

Investigating the Link between Environmental Scarcity and Conflict in Darfur¹

Paul Omondi

Abstract

Although it is widely acknowledged that environmental factors are seldom, if ever, the sole cause of conflict, there is increasing recognition that the effects of climate change contribute to security risks as a result of changes in environmental conditions and increased competition for natural resources. This paper takes the view that an important impact of these environmental stresses in Darfur was resource scarcity. In turn, increased shrinkage of livelihoods undermined the resilience capacity of the local communities to drought-related shocks, creating opportunities for conflict. The central aim of this paper is to interrogate the resource scarcity-security relationship, focusing primarily on two types of evidence. The first relates to rainfall records, which is primarily associated with supply-induced scarcity. Rainfall patterns showed a declining trend and variability from the mid-1970s through to the 1980s. The second relates to population pressure, which is primarily associated with demand-induced scarcity. On this evidence, demographic trends show that a marked increase in population density since the mid-1970s has put pressure on both the pastoral and agricultural livelihood systems. Placing the above into perspective, this paper provides the basis for a more holistic appreciation of the Darfur problem, and for looking at the ongoing conflict in depth.

1. Introduction

Darfur continues to experience violent conflict that severely affect human security, resulting in considerable loss of life and displacement. Over the years, the conflict has become more widespread, in terms of frequency and geographical spread. It is widely recognised that the conflict has been driven by a range of factors, including such disparate dimensions as economic and political marginalization and land use and ownership differences. In recent years, however, much research has tended to situate the conflict within the context of environmental risks. Geographically, Darfur lies on the Sudano-Sahel belt,² a region on climatic stress thresholds, where insecurity is also a highly salient issue.

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² Sudan-Sahel Belt is an ecological zone spread across the continent from Senegal to Sudan. The zone

Ideally, understanding the climate change context of the continuing conflict calls for more analytical attention to the underlying causes of the localised violence prior to the outbreak of the civil war. The climatic patterns associated with climate change in Darfur started to manifest themselves from the early 1970s. These changes occurred during a time when the region witnessed an increase in the frequency of localised conflicts. The combination of persistent drought and population growth resulted in shrinkage of natural resources and livelihoods and, consequently, movements and possible resettlement of the northern Darfur populations into southern Darfur. The argument here is that these conditions nurtured the circumstances in which ethnic cleavages and violence seethed since the mid-70s, contributing to conflict as a coping strategy against scarcity.

It is clear that, over generations, the inhabitants of Darfur had devised livelihood techniques and coping mechanisms that were suitable and sustainable for the region, with the apparent goal of mitigating potential security risks between the pastoralists and farmers. Mamdani (2007) points to "community-level split inside Darfur, between nomads and settled farmers, who had earlier forged a way of sharing the use of semi-arid land in the dry season." Unfortunately, the climatic and demographic transitions that set in towards the late 1970s seemed to have generated consequences that could no longer be covered by these strategies. With the disintegration of these livelihood techniques and coping mechanisms, "co-operation turned into an intense struggle over diminishing resources". In a large way, therefore, the resultant conflict can be viewed as a result of diminished ability of the inhabitants to cope with the emerging ecological challenges.

This paper seeks to further the understanding of the relationship between climate change and security in Darfur prior to the outbreak of the large-scale civil war in 2003, and to provide some insights on the changing dynamics of pastoralist-farmer interaction and emergent risk of conflict. Whereas political dynamics and governance issues have also influenced the security circumstances in a major way, the main focus of this paper is on the ecological dimension as a possible causal link in the insecurity situation. It is therefore important to note that this paper's intention is not to present environmental pressures as the singular cause of the conflict, overlooking the role of high politics.

The remaining sections of this paper have the following structure: section two provides a brief conceptual review relevant to an understanding of environmental degradation, scarcity and conflict in Darfur. Section three provides a discussion on environmental degradation, scarcity and conflict in Darfur, first sketching out the broad ecological context of Darfur. The section then proceeds to examine the context and drivers of localized conflicts in the region. Finally, this section interrogates the resource scarcity-conflict relationship, specifically focusing on the

constitutes the transition between the hyper-arid Sahara desert to the north and the savanna regions to the south.

role of rainfall and population. Section four looks at response to climatic risks in the context of adaptation versus conflict. More specifically, it examines the dynamics of the pastoralist-farmer relationship, providing an assessment of the community coping and conflict management strategies, and examining the factors that appeared to have contributed to the collapse of these mechanisms. The paper concludes with section five, providing two key conclusions: first, that reduced resilience and adaptive capacities resulted in the collapse of the community coping and conflict management strategies, in turn creating deep-seated ecological traps that, over time, transformed the pastoralist-farmer relationship into one of inter-ethnic competition. Second, that the ethnic dimension of the conflict is largely a manifestation of competition for resources.

2. Conceptual issues

2.1 Scarcity and conflicts: Exploring the links

This paper uses the 'scarcity' paradigm as a framework for analyzing the ways in which climate change mediates between environmental stress, competition over natural resources and conflict. Although environmental degradation does not, of necessity, mean scarcity, epistemological perspectives on resource scarcity closely link it with environmental degradation. The operative definition offered by the UN Interagency Framework Team for Preventive Action succinctly sums up 'environmental scarcity' as "a situation where renewable resources—such as water, forests or productive land—are degraded or decreasing (in the sense that the resource is used faster than it is replenished)" (UNEP, 2010, p. 4). Homer-Dixon, Boutwell & Rathjens (1993, p. 42) provide broad account of the means through which scarcity is generated. Arguably, three processes that constitute sources of scarcity include the decrease in quantity and quality of resources at a rate faster than their renewal, population growth, and unequal resource access.

The conceptual development of scarcity underscores the interrelated issues of resource competition and violence, and has of recent gained prominence as a central point for clarifying conflict motives. A Situational Analysis Report from the UN Office for the Coordination of Humanitarian Affairs (UNOCHA) (2009, p. 3) observed that the pressure on scarce resources like water, biomass and pasture has become the trigger for most conflicts in the pastoral regions of Africa.

Progress made in the exploration of environmental security over the past two decades has presented different ways of understanding environment, scarcity and conflict. Making a contribution to the understanding of the connection between environment and conflict, Libiszewski (undated, p. 12) defines environmental conflict as "...traditional conflicts induced by environmental degradation". According to Libiszewski, environmental conflicts are characterised by the principal importance of degradation in one or more of the following fields: overuse of renewable resources; overstrain of the environment's sink capacity; impoverishment of the living space (Ibid). Certainly, Homer-Dixon and the

Toronto Group deserve tribute for attempting to disentangle the scarcity-conflict dynamics. They operationalized three possible pathways that link environmental change or scarcity to conflict. These are classified as: 'Simple scarcity conflicts' in reference to resource wars between and within states; 'Group-identity conflicts' in reference to conflicts arising from scarcity-induced population movements; 'Deprivation conflicts' in reference to scarcity induced by economic hardships and socio-institutional disruptions.

Harris (cited in Herrero, 2003) adjudicates the environment, scarcity and conflict model, drawing attention not just to the resource scarcity-conflict relationship, but ties the occurrence of conflict to diminished resilience and capacity to cope with the climatic transitions. He posits that conflict, like many other cultural features, was a matter of cultural adaptation to conditions of demographic pressure and scarcity of natural resources. From this perspective, we can view environmental conflict as a legacy of resource crisis shaped by cultural adaptation rather than, as he observes, "an instinctive reaction to ecological stress" (Herrero, 2003, p. 8). Viewed in this manner, it is instructive to see conflict as a coping strategy against livelihood shrinkage. Harris' conceptualization offers one fundamental conclusion: that conflict is but a means of coping with or adapting to livelihood shrinkage. This position indicates that any useful analysis of environmental conflict requires the contemplation, in combination, of both ecological transition and capacity to cope.

2.2 Theoretical alliances

The theoretical alliances that gather around the scarcity-conflict argument lend themselves to the Malthusian assumption, which underlines a possible causal link between population increase, resource shortage and violence. This neo-classical posture is represented quite explicitly in two schools. One school is represented by the aforementioned Toronto Group. Thomas Homer-Dixon, who is essentially the most renowned representative of this school, outlines four social effects of environmental degradation. These are: a decrease in agricultural production; general economic decline; population displacements, and disruption of institutions and social relations. Accordingly, the group argues, these social effects generate and reinforce instability, leading to violent conflict.

The second view on the scarcity-conflict viewpoint emerges from the 'Environmental Conflicts Project' (ENCOP) of the Swiss Federal Institute of Technology in Zurich and the Swiss Peace Foundation in Bern. The mainstay of ENCOP is that environmental conflicts manifest themselves as fighting over resources, although the emphasis here is on environmental change or degradation rather than on the concept of resource *per se*. The ENCOP school highlights degradation as occurring in the following ways: overuse of renewable resources; overstrain of the environment's sinking capacity (to deal with pollution), and impoverishment of the living space. Ultimately, degradation leads to environmental conflicts that "manifest themselves as political, social, economic, ethnic, religious,

ideological or territorial conflicts, or conflicts over resources or national interests, or any other type of conflict" (Libiszewski, undated:12).

The 'Toronto Group' is generally credited with attempting to more thoroughly elucidate the concept of environmental scarcity. Howard and Homer-Dixon (1996, p. 5) differentiate three variants of scarcity. These are: demand-induced scarcity caused by population growth or increased per capita resource consumption; supply-induced scarcity, caused by degradation and depletion of environmental resources; and structural scarcity, caused by an unbalanced distribution of resources that severely affect less powerful groups in the society. The three types of scarcity provide important conceptual clarifications of the scarcity-conflict nexus in Darfur. The three paragraphs below briefly discuss the three types of scarcity and the possibilities of increasing the risk of violent conflict in Darfur.

Supply-induced scarcity: Supply scarcity was generally caused by a decrease in rainfall. This was chiefly visible in considerable rainfall variations and decline from the 1960s through to the 1990s. One important implication of these climatic changes was diminished resilience of the nomadic groups to cope with the climatic variations, subsequently leading to conflict as a coping strategy. The most notable is the great drought and famine of 1984-85 that "led to localized conflicts that generally pitted pastoralists against farmers in a struggle for diminishing resources, culminating in the Fur-Arab war of 1987-89" (IRIN, 2007).

Demand-induced scarcity: Population is identified as an important factor in demand-induced scarcity. In Darfur, this can be better appreciated by looking at the demographic shifts. Driven by population growth, the period 1973-83 saw considerable expansion in population density, growing from 4 to 10 people per square kilo meter. As the amount of rainfall declined, large groups were forced to migrate from the northern to the southern parts of Darfur, in so doing setting deep traps that degenerated into ethnic violence shaped by increasing resource competition and emerging anti-'outsider' mobilizations.

Structural scarcity: An important factor at the core of structural scarcity and source of political tension has been land use and land ownership issues. Land resource is a central function of the livelihoods, both for the inhabitants of African descent who are predominantly sedentary farmers, and those of Arab descent who are primarily pastoralists. The two groups have dissimilar land-use requirements and patterns, and therefore also customarily asserted control and claimed rights over land in different ways. The administrative boundary changes imposed by the predominantly Arab regime in Khartoum served to alienate the farming tribes (Paglia, 2007, p. 34). Tensions were reinforced by contemporary land administration issues influenced by nearly 35 years of land-related legislation. The most notable legislative events were the 'Unregistered Land Act' of 1970 and 'Civil Transactions Act' of 1984, which underscored the "principle of state ownership of the land" (USAID, 2003, p. 46). These legislations conferred ownership of all non-

registered customary lands to the state, thereby removing the control of poor rural communities over their land (Ibid, p. 9). This became the rallying point for radicalism and rebellion by the African communities, and as a result, the racial meaning (of the term African) came to take a strong hold in both the counter-insurgency and the insurgency in Darfur (Mamdani, 2007). On the other hand, the Arab migrants from northern Darfur, hitherto 'guests', were ready to claim rights for establishing their own native administration structures in their new homes since the land they occupy belongs to the government (Abdul-Jalil, 2006, p. 18).

2.3 Conceptualizing the Darfur conflict: Causal link between scarcity and conflict

Debate on whether competition over natural resources led to conflict is confronted by one critical question: is it logical to expand the notion of natural resources into the origin of conflict in Darfur? Attempts to answer this question have rendered Darfur a ubiquitous case study as far as emerging discussions of the environmental dimension of human security is concerned.

Figure 1 below presents a conceptual diagram of the causal link between scarcity due to climate change and conflict in Darfur. Drawing on the synopsis of the three types of scarcity outlined in the diagram, it is easy to recognise that the issues related to the environment largely emerge as 'proximate causes'. Due to ecological stress, the mainly northern populations moved and settled in the southern parts of Darfur, heightening pressure on grazing land and water. The decline of rainfall resulted in reduced production, and for compensation, horizontal expansion of farming became an option for the farmers. On the other hand, due to population increases, the average land holding per household or person has decreased (Fadul, 2004, p. 36). The result is that ethnic fault-lines became more concrete, with these differences expressed through violent conflicts.

3. Environmental degradation, scarcity and conflict in Darfur

3.1 A look at Darfur's ecology

Darfur is located in the western part of Sudan. The region is relatively expansive, covering an area of about 496,400 km², which represents approximately 26 percent of the total area of Sudan Republic. Darfur lies within a region where ecological risks are relatively high. Virtually the entire Darfur region is characterised as arid. In spite of this broad categorization, however, the region has different ecological configurations, typically desert, semi-desert and low-rainfall savannah woodland settings. The northern region of Darfur is desert, the Sahara, and years may pass without any rainfall. The eastern region is semi-desert, similarly with little water. The western region of Sudan is generally characterized as arid. The southern region of western Sudan is known as the *qoz*, a land of sand dunes that in the rainy season is characterized by a rolling mantle of grass and has more reliable sources of water with its bore holes (Bilsborrow, et al., 1990; Robinson, 2004).

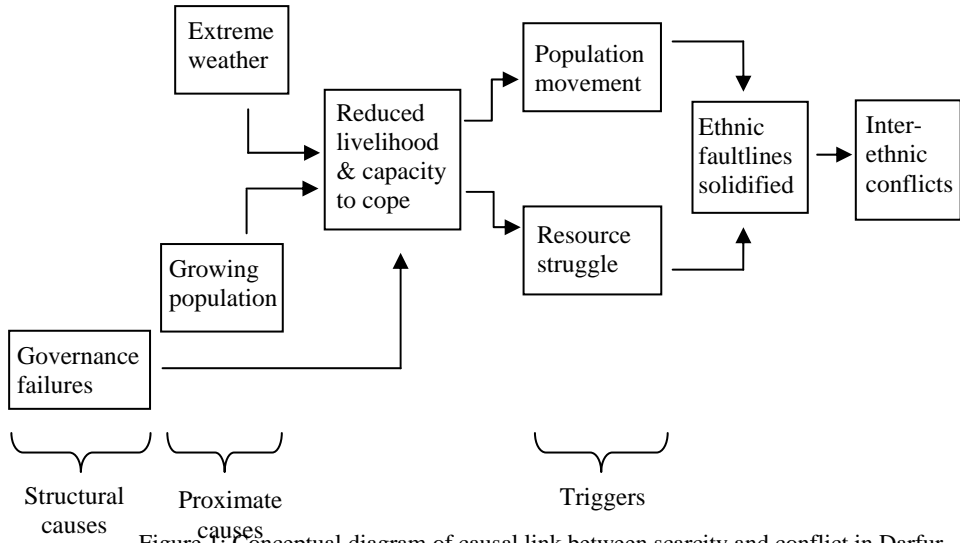


Figure 1: Conceptual diagram of causal link between scarcity and conflict in Darfur

The important threats related to environmental deterioration in Sudan, and for that matter in Darfur, are primarily linked to long-term aridity associated with increased temperatures and decreased precipitation. Thus, for a region that is already exposed to many environmental hazards, the existing ecological trends, if not addressed, are likely to intensify vulnerability. Climate models in Sudan's First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) project a scenario of warmer temperatures relative to the baseline (1961-1990). Accordingly, average temperatures are expected to rise significantly by 2060, by 1.5°C - 3.1°C above the baseline during August and 1.1°C - 2.1°C during January. In contrast to the increases in temperature, the projections indicate that average rainfall will reduce by about 6mm per month during the rainy season (Government of Sudan (GOS), 2007:5).

One of the most salient features of environmental degradation is annual loss of forest and other wooded land. In Darfur, there is a total annual loss of 251,333 ha against an annual regeneration of 153,201 ha. Furthermore, Darfur, together with Kordofan and Equatoria States, faces a further loss of forest, due to desertification, war, and so on. In Darfur, the total annual additional loss of forest is 18,281 ha (FAO, 2010, p. 7).

But perhaps more important is that continued insecurity in Darfur has sustained negative impacts on the environment. More specifically, displacement into slums, camps and informal settlements sets the stage for continued environmental degradation. UNEP findings (2007, p. 104) indicate that impacts related to the concentration of people in camps or settlements include deforestation and the fuel wood crisis in dry land camp areas; land degradation; unsustainable groundwater extraction; and water pollution. However, it should, however be considered that, at

another level, massive population movements is a major factor in regeneration of vegetation.³

One way to examine the manner in which climate change is inducing scarcity in Darfur is to look at potential impact on water resources and agricultural production. Both water resources and agriculture are identified in the National Adaptation Programmes of Action (NAPA) of Sudan to be sectors that are quite vulnerable to climate change (GOS, 2007).

Access to water: Climate change is predicted to pose an ongoing threat to water resources in Sudan. It is shown that, at the country level, Sudan's water resources will be adversely affected by climate change. Water scarcity is primarily a result of decreased precipitation and/or increased temperatures and evaporation, with a subsequent impact on groundwater recharge. The projections also indicate that, under these conditions, soil moisture is likely to decline (GOS, 2007, p. 6). But what is probably of more immediate concern is continued groundwater depletion. According to the UN Secretary General Ban Ki-moon, "The scarcity of water in Darfur is growing, with reports of a significant number of wells drying up," (Charbonneau, 2010).

Agricultural production: Although agriculture remains the major economic activity of Darfur, productivity is affected by climatic change and environmental degradation. Drought threatens approximately 12 million hectares of rain-fed agriculture land, particularly in the northern Kordofan and Darfur states (Zakieldeen, 2007, p. 15). The predictions of Sudan's NAPA for the food production system is one of dwindling output, chiefly as a result of desertification of arable areas. Accordingly, the humid agro-climatic zones are likely to shift southward, rendering areas of the north increasingly unsuitable for agriculture (GOS, 2007, p. 6). This representation accords with recent UNEP outlook on long-term crop production. Using climate model to project the scale of potential changes in crop yields for sorghum, millet and gum arabic, the results suggested a significant drop in crop production in the region of El Obeid, predicting a drop by 70 percent, from 495 kg/hectare to 150 kg/hectare (UNEP, 2007, p. 61).

3.2 Context and drivers of localised conflicts in Darfur

The scope of the analysis of the localised conflicts in Darfur in this paper covers the period 1963 to 2002. This span of time was chosen for the fact that the period was characterised by increased incidences of localised tribal violence, and it was also considered that the post-2003 data may introduce biases in the analysis because most of the violence by then pertained largely to emerging ethno-political dynamics, which propelled the conflict into higher-level political dimensions.

³ Russell Schimmer (2009, p. 324) established a steady increase of non-agricultural vegetation coverage and vigour, in formerly agrarian and livestock grazing ranges deserted due to the conflict.

The wider literature on Darfur suggests that the region has been an arena for inter-ethnic conflicts throughout recorded history. Conception of how the ethnic dimension has influenced the security circumstances is espoused from two perspectives: ethnic identity and means of livelihood. On the basis of ethnic identity, the inhabitants are broadly classified as either African or Arab. Ethnically, Arabs constitute 39 percent while Africans make up 61 percent (Schimmer, 2010, p. 24). Notably, the ethnic pattern of identity seems to be the one that has shaped the region's socio-political trajectory.

On the basis of means of livelihood, the inhabitants are classified as either sedentary farmers or nomadic pastoralists. Most people of African descent are sedentary farmers and reside mainly in the southern region of Darfur, exceptions being Zaghawa and Bedeyat tribes, that together with most people of Arab descent are nomadic herders and inhabit mainly the northern zone of Darfur.⁴

The two sources that were reviewed during the preparation of this paper: UNEP (2007, p. 82) and Suliman (2000, p. 12) established a total number of 45 conflict incidents occurred over a 34-year period, between 1968 and 2002. According to the records, the conflicts involved a total of 34 ethnic groups, comprising 16 African and 18 Arab communities, in essence representing 14 sedentary farmer and 20 pastoralist communities.

3.3 Livelihood patterns and links to local conflicts in Darfur

Inherent in the debate around the localised conflicts in Darfur is the aspect of livelihoods. The patterns of livelihood are broadly classified as either nomadic pastoralism or sedentary farming. Although the conflict that has afflicted the region is widely viewed as a conflict between the Arab and Black African communities, it is patterns of livelihoods that appear to have, in the main, influenced the security threats.

Figure 2 provides information about the livelihoods of the main parties in the local conflicts in Darfur during the specified period. Conflict records suggest that, out of the 39 incidents for which we are able to identify the main actors, the highest number (26) were those that pitted a pastoralist group against a sedentary farmer group. On the other hand, 13 incidents involved two pastoralist groups. An observation that deserves attention is that none of the incidents played out as a 'farmer-farmer' clash, notwithstanding the fact that up to 14 sedentary farmer groups were involved in conflicts with Arabs. Although it is difficult to tell who between the pastoralists and sedentary farmers were the aggressor, the pattern of violence compellingly suggest that it was the pastoralists. A plausible answer lies in the fact that, among pastoralists, migration constitutes an important mechanism to deal with climatic stress, putting the pastoralists and sedentary farmers into conflict with each other. Viewed against the backdrop of the ethnic identities of the main actors, the livelihoods issue appears to be a more nuanced factor than

⁴ Unlike the Arab pastoralists, the Zaghawa and the Bedeyat are primarily camel herders

ethnicity, which in a way goes against the inherent assumption regarding the influence of ethnicity as the single most important factor in the occurrence of violence.

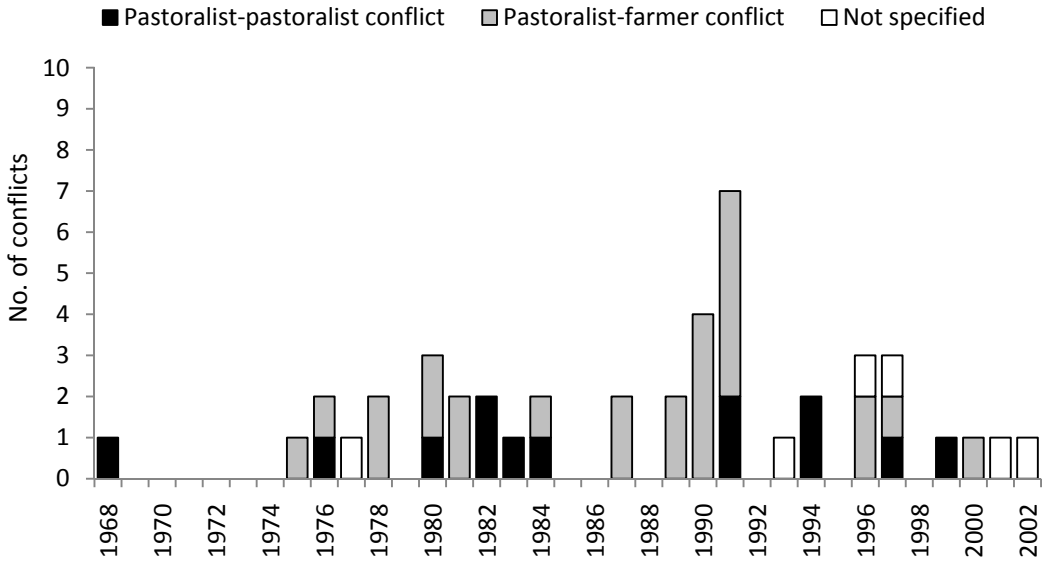


Fig. 2: Livelihoods of the main parties in the local conflict in Darfur between 1968 and 2002. Sources: UNEP (2007); Suliman (2000)

3.4 Assessment of the conflict drivers

The debate over the factors responsible for the conflict in Darfur illustrates the intricacy of a conflict that has various dimensions. There is no doubt that many of the drivers of local violence in Darfur were, at least in part, environmental. The way to corroborate this is to look at causes of conflict at the local level. Figure 3 presents the issues revolving around the local conflicts prior to the large scale war.⁵ A clear observation that emerges is that issues related to natural resources—resource disputes and territorial disputes—constituted the overriding causal factors of the violence. Additionally, aspects of resource issues, notably grazing rights, can be discerned as having played an important role, in combination with other factors in the occurrence of tribal conflicts.

Taking the above into account, there is certainty that resource scarcity was an important aspect of insecurity in Darfur. This is mainly due to the fact that the environmental pressure that prevailed in northern Darfur since the 1970s rendered, particularly, the pastoralist groups vulnerable to losing their livelihoods. In the face

⁵ For the purposes of this discussion, the conflict drivers are classified into four broad categories: Resource disputes (grazing and water rights); Territorial disputes (administrative boundaries, land disputes); Administration and leadership disputes (local political); Combined factors (local politics, grazing rights and cattle raiding).

of these stresses, the pastoralists adopted a range of coping strategies, some of these making them more vulnerable to conflict. The findings from the UNEP assessment (2007, p. 86) draws attention to three pastoralist coping strategies (among others) that generate the risk of conflict. These are: competing directly with other grazers for preferred areas of higher productivity (conflict risk), moving and grazing livestock on cropland without consent (conflict risk), and reducing competition by forcing other pastoralists and agriculturalists off previously shared land as a last resort (proactive conflict).

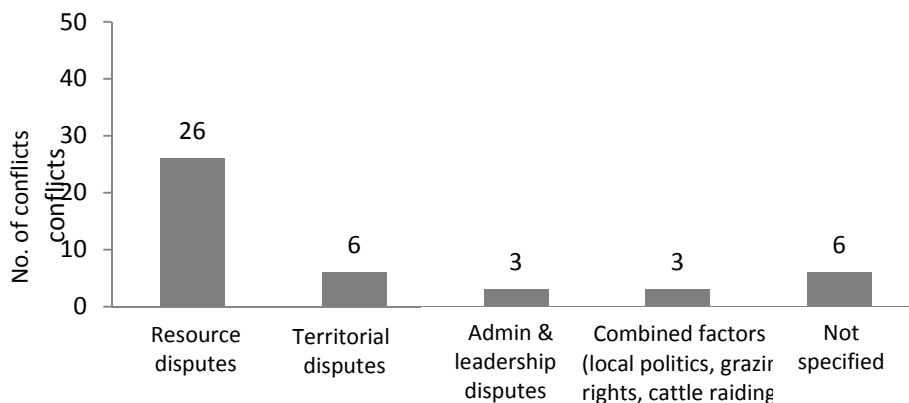


Fig. 3: Drivers of local conflicts in Darfur between 1968 and 2002
Sources: UNEP (2007); Suliman (2000)

3.5 Environmental scarcities, vulnerability and conflict risk

As noted in an earlier section in this paper, the three types of scarcity (supply, demand and structural) all predisposed Darfur to security risks, in one way or another. As a basis for discussion, however, the analysis in this section focuses primarily on the supply and demand variables of scarcity, which are key to the case and, therefore of more relevance in this context. The linkages between these scarcities and conflict are discussed in detail below.

3.5.1 The role of rainfall as a contributing cause of scarcity and conflict: The existing literature is replete with evidence of linkages between rainfall shortage and the occurrence of local conflict. It is important to note that, although the analysis provided in this section is made for Darfur as a whole, rainfall has a very high variability both spatially and temporally. Figure 4 presents the annual mean rainfall in Darfur for the period 1963-2002. As reflected in the inter-annual means, the data shows evidence of dynamic variability virtually throughout the 1960s to 80s rainfall history. The most outstanding negative outliers occurred during the 1980s period, which was also associated with the period of the most intense drought in Sudan's recorded history.

A useful way to look at rainfall trends is also to examine long-period average precipitation, in this case based on inter-decadal means. Considered wholesale,

there is indication of lower rainfall between 1972-82 and 1983-92 decadal interludes. Notable inter-decadal outliers are evident in 1972, 1982 and 1988. Kevane and Gray (2008, p. 5) established that the series exhibited one structural break in 1972, which accords with the dating of negative outlier in 1972.

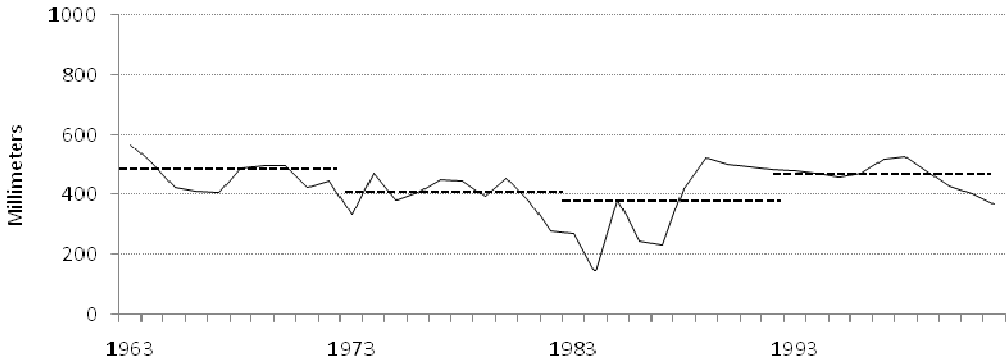


Fig. 4: Annual mean rainfall in Darfur between 1963 and 2002
Sources: Suliman (2008); Kevane and Gray (2008)⁶

Table 1 again displays the rainfall estimates for Darfur between 1936-2002, presented as minimum, maximum, mean and coefficient of variation (CV)⁷ in five-year bases. Overall, the data points to relatively high rainfall variability as reflected in an overall CV of 21.0 percent. Of note here is the five-year period between 1983 and 1987 in which the most variable rainfall was recorded, with a CV of 34.0 percent.

Having noted this, we can now look at the interrelation between rainfall and conflicts in Darfur during this period. In Figure 5, rainfall is plotted against conflict records. The conflict data is presented in stacked columns, with each stack representing numbers of conflict incidents. It can be seen that the period since the mid-70s saw a definite increase in the level of local conflicts in Darfur. It is, however worthy of note that fewer violent incidences occurred between 1983 and 1986 in spite of the particularly low rainfall.

⁶ For the period between 1989 and 2002, the overall precipitation estimates are based on the combined average for four latitudinal-longitudinal nodes: Northwestern (lat. 13.75, long. 23.75); Northeastern (lat. 13.75, long. 26.25); Southwestern (lat. 11.25, long. 23.75) and Southeastern (lat. 11.25, long. 26.25), based on David Lister, Climate Research Unit. As such, the 1963-1988 and 1989-2002 datasets are not necessarily comparable.

⁷ The CV represents the ratio of the standard deviation to the mean of the five-year integrated precipitation values, and is useful for comparing the degree of variation.

Table 1: Mean rainfall for Darfur in five-year period between 1963 and 2002

Period	Minimum	Maximum	Mean	CV
1963-1967	408	565	462	15
1968-1972	424	496	469	7
1973-1977	330	468	407	13
1978-1982	275	451	388	18
1983-1987	143	381	253	34
1988-1992	418	520	481	8
1993-1997	455	513	478	5
1998-2002	370	523	440	14
Overall	143	565	422	21

Sources: Suliman (2008); Kevane and Gray (2008)

Interestingly, what we seem to observe is that years of negative outliers appeared to record none or lower incidents of conflict. On the contrary, an increase in conflict incidents appeared to coincide with the years of positive outliers, notably 1990-91 and 1996-97. It is perhaps for this reason that scholars such as Kevane and Gray (2008) critique attempts to correlate rainfall with the emergence of Darfur conflict. They argue that, although there is evidence of structural break to a lower level of rainfall in northern Darfur in the early 1970s, rainfall in Darfur did not decline significantly in the years immediately prior to the crisis. They, however, appear to observe caution on this conclusion, noting that, for longer periods of time, say 50 year periods, there is considerable evidence of a decline.

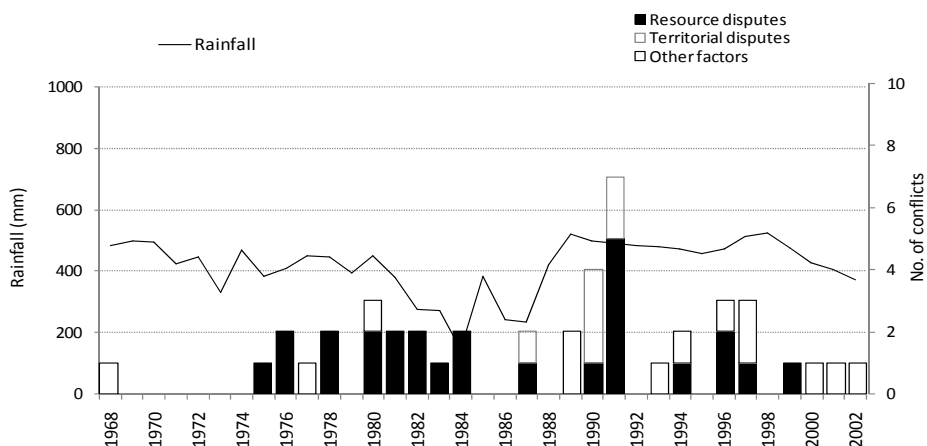


Fig. 5: Relationship between rainfall and conflict in Darfur between 1963 and 2002

Sources: Rainfall records: Suliman (2008); Kevane and Gray (2008);

Conflict records: UNEP (2007); Suliman (2000)

To discount the rainfall-conflict linkage, Kevane and Gray make the observation that structural break to lower mean rainfall levels appear to be uncorrelated with subsequent conflict in other Sahelian African countries, yet levels of violence have been nowhere near those of Darfur (2008, p. 2). But probably more interesting is

their second observation that many African countries that have not experienced structural declines in rainfall nevertheless saw increased conflict over the past several decades. To understand the rainfall-conflict relationship, nonetheless, we must first acknowledge the fact that pastoralists have over generations become well adapted to coping with harsh environments of Arid and Semi-arid Lands (ASALs) of the Sahel. Putting this into perspective, analysis of the rainfall-conflict relationship can therefore never be based on the presence or absence of immediately identifiable violent events, rather, conflict can be understood as the effect of long-term reduced adaptive capacity to conditions of low rainfall, which makes it more difficult to pinpoint the relationship.

Having noted the above, it becomes necessary to draw a distinction between the conflict drivers relative to rainfall over time. As shown, factors related to resource competition have been the most pronounced throughout the history of local conflicts. As such, resource scarcity may indeed be the common factor behind the eruption and surge in local conflicts. An important observation is that issues related to territorial disputes began to emerge during the late 1980s and became particularly intense in 1990-91. This may be attributed to the massive movements of people as a result of the drought and famine of the mid 1980s, which more profoundly affected the pastoralists. Virtually all reports from past studies investigating environmental linkages to local conflicts in Darfur cited pastoralist movements from the northern to southern parts of Darfur as a major cause of conflict. The UNEP (2007, p. 59) assessment shows that "Annual variability and relative scarcity of rainfall—in the north of Sudan in particular—have a dominant effect on agriculture and food security, and are strongly linked to displacement and related conflicts."

3.5.2 Population growth as a contributing cause of scarcity and conflict: The notable factor affecting demand-induced scarcity is population growth (UNEP, 2007, p. 85). That said, population pressure has, in effect, been identified as an important contributor to the increase in local conflict in Darfur. Comparison of the population growth rates between 1956-2003 censuses portrays a sharp demographic shift, indicating a population rise from just over 1 million in 1956 to approximately 6.5 million people in 2003 (Fadul, 2004, p. 35; United Nations Statistics Division, 2008, p. 18). In line with this growth, the almost half century period witnessed a relatively large increase in the population density, growing from 3 to well over 18 persons per km² (Ibid).

Differences in growth rates are, however, evident when comparison is made between North and South Darfur. For example, between 1983 and 1993, North Darfur's population dropped from approximately 1.3 to 1.2 million. On the contrary, South Darfur witnessed an increase from approximately 1.8 to 2.2 million (Mundt, 2011). Continued differences in the population growth rates are further noted for the period 1998-2003. Expressed as percentages, the population growth rates are given as 3.2 percent and 3.5 percent in North and South Darfur

respectively (World Bank, 2003, p. 1). This may partly be reflective of the well documented population movements and resettlement from the North to South Darfur during the period. A review of the literature shows that numerous Zaghawa pastoralists lost their livestock and moved south, where they became farmers. Tama and Gimir populations also moved south. At the same time, Arab nomads from northern Darfur and Chad established *damras* (nomad settlements) further south in Darfur (Tearfund, 2007, p.21).

Studies of relationship between population movements and unfavourable environmental conditions in the greater Sudan confirm that intensified migration patterns as a result of unfavourable environmental conditions were in fact not confined to Darfur. For example, the drought of the 1980s had a dramatic effect on pastoralist movements in the Jonglie region of Southern Sudan. The durations of stay seem to range from few months to well over twenty years (Omondi, 2011, p. 7). It is clear from the foregoing that, the propensity for longer periods of stay is what breeds inter-ethnic conflicts. Longer periods of stay can be interpreted as going against the customary system of seasonal migration, which is the essence of the right of access to resources during the dry seasons (Ibid).

Other than the general population increase, again what is remarkable is the decline of population segment identified as nomadic. A comparison of the nomadic population from four censuses conducted between 1956 and 1993 shows dramatic decline in Darfur's nomadic population. Relative to the total population, the nomadic population was only about 4 percent, down from about 15 percent and 19 percent in 1983 and 1973, respectively (Darfur Relief and Documentation Centre (DRDC), 2010, p. 25). This, in a way, points to increased motivation amongst the nomadic groups to turn to sedentary farming, particularly during the 1980s. This perspective accords with the observation that "nomadic groups are currently subject to the severe constriction of their pastoralist domain, accompanied by the blocking of livestock migration and trade routes by conflict-related insecurity, which has in turn badly affected traditional livelihoods" (Mundt, 2011).

An important implication of the population pressure and increasing demand for higher levels of food production, particularly in southern Darfur, is the effect on the extent and intensity of land use, which ultimately had a long-term impact on food production. Concomitant with this argument, traditional land use has been significantly altered. For example, this has led to shorter fallow periods and hence to the removal of vegetation cover and the dismantling of the top soil layer on the *qoz* sands, opening the possibilities for reactivation of the consolidated sand dunes and the advancement of moving sands (Mangouri, 2004, p. 46). Farming has also been extended the light clay and *gardud* soils on the *wadi* beds, which previously were reserved for dry season grazing areas for the livestock of nomads and settlers (Fadul, 2004).

4. Response to climatic risks: adaptation versus conflict

4.1 *Inter-community mechanisms and conflict management strategies*

While it would be unrealistic to claim that relations between pastoralists and agricultural communities in Darfur were consistently good, the capacity of Darfur's inhabitants to cope with the climatic variations in large part was derived from the complementary nature of their dissimilar livelihood. It is noted that, until 1970, there is also a well-documented history of local resolution for such conflicts, through established mediation and dispute resolution mechanisms (UNEP, 2008, p. 83). For that reason, the level of inter-ethnic cooperation has been a key element of both ecological adaptation and conflict management strategies.

The strategies of the local communities involved livelihood techniques that were suitable and sustainable for the fragile Western Sudan habitat where Darfur is located. Research shows that communities in Darfur developed a range of coping mechanisms that involved regulations governing the use of natural resources. These strategies were underpinned by a system of reciprocity between nomadic and farming groups. Accordingly, the ecological variations between different *duur*⁸ (homelands) encouraged tribal leaders to establish close, symbiotic relations, amounting almost to alliances, that became important mechanisms ensuring the access of pastoralists to land and natural resources (Young et al., 2009, p. 40). As a general rule, the communities tried to avoid acts that would cause tension. Essentially, these measures were institutionalised and became well-recognised within the local government and community systems.

One approach involved the accommodation of newcomers, known as *hakura*. This system allowed for settlement⁹ of newcomers, whether they are individuals or groups, provided that they adhered to customary regulations, the most important of which is to remain subject to the administrative authorities of the host tribe, irrespective of whether they are temporary visitors or have the intent to settle permanently (Abdul-Jalil, 2006, p. 17). As noted, for the nomadic groups, this arrangement afforded them the advantage of exploiting a variety of resources in different ecological zones (Ibid).

Another approach was the communal grazing scheme known as *talaig* that tended to create a symbiotic relationship between sedentary farming and nomadic pastoralist groups. *Talag* enabled pastoralists to cope with the harsh environment by allowing free use of the crop residue by all the pastoralist communities. Local governments enhanced the practice by issuing legislation and local acts, by determining a certain time after the rainy season for the farmer to collect their crops and leave the crop residue to be used by animals from all the community (Fadul, 2004, p. 40).

⁸ The term *duur* refers to homelands, and is the plural form of *dar*.

⁹ Settlement in this regard did not imply ownership of the land.

The third approach involved the designation of cattle routes known as *marahiel* and *masarat* (cattle routes up and down the region), to prevent potential conflicts between the pastoralists and farmers (USAID, 2003, p. 21). Livestock migration routes enhanced pastoralists' ability to cope with climatic variability. Some routes were officially recognised by the local government and communities, although some tribes also followed routes that were negotiated but not officially recognised. In Darfur, this arrangement provided for eleven passages on the eastern and western parts of Jebel Marra Plateau (Fadul, 2004, p. 30).

4.2 Scarcity and collapse of inter-community mechanisms

The ecological pressures on inter-community mechanisms can be appreciated from the well-documented population movements from the north into the central, southern and western parts, especially attributed to the drought of 1984-85 (De Waal, 1989). However, these movements also created deep-seated ecological traps that, over time, transformed the pastoralist-farmer relationship into one of inter-ethnic competition and conflict rather than cooperation and co-existence. The supply- and demand-induced scarcity factors go a long way in explaining the collapse of the existing conflict management strategies. It stands to reason that these coping and conflict management systems began to disintegrate due to reducing rainfall and diminishing resilience of the local communities.

First, looking at mechanism based on *hakura*, the collapse of this mechanism has been variously attributed to population thresholds. The toll from these movements reduced "the ability of local people to adapt to the new realities and the subsequent questions of land use and resource sharing continued to threaten peaceful coexistence in the area and the social cohesion of the entire community" (King and Osman, 2004, p. 12). This makes a case that the migrating pastoralists extended the duration of their stay or chose to permanently settle in their new locations. As noted, this situation that was destined to incite local tensions and provoke violent resource-based conflicts (Ibid).

The collapse of mechanisms based on *tailag* is similarly most often blamed on changing rainfall. Farmers could not start planting or harvesting according to the cultivation cycle. Accordingly, the expected dates of crop harvest became unpredictable. On the other hand, the environmental stresses also disrupted nomadic grazing practices; pastoralists had to move earlier to escape the drought and the lack of grazing land and water (USAID, 2003, p. 44). The migratory movements of nomads during the rainy season caused crop damage and eventually led to open conflicts between farmers and herders (Okello et al., 2004, p. 10).

The factors that led to the collapse of the mechanisms based on *marahiel* and *masarat* are, however, not quite as straightforward, but can possibly be explained on the basis of all three types of scarcity. Migration routes that have traditionally been used are no longer available due to the introduction of mechanised farming, which took away crucial farming and pastoral rangelands and migration routes. To

a large extent, this may explain the apparent decrease in the population of the nomadic groups. For example, due to the uncontrolled expansion of mechanised farming, pastoral migration routes are increasingly becoming narrower and shorter, between 150 and 300 metres wide as compared to 2 to 4 miles during the colonial time (Babiker, 2011, p. 5).

5. Conclusion

This discussion has addressed the main issues at the centre of the debate about whether climate change and, for that matter, environment, is responsible for the human security situation in Darfur. While there is no agreement as to the extent environmental phenomena have played a role in producing the current conflict in Darfur, the evidence presented shows that the periods during which Darfur witnessed climatic transition and a demographic shift overlapped and these periods were accompanied by local conflicts. This view corresponds with the large body of literature that similarly suggests a link between scarcity and security.

Revisiting the coping and conflict management strategies in Darfur, it has been shown that pre-existing inter-ethnic relationships were shaped by cooperation and interdependence between the herder and farmer communities. These measures were well integrated in the local government and community systems. The prevailing circumstances in Darfur therefore point to the collapse of the traditional inter-community mechanisms for coping and conflict management, which in the past facilitated accommodation of newcomers, communal grazing and designated cattle routes. The failure to practice prudent governance management measures in the region included obliteration, through legislation, of the long-established land tenure system that played an important role in the pastoralist-farmer symbiotic relationship.

The evidence offered in this paper points to two observations: The first observation is that the localised conflicts that eventually led to large-scale conflict were not simply the result of environmental scarcity, but rather can be viewed as a response to increased vulnerability and reduced resilience. Reduced resilience and adaptive capacities as a result of the collapse of the above mentioned inter-community mechanisms for coping and conflict management strategies created deep-seated ecological traps that, over time, transformed the pastoralist-farmer relationship into one of inter-ethnic competition. From this, we take the view that climatic change on its own was essentially not an immediate cause of conflict; rather it is the diminished resilience and ensuing collapse of the community coping and conflict management mechanisms that most critically set the stage for the violence.

The second observation relates to the ubiquitous ethnicity-environment question. It is apparent that the ethnic perspective is often dichotomised on the basis of Arab and Non-Arab, continues to be emphatic, and has often masked the livelihood dimension in a variety of ways, which is in every respect the most salient factor.

Notably, in Darfur, ethnicity and livelihood are closely related aspects of identity formation, and it is probably this that makes it difficult to map out causalities when it comes to the ethnicity-environment question. Thus, whereas ethnicity lies at the heart of this conflict, the ethnic dimension is a product of the wider environmental stress, and can therefore be considered, at most, an indirect cause of the conflicts. By this account, environmental challenges are a more real and immediate problem in Darfur. In contrast, ethnic fault-lines are solidified once conflicts emerge, and at that point ethnicity begins to have a more causal effect in perpetuating violence (Suliman, cited in Kuznar & Sedlmeyer, 2005, p. 5-6).

Overall, this paper provides a basis for a more holistic appreciation of the Darfur problem, and for looking at the ongoing conflict in depth. The Darfur conflict can only be more adequately addressed by getting to the underlying causes, which are environmental. Therefore, the following recommendations will be pertinent:

- It is necessary to separate between the different layers of causes of the Darfur crisis, to allow for more focused intervention. Currently, the Darfur problem straddles political, security, ethnic, economic and ecological dimensions. Placing the above into perspective, what is of relevance to this discussion is that the ecological dimension needs to be tackled through relevant approaches. This underscores the need to particularly address issues such as deforestation, which have significant consequences on the environment.
- Sustainable natural resource management needs to be incorporated at the local community level. This means that the carrying capacity of a given area should be assessed against demand and appropriate strategies implemented to ensure environmental degradation are mitigated.
- Policy-wise, this paper speaks to the value of instituting indigenous or contemporary adaptation, conflict management and early warning mechanisms. This calls for a return to institutionalization of community-based mechanisms in order to facilitate collaborative regulation of the use of communal resources, including water, pasture and agricultural land, and migration routes.
- Given that Darfur is an ecologically fragile region with economies largely dependent on the environment, the over-dependence on primary production is very delicate and brings into question the sustainability of current livelihood systems. Grappling with the challenges of livelihoods and rising population, it is prudent to put together measures that trim down demand-induced scarcity by supporting alternative livelihoods away from primary production.

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