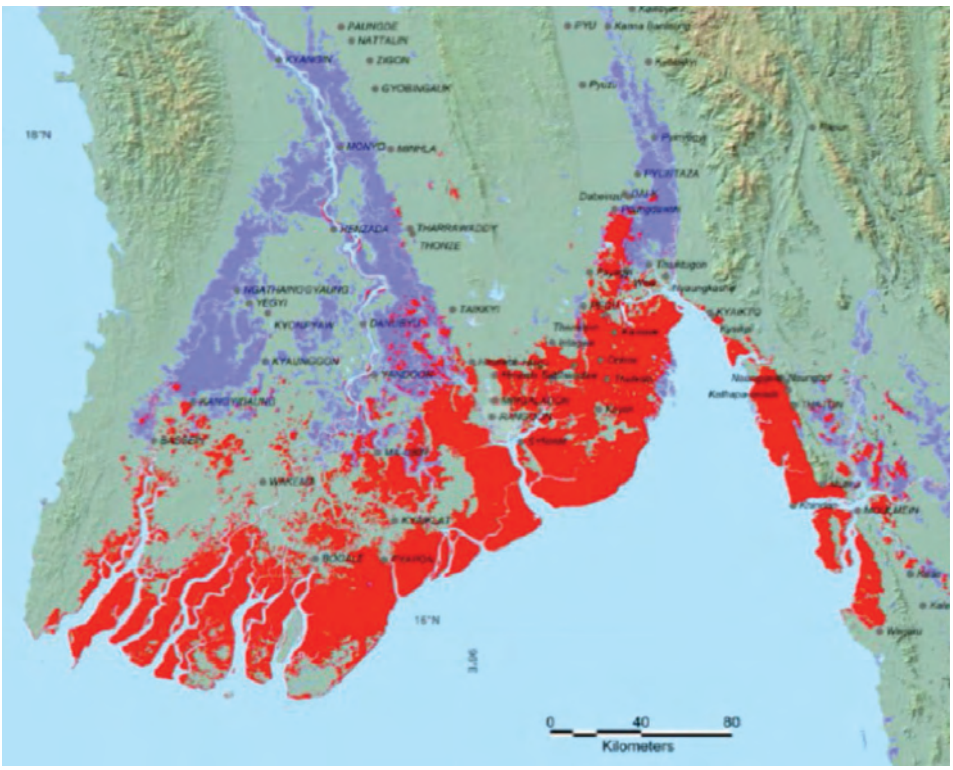
3.2.6 Myanmar

Myanmar is affected by extreme weather events including cyclones and storm surges. In 2008, tropical cyclone Nargis caused over 138,000 fatalities, while storm surges have caused extensive flooding in the densely populated coastal areas of the Irrawaddy Delta (Revenga *et al.*, 2003; Brakenridge *et al.*, 2013). Decreasing trends in such events are reported, though the country remains at high risk from climatic impacts, exacerbated by concentrated multi-dimensional poverty (Eastham *et al.*, 2008; Wassmann *et al.*, 2009b). Rice production is affected by increasing heat stress and SLR, leading to salinity intrusion (Wassmann *et al.*, 2009a, Wassmann *et al.*, 2009b). It is suggested that DRR methods employed in response to cyclone Nargis could be successfully applied to climate change adaptation (Murray *et al.*, 2012).

3.2.7 Nepal

The Himalayan glaciers of Nepal provide a freshwater resource for the country, yet climate impacts are increasing meltwater and runoff, ultimately intensifying flood events. Flood related mortality indicates children as most vulnerable, with floods increasing child mortality rates six-fold (Pradhan *et al.*, 2007). Complex social, political and environmental contexts alongside inadequate physical and institutional infrastructure systems has been found to worsen the impacts of flood events, as was exemplified by the failure of the Kosi River embankments in 2008 (Moench, 2010). Health impacts are reflected by changing malaria rates, outbreaks of Japanese encephalitis (Devi and Jauhari, 2006; Dev and Dash, 2007; Dahal, 2008; Laneri *et al.*,

Figure 3.6. The intersection of inland and storm surge flooding in Myanmar. Red indicates the tropical cyclone Nargis storm surge along the Irrawaddy Delta and Myanmar, while blue indicates areas flooded by the river in previous years



Source: Brakenridge et al., 2013

2010) and increased tuberculosis (Pokhrel *et al*., 2010). Climate impacts on Himalayan trekking will impact the tourist industry upon which Nepal is heavily reliant (Nyaupane and Chhetri, 2009), yet because tourist resource use is much higher than local resource use, there is potential for losses to balance out. A strong correlation between household poverty and climatic vulnerability have been found (Ghimire *et al*., 2010), which is expected to be exacerbated for those with limited social networks (Menon, 2009). In the Humla district, climatic, socio-economic and environmental shifts alongside gender roles and caste relations impact livelihoods. Furthermore, climatic shifts have elicited socio-economic changes within Dalit communities, including crop, employment and trade diversification; while deforestation, population pressure and agricultural decline have encouraged female mobility (Onta and Resurreccion, 2011). Adaptation responses are limited by institutional barriers, such as the prioritisation of male land ownership, which reduces women's adaptation decisions, and political discrimination, which hinders adaptation mainstreaming (Jones and Boyd, 2011). At the national-level, Nepal' s response is reflected in their Framework on Local Adaptation Plans for Action (LAPA) (see Box 3.7).

3.2.8 Yemen

Yemen is mentioned in one multi-country analysis that indicates the country's capture fisheries to be highly vulnerable to climate change (see Box 3.5).

3.3 LDCs in the Small Islands

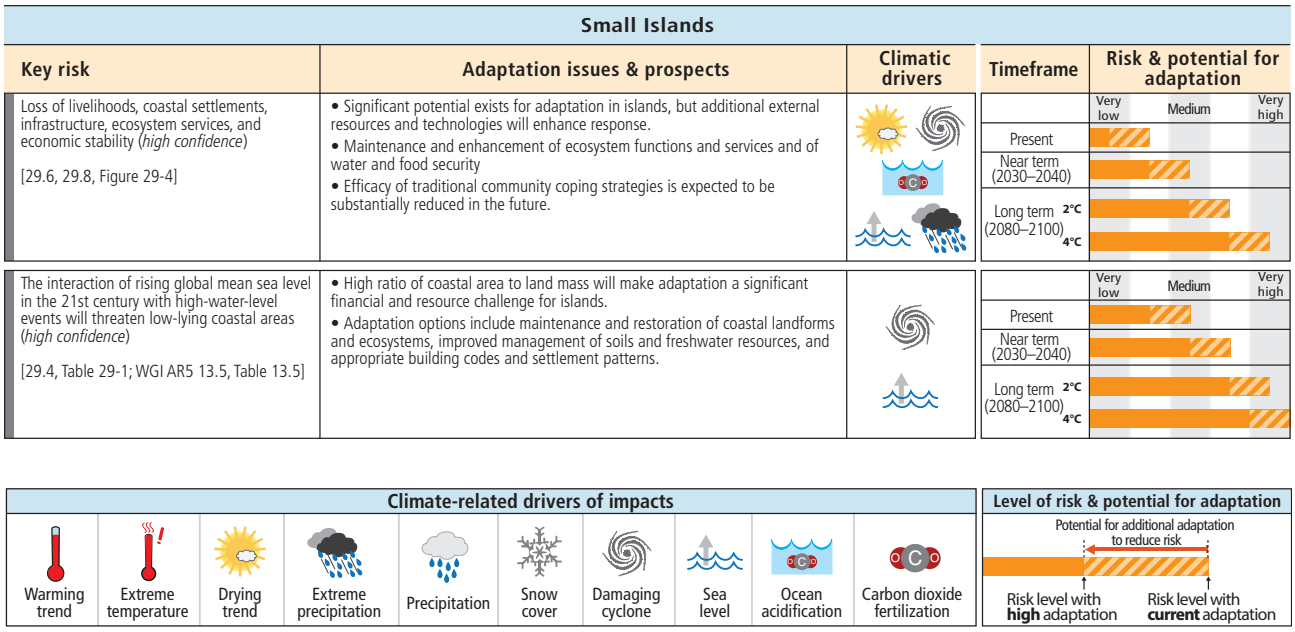
The diversity of the small islands, in terms of their geomorphology, culture, ecosystems and populations is reflected in their disparate vulnerabilities and adaptation requirements (Rasmussen *et al*., 2011). The summary of risks and adaptation for the Small Islands indicates multiple and varied climatic changes alongside some coping strategies. Increased drying is accompanied by cyclones, ocean acidification, extreme precipitation and SLR, threatening these low-lying areas and causing livelihood, settlement, infrastructural, ecological and economic damages. Adaptation approaches face critical resource and sustainability challenges, yet there is potential for maintenance of ecosystems and natural resources, which can be enhanced through technological application and external support (see Figure 3.7). In general, the Small Islands are viewed as

BOX 3.7. NEPAL'S FRAMEWORK ON LOCAL ADAPTATION PLANS FOR ACTION

Nepal has prepared a LAPA in order to implement NAPA priorities and help to integrate climate adaptation and resilience aspects in local and national plans. The premise of the LAPA is that local adaptation plans should be prepared and implemented in consideration of the sector and location, resource availability and distribution system, community access to public services and facilities, and region and areas affected by climate change. As such, the four guiding principles determine that a bottom-up, inclusive, responsive and flexible approach will be taken for integrating climate adaptation and resilience into local and national planning, and it is expected that the LAPA will provide the effective delivery of adaptation services to the most climate vulnerable areas and people. After piloting in 2010, the LAPA was adopted in 2011, making Nepal the first country to promote such a bottom-up approach to adaptation planning and implementation. The approach will support a range of activities from local to national-level planning, including to identify the most climate vulnerable at the local-level, alongside their adaptation challenges and opportunities; to find approaches that ensure local communities are responsible for decision making about their adaptation needs; to prepare and integrate LAPAs into local and national pans; to mobilise implementation agents and resources; to implement adaptation actions efficiently; to conduct monitoring and evaluation assessments of related activities; and to identify cost-effective adaptation alternatives for scaling up into local and national planning. The process involves cooperation and collaboration between local and national-level institutions to ensure both top-down and bottom-up processes are applied in the preparation of plans, through seven defined steps: 1. Climate change sensitisation; 2. Climate vulnerability and adaptation assessment; 3. Prioritisation of adaptation options; 4. LAPA formulation; 5. LAPA integration into planning processes; 6. LAPA implementation; 7. LAPA progress assessment. Ultimately, the LAPA framework seeks to ensure integration and implementation of climate adaptation and resilience actions into sectoral plans, programmes and projects, and to ensure that people, community and their resources are adaptive to climate change. This forward thinking strategy from Nepal has determined the country as a leader among the LDCs in identifying a proactive, effective and more sustainable approach to responding to climate change.

Government of Nepal, 2011

Figure 3.7. Climate Change Risks and Potential for Reducing Risks for the Small Islands



Source: IPCC, 2014b

being particularly vulnerable to climate change, already experiencing the impacts of SLR in particular. In the small island LDCs, coastal flooding is projected to incur a reduction of several percentages of the national GDP by 2100, due to annual damage and protection costs (Hinkel *et al*., 2013). Four of the Small Islands have been categorised as LDCs, to include Kiribati, the Solomon Islands, Tuvalu and Vanuatu, all of which are discussed below.

3.3.1 Kiribati

The impacts expected for Kiribati in tandem with the economic status of its population have ranked the country among the ten nations with the highest protection costs in relation to GDP (Tsyban *et al*., 1990). Kiribati is vulnerable to aquatic and terrestrial impacts. Natural resources from the sea are critically impacted by pollution, leading to high rates of Ciguatera fish poisoning (Chan *et al*., 2011) and coral bleaching, the latter of which causes high rates of coral mortality (Alling *et al*., 2007). This can be more effectively addressed through isolation of reefs rather than direct human interference (Donner *et al*., 2010; Gilmour *et al*., 2013). Shoreline changes are caused by SLR in the absence of protection structures (Rankey, 2011). Protection has been limited due to technical and financial barriers (Duvat, 2013), yet it is supported by sediment accretion in mangrove areas (Rankey, 2011). Socio-economic vulnerabilities are related to the management of urbanisation, land tenure, pollution, sanitation and health, in terms of increased incidences of malaria and dengue fever (Russell, 2009), alongside a lack of climate change knowledge, particularly amongst remote communities. Yet adaptation responses are challenged by barriers to community engagement and understanding, stemming from traditional beliefs and governance approaches (Kuruppu, 2009; Lata and Nunn, 2012). Moreover, attempts to enhance freshwater supply were contested by communities due to encroachment on traditional lands (Moglia *et al*., 2008a, 2008b). Further assessments of adaptation projects in Kiribati have been limited by a lack of baseline data.

3.3.2 Solomon Islands

The Solomon Islands are impacted by extreme cyclones and flooding events, which cause extensive damage and inundation. A cyclone in 2008 caused widespread submersion resulting in displacement and saline intrusion (Hoeke *et al*., 2013). Civil society in the Solomon Islands plays an important role in adaptation through community risk assessment, and the application of local knowledge, preferences and norms (Fazey *et al*., 2010). In rural areas, vulnerability is responded to through diverse traditional construction methods, ranging from the elevation of concrete floors to the building of low and aerodynamic houses (Rasmussen *et al*., 2009). Such traditional methods are perceived to provide more resilience, with a perception amongst some communities that houses constructed from modern materials and by modern practices are more vulnerable to tropical cyclones (Rasmussen *et al*., 2009). Traditional knowledge has also proven to be

Table 3.5. Small Islands LDCs and Regularity of Citation throughout the IPCC AR5 WGII

REGULARLY CITED	OFTEN CITED	SOMETIMES CITED	RARELY CITED	NOT CITED
	Solomon Islands	Kiribati Tuvalu Vanuatu		

useful in short-term weather forecasting (Lefale, 2010), though local capacity to observe long-term climate change has been questioned (Hornidge and Scholtes, 2011; Lauer and Aswani, 2010). Moreover, traditional approaches to farming and land use management have been effective in supporting food security under social and environmental change (Reenberg *et al*., 2008; Mertz *et al*., 2010). Here, community cohesion, effective leadership and collective action have strengthened resilience and contributed to the successful governance of the commons (Schwarz *et al*., 2011; Tompkins *et al*., 2008).

3.3.3 Tuvalu

In Tuvalu, high tides and subsequent flooding impact terrestrial systems (Yamano *et al*., 2007; Locke, 2009). Communities vulnerability is heightened through their tendency to settle in shoreline and swampland areas, a trend attributed to rapid development and population growth (Yamano *et al*., 2007). Aquatic impacts include high rates of Ciguatera fish poisoning (Chan *et al*., 2011). Tuvalu was ranked among the ten nations with the highest protection costs in relation to GDP (Tsyban *et al*., 1990). Economic support is gained from increased tourism rates (Farbotko, 2010; Prideaux and Mcnamara, 2012), though this can be environmentally destructive. Alongside financial pressure, it is indicated that cultural barriers, including traditional belief systems and a lack of urgency in climate responses, limit adaptation (Mortreux and Barnett, 2009). Similarly, it has been found that out-migration is not driven by perceptions of climate change (Mortreux and Barnett, 2009; Shen and Gemenne, 2011). In fact, a Pacific Access Category of migration has been agreed between New Zealand and Tuvalu that permits 75 Tuvaluans to migrate to New Zealand every year (Kravchenko, 2008), however, despite forecasts that the island could become uninhabitable, residents have remained for reasons of culture and identity (Mortreux and Barnett, 2009).

3.3.4 Vanuatu

Cyclones, coastal flooding and SLR are cited as significant impacts resulting from climate change in Vanuatu. These lead to inundation of low-lying settlement areas, causing community displacement (Ballu *et al*., 2011), and to damaged crops, transport facilities and infrastructure (Richmond and Sovacool, 2012). Livelihoods are also affected by high rates of Ciguatera fish poisoning (Chan *et al*., 2011). Tourism represents a particularly important source of income for communities in Vanuatu (Pascal, 2011; Laurans *et al.,* 2013), yet tourist operators give low priority to climate change adaptation (Klint *et al.,* 2012). In fact, rural tourism has increased levels of exposure to climate change impacts, as a result of carbon emissions resulting from diving activities. Community risk is exacerbated through a lack of awareness, particularly among remote communities, whose climate change knowledge often contrasts sharply with that of communities in major centres. In a study of the suitability of insurance for farmers as a risk management measure, researchers found that a lack of demand for insurance was reinforced by the resulting under-availability of suitable food insurance products (Angelucci and Conforti, 2010).

3.4 The Americas

The Americas are home to only one LDC; Haiti. As such, a generalisation of the region's risks and adaptation approaches can be misleading in this context. Instead, Haiti is discussed in isolation, though only one specific citation to Haiti is included in the IPCC AR5 WGII.

3.4.1 Haiti

The IPCC AR5 WGII indicates that Haiti is characterised as a country with substantial failures in governance. Past experiences have indicated such countries as facing great challenges in coping with extreme climatic events, or in supporting citizens to cope and adapt (Lautze *et al*., 2004; Ahrens and Rudolph, 2006; Menkhaus, 2010; Heine and Thompson, 2011; Khazai *et al*., 2011).

Discussion – The Portrayal of LDCs in the IPCC AR5 WGII

4

Examination of the LDCs in the IPCC AR5 WGII has revealed the current state of knowledge about the exposure of these countries to climate impacts, alongside the vulnerabilities this presents and the adaptation approaches being applied in response. Where referred to as a group, the IPCC report discusses the context of the LDCs and the processes through which LDCs seek support in responding to climate change as well as securing funding for such responses from the UNFCCC. The implications of impacts, vulnerabilities and adaptation options for LDCs as a whole is limited by being much generalised, with responses understood through national plans and international support for such plans, discussed on an aggregate level. The examination of individual countries offers a greater depth of understanding of the current state of knowledge for LDCs in relation to climate impacts, vulnerabilities and adaptation. It is apparent that LDCs share similar vulnerabilities, not only due to expected climatic impacts, but also as a result of the numerous compounding factors that heighten their vulnerability and reduce their coping capacity. Such vulnerabilities must be understood in tandem with the socio-economic context of each country. The report also indicates a range of positive and successful adaptation and response measures applied by the individual LDCs.

Though broad insights can be construed, the detail and extent to which the LDCs are discussed, highlighted and prioritised, is limited. There is much disparity between the amount of information provided for each individual LDC and between the regularity with which each LDC is referred to. Bangladesh represents the LDC most regularly cited and there is significantly more information available for this country than others. In fact, there is an entire lack of specific references to five of the 48 LDCs, namely Eritrea, Liberia, São Tomé and Príncipe, Sierra Leone and Timor-Leste. A comprehensive portrayal of each individual country is not provided. For instance, the information on Bhutan focuses solely on its coping mechanisms, while specific impacts and vulnerabilities are not mentioned. While these impacts and vulnerabilities can be deduced from discussions of the South Asia region in general, this under-emphasis in the IPCC report could reduce the recognition of the vulnerabilities of this country. Particular focuses for certain countries are apparent. For example, there is an emphasis on community participation in responses to climate change in the Solomon Islands; in gender inequality in vulnerabilities in Bangladesh and Malawi; in governance failures in Haiti, Somalia and Afghanistan, and alongside this, conflict for the latter two. This gives an indication of variable research trends between different LDCs. In addition, impacts and vulnerabilities are often highlighted through multi-country studies. By grouping multiple LDCs, these studies portray a surface understanding of impacts rather than a concise indication of individual situations. Though they provide interesting points for comparison, none of the multi-country studies featured in this IPCC report includes all of the LDCs and in fact, the Small Island LDCs and Haiti are not incorporated into any of them.

Disparity in the information available for extraction from the report may be due to the availability of quality and published data. For example, in Alison *et al.'s* (2009) study of fisheries, the lack of available data resulted in the exclusion of 60 nations from the intended analysis. This included the exclusion of many LDCs; Afghanistan, Benin, Bhutan, CAR, Chad, Djibouti, Equatorial Guinea, Eritrea, Lesotho, Liberia, Myanmar, Rwanda, Somalia, Kiribati, Sao Tome and Principe, Solomon Islands, Timor-Leste, Tuvalu and Vanuatu all had to be left out of this analysis. Similarly, the type and prominence of research available for certain countries may in part be a result of the context of each country. Instability in some LDCs, such as Haiti, Somalia or Afghanistan, may mean that in-country studies are difficult to conduct. On the other hand, experienced extreme events may draw the attention of researchers. For example, the severity of the drought and famine in Mali in the 1980's and the history of cyclones in Bangladesh is likely to have increased recognition of the need for research in these places. The quantity of information about Bangladesh included in the IPCC AR5 WGII report, in comparison to other LDCs, cannot go unnoticed. It may be due a greater amount of knowledge on Bangladesh being available, possibly due to its regular classification as the country that is most vulnerable to climate change. It follows that an understanding of the context of each individual LDC could provide insight into the research availability for that country. Shortfalls in research availability can give a distorted understanding of the situation for each country, and as such, for LDCs as a whole. Beyond the IPCC AR5 WGII report, inaccuracy or unavailability data in developing countries can lead to their lack of inclusion in the categorisation of LDCs (UN, 2008), as such disqualifying them for the support lent to such countries by operatives such as the GEF and WMO.

In gathering the individual country data together, the lessons drawn from each LDC can be considered for all LDCs in order to highlight issues of potential concern. Processes for ensuring that such lessons are extracted, disseminated and shared with other LDCs, and with institutions that can support them, must be carefully considered by the multi-level stakeholders looking to support LDCs. The same applies to the approaches employed for targeting the appropriate audience for these lessons. Comprehensive strategies for these approaches need to be formed. These least developed nations have been highlighted and categorised as being particularly vulnerable to climate change and other stressors. Moreover, they are understood to have reduced capacity to cope with such pressure. Considering this heightened exposure, reflection upon how developed countries, intergovernmental organisations and targeted support mechanisms are addressing the needs of the LDCs in the face of a changing climate, is crucial. To assist this, it seems necessary that more direct and comprehensive information about each LDC be provided in future IPCC reports.

Conclusion

5

Despite the need for more comprehensive data on LDCs in the IPCC report, what is clear is that these countries are very vulnerable yet are also addressing this vulnerability through various multi-scale processes. Coping capacity is exemplified within affected communities, and, moreover, national-level efforts to support such capacity are increasing. It is essential that these actions are monitored and assessed, and that lessons are highlighted and shared both with other LDCs who may be seeking similar responses, and with other national and external bodies that have the ability to lend some support to LDCs. Moreover, the relevance of the information in the IPCC reports for LDCs must be clarified and discussed within the report itself. South-south learning is crucial but not in isolation from global support, both financially and politically, and through increasing efforts to curb climate change through mitigation. The information provided in the IPCC must be translated into a format that is easy to digest by the community of interested stakeholders outside of this group of experts, to ensure that current knowledge is acted upon in effective ways, not only by policy makers, but by decision makers within wide-ranging institutes and at multiple scales. Moving forward, the production, availability and uptake of quality research from LDCs needs to be addressed and enhanced. This is to ensure that adequate knowledge about these countries is available in internationally recognised spaces and formats, to an international audience, to the experts responsible for authoring the IPCC reports and to all those responsible for transferring information to policy makers. Where quality research already exists, its uptake must be encouraged. More comprehensive, conclusive and accessible information regarding LDCs in the IPCC reports can aid this support and provide objective guidance for policy makers at national and international levels to ensure that the LDCs are more effectively aided in their response to climate change.

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Acronyms

AR5	Fifth Assessment Report
CBA	Community-Based Adaptation
DRR	Disaster Risk Reduction
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNI	Gross National Income
IPCC	Intergovernmental Panel on Climate Change
LAPA	Local Adaptation Plan for Action
LDC	Least Developed Countries
LDCF	Least Developed Countries Fund
NAPA	National Adaptation Programmes of Action
NAP	National Action Plans
NCCRS	National Climate Change Response Strategies
PPCR	Pilot Program for Climate Resilience
SLR	Sea Level Rise
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organisation
WGII	Working Group II

The Fifth Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change was released in 2014. It examines the impacts of climate change, inherent vulnerabilities and adaptation responses across the globe. The Least Developed Countries are identified as being particularly vulnerable to climate change due to economic and capacity barriers. This paper examines the LDCs within the IPCC report to highlight how climatic impacts, vulnerabilities and adaptation are portrayed for these countries. It illuminates a need for a greater focus on the LDCs by the IPCC and for further research concentrated on the LDCs in general, in order to enhance the state knowledge on LDCs and appropriately guide related policy.

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International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
email: info@iied.org
www.iied.org

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