

RISING TEMPERS, RISING TEMPERATURES:

A LOOK AT CLIMATE CHANGE, MIGRATION AND CONFLICT AND THE IMPLICATIONS FOR YOUTH IN THE SAHEL REGION

Erik Alda

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Executive Summary

Climate change is perhaps the most important development issue of the twenty-first century. The costs and consequences of climate change already being observed in many countries are severely impacting the livelihoods of millions of people, but especially those of the poorest. This paper investigates the causal chain between climate change, migration and conflict in the context of the Sahel region, with special focus on implications for the youth cohort living in the most vulnerable rural areas, and concludes with policy recommendations aimed at mitigation of the effects of climate variability and prevention of youth engagement in climate change effects-related conflict and crime.

Section 1 of the paper provides a brief overview of the relationship between the Sahel region of Africa and climate variability trends and predictions, ultimately posing the primary research question of the study: Is the Sahel region more likely to have a higher probability of conflict and migration as a result of climate change and climate change-related events?

In Section 2, research and analysis aim to identify causal paths between climate change, migration, and conflict via structural equation modeling focusing on recent climate change trends in the Africa and Sahel regions, particularly changes in temperature and rainfall, and analyzing the consequences of this climate variability, namely migration and conflict. The results of the analysis yield findings supporting the hypothesis found in the existing literature that climate change, itself, does not cause conflict directly, but rather through a variety of channels such as migration, and ultimately concludes

that further research is needed in order to better understand the mechanisms and paths through which climate change might increase the risk of conflict.

Section 3 brings the aspect of youth into the analysis, arguing that youth living in the rural Sahel region will likely find themselves particularly vulnerable to increased climate change and variability, which will have direct and indirect implications on the security and livelihoods of these individuals. The paper explores the past, current and predicted issues faced by rural Sahel youth affected by the impacts of climate change, such as chronic unemployment and engagement in the illicit sector due to rural to urban migration from regions affected by drought, desertification and resource scarcity.

The final section of the paper offers policy recommendations for addressing negative climate-change related consequences through two key paths of intervention: (i) Climate change adaptation measures and (ii) conflict and crime prevention measures. Recommendations for climate change adaptation measures aim at improving governmental capacity, building social capital in areas such as resilience and empowerment, and increasing asset-based adaptation. Recommendations for conflict and crime prevention measures center on providing employment and training programs as well as promoting the preservation of pastoral practices such as crop-livestock systems (Izcowicz et. Al, 2012; Shapland et. Al, 2013). Policies and programs should be tailored to the needs and characteristics of each country in the region instead of “one size fits all” programs.

I. Introduction

Climate change is arguably the most important development and policy challenge of the twenty-first century (Verner, 2010). The negative consequences of climate change are and will continue to be a threat to some of the recent progress in terms of poverty reduction, economic growth and health gains. In addition, climate change is also likely to unravel conflict as a result of increasingly limited access to basic resources. The intersection between climate change, loss of livelihoods, migration, and conflict are of particular importance in the developing world.

The costs and consequences of climate change have already been observed in many countries (NASA, 2012). In the coming decades, the forecasts anticipate worrisome trends. For example, the Inter-Governmental Panel on Climate Change predicts that temperature increases in the coming decades from 2 to 4 degrees Celsius are likely to have significant damaging effects globally (IPCC, 2010). According to estimates from the UN, countries in Africa are more likely to be more vulnerable to the effects of climate change. In excess of 250 million people are likely to be affected by rising temperatures and the negative effects associated with it, which include water and food security and the loss of livelihood. Further, countries in West, North and East Africa are more likely to bear the brunt of the effects of climate change (UNEP, 2011).

Although the negative consequences of climate change will affect everyone, females, children and youth are particularly vulnerable (UNESA, 2010). Particularly the youth in fragile regions of Africa like the Sahel are likely to be more affected by the rapid and extreme change in weather patterns. Extreme weather events and increased climate variability will have direct deleterious effects on the health and safety of many youth in this region. For example, it is estimated that between 30 to 50 percent of youth in Africa currently lack access to adequate basic services and, thus, are at an increased risk of climate change (UNESA, 2010).

The two most pressing negative consequences of climate change are migration and conflict. The deteriorating conditions resulting from climate change can cause an accelerating increase in migration patterns. Increased migration patterns can exact negative effects on the already overstretched local capacity of the recipient locations as well as potentially affecting the climate of these locations. Conflict is, therefore, perhaps the most serious outcome of the negative effects of climate change. In fact, climate change is already being increasingly considered a security threat in the Africa region (ISS, 2013).

Given all of the above, is the Sahel region more likely to have a higher probability of migration and conflict as a result of climate change and climate change-related events? More importantly, what are the implications for the youth population, given that it is a key cohort for the present and the future of the region? This paper attempts to answer this question by investigating the links between climate change and climate change-related events, migration, and, ultimately, conflict. It is important to note, however, that this paper does not attempt to cover or address the vast complexities of climate change and its consequences. Rather, it briefly describes the recent evolution of climate change in Africa, and, in particular, for the Sahel region, and discusses how one of the most important consequences of climate change - conflict and crime - can affect one of the most vulnerable population cohorts: youths. The remainder of the paper is organized as follows. Section 2 discusses the effects of climate change with a particular focus on Africa, which is likely to experience more intensely the consequences of climate change. Section 3 discusses the implications that climate change will have for the youth in the Sahel region. Finally, Section 4 of the paper presents the conclusion and provides broad policy recommendations on how governments can best employ adaptation measures to climate change so that these youths can adapt to the rapidly changing climate and its negative consequences while, at the same time, preventing them from engaging in conflict and crime.

2. Purpose of the Study

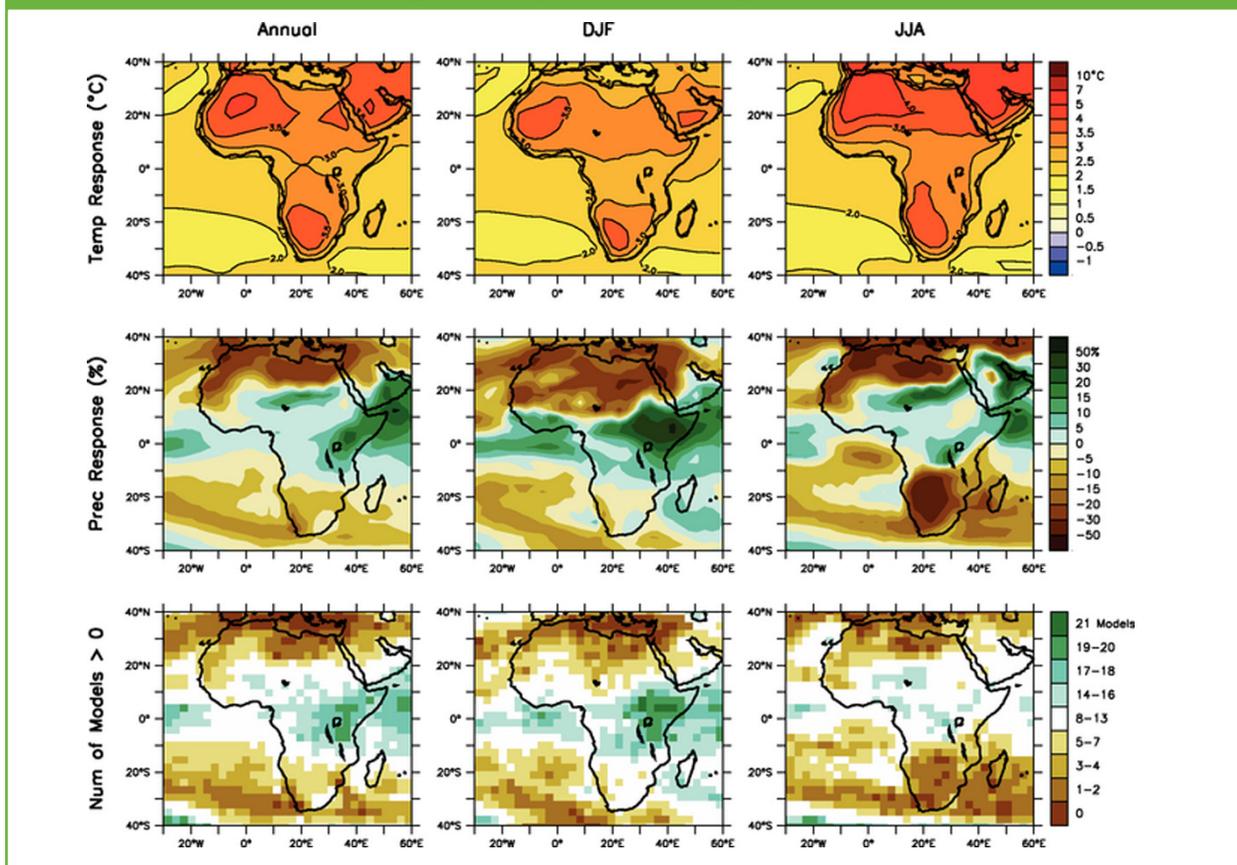
2.1 Climate Change: Recent Trends in the Africa and Sahel Regions

Available evidence demonstrates that the climate is changing rapidly. In the past century temperatures have increased almost by 1°C, of which more than 0.5°C has taken place since 1979 (IPCC, 2007). Rainfall patterns have also changed and are increasingly erratic throughout the continent (Tadesse, 2010). According to IPCC's fourth synthesis report, the increases in climate change and climate variability pose a serious threat to long-term development in Africa, which is further aggravated by the interplay of other development stresses such as poverty, weak institutional capacity, and poor infra-

structure, among others (IPCC, 2007). While there is limited information about the real effects of climate change in Africa, predictions suggest the following scenario (as it appears in Conway, 2009; ICC, 2010)

- Drier subtropical regions will warm more than the moister tropics;
- Southern Africa will become much hotter (as much as 4°C or more) and drier (precipitation falling by 15 percent or more);
- Wheat production in the north and maize production in the south are likely to be adversely affected;

Figure 1 - Projected climate change in Africa



- Eastern Africa, including the horn of Africa, and parts of central Africa average rainfall is likely to increase but it will come in the form of intense floods;
- Vector-borne diseases such as malaria and dengue may spread and become more severe;
- Sea levels will rise, perhaps by half a meter, in the next fifty years, with serious consequences in the Nile delta and certain parts of West Africa.

In the Sahel region, climate trends over the past century have varied by country but, on average, the region has experienced increases in mean temperatures and a decrease in the amount of rainfall (IPCC, 2007).

2.2 Changes in Temperature

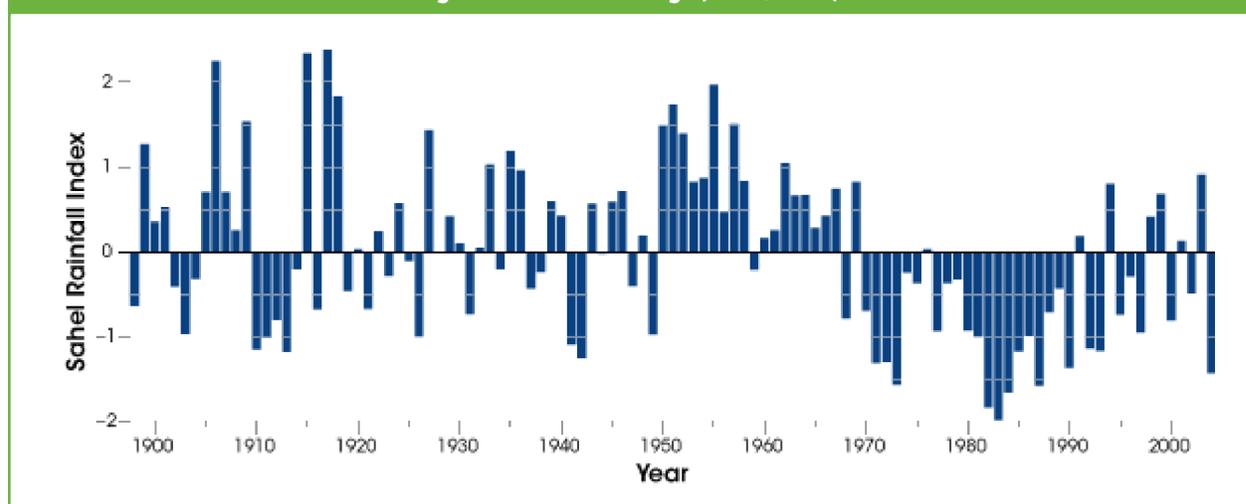
Specific temperature-change predictions in the Sahel region are significant and vary by country and sub-regions within countries. While it is predicted that the average increase in temperature in Africa will range between 0.2°C and 0.5°C in the coming decades, countries in the Sahel are likely to suffer higher temperature increases (Kandji, Verchot, and Mackensen, 2006). For example, Burkina Faso is expected to suffer an increase in temperatures by 2.5°C; Chad will suffer increases of 0.6°C and 1.7°C; Mali could experience increases in temperature as high as 4°C (Kandji et al., 2006). Further, the increase in temperatures is likely to be unequally distributed within countries (UNEP, 2011).

The southern parts of Mali, for example, are expected to experience a decrease in temperatures whereas in the northern regions of Mali and Mauritania, the increase in temperature can go up to 4°C and 2°C, respectively. Such variation in temperatures coupled with recurrent and more intense droughts is likely to reduce agricultural production as well as accelerate the process of desertification. This will reduce the livelihoods of the poorest population living in those areas and will trigger new waves of migrants.

2.3 Changes in Rainfall

In addition to increases in mean temperatures, the region is also likely to be affected by changes in precipitation patterns. Data on rainfall patterns for the past century shows an increase in absolute rainfall ranging from 100mm to more than 250mm, annually (UNEP, 2011). Such an increase, however, masks tremendous variation within and between countries in the region as well as the intensity of the rainfall. For example, it is expected that the increase in rainfall could come in very intense forms, such as deluges and flooding. Moreover, research shows that too much rain can also affect the degree to which rain-fed agriculture can be practiced effectively (ECOWAS, 2006). Rainfall variation will also affect the seasonality of the rains and its severity. The occurrence of floods in the region has increased in the past 30 years. The data indicate that during the 1985-2009 period, the frequency and area of the flooding increased significantly (UNEP, 2011). The

Figure 2: Rainfall Average (NASA, 2012)



negative impacts of increased flooding to agricultural production and the populations living in those areas are also significant. For example, the floods in 2010 in the lower Niger River valley affected nearly 10,000 Ha of rice (Boyd et al., 2013). Similarly, in 2008, the floods in Somalia destroyed at least 8,000 Ha (IRIN, 2008).

2.4 Consequences of Climate Change: Migration and Conflict

As climate change is expected to affect rainfall variability, water resource availability, land degradation and land availability, one should begin to look for links between these causal factors and different types of conflict, including one-sided violence, intra-State violence between groups and unorganized violence. A variety of factors are likely to be determined to condition the results. One mechanism through which climate changes affect migration and conflict is climate change-related natural disasters (Slettebak, 2012). The regional climate trends observed over the last 40 years across the Sahel and the Horn of Africa show that temperatures have risen, droughts have been recurrent and severe, rainfall has generally increased and floods have occurred more frequently and with greater intensity. Furthermore, there has been a general increase in mean temperature across the region since 1970, with more than half the population experiencing an increase of between 0.5°C and 1°C.

While the mean seasonal rainfall is below the long-term average (1900-2009, Figure 1), precipitation has increased in some parts of the region, although the flooding has increased in frequency and severity. The area has experienced recurrent and severe drought since the 1970s, which has had a very significant impact on livelihoods, particularly among pastoral peoples, through the gradual and growing unsuitability of traditional grazing grounds and the drying of important water bodies.

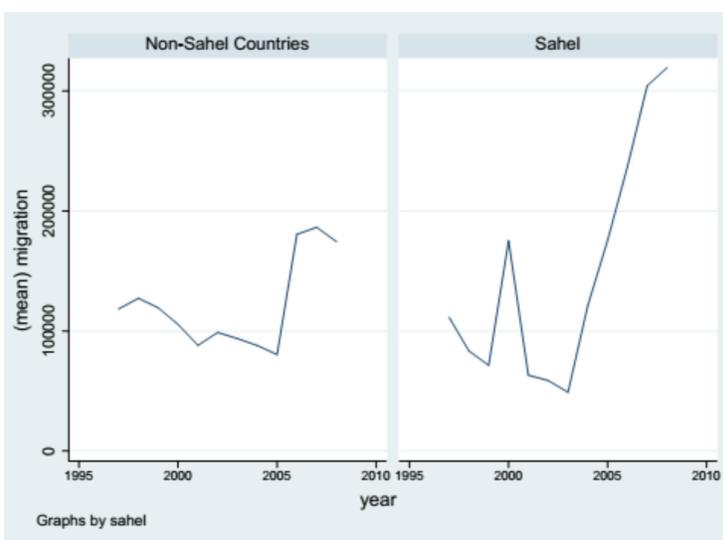
Cyclical droughts in the Horn of Africa and across the Sahel are increasing in frequency, with the drought cycle

on average increasing from one in eight years to one in every two or three years. The impact of such a change of agricultural production and pastoral lifestyles is substantial, as these populations, therefore, may be forced to migrate in order to subsist.

Much of the current concern regarding the security implications of climate change relates to the possible adaptive methods that might be chosen by individuals, communities, and States in the face of large-scale and/or rapid disruptions to their economies and societies. Migration is one such adaptive method. Throughout history, migration has been a chosen response in the face of poverty, resource scarcity, ethnic tension and conflict, and local environmental change may simply come to serve as yet another push factor. The Horn of Africa, for example, faces the worst drought it has seen in the past 60 years. The crisis has resulted in massive displacement within Somalia and across borders into northern Kenya, Yemen, Ethiopia and Djibouti. In fact, data collected by UNHCR show a significant increase in the number of migrants in recent years (Figure 3).

The scale of internal and cross-border migration, is, therefore, expected to rise in the face of drought and desertification. This argument is based on the assump-

Figure 3: Population Migration (Total population received in country of asylum)



Source: Own Analysis

tion that increased population growth will increase demands for resources, which, in turn, leads to land and water degradation and distributional conflicts. Even if one were to assume these conventional causal mechanisms are valid, this analysis does not identify short-term causes that trigger the outbreak of conflict.

There have already been cases of mass population movements in response to climate variability throughout the Sahel and the Horn of Africa. One study analyzing 38 cases since the 1930s in which environmental factors played a role in triggering mass migration concluded that in 19 instances some form of conflict resulted (Reuveny, 2007). The study affirms, however, that environmental factors do not work in isolation, but rather they contribute to pre-existing migration flows. Conflict arises when migrants, particularly those of a different nationality or ethnicity, move quickly and in large numbers into neighboring States already suffering conflict and/or similar environmental degradation. Another study of civil wars between 1945 and 2005 found that of 103 ethnic conflicts, 32 included violence between members of an ethnic minority resident in a particular region and recent migrants from other areas (Fearon and Laitin, 2003). Similarly, Homer-Dixon (1994) argues that large scale climate induced migrations might contribute to aggravating existing tensions—ethnic, social, political or economic—that could trigger the onset of conflict.

The links between climate change and conflict have been tested extensively in the literature although the causality mechanisms are not well understood. One such study using geo-referenced data found that water and land scarcity are only weak predictors of future conflict while high population density is a consistently strong predictor of armed conflict. The same study also found that the interaction of population growth and water scarcity proved to be significant (Raleigh & Urdal, 2007).

Burke et al used 1981 to 2002 panel data on climate variation and conflict events to examine the historical risk of conflict in Africa. The results revealed that temperature can affect agricultural yields through increases in crop and surface water evapotranspiration, resulting

in heightened water stress in the absence of irrigation. The combined effects of these mechanisms could be expected to reduce African staple crop yields by 10 to 30 percent for every degree of Celsius of warming. This is an important finding in the light of the heavy dependence of African countries on agriculture. Adverse consequences of climate change for food security in Africa seems inevitable, as demonstrated by the food situations in Somalia and the Sahel.

One particular study specifically predicts the likelihood of conflict emergence in sub-Saharan Africa related to environmental degradation (Magadza, 2000). Magadza foresees conflict arising out of increased frequency and/or severity of droughts. The author based his prediction, however, on an extrapolation from current conditions, using no predictive data. Another study suggests an increase of 54% in armed conflict in Africa by 2030 compared to the 1980-2000 period (Adano & Daudi, 2012). It assumes, however, a link between violent conflict and climate-induced conflict.

Other research, however, reports contradictory results, delinking climate change from conflict. For example, Slettebak (2012) replicated Fearon and Laitin's (2003) data on conflict, and after including the population measure in the regression model, the linkages between climate change-related natural disasters and the onset of conflict disappeared.

Although the empirical evidence linking climate change to conflict appears to find contradictory arguments, available data increasingly show that climate-related natural disasters are a problem for the Sahel region.

In order to tease out the effects of climate-related disasters on conflict, this paper's analysis employs a dataset (Slettebak, 2012) on climate change-related natural disasters to test whether this relationship holds for the Sahel region.

The data include measures related to the onset of conflict, population and economic measures, and climate related disaster measures. In addition, the analysis includes a variable that captures the migration patterns in the Sahel countries by country of asylum.

In order to understand the relationship between climate change, migration, and conflict, this paper employs two different approaches. The first approach uses a similar

Table 1 - Results of Regression Analyses of Climate Change Related Disasters and Conflict

| VARIABLES | Probit:Sahel | Probit:Sahel | Probit:Africa | Probit:Africa |
|---------------------------------------|--------------|--------------|---------------|---------------|
| Conflict previous year | -0.907** | -1.101*** | -0.439* | -0.441* |
| | [0.45] | [0.41] | [0.25] | [0.25] |
| F&L per capita income (lagged) | -0.718 | -0.89 | -0.172** | -0.172** |
| | [0.59] | [0.61] | [0.07] | [0.07] |
| F&L log population (lagged) | 0.362*** | 0.354** | 0.141** | 0.138** |
| | [0.12] | [0.17] | [0.07] | [0.07] |
| F&L log (% mountainous) | 0.138 | 0.114 | 0.0435 | 0.0363 |
| | [0.15] | [0.13] | [0.06] | [0.06] |
| F&L instability (lagged) | -0.0889 | -0.00187 | 0.0629 | 0.0578 |
| | [0.48] | [0.39] | [0.15] | [0.15] |
| F&L democracy (lagged) | 0.0369* | 0.0375* | 0.0280** | 0.0283** |
| | [0.02] | [0.02] | [0.01] | [0.01] |
| F&L ethnic fractionalization | 0.248 | 0.378 | 0.138 | 0.0923 |
| | [0.42] | [0.53] | [0.31] | [0.31] |
| F&L religious fractionalization | -0.83 | -1.274** | 0.0819 | 0.119 |
| | [0.58] | [0.50] | [0.39] | [0.38] |
| Climate-related disaster, binary | -0.0801 | | -0.375 | -0.520* |
| | [0.30] | | [0.24] | [0.28] |
| Drought | | 0.767** | -0.19 | 0.319 |
| | | [0.33] | [0.38] | [0.22] |
| Flood | | 0.0831 | 0.0465 | 0.173 |
| | | [0.18] | [0.22] | [0.12] |
| F&L oil exporter | | | 0.573** | 0.582*** |
| | | | [0.22] | [0.22] |
| Sahel | | | -0.834 | -0.793 |
| | | | [1.20] | [1.28] |
| Sahel* F&L per capita income (lagged) | | | -0.0936 | -0.0603 |
| | | | [0.46] | [0.45] |
| Sahel* F&L log population (lagged) | | | 0.11 | 0.106 |
| | | | [0.16] | [0.17] |

| | | | | |
|--|-----------|-----------|-----------|-----------|
| Sahel* F&L log (% mountainous) | | | 0.103 | 0.104 |
| | | | [0.12] | [0.12] |
| Sahel* F&L oil exporter | | | -1.354*** | -1.406*** |
| | | | [0.38] | [0.38] |
| Sahel* F&L instability (lagged) | | | 0.313 | 0.292 |
| | | | [0.24] | [0.24] |
| F&L democracy (lagged) | | | -0.0207 | -0.0213 |
| | | | [0.02] | [0.02] |
| Sahel* F&L ethnic fractionalization | | | 0.106 | 0.112 |
| | | | [0.57] | [0.58] |
| Sahel* F&L religious fractionalization | | | -0.557 | -0.522 |
| | | | [0.67] | [0.66] |
| Sahel* Drought | | | 0.828** | |
| | | | [0.47] | |
| Sahel* Conflict previous year | | | -0.0947 | -0.0455 |
| | | | [0.38] | [0.38] |
| Sahel*Flood | | | 0.129 | |
| | | | [0.23] | |
| Sahel* Climate-related disaster, binary | | | | 0.211 |
| | | | | [0.30] |
| Constant | -3.927*** | -3.898*** | -2.939*** | -2.909*** |
| | [1.10] | [1.46] | [0.55] | [0.56] |
| Observations | 172 | 172 | 1671 | 1671 |
| Standard errors in brackets; * p < 0.10, ** p < 0.05, *** p < 0.01 | | | | |
| Source: Own Analysis; Dependent Variable: Conflict Onset (0/1) | | | | |

methodology as the one employed by Slettebak (2012). This study, however, isolates the Sahel region and then compares it with the rest of Africa. The models are then estimated using probit regression with the onset of conflict as the dependent variable and then a variety of explanatory variables related to climate change and conflict. The second approach is a structural equation model to discern the direct and indirect effects of climate related disasters on migration and on conflict.¹

¹ For more information on the dataset and the regression models used, see Slettebak (2012).

The results of the regression analysis presented in **Table 1** reveal that proxy measures for climate change-related disasters such as the occurrence of droughts have a positive and statistically significant association with the onset of conflict in the Sahel region. The floods are also positively correlated with conflict, but the estimate is statistically insignificant. Interestingly, in the first model specification, the binary measure for climate related disasters is in the opposite expected sign and it is insignificant, controlling for other factors.

The variable that captures whether a country has experienced conflict in the previous year was significant and

negative. This is a somewhat unexpected finding since it is expected that the prior conflict would have some degree of inertia into subsequent years. This finding, however, is in line with previous research on this topic (see Fearon and Laitin, 2003).

The results of the second model specification, however, mask variance between countries in the Sahel region.

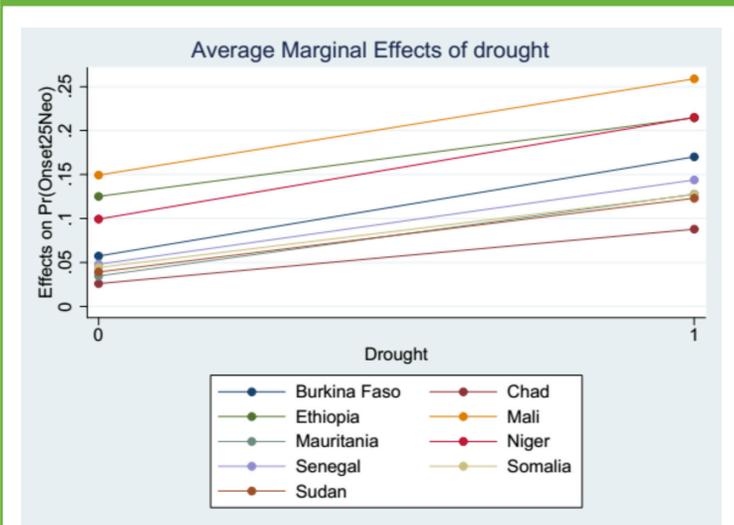
Figures 4 and 5 present the average marginal effects of conflict by levels of drought and flood. The plot suggests that the relationship between the average increase in probability of outbreak of conflict and the presence or absence of drought is quite significant for countries like Mali, Ethiopia, and Niger (see Figure 4 and 5).

After presenting the results for the countries in the Sahel region, it is important to look at whether they are different from the rest of Africa. Columns 3 and 4 in Table 1 present the regression for the whole African continent and include interaction terms of the explanatory variables with the dummy variable for the Sahel. Given the way in which the regression model is specified, findings reveal whether impacts for the Sahel are different from the region as a whole. Overall, the analysis shows that the Sahel, on average, is not different from the rest of the region as a whole. It is interesting to note that the interaction term between the drought dummy and the Sahel dummy is statistically significant and positive, suggesting that conflict in the Sahel is conditioned by the presence of drought.

Figures 6 and 7 present the plot of the marginal probabilities of the interaction term. While the dummy for the Sahel and drought are not statistically significant in the main analysis, their interaction was significant. Figure 5 shows that the marginal effects for interaction term were larger for the Sahel countries than for the rest of the region. In Figure 6, the variables “Sahel” and “Flood” did not yield any statistical result in the main analysis nor did the interaction term show any statistical significance. However, the plot shows significant variation in the interaction term depending upon the level of flooding. The remaining variables in the regression are similar to those found in columns 1 and 2 of Table 1.

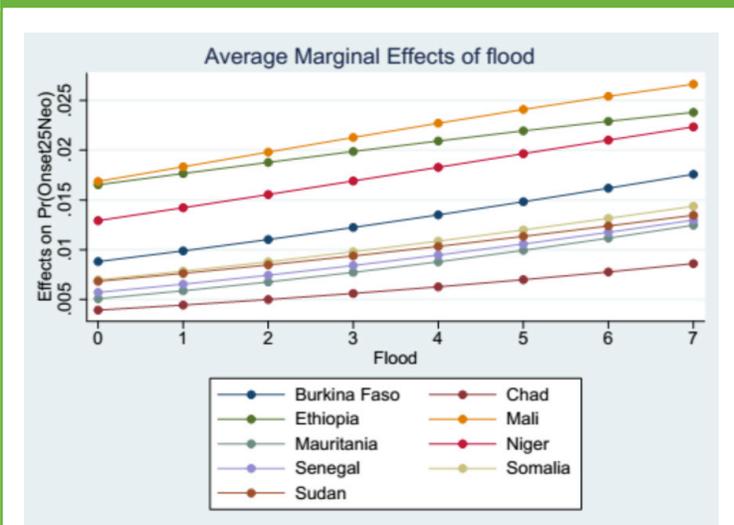
The results presented above show that climate change-related disasters appear to have a significant correlation with the onset of conflict in the Sahel region. While these

Figure 4: Average Marginal Effects (Drought)



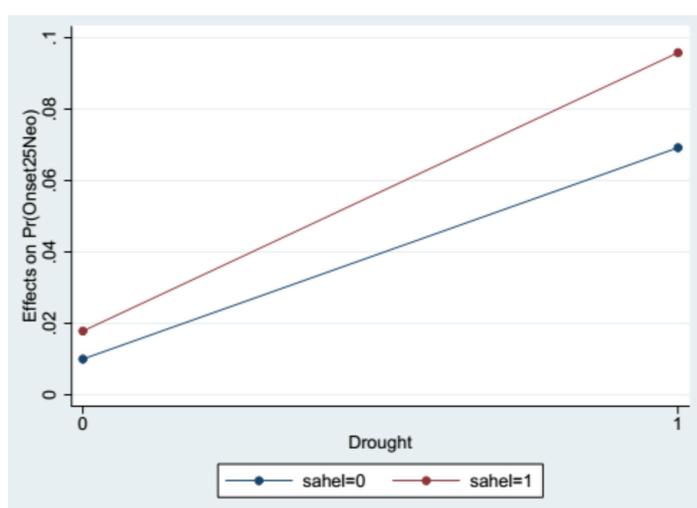
Source: Own Analysis

Figure 5: Average Marginal Effects (Floods)



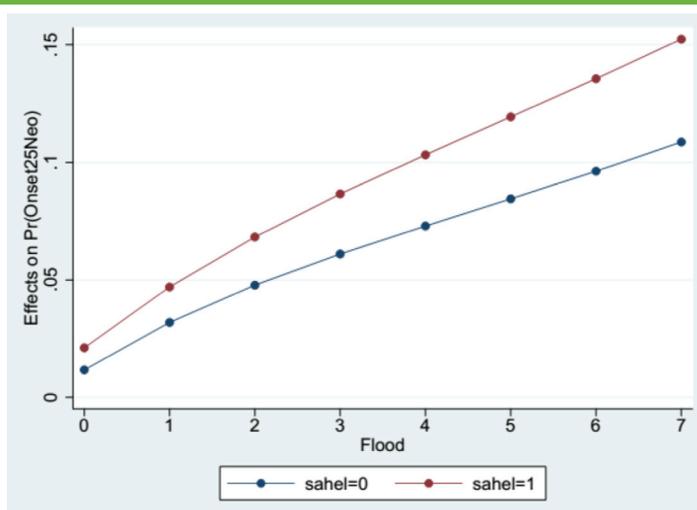
Source: Own Analysis

Figure 6: Marginal Effects of Interaction Term (Sahel*Drought)



Source: Own Analysis

Figure 7: Marginal Effects of Interaction Term (Sahel*Flood)



Source: Own Analysis

results are consonant with previous research on climate change and conflict, these findings should be interpreted as mere correlations and do not imply causation. More research is needed to be able to better identify the causal mechanism/s through which climate change causes conflict.

The preliminary analysis presented above only offers estimates on the correlation between climate change-

through climate change related disasters- and conflict. However, as mentioned previously, conflict can be a direct consequence of climate change and also an indirect consequence as a result of an increase in climate change-related migration (Rubin, 2010). Understanding the direct and indirect effects of climate change on migration and conflict are important since the climate-security literature identifies - albeit without much empirical support - climate change induced migration as a potential cause for conflict (Raleigh et al, 2008). Therefore, this paper employs a structural equation modeling approach to ascertain whether climate change and climate change-related disasters are correlated with migration and, migration, in turn, is correlated with conflict. An advantage of structural equation models is that it permits one to estimate the direct, indirect and total effects of the independent variables on the dependent variable.

For the purposes of this analysis, the same dependent variables are employed as in the analyses before - the onset of conflict (0/1). Because it is unlikely that conflict occurs in the immediate aftermath of a climate change-related disaster, the dependent variable is advanced by one year so that the explanatory variables are lagged.² The migration variable employed for this analysis is the log of the total number of migrants by country of asylum (UNHCR, 2013). The remaining variables in the analysis are the same as those employed in previous analyses above.

The results of the structural equation model are presented in Table 2. The estimates yield interesting results.³ First, migration is statistically signif-

² I also re-estimated the model forwarding the dependent variable by 2, 3, 4, and five years. However, after the second year forward the model became really unstable and the sample became really small to draw any meaningful inferences.

³ Only those measure related to climate change and conflict are discussed.

Table 2 - Results of Structural Equation Modeling

| VARIABLES | Conflict Onset (Forward 1 year) | Migration (Logged) |
|-----------------------------|---------------------------------|--------------------|
| Migration (Logged) | 0.0293* (0.0168) | |
| GDP per capita (lagged) | -0.0545 (0.0580) | |
| Population (Logged) | 0.0316** (0.0143) | |
| % Mountainous (Logged) | 0.0199 (0.0142) | |
| Oil Exporter | -0.139† (0.0386) | |
| Political Instability | -0.0165 (0.0187) | |
| Polity2 | 0.00439 (0.00369) | |
| Ethnic Fractionalization | 0.0218 (0.0751) | |
| Religious Fractionalization | -0.00781 (0.0986) | 0.272** (0.132) |
| Flood | -0.00900 (0.0157) | -0.380 (0.235) |
| Drought | -0.00450 (0.0243) | 2.595† (0.713) |
| Conflict Previous Year | -0.162† (0.0578) | 8.767† (0.621) |
| Constant | -0.417* (0.216) | 8.767† (0.621) |
| Observations | 694 | 694 |

Robust standard errors in parentheses; † p<0.01, ** p<0.05, * p<0.1

Source: Own Analysis

Dependent Variable: Conflict Onset (0/1)

Dependent Variable: Total Migration by country of asylum (logged)

icant and positively associated with higher likelihood of conflict, albeit the effect is small (only at the 10% level of significance). Second, the measures for floods and drought generate somewhat surprising results as they carry the opposite expected sign, however they are not statistically significant. These results might be capturing the fact that when intense flooding occurs, people are forced to migrate, which is supported by the positive and statistically significant coefficient of flood on migration. As expected, flooding does increase the likelihood of migration, controlling for other factors. The positive correlation of the flooding variable in migration can be interpreted as both a direct impact of flooding on migration and an indirect impact of flooding on battle deaths via migration.

The measure that captures whether the country had conflict in the previous year is not directly associated with a higher number of battle deaths but its effect is mediated by the migration variable. Moreover, the effect of previous conflict on migration is actually quite large and statistically very strong.

In sum, structural equation modeling allowed to identify the causal paths between climate change, migration, and conflict.⁴ The results of the analysis yielded interesting findings supporting the hypothesis found in the literature that climate change, per se, does not cause conflict directly, but rather through a variety of channels such as migration (Rubin, 2010). More research, however, is needed in order to better understand the mechanisms and paths through which climate change might increase the risk of conflict.

⁴ The term causal path does not indicate a causality mechanism.

3. Climate Change Implications for Youth

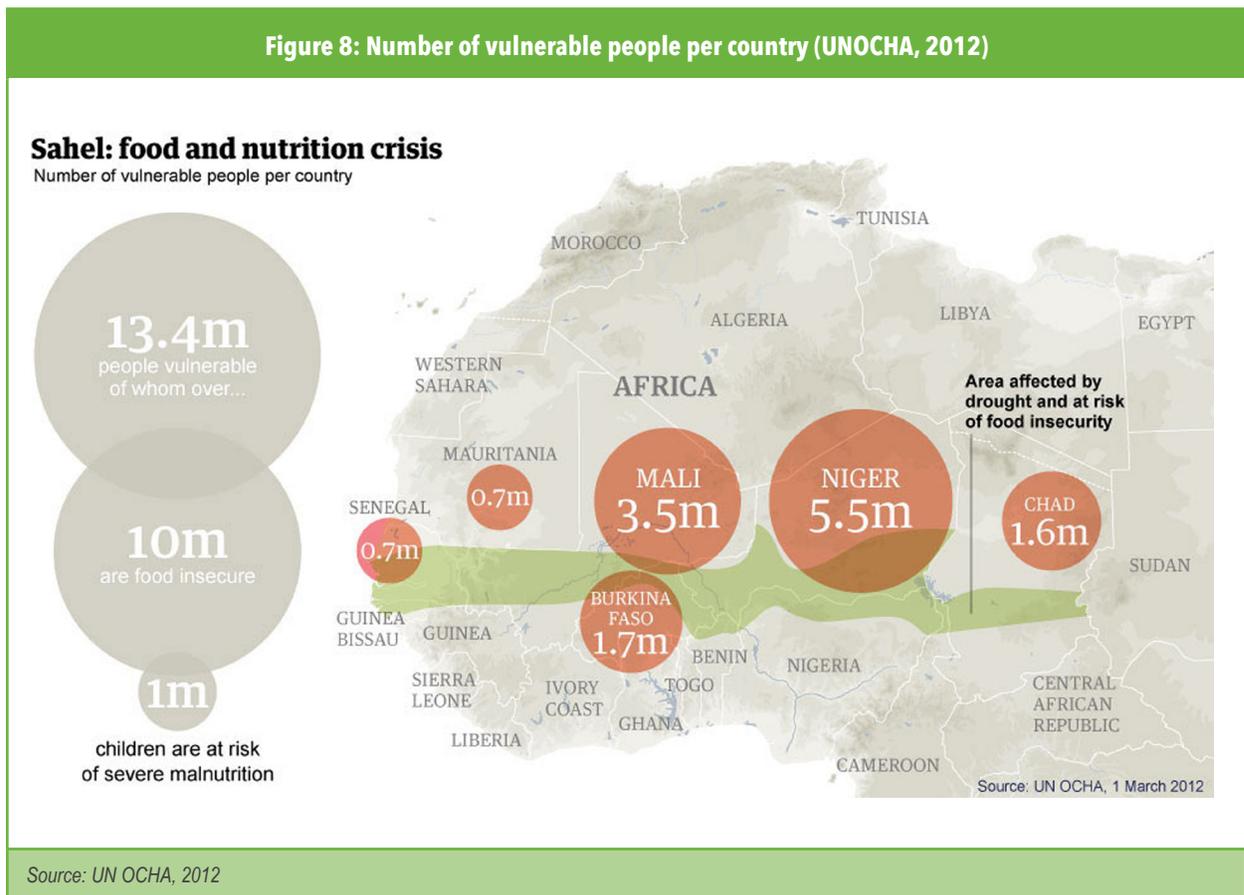
As mentioned in the previous section, the effects of climate change and climate-related disaster will likely affect the poorest and most vulnerable. Increasing climate variability and climate change-related events will further erode their already stretched capacity to cope in addition to having insufficient assets for adapting to the rapidly changing circumstances (Verner, 2010).

One of the population cohorts that will be affected the most is the youth. In particular, youths who live in rural areas will be hard hit by the progressive depletion of natural resources as a result of climate change, as their livelihood is dependent on agricultural production and

livestock. Furthermore, increasing population growth will compound challenges associated with diminishing natural resources in this region. Population data on youth 15 to 29 years of age showed that, between 2000 and 2012, the average size of the youth cohort was 26.8% in the Sahel region, compared to 28.5% in the rest of Africa. By 2020, the Sahel's size of the youth cohort is expected to increase to 28.1%, compared to a decline to 28.2% for the rest of Africa.

Around 70% of youths in Africa live in rural areas and their livelihood depends entirely on agricultural production (UNESA, 2010; World Bank, 2009). In the Sahel region, youth live in rural areas as part of pastoral-

Figure 8: Number of vulnerable people per country (UNOCHA, 2012)



Source: UN OCHA, 2012

Table 3 - Direct, Indirect, and Total Effects of Explanatory Variables on Conflict Onset and Migration

| | Direct Effects | | Indirect Effects | Total Effects | |
|-----------------------------|------------------------------------|--------------------|---|------------------------------------|--------------------|
| | Onset of Conflict (Forward 1 year) | Migration (Logged) | Onset of Conflict Migration (Forward 1 year) (Logged) | Onset of Conflict (Forward 1 year) | Migration (Logged) |
| Migration (Logged) | 0.029** | | | 0.029* | |
| GDP per capita (lagged) | -0.05 | | | -0.05 | |
| Population (Logged) | 0.031** | | | 0.031** | |
| % Mountainous (Logged) | 0.02 | | | 0.02 | |
| Oil Exporter | -0.138† | | | -0.138† | |
| Political Instability | -0.02 | | | -0.02 | |
| Polity2 | 0.00 | | | 0.00 | |
| Ethnic Fractionalization | 0.02 | | | 0.02 | |
| Religious Fractionalization | -0.01 | 0.272** | 0.01 | -0.01 | |
| Flood | -0.01 | 0.272** | 0.01 | 0.00 | 0.272** |
| Drought | 0.00 | -0.38 | -0.01 | -0.02 | -0.38 |
| Conflict Previous Year | -0.162† | 2.595† | 0.075** | -0.086† | 2.595† |

Source: Own Analysis
†<0.01 ** <0.05 * <0.10 levels of statistical significance

ist communities⁵. These traditional communities pass on their knowledge from one generation to the next. Pastoralists generally have extensive historical knowledge about climate variability and how to cope with it. However, the intensity, frequency, and erratic nature of climate change events pose a threat to this knowledge. For example, research in Latin America suggests that indigenous peoples tend to find fault in their shortcomings in the way they dealt with land and resources for the current climate change and climate variability related issues (Verner, 2010). Thus, the increasing pressure of climate change is compromising the future of pastoralist communities if agriculture and livestock continue to be the sole sources of employment and livelihood in this region (UNESA, 2010). In addition to dealing with the stressors related to climate change, lack of government resources to assist these communities in periods

⁵ 20% of the whole population in the Sahel are pastoralists (www.sahel.org.uk)

of extreme events further isolated such populations (UNESA, 2010). Further exacerbating the situation is the issue of weak governance, which is rampant in this region.⁶ For example, the World Bank Governance Indicators show that the countries of the Sahel region have some of the lowest average institutional governance scores in the world (World Bank, 2013).

The growing youth bulge in Africa, and in the Sahel region in particular, presents a serious challenge as well as an opportunity for policymakers in the region. Governments in the region should, therefore, devise policies to ensure that the growing youth cohort can be a productive asset for the countries in the region instead

⁶ For example, if we analyze at the World Bank Governance Indicators countries that form the Sahel region have some of the lowest average institutional governance scores in the world. For example, the world's average for the governance indicators for the 1996 to 2011 period stands at 0 whereas the average for the countries in the Sahel region is -2.1 on a scale in which the lower bound of the indicator is -2.5.

of a potential risk factor for conflict and crime.

As a result, areas vulnerable to climate change in the Sahel region lack even the most basic governmental presence in terms of infrastructure, education, and social protection programs, which will impact the development—both economic and social—of these areas (Gubbels, 2011).

In light of the situation described above, it is important to look at how climate change can affect the youth. As it has been argued previously, migration might be an increasingly used mechanism to adapt to climate change (Brown, 2007). Data show that the lack of infrastructure, employment, and social programs has led to massive migration in the region (ibid.). In fact, the traditional temporary migration southward into main urban centers has been replaced by a more permanent migration into urban centers. A compounding, and more serious issue, is the risk of conflict and criminality that increases as a result of youth migration into urban areas. Whether or not conflict and crime occur will depend upon a complex interplay of socio-economic factors at the destination location. But, these socio-economic risk factors are already present. Chief among them, (i) youth unemployment is already among the highest in the world in many countries of the Sahel (United Nations, 2013); (ii) climate change and induced migration may exacerbate existing social and ethnic inequities; and (iii) weak infrastructure in urban areas in these countries lacks the capacity to cope with the rapid population growth, scarce resources, and limited employment opportunities will increase the number and frequency of disputes over them (Boano, Zetter and Morris, 2008).

Evidently, this complex array of risk factors will likely trigger conflict before long and is already pushing many youths into organized crime. There is increasingly convincing evidence that suggest many of these unemployed youth are targets of the increasing activities of Al-Qaeda in the Maghreb (Jamestown Foundation, 2011). The Sahel serves as a transshipment corridor for drug trafficking, human smuggling and other organized crime activities (Werz and Conley, 2012). As terrorism and organized crime activities in the region continue to proliferate⁷ and disaffected youths continue to struggle

7 Since 9/11, the number of terrorist attacks in this region have increased ten-fold from 21 in 2001 to more than 200 in 2009 (Alexander, 2012).

with formal means of employment, they will likely find themselves increasingly recruited by organized crime groups to make a living (Ohlsson, 2000).

Table 4 presents the results of the regression analysis after controlling for the share of youths 15 to 29 years old over the total population. In the Sahel countries, the analysis indicates that the higher the percentage of youths in the region the more likely countries are to engage in conflict, controlling for other factors. In other words, an increase in one percent in the share of the youth population increases the risk of conflict, albeit marginally, by 29 percent, all else equal. This result is in line with other studies where the size of the youth population is associated with a higher probability of conflict (Beehner, 2007). This result also suggests that given the climate change and youth population projections for the region, the risk of conflict and onset in the region is likely to increase in the future.

As in the previous regression analyses, drought is statis-

Table 4 - Estimation Results: Probit Regression for the Sahel Region

| VARIABLES | Coefficient | (Std. Err.) |
|---------------------------------|-------------|-------------|
| Conflict previous year | -1.025* | (0.473) |
| F&L per capita income (lagged) | -1.293* | (0.606) |
| F&L log population (lagged) | -0.070 | (0.158) |
| F&L log (% mountainous) | 0.308* | (0.145) |
| F&L oil exporter | 0.122 | (0.492) |
| F&L instability (lagged) | 0.082 | (0.322) |
| F&L democracy (lagged) | 0.018 | (0.019) |
| F&L ethnic fractionalization | 1.843* | (0.769) |
| F&L religious fractionalization | -1.511** | (0.325) |
| Drought | 0.641† | (0.339) |
| Flood | 0.011 | (0.183) |
| Youth (%15-29) | 0.292* | (0.138) |
| Constant | -6.450** | (2.327) |
| Observations | 694 | 694 |

Source: Own Analysis;

†<0.01 ** <0.05 * <0.10 levels of statistical significance

tically significant and positively associated with a higher likelihood of conflict, controlling for other factors. Conversely, floods do not show any statistically significant effect on the onset of conflict. The results of this analysis, therefore, clearly suggest that the size of the youth population matters for the onset of conflict in this region. Figure 8 presents the graphs of the size of the youth population cohort in the Sahel, which is very significant in countries like Mali or Eritrea (see Annex A).

Heightened risk of conflict and crime for youths in the Sahel will be elevated directly through climate change and its deleterious effects on natural resources; and indirectly through the compounded effects of migrating to urban areas. The onset of conflict and crime will be first mitigated through effective climate change adaptation policies. However, doing so may prove challenging due, first, to weak governmental capacity to provide the tools and mechanisms to the most vulnerable communities to be able to increase their resilience; and second, due to permanent migration flows into urban areas, which are already placing additional stresses on the already scarce resources and weak institutional capacity of local governments. In addition, government capacity must be improved to respond quickly to mitigate the influence of climate change factors and socio-economic factors.

Conflict and crime prevention strategies that target youths, in particular, should be prioritized by policymakers. Strategies for youth can take many forms, but some of the most commonly utilized programs are those related to employment since unemployment appears to be one of the major risk factors for youths engaging in conflict and/or crime (Ihlanfeldt, 2006). In fact, for the majority of youth who lack a university degree, finding employment in the formal sector is virtually impossible. The vast majority of youths that come from pastoralist communities can barely read or write, thus, making it even more difficult to enter the formal labor market if they migrate to urban centers. Employment and public works programs are, thus, devised to provide a meaningful source of income. However, these programs are generally limited to several months/years and tied to a specific project. Youths learn a set of skills in order to increase their employability and might find short-term employment during the life of the project. One of the major limitations encountered is the lack of sustainabil-

ity beyond the life of the project and youths are not able to capitalize on the skills learned to secure longer-term jobs, which, in turn, might increase the likelihood of turning back to crime.

Most evaluations of these programs have been conducted in developed countries and very few in low and middle-income countries. Evaluations in developed countries show limited impact: only 15 percent of youth employment programs in low and middle-income countries have evaluated the effects of these programs' interventions on beneficiaries' outcomes.⁸

The available evidence on actual program impact shows that learning technical skills alone does not appear to have a significant effect in maintaining a job over the long term. However, one aspect that, coupled with learning technical skills, seems to work in the long-term is life skills. Programs that use a three-prong approach that includes life skills, vocational skills, and job attachment appear to have a more sustained impact even in the absence of employment. For example, a recent impact evaluation conducted by the Inter-American Development Bank (IADB) on an employment program for youths found that the life skills component of the program had a significant impact on the beneficiaries' employability and ability to maintain a job (Ibarrarán et al., 2012). Thus, it appears that while youth employment programs in isolation have limited impact, the inclusion of life skills modules into these programs might have positive effects in both the short term and long term. More research, however, is needed in order to understand the mechanisms through which life skills training help youths enter the labor market.

Finally, new and innovative approaches, such as youth micro-finance programs are being implemented in an effort to address issues of unemployment for disaffected youth. For example, Yemen, with the assistance of Qatar, is currently implementing a youth-finance facility that provides financial services (micro-loans) to young adults ages 18 to 30. The main objective of this facility—Al-Amal microfinance Bank⁹—is to provide youths with access to fixed income loans from US\$50 to US\$100 to start a business or to expand a current business.

8 <http://www.youth-employment-inventory.org>

9 <http://www.alamalbank.com/index.php?lang=en>

4. Conclusion and Policy Options

Climate change is perhaps the most important development challenge of the twenty-first century. The implications of climate change for the Sahel region are significant and likely to play out in different ways. Two of the most important effects of climate change for the future of the Sahel are migration and, potentially, conflict (UNEP, 2011). This study has attempted to establish the link between climate change, migration, and conflict with a particular regional focus - the Sahel region - and population focus - the youth. At the regional level the results of the preliminary analyses reveal that climate change-related disasters have a strong correlation with behavioral responses such as migration and conflict. At a population level, while the poorest will be affected the most by the negative consequences of a changing climate, youths are the cohort that is likely to be affected the most by a complex interplay of compounding factors related to climate change and socio-economic conditions (UNESA, 2010).

The findings of this study, however, should be interpreted with caution since they do not identify causality between climate change and migration and/or conflict. While the estimates from the regression analyses are robust in the sense that climate change and climate change-related disasters pose a serious risk for conflict in many vulnerable areas, they call for further research. Most research on this topic has not concluded that climate change alone causes conflict. The mechanisms through which conflict takes place are complex and varied and climate change is increasingly becoming an important one. Additional research on this area should aim at identifying the areas within the countries of this region that are most vulnerable to the negative consequences of climate change. Also, given that climate change poses a serious risk to the onset of conflict, it is also likely to put at risk gains made in post-conflict reconstruction/stabilization programs.

In light of the serious situation that young people in the Sahel are facing, what are the potential policy options

to ensure that this cohort acquires tools and mechanisms to adapt to a changing climate and prevent them from migrating to urban areas and increase the risk of engaging in conflict and crime? Because the consequences of climate change are transferred through multiple channels, policies will have to be designed and implemented to address these issues on multiple fronts. Based on the findings, this study has identified two potential key avenues through which policies can be devised: (i) climate change adaptation measures and (ii) conflict and crime prevention measures. These two areas are not exclusive and can benefit from each other.

4.1 Climate Change Adaptation Measures

Building resilience to climate change by adapting to it is considered a good development policy (Verner, 2010). It requires both national and local governments to devise coordinated strategies to effectively respond to the needs of local communities. There are several policy areas through which climate change adaptation can be implemented (Verner, 2010).¹⁰ These options target three key areas of development: (a) Good governance; (b) Social capital; and (c) Asset-based adaptation.

- i. **Good Governance:** Improving the institutional capacity at the national and local government levels is a key pillar for effective climate change adaptation policies. Government entities should have adequate human, financial, and infrastructure capacity to identify and respond to issues related to climate change and make services accessible to the most vulnerable population. Improving government capacity, however, poses a serious challenge for many of the countries in the Sahel region. As mentioned above, institutions in the

¹⁰ For an extensive review of these areas, please refer to Verner (2010).

Sahel are weak and responses to climate-related crises have already reduced governmental capacity (Kandji et. al, 2006).

- ii. **Social Capital:** Social capital encompasses a broad range of behaviors and interactions between communities and individuals that ultimately influence the degree of their vulnerability to climate change. In the face of a rapidly changing climate and the increasing scarcity of resources, cooperation between communities is likely to decrease. Programs at the community level should aim at building resilience while restoring cooperative relations so that communities can be equipped to respond to climate change. Well-designed community-driven development programs (CDD) can contribute to empowering communities and strengthening cooperative relationships to effectively adapt to climate change. Some CDD programs have shown promising results and best practices should be adapted to the local characteristics of the countries in the Sahel region (Verner, 2010).
- iii. **Asset-based Adaptation:** The household assets of the poor are far more vulnerable to the negative consequences of climate change (Verner, 2010). It is in this context devising mechanisms to prevent an accelerated depletion of household assets - livestock, education, health, income - is crucial to increase the resilience and adaptive capacity of vulnerable households to climate change.

4.2 Conflict and Crime Prevention Measures

Preventing conflict and crime is also good development policy. There is ample evidence that crime and conflict disrupt economic development, social resilience, and democratic stability (World Bank, 2011). Devising

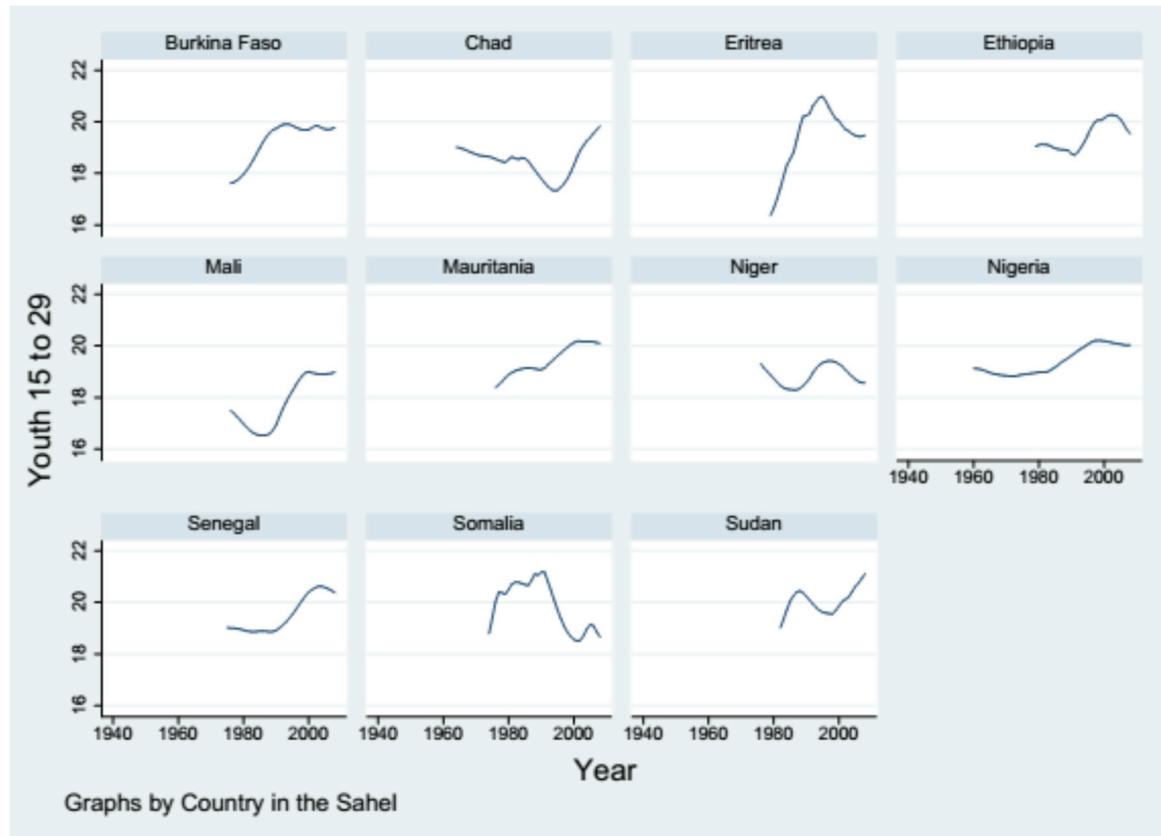
policies to address the risks of conflict and crime require adapting them to the local needs instead of employing a “one size fits all” approach. There is significant heterogeneity between countries in the Sahel that calls for tailored approaches. Potential policy areas could target (a) urban youth and (b) rural youth. Both are related to providing employment for this cohort since it is one of the main risk factors for conflict and crime (World Bank, 2011).

Providing skills and employment opportunities for unemployed **urban youth** is instrumental to prevent conflict and crime both in the short and long term. Youths in urban areas are more likely to suffer from disaffection as they might have already gone through the process of migrating to urban areas due seeking better ways to earn a living. Programs should be available to ensure that they earn basic skills and can enter the labor market. However, in addition to providing basic vocational skills, employment and training programs should also incorporate life-skills training.

Rural youth might be inclined or forced to migrate as a result of climate change. In order to prevent this cohort from migrating to urban areas, it is important to provide proper mechanisms for pastoralist activities to be preserved. Pastoralist communities have devised strategies to adapt to climatic change for centuries. As the climate changes rapidly, governments in the region should ensure that policies and programs enhance the capacity of these communities to adapt and possibly expand their activities. There is evidence that multi-level government coordination - from national to local - coupled with land-use management and land-use regulations and investment in infrastructure could contribute for the sustainability of pastoralist communities and expansion crop-livestock systems (Izcowicz et Al, 2012). As a result, youths would have access to employment opportunities within their communities.

Annex

Figure 9: Youth Population Cohort in the Sahel Countries



Source: Own Analysis

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