

Poverty, Vulnerability and Climate Change in Ethiopia
Matt Baricevic
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University of Toronto

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SECTION 1 – Introductory Remarks

1.1 Introduction

The phenomenon of climate change is a significant problem with significant implications for the most poor and vulnerable actors in the global community. While a considerable amount of research has been directed at examining the concept of climate change, the study of the interaction between non-climate and climate related causes has not been explored as thoroughly. Research to support this linkage remains immature due to a lack of studies focused on the interaction between non-climactic and climactic causes of poverty in Ethiopia coupled with the question of how these two variables interact. The problem remains pressing and merits additional research because of its potential impact on the world's poorest and vulnerable. Research dedicated to examining this linkage will serve to provide evidence that will help reduce global socioeconomic disparity, and promote equality and human rights.

Subject

The subjects of this research paper are as follows: the nation of Ethiopia; non-climactic causes of poverty; climactic causes of poverty; vulnerability and poverty, and the nature of the interaction between non-climactic and climactic causes of poverty.

Variables

Poverty will be subdivided into the two following causal variables: climactic and non-climactic causes of poverty. Non-climactic causes of poverty will be further subdivided

into the following variables: arable land; deforestation; soil degradation; crop failure, and infrastructure.

Climactic causes of poverty will be subdivided into the following variables: food security and malaria.

Each of these two variables—namely, climactic and non-climactic—will be independently examined to determine their casual factors. Once this has been determined, the nature of the relationship between these two variables will be examined.

1.2 Statement of Research Purpose

The purpose of this research paper is to determine if the two variables of non-climactic and climactic causes of poverty interact. A fundamental question intrinsic to this paper is the nature of the interaction between climactic and non-climactic causes of poverty. I will argue that these two variables interact. I will assert that the variable of non-climactic causes of poverty renders Ethiopia vulnerable and exposed to climactic causes of poverty which further exacerbate poverty, vulnerability, and serve to reinforce a cycle of poverty in Ethiopia.

While many research studies have examined the negative effects of climate change, very few studies have noted the following distinctions: first, they have failed to explore the effects of climate change on the (LDC's) least developed countries—33 out of 48 being in Africa.¹ Second, they have not examined the effects of climate change on the most vulnerable populations in the LDC's. Third, few have examined an LDC as a case study by which to examine the negative effects of climate change. By exploring these three

factors, this study will operate within a context of associated studies and will provide an additional contribution to the literature pertaining to climate change.

1.3 Research Question: The goal of this paper is address the following two research questions: first, do non-climactic causes and climactic causes of poverty in Ethiopia interact? Second, if so, how do they interact?

1.4 Organizational Logic

The organization behind this paper is to examine how non-climate causes of poverty in Ethiopia and climate related causes interact and, if so, how they interact.

I will begin by examining the variable of climate change and its influence on global temperature change. The rationale behind this section is that the notion of global temperature change has often been contested. In order to reinforce the groundwork of my argument, I will use objective data to validate my assertion that global temperature change is a real process rooted into objective, scientific fact. This substation will serve to as the independent variable influencing climactic causes of poverty.

I will then offer definitions of poverty and vulnerability. The academic study of poverty results in a vast, interdependent set of considerations that span a variety of disciplines.

The purpose behind these definitions is to propose, and narrow down amongst a plethora of literature, a set of definitions that pertain to the academic scope of this research paper.

Following this, I will examine the nation of Ethiopia. An examination of the regional context and historical evolution of the country will provide a contextual introduction.

I will then individually advance causes of poverty in Ethiopia independent of climate change. They will be subdivided into the following variables: arable land; deforestation; soil degradation; crop failure, and infrastructure. I will use these variables to advance my assertion that non-climactic and climactic causes of poverty interact. I will argue that these non-climactic causes of poverty result in vulnerability to the negative effects of climate change.

I will then advance causes of poverty in Ethiopia dependent on climate change. I will use the data presented alongside the two variables to assert that climate and non-climate causes of poverty in Ethiopia interact. I will argue that climactic causes of poverty—global temperature increases, food shortages, and vector borne diseases—in particular, malaria—weaken resilience, adaptive capacity, exacerbate vulnerability which leads to greater poverty. I will argue that climactic causes of poverty are provided an opportunity—manifested through non-climactic causes of poverty and vulnerability—to interact and further perpetuate a negative cycle of poverty.

SECTION 2 - Climate Change and Poverty in Ethiopia

2.1 A Case For the Independent Variable of Climate Change.

The scientific body, known as the Intergovernmental Panel on Climate Change (IPCC) has stated in its 2007 report that “warming of the climate is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising.”² Emissions of greenhouse gases and aerosols due to anthropogenic activities continue to change the atmosphere in ways that are expected to alter the climate.³

The global average surface temperature has increased over the 20th century by about 0.6°C.⁴ Concentrations of atmospheric greenhouse gases and their radiative forcing have continued to rise due to anthropogenic activities.⁵ Global average temperature and sea level are projected to rise under all IPCC SRES scenarios.⁶ Natural factors have made minor influences to radiative forcing over the past century.⁷

Anthropogenic factors will continue to alter atmospheric composition during the course of the 21st century.⁸ The concentration of atmospheric CO₂, increased from roughly 280 ppm in 1750 to 379 ppm in 2005.⁹ This translates into an increase of roughly 99ppm of atmospheric CO₂ in 255 years. This upsurge is particularly startling when it is noted that the concentration of atmospheric CO₂ increased only 20ppm over the past 8000 years before industrialization.¹⁰ Solomon et al have found that climate change that occurs due to increases in CO₂ concentration is largely irreversible after emissions cease.¹¹

The acceleration of these emissions continues to grow: world CO₂ emissions (metric tons per capita) have risen since 1960, when 3.1 metric tons per capita in emissions was recorded.¹² World CO₂ emissions steadily grew and reached their highest point in 1979, when 4.5 metric tons in emissions was recorded.¹³ This number remained unsurpassed until 2004¹⁴. In 2008 emissions grew to 4.8 metric tons—the largest CO₂ emissions figure on record.¹⁵ The trend in this data strongly suggests is that CO₂ emissions will continue to increase. It is predicted that a level of 550 ppm could be reached by 2035—a temperature increase of 2 degrees Celsius is predicted to accompany this level when it is reached.¹⁶

2.2 Climate Change and its Influence on the Variable of Global Temperature Change.

Climate change is affecting global temperature change. An increase in temperatures during the past four decades in the lowest 8 kilometers of the atmosphere has been documented by the IPCC.¹⁷ Snow and ice cover has decreased while global average sea levels have increased.¹⁸ 1998 and 2005 were the warmest years since recordkeeping began in 1850.¹⁹ 11 of the 12 years 1995 to 2006 shared the distinction of being among the warmest years since 1850.²⁰

As the mean annual temperature increases, the Horn of Africa will grow more vulnerable to drought and the ensuing risk factors for famine. It is predicted that climate change will intensify droughts.²¹ A study, conducted by Fischer and others, has predicted that the land suitable to grow wheat will disappear by 2080.²² These risk factors point to rising

incidences of famine, a decline in GDP, and worsening health. The developing world holds over a hungry billion people, 1.6 billion without access to electricity, and 1 in 4 living in extreme poverty.²³ These effects on health will only grow worse as the planet warms.

The countries of Sub-Saharan Africa remain overly reliant on their precarious natural resources. While the population of Africa is one seventh of the world's population, figured at slightly over a billion people, it is responsible for only 4% of carbon emissions.²⁴ Africa remains the most vulnerable continent to the effects of climate change in the world.²⁵ Roughly 67% of the land mass of Sub Saharan Africa is composed of arid land or desert.²⁶ Rainfed agriculture employs 70% of the population and contributes 23% to its GDP.²⁷

SECTION 3 - Definitions of Poverty and Vulnerability

3.1 Poverty

According to *A Dictionary of Sociology*, poverty is defined as a “state in which resources, usually material but sometimes cultural, are lacking.”²⁸ The dictionary, as well, notes that it “is common to distinguish between absolute and relative definitions of poverty.”²⁹ “The distinctive feature between these two designations is found in reference to a particular *state* of poverty.

Definitions of absolute poverty lend themselves to underdeveloped countries due to the fact they measure poverty in terms of subsistence levels. When income is used as a measure of the poverty line, it is apparent that individuals are unable to meet a basic necessities required to achieve subsistence.³⁰

In 1995, at the World Summit on Social Development in Copenhagen, 117 countries convened and to set forth a plan of action to eliminate absolute and lessen overall poverty. Absolute poverty was defined as “a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services.”³¹ Persons living in conditions of absolute poverty cannot fulfill these elementary physical needs.

In his presentation entitled, *Indicators of Poverty & Hunger*, David Gordon lists 8 measures of severe deprivation of basic human relating to absolute poverty—it must be noted that, although such criteria applies to children, it may be, as well, readily applied to adults. The absolute Poverty threshold is equivalent to 2 or more, out of 8, severe deprivations of basic human need. The eight basic human needs are listed as follows:

1. Food
2. Safe drinking water
3. Sanitation facilities
4. Health
5. Shelter
6. Education
7. Information
8. Access to services

Definitions of Inequality

A suitable definition of inequality is reliant on its purpose.³² The requirements of this paper necessitate a definition of international global inequality, defined as “*between-country inequality*, which is inequality among individuals in the world with each individual assigned the average per capita income of his or her country of residence.”³³

How is Poverty Measured?

Poverty will be measured using two poverty headcount ratios: the first will measure the percentage of the population living on \$1.25 per day—it must be noted that the World Bank uses this indicator to measure extreme poverty.³⁴ The second will list the percentage of the population living on less than \$2 a day. According to World Bank Data on Ethiopia, in 2005, the percentage of the population living on less than \$1.25 a day at 2005 international prices was listed at 39.0%³⁵. In the same year, the percentage of population living on less than \$2 a day was listed as 77.6%.³⁶

3.2 Vulnerability to Climate Change

In its publication, *Methods of assessing Human Health Vulnerability and Public Health Adaptation to Climate Change*, vulnerability to climate change is defined by the IPCC, within a framework of global climate change as: “the degree to which individuals and systems are susceptible to or unable to cope with the adverse effects of climate change, including climate variability and extremes”³⁷

The ability for a population to adapt is implicitly related to vulnerability. Climate change stresses adaptive capacity and institutional coping mechanisms: “most institutional coping mechanisms include emergency aid, credit services, safety net, water distribution, awareness raising on saving and use of technology”³⁸. If a population is unable to alter or cope with these projected increases it is therefore vulnerable. A population’s political, economic and geographical position determines its vulnerability.³⁹ Countries that bear the distinction of being underdeveloped are disproportionately vulnerable to the physical effects of climate change.

3.3 Poverty and Vulnerability

Vulnerability is often determined by poverty. The nature of poverty is that it is interdependent and does not function within a vacuum. Yet, in many instances, it is measured solely in singular terms of income, literacy, or access to health care.⁴⁰ It remains that studies of vulnerability, interrelation and interdependence are often overlooked.

One of the strongest determinants of vulnerability is adaptive capacity, which is significantly influenced by a nation's level of wealth. Adaptive capacity, in turn, is defined as the ability to “adjust to potential damages, to take advantage of opportunities and to cope with the consequences.”⁴¹ It can, as well, be both anticipatory and responsive.⁴² The required resources, critical institutions, human capital, social capital and information management capacity⁴³ necessitated to effectively respond are intertwined with a country's wealth. The ability to adjust and cope with the physical effects of climate change is dependent on the accessibility of services and resources that are routinely provided by the state in developed nations. Such resources, in turn, are dependent on a nation's level of economic development.

Resources such as water infrastructure, roads, medical clinics, labor, education and information services are all dependent on state funding which is intertwined with the economic capacity of a nation. A developed nation will possess the economic capacity to offer services and resources in response to the physical effects of climate change; an underdeveloped nation like Ethiopia does not share such a distinction. Its adaptive capacity is constrained by poverty, which strongly constrains the ability to utilize such options, and effectively anticipate and react to the negative effects of climate change.

Vulnerability further determines the likelihood of falling into, or worsening the present state of poverty—a lack of capital results in a lack of resources.⁴⁴ Exposure to the negative effects of climate change results in the lessened ability to cope, adapt, remain resilient, and further reinforces the cycle of poverty. The resources that are needed to

meet the challenges presented by the negative effects of climate change are determined by a population's economic state.

3.4 Interactions between Poverty and Vulnerability

Climate Change will further exacerbate vulnerability and poverty. The key aspect behind this interaction is the following: preventable drivers of poverty—such as a lack of food security and malaria—are provided the opportunity to manifest themselves because a country does not possess the resources to anticipate and respond to these effects. Due to the fact that Ethiopia remains underdeveloped, it cannot sufficiently adapt, nor react, to these drivers of poverty in the same capacity as a developed nation.

This interrelatedness between poverty and vulnerability, in relation to underdeveloped countries, for example, is illustrated through a study of sub-Saharan Africa conducted by McNeil in 2000. McNeil arrived at the consideration that malaria “reduced annual rates of economic growth by 1 percentage point over the period 1965-1990. As a consequence, the present level of economic output in Sub-Saharan Africa is 25 percent lower than it would have been if malaria had been eradicated in 1965.”⁴⁵ A developed country possesses the economic capacity to anticipate and respond to negative drivers such as food insecurity and malaria stemming from climate change—an underdeveloped country does not possess this capacity. It falls victim to the same drivers a developed country can counteract because of its infrastructural capacity.

SECTION 4 – Ethiopia

4.1 Regional Context of Ethiopia

The United Nations Statistics Division states that the designation of Sub-Saharan Africa is frequently used to designate all of Africa except Northern Africa.⁴⁶ The Food and Agriculture Organization of the United Nations has defined the countries inhabiting the Horn of Africa as Djibouti, Ethiopia, Kenya, Somalia, and Uganda.⁴⁷

4.2 Historical Evolution of Ethiopia

Many academics attribute the starting point of the modern history in Ethiopia to the reign of Tewodros II in the 19th century. It was during this period that Tewodros II reunited the country and worked to reinstate power to the throne.⁴⁸ In 1896 the Italians attempted an invasion yet were defeated by the emperor Menilek II. The Ethiopian emperor allowed the Italians to retain the frontier province facing the Red Sea which they named Eritrea.⁴⁹ Menilek II provided armies to overthrow the southern highlands and lowlands resulting in the present nation state of Ethiopia.⁵⁰ It must be noted that Menilek's reign provided an avenue for Western influence and technology.

The Italians returned and colonized the country from 1936 to 1941. Following the end of the Second World War, the Ethiopian emperor, Haile Selassie attempted to introduce public education and various other reforms. The perceived sluggish speed of the reforms, however, resulted in widespread discontent and an attempted coup occurred in 1960.⁵¹ A successful mutiny transpired in 1974, which resulted in the collapse of the imperial government. A group of junior military officers, known as the Derg, assumed power in 1974 and ruled the country for 17 years. In 1977 Somalia attempted to conquer the

southeast lowlands which contained a significant portion of Somalis; however, combined Soviet and Ethiopian action frustrated their efforts. The Tigray People's Liberation Front and other resistance groups worked to form the Ethiopian People's Revolutionary Democratic Front, a multi-party democracy, leading to the breakdown of the Derg in 1991.⁵² The country's constitution was created and ratified in 1994 and provides for a parliamentary form of government.⁵³ Although Ethiopia has become gradually more stable in contrast to its previous history, Ethiopia and Eritrea waged war over a common border from 1998 to 2000.

4.3 Governance of Ethiopia

The U.S Department of State has defined Ethiopia's human rights record as poor.⁵⁴ Police have illegally detained protesters, political opposition, and restricted freedom of assembly. Privacy rights are regularly ignored; children are forced into labor, and women are often assaulted.⁵⁵ Although the judiciary is developing, rights afforded under the constitution are frequently overlooked and administrative functioning is hampered by a lack of funding.⁵⁶ The government has a history of restricting press freedoms; radio and television operate under government control.⁵⁷

SECTION 5 - Causes of Poverty Directly Related to Climate Change

5.1. How Does Climate Change Influence the Variable of Food Security?

A study conducted by the International Food Policy Research Institute (IFPRI) has arrived at the conclusion that both human welfare and agriculture will be unfavorably affected by climate change.⁵⁸ The vice president of sustainable development for the World Bank has stated that the yield of food in Africa could decrease by nearly 50% in the coming 20 years.⁵⁹

The consensus amongst the scientific community is that Africa remains the most exposed and vulnerable continent in relation to climate change.⁶⁰ Increasing climatic disasters coupled with an expected increase in the global climate has rendered the Horn of Africa vulnerable to the effects of climate change. Climate change will ultimately threaten the developmental gains seen in the Horn of Africa and the continent as a whole.⁶¹

The looming threat of climate change in relation to development is notable when Sub-Saharan poverty statistics are examined: life expectancy is now lower than 30 years ago.⁶² Average income, in real per capita terms, is lower now than it was at the end of the 1960s.⁶³ One African in four has access to electricity and one in five lives in a country affected by conflict.⁶⁴ As the effects of climate change are added to this already precarious mix, the end result is that the position of the world's most poor and vulnerable will be further marginalized.

The scientific community has issued the following projections pertaining to Central and Eastern Africa: the region will be warmer by about 1 degree Celsius by 2030 and by about 2 degree Celsius by 2050.⁶⁵ Climate change will diminish the capacity of natural drivers that support agriculture. It will also experience rain variability and an escalation in the degree of extreme rainy and dry seasons. An increase in temperature will require more water for plants⁶⁶—a problem exacerbated during an extreme dry season or times of drought. An increase in temperature will force crops to grow and ripen at a faster rate that will decrease their productive yield.⁶⁷

The poor are heavily reliant on climate sensitive industries such as fishing and agriculture.⁶⁸ The primary method of livelihood for the rural poor is derived from rainfed agriculture. It employs 70 percent of the population and contributes to 30 percent of the GDP.⁶⁹ Although expected rainfall changes are less reliable than forecasts of temperature, decreases are expected in the Sahel and southern Africa.⁷⁰ The temperature in Africa is likely to increase by 1.5 to 4°C this century.⁷¹ It follows that an expected increase is larger than the global average and will herald an increase in extreme weather related events. This will translate in reduced livestock productivity, reduced crop productivity, and drinking water shortage.⁷²

Greater vulnerability to the effects of climate change is shaped by socioeconomic status and civil discord. Africa and, in particular, Sub-Saharan Africa has been marred by conflict. This has resulted in precarious state fragility and the inability to provide adequate provisions for its citizens. Cascading effects resulting from climate change will

further exacerbate these issues: mass migration will increase, as will social strife and conflict, resulting in the fragility of the state and the exacerbation of inequality⁷³

A significant portion of the African populace is reliant on land resources.⁷⁴ Overgrazing has worsened its suitability and forests are being cut in favor of land inappropriate for permanent agriculture.⁷⁵ Such land mismanagement has resulted in estimates that 67% of the entire region of Sub-Saharan Africa has been exposed to land degradation, with roughly 25% rated severe to very severe.⁷⁶

82% of Africans live in rural areas.⁷⁷ It follows that agriculture is a sector that plays a significant role in the economy of Africa and the day-to-day lives of its citizens.

However, agriculture is also extremely vulnerable to climate change. Sub-Saharan Africa, in contrast to other World Bank Regions, currently possesses extraordinarily low agricultural productivity rates.⁷⁸ As global temperatures grow warmer and as more severe climatic incidences are expected to arrive, this precarious level of agricultural productivity will further decline. These effects are compounded in light of preexisting poor soil erosion and nutrient depletion stemming from a disregard of the agriculture sector.⁷⁹ The mining of soil nutrients has altered roughly 75% of Africa's farmland.⁸⁰

Climate change will further compound these preexisting vulnerabilities and will render those who inhabit the world's poorest continent yet poorer. Although agriculture is implicitly related to economic growth and the lessening of poverty rates⁸¹, it also remains extraordinarily vulnerable to the effects of climate change. Current trends indicate that

climate change will significantly affect the agriculture sector. The IPCC has stated that, globally, the land demarcated as dry is thought to have increased by roughly 50% since the 1970's. Due to the effects of climate change, it is expected that, by 2020, between 75 and 250 million Africans will be vulnerable to growing water stress. It is inevitable that economic growth will be curtailed and poverty rates will only grow more significant. All of these drivers point to a growing incidence of drought and malnutrition, significantly affecting both grain and livestock production.

40% of Central and Eastern Africa's GDP is derived from agriculture. The vulnerability of this dryland region to the effects of climate change, in relation to other parts of the world, is nearly uncontested. According to the IPCC, the temperature in Western and Central Africa will increase by 3.2 degrees Celsius.⁸² Crop production will be negatively affected due to variable rainfall, coupled with extreme projected climatic events, that will compromise water and nutrient availability.⁸³ The UNDP has stated that one incidence of drought will increase poverty by 12% to 14% and will lower GDP by 7% to 10%.⁸⁴ The region of Central and East Africa has recorded famines and severe droughts in 1973-74, 1984-85, 1987, 1992-94, 1999-2000, 2005-2006, and 2010-11.⁸⁵

A recurring theme running throughout the literature on climate change and Ethiopia is that little is known about its vulnerability to the physical effects of climate change. This may be readily attributed to a lack of literature on the topic. By 2008 the government of Ethiopia had not drafted a specific strategy for addressing climate change and was in the process of enacting a response in 2009.⁸⁶

The consensus amongst the IPCC is that climate change will increase average temperatures, resulting in “dry places getting drier and wet places getting wetter.”⁸⁷ As the science of climate modeling has increased in precision and capability, the projections of food security in vulnerable regions have grown more troubling. The already arduous task of attaining food security will, according to the new models, become increasingly compounded by the looming presence of climate change. The common consensus amongst members of the scientific community is that “countries in temperate and polar regions will enjoy increased agricultural production, while countries in tropical and subtropical regions are likely to suffer agricultural losses.”⁸⁸

An analysis of the 46 poorest countries has noted that food production, per capita, has fallen by 10% in the past 20 years.⁸⁹ Climate change spells significant consequences for the region of Africa. Per capita food production and agricultural yields have been declining while growths in the population will double the need for the basic necessities of life, such as food and water, in the next 30 years.⁹⁰ In 2002, the World Bank Data Bank listed Ethiopia’s population as 69,040,669; it is listed as 82,949,541 in 2010.

Models have forecast lower rainfall and higher average temperatures in semi arid regions.⁹¹ They have, as well, noted the increase in the likelihood of El Nino Southern Oscillation (ENSO) events, noting more constant and concentrated events since the mid 1970s.⁹² What remains significant is that, for the past 200 years, ENSO events have been correlated with all weather related famines in the occurring in the Horn of Africa.⁹³

If the very concept of food security is about “adequate access to food, which can be acquired through trade as well as production,”⁹⁴ the presence of climate change will

further undermine the adaptive capacity of vulnerable populations to obtain food. The countries depending the most on agriculture are also the ones that are most vulnerable to the physical effects of climate change. In addition, they also possess the fewest alternative means for income and the fewest options for alternative measures. Their dependence on natural resources makes them the most exposed to the physical effects of climate change. Wealthier countries possess the adaptive capacity to deal with the physical effects of climate change and may benefit from increased agricultural yields.⁹⁵ The incidence of falling harvests due to the effects of climate change will pose considerable challenges for these vulnerable populations. Furthermore, food prices will increase as a result of decreasing domestic food production.⁹⁶

Crop production that is primarily rainfed is the foundation of all subsistence farming in the vast majority of Ethiopia, accounting for nearly all of the land area cultivated per year.⁹⁷ The primary method of cultivation regarding food crops is done by the means of traditional farming. Causes of inferior crop production are “declining farm size; subsistence farming because of population growth; land degradation due to inappropriate use of land.”⁹⁸ However, one significant source of substandard food production is the problem of drought, which often contributes to famine. In her case study of Northern Ethiopia, Elizabeth Meze – Hausken has noted that the link between rainfall failure and cultivated productivity is undisputable.⁹⁹ Climate related disasters therefore make Ethiopia reliant on food aid.¹⁰⁰

Another vulnerable Ethiopian sector affected by climate change is livestock. Ethiopia possesses the 10th largest population of livestock in the world and the largest in Africa.¹⁰¹ This sector is responsible for 12% to 15% of its total GDP and contributes 25% to 30% to

its agricultural GDP.¹⁰² The ongoing problem of drought, coupled with anthropogenic desertification, has expended considerable portions of land area and makes water resources even more vulnerable. Recurrent drought, therefore, is one the primary constrictions to this sector.¹⁰³

According to the country's National Adaptation Programme of Action, climate change will result in fluctuations in precipitation patterns, rainfall variability, and temperature. These subsequent changes could increase the probability of floods and droughts.¹⁰⁴ Variability and intensifications of droughts and heavy precipitation diminishes agricultural yields which, in turn, undermine food security.¹⁰⁵ The World Bank has indicated that these negative events will increase the probability of food shortages and inhibit economic growth.¹⁰⁶

5.2 How Does Climate Change Influence the Variable of Malaria in Africa?

In 2008, the Ethiopian Federal Ministry of Health stated that malaria was the leading cause of mortality and morbidity in the country.¹⁰⁷ It remains widespread in 75% of the country with 50 million individuals now at risk.¹⁰⁸ As of 2010, malaria accounts for 20% of child deaths in the country.¹⁰⁹ Although an effective means for addressing the disease is education, only 38.2% of women, for example, living in malaria susceptible areas employ mosquito nets as means to reduce transmission rates.¹¹⁰ Although such preventative efforts are promising, it remains that, as the Ministry of Finance and Economic Development (MoFED) has noted, climate shocks continue to frequently contribute to outbreaks. The return of more climactic incidences stemming from climate

change could further amplify outbreaks of malaria. As a result, the MoFED has recommended that the Government of Ethiopia note the impact of climate change.¹¹¹

Temperature is a major factor in relation to the risk of vulnerability to malaria.¹¹²

Parasites within the mosquito are extremely sensitive to temperature so that climatic factors remain determinants.¹¹³ This fact is particularly troublesome in light of Ethiopia's population distribution. Although Ethiopia's hot zone composes over 50% of its landmass, only 11% of the population resides in this region.¹¹⁴ The majority of the population, roughly 75%, reside 1500 to 2400 metres above sea level; Roughly 14% resides in altitudes of 2400 metres above sea level.¹¹⁵

A significant number of Ethiopians continue to live in the highlands, reflecting long standing and well entrenched cultural preferences.¹¹⁶ The acute concentration of the population presents notable problems for Ethiopia. The National Meteorological Association has stated that climate change is expected to bring about the advancement of malaria from the lower altitudes of Ethiopia, notably the Afar region, and Somalia to the higher altitudes of Tigray and Amhara.¹¹⁷ This projection is particularly troubling in light of the fact that 80% of the population resides in the highlands which cover 45% of the nation.¹¹⁸

It remains that altitude is one of the greatest and most tested defenses against malaria.¹¹⁹

As early as the 16th century, the Spanish arrived at the conclusion there was nearly no malaria at altitudes in the New World.¹²⁰ Many Ethiopian farmers situated in the lowlands still flock to the highlands until the malaria season has concluded.¹²¹ However, the IPCC has arrived at the consideration that the mean temperature of the Earth's surface

will increase by roughly 1 to 3.5 ° C in the coming century.¹²² It must be noted, as well, that higher local temperatures can result over a shorter period of time from the effects of deforestation, resulting in surface temperatures rising from 3 to 4 ° C.¹²³ A linkage has been made between the increase in annual temperatures in the Usamabara Mountains in the United Republic of Tanzania and increasing malaria.¹²⁴

After malaria is introduced into a highland region it begins to manifest as a result of agroforestry development.¹²⁵ Malaria breeding occurs in little sun-drenched puddles that are often formed as a result of human activity.¹²⁶ A considerable portion of the African highlands is forest covered; however 8% of highland forests have been cleared, largely for the cultivation of crops, between 1981 and 1990, providing an ideal breeding ground for mosquitoes.¹²⁷ Deforestation was considered to be a significant casual factor in the increased malaria in the Usambara Mountains in Tanzania.¹²⁸

It is difficult to conclusively state that malaria epidemics are occurring in the region. However, there remains strong evidence that endemic malaria is a growing issue in Ethiopia.¹²⁹ Climactic factors serve as the casual factors for the increase in malaria. Breeding grounds for mosquitoes are dependent upon rainfall; an increase in temperature increases parasite development and the mosquito's survival rate.¹³⁰ Recent studies have demonstrated increasing temperatures will likely raise the highland's vulnerability in terms of both continental and national scales.¹³¹

Although climate change is a relatively new phenomenon, The Fourth Assessment Panel of the IPCC has arrived at the conclusion that climate change has started to influence human health. An increase in temperature affects pathogens and vectors.¹³² Recent

studies have noted the association between short-term climactic change in Columbia and Venezuela with the ENSO cycle.¹³³

In 1994 The World Health Organization (WHO) estimated that 41% of the global population is at risk of malaria.¹³⁴ Climate change will serve to increase the transmission rate of malaria. A 14% increase in cases of malaria, exposing 90 million people, is expected by 2030.¹³⁵ Rising temperatures are increasing the transmission of malaria, which remains Africa's leading killer, to alarming levels.¹³⁶

Malaria is a disease that remains extraordinarily sensitive to climate. Current research seems to suggest that the transmission of malaria is being increased through climate change. Research groups have begun to publish studies which demonstrate how climate change will affect the transmission of malaria. Studies modeling seasonal changes in transmission have noted a 16–28% increase in person – months of exposure to malaria in Africa by 2100.¹³⁷ Another study, based on biological models, states there may be a global increase of 260 to 300 million people in 2080 who inhabit a potential transmission zone—representing a 2% to 4% increase in the number of people at risk for malaria.¹³⁸ A further study examining malaria's altitudinal reach, has suggested a 5% to 7% increase in malaria distribution in Africa by 2100.¹³⁹ A projected increase in temperature change will have drastic repercussions for those who it targets most severely. 75% of the estimated 700,000 to 2.7 million people who die each year from this disease are African children.¹⁴⁰ The World Bank has stated that warmer temperatures stemming from climate change have already altered the transmission capabilities of vector borne diseases in Ethiopia. In 2003, 16 million cases of malaria were identified, an increase of 6 million

more than average.¹⁴¹ The migration of malaria vectors to highland areas is a significant risk factor. Minor displacements in the geographical distribution of malaria in Ethiopia will expose millions more to infection.¹⁴²

SECTION 6 - Causes of Poverty in Ethiopia Independent of Climate Change

6.1 Poverty in the Region

Sub-Saharan Africa continues to face many significant problems and challenges as it enters the twenty first century. The Food and Agriculture (FAO) organization of the United Nations has stated it is the only region in the world expected to herald an upsurge in poverty.¹⁴³ The region noted an upswing in poverty from 184 million in 1985 to 216 million in 1990.¹⁴⁴ It must be noted that the World Bank classifies Ethiopia as the second most populous nation in Sub-Saharan Africa.¹⁴⁵ In 2009, average life expectancy is listed as 58 years in Ethiopia. The World Bank's country brief registers Ethiopia as one the poorest nations in the world. Its per capita income, US\$380, is significantly lesser than the average Sub-Saharan per capita income, at US\$1165.¹⁴⁶ In 2005, 81.80% of the urban Ethiopian population was listed as living in slums.¹⁴⁷

The FAO has stated that the root causes of poverty in Sub-Saharan Africa may be traced back to negative external conditions such as external debts, unequal trade practices, and structural adjustment programs.¹⁴⁸ Domestic conditions, such as internal strife, unstable political institutions, inefficient agricultural practices are also significant factors that contribute to poverty.¹⁴⁹

6.2 Causes of Poverty in Ethiopia Independent of Climate Change

The Government of Ethiopia's report: *A Plan for Accelerated and Sustained Development to End Poverty* (PASDEP) contains many policy changes needed to decrease poverty. Although the study is comprehensive in nature, it does not arrive at a

structured account of poverty—in fact, much of the existing literature does not provide a general account of the root causes of poverty. However, the researchers Philippa Bevan and Alula Pankhurst have examined the report and organized causes of poverty into clusters¹⁵⁰. Their account will provide the groundwork for a description of poverty in the country.

Although many definitions of poverty exist, it may be reasonably inferred that poverty is an interconnected process. A conventional analysis of poverty (i.e. one based on a monetary standpoint) views poverty in relation to command over commodities.¹⁵¹ It is considered the inability to reach the lowest possible threshold based on income. Another perspective is based on the capacity to function in society—the poor are viewed as deficient in terms of key capabilities. These definitions, however, are too limited for a country as complex as Ethiopia. It follows that this section will focus on the natural, and infrastructural, causes of poverty.

6.3 How Does Ethiopia Generate Wealth?

85% of the population depends on agriculture both as a source of livelihood and employment.¹⁵² Agriculture contributes to roughly 50% of its GDP and provides for 88% of its export earnings.¹⁵³ Rain fed agriculture remains the primary factor in relation to food security.¹⁵⁴

Coffee accounts for a significant portion of Ethiopia's export earnings. According to the IMF, in 2005, coffee attributed for contributing 41 per cent of total foreign exchange earnings.¹⁵⁵ Coffee serves to sustain the livelihoods of more than one million coffee

growing households¹⁵⁶; it is estimated that 15 million people are dependent on the crop for their livelihood.¹⁵⁷

6.4 Who is Poor in Ethiopia?

In the paper *Essays on Poverty, Risk and Consumption Dynamics in Ethiopia*, rural and urban Ethiopia was examined in relation to poverty and income distribution. It was found that 65% of overall inequality was attributed to rural areas due to the following considerations: access to market; difference in location; extent of land; dependency ratio in the household; and age in the household.¹⁵⁸ However, in urban areas, 49% of inequality was linked to educational and occupational disparity. It was found that, in light of these considerations, structural factors were the main contributors to inequality within the country and the difference between rural and urban populations.¹⁵⁹ Structural factors are defined as those that were considered “deep seated” and served as the roots of poverty found in the form of drought, disease and unfavorable conditions of trade.

It was also found that rural areas were considered more vulnerable, in that they were more likely to re-enter conditions of poverty in comparison to their urban counterparts.¹⁶⁰

Rural households were more likely to be poor if they were headed by women, by individuals who had not finished primary school, were far removed from town, and were deficient in land resources.¹⁶¹ The defining variable in relation to urban households, however, was education: the degree of education the head of the household possessed was correlated to poverty rates.¹⁶²

6.5 Causes of Poverty: Arable Land, Deforestation, Soil Degradation and Crop Failure

Material causes refer to the physical and human resources utilized to provide a means of livelihood. These variables strongly affect the level of poverty within the country. A lack of arable land, notable increases in population, coupled with a lack of jobs at the manufacturing and service level, has resulted in significant stress placed on Ethiopia's land and forest resources.¹⁶³ This issue is especially pronounced in light of the fact that land degradation caused significant deficiencies in food and famine in 1973 and 1984.¹⁶⁴

As the population of Ethiopia increased, more crop and forest areas were required to provide for the increasing needs of the population. Yet, as the process of deforestation was conducted, nearly no attention was paid to sustain the vegetation cover nor was an effective reforestation program implemented.¹⁶⁵ The consequence of such practices is that the land is now more predisposed to air and water erosion.¹⁶⁶

Soil degradation, as well, can be attributed to livestock. Vegetation cover deteriorates as animal hooves graze over the vulnerable surface soil.¹⁶⁷ This process also results in vegetative residue, which causes severe air or water erosion.¹⁶⁸

The annual level of rainfall in semiarid zones is sufficient to produce crops twice a year.¹⁶⁹ However, the soil in semiarid areas does not retain water efficiently and remains low in organic matter content.¹⁷⁰ As a result, crops remain under the constant threat of losing their supply of water. In addition to these factors, much of the soil in Ethiopia has low fertility.¹⁷¹

6.6 Infrastructure

Access to economic infrastructure is severely limited. Many roads are incapable of handling the elements of weather and few feeder roads exist.¹⁷² In 2007 the country had 1 passenger car (per 1000);. The rural poor have limited access to markets and public services.¹⁷³ For instance, the average length to basic postal or transport services ranges from 20 to 26km.¹⁷⁴ Ethiopia's internet users number 0.75 per 1000. Its telephone lines (per 1000) were listed as 1.0957 in 2010.

As well, health infrastructure remains significantly underdeveloped. Average health care units are in short supply in the continent as a whole. There is one health station per 8000 in Africa.¹⁷⁵ In rural Ethiopia there is one unit for every 23000 and a health centre for close to 300000 people.¹⁷⁶ The distance to the closest health facility is roughly 10 km.¹⁷⁷

According to the World Health Organization, communicable health diseases remain a pressing concern for the country, with 60 to 80% of health problems being attributed to infectious and communicable diseases.¹⁷⁸ Ethiopia's adult HIV prevalence was considered to be 2.2% in 2008¹⁷⁹. Ethiopia ranks 7th out of the world's 22 high burden countries for tuberculosis.¹⁸⁰

An uncertain political system during the preceding decades has undermined the state's ability to efficiently manage infrastructure inherent to the stable functioning of a society. The result of the current infrastructural system is that individuals remain reliant on environmental resources for water, waste disposal, and firewood.¹⁸¹ Over 50% of rural households are reliant on streams and lakes for their cooking water supply.¹⁸² Fewer than

10% use wells that are considered safe yet 20% use exposed wells.¹⁸³ Although unsafe water can be boiled, other resources such as firewood, a common item used for fuel, remain scarce.¹⁸⁴

SECTION 7 – Climate - Related and Non - Climate Related Causes of Poverty in Ethiopia

7.1 Are Climate and Non–Climate Causes Related?

A significant driver of poverty rests with environmental problems. The growing presence of climate change will undermine Ethiopia’s most treasured asset—its agriculture that is both intertwined with GDP and remains a source of livelihood for a significant number of its population. Amartya Sen’s definition that poverty is “capability deprivation”¹⁸⁵ As the negative effects of climate change manifest themselves, the poor are deprived of capabilities required to affect their development and social mobility.¹⁸⁶ The climatic causes of poverty restrict “the opportunities and capabilities they need to secure their well being”¹⁸⁷

Climate change results in economic and health insecurity. The capability of generating income from agriculture is undermined by climate change, resulting in economic insecurity. Malaria is a negative driver that results in health insecurity. These insecurities, therefore, translate into vulnerabilities that further exacerbate preexisting non- climactic causes of poverty.

7.2 Major reciprocal relationships Climate and Non–Climate Causes of Poverty

The major reciprocal relationship between the two variables is that the non-climatic causes of poverty generate a context of vulnerability. Climactic causes of poverty further exacerbate poverty for the reason that the ability to anticipate and respond is already

compromised. The preexisting non-climactic causes of poverty—notably arable land, deforestation, soil degradation and crop failure and a lack of infrastructure— compound vulnerability and provide the context for climatic causes—such as food security and malaria—to exacerbate poverty, resulting in a negative cycle between the two variables. Non-climactic causes set the stage; climactic causes exacerbate an initial position of poverty.

7.3 Climate Change and Agriculture

An example of the interaction between these two variables, which exacerbates poverty, rests in the consideration that Ethiopia’s means of generating income is constrained by poverty levels, caused by non-climactic factors, that limit its choices for alternative means of income. Its reliance on agriculture as a source of GDP will ultimately be compromised by climate change.

The World Bank’s Climate Change Portal possesses vulnerability indicators that provide Ethiopia’s most recent climate data. In 2007, the percentage of agricultural land area that Ethiopia possessed was 35.08%¹⁸⁸; the percentage of arable land, meaning land that may be utilized for growing crops, was listed as 14.04%.¹⁸⁹ In 2009, Ethiopia’s percentage of permanent cropland was cited as 34.99%. Climate change will undermine food security by reducing the amount of arable land in Ethiopia.

Ethiopia’s headcount rate of poverty, posited by world development indicators, is 44%.¹⁹⁰ Ethiopia remains vulnerable to the negative effects of climate change due to its reliance on climate sensitive activities for agriculture and industry. It stands to fall into greater poverty because of its reliance on a precarious resource. A history of extreme droughts,

floods, rising temperatures, and undependable rainfall has rendered the country at the mercy of an often inhospitable climate that is projected to worsen. Climactic vulnerability further compounds the susceptibility of a population that considers its important sector to be rain fed agriculture that, will implicate food security, and deepen a state of poverty fashioned by non-climactic variables.

It follows that Ethiopia's economy, and therefore GDP, is closely intertwined with the rhythms of an erratic climate. Periods of drought and famine are correlated with a declining GDP; the absence of such factors likewise is linked with improved contributions to the GDP.¹⁹¹ The ability of nations to adapt to negative climactic events is provided by economic and political capacity. A nearly 50% dependence on rain fed agriculture within the context of an erratic climate therefore constrains Ethiopia's overall economic development, making it vulnerable and increasing the likelihood of further poverty. Roughly 90% of the Ethiopian labor force depends on this sector for their livelihood and employment.¹⁹² Extreme climactic events, such as flooding and droughts, reduce crops and cattle herds. Preexisting non-climactic conditions poverty—most notably found in a lack of economic capacity—further compounds Ethiopia's ability to implement institutional adaptive measures and remain resilient in times of climactic crisis. A state of preexisting poverty, combined with the negative climatic driver of temperature change, is a two-way process: the inability to find other sources of income due to poverty constraints, is further compounded as climate change weakens a GDP closely intertwined with agriculture, perpetuating a negative cycle amongst the two variables.

A study conducted by Torben Mideksa has found that climate change will compound Ethiopia's economic development in two ways: first, agricultural production will be lessened, diminishing Ethiopia's GDP by roughly 10%;¹⁹³ second, the resulting growth in income disparity will result in the country's overall wealth distribution becoming even more unequally skewed.¹⁹⁴ As the GDP falls funding for services and resources falls and the cycle of poverty is exacerbated by climate change.

The common consensus is that rising temperatures will lower farm production in many developing countries since their current warm climate hinders agricultural output.¹⁹⁵ A study conducted by Dell et al, examining 136 countries, proposes that economic output is reliant on rainfall and temperature.¹⁹⁶ The study suggests that productivity growth is decreased by 1.10% for a 1° C increase in temperature. A projected increase of climate temperatures by 2.5 and 5 with decreasing rainfall of 7% and 14% decreases net revenue per hectare by US\$0.934 and US\$0.933.¹⁹⁷ By 2060, temperature is projected to increase by 1.1 to 3.1°C; by 2090; it is expected to increase by 1.5 to 5.1°C.¹⁹⁸

A dependence on an agricultural sector that is inherently susceptible places the population in an uncertain position. The mixing of these two variables found in a lack of alternative means of income, substandard infrastructure, variability in the climate, high population growth, and eroding land resources, works to further diminish an already limited set of assets enacted by non-climatic causes of poverty. This shortage of assets therefore results in the inability to react to shocks, resulting in greater vulnerability and poverty. In The World Bank report, *The Social Dimensions of Adaptation to Climate Change in Ethiopia* resilience is not defined to the narrow span of a few sectors—the performance of the national economy is considered closely intertwined to resilience.¹⁹⁹

Adaptation in turn requires financial resources and assets to tackle newfound problems. Ethiopia is in such an initial vulnerable state that its adaptive capacity is severely undermined. A disproportionate dependence on the agricultural sector further weakens Ethiopia's adaptive capacity. The World Bank has suggested constructive adaptation measures are ones that gradually lessen a dependence on climate sensitive sectors, such as agriculture.²⁰⁰ Yet it is difficult to believe that this is a viable option in a country with such an underdeveloped infrastructure—for example, the percentage of paved roads was 13.67% in 2007.²⁰¹ A nation lacking a base level of infrastructure almost forces reliance on the precarious agriculture sector. This translates into a nation that does not possess a viable alternative sector and one that does not possess the means to diversify its income nor cope with the effects of climate change.

Ethiopia possesses many of the indicators of low adaptive capacity. It is biophysically vulnerable—particularly due to soil erosion; it is socially vulnerable in the sense that much of the labor force is dependent on agriculture for its livelihood; it is also technologically vulnerable due to inadequate infrastructure.²⁰² Ethiopia's crop suitability has been diminished, alongside its ability to maintain good soil. As crop suitability falls, vulnerability of households to significant climactic change increases.²⁰³ The United Nation's Development Program's 2011 Human Development Index Rankings lists Ethiopia as 174th out of 187²⁰⁴ in terms of human development. Higher development entails higher accessible social capital.²⁰⁵ Climate change will curtail growth of the agricultural sector. It will exacerbate preexisting non-climactic conditions of poverty and will reinforce the cycle of poverty in Ethiopia.

SECTION 8 - Concluding Remarks

An initial position of poverty and vulnerability on the global stage renders Ethiopia far more susceptible to the negative physical effects of climate change than developed countries. The negative effects of climate change further reinforce the cycle of poverty, dependency and vulnerability. It follows that the interaction of these two variables is not simply a climactic event—climate change serves to render the poor even poorer and further undermines the most basic dignities of its population.

Climate change will result in deteriorating food security and human health. The effects will be unequal: means of subsistence will be weakened as food security worsens and human health will be undermined as malaria encroaches upon the upper highlands of Ethiopia. Developed nations will not bear the burden of the negative physical effects of climate change as earnestly as the least developed countries. The nature of poverty is that it is an interdependent process and affects the most unstable and vulnerable actors. Climate change will disproportionately affect the most poor and vulnerable and will worsen their initial position in society by exacerbating preexisting conditions of poverty and vulnerability.

The extent to which we may generalize from these case findings is significant. As this case study has demonstrated, as climate change worsens underdeveloped nations in addition to Ethiopia will be incapable to respond and adapt to the negative effects of climate change. Their present state of poverty, attributed to non-climactic drivers, will be further exacerbated as climate change undermines health through vector borne diseases and food security by the means of temperature change.

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