

**GEOGRAPHY OF INTERNAL CONFLICTS:
A CASE STUDY OF DARFUR**

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DECLARATION AND CERTIFICATE

DECLARATION

I declare that the dissertation entitled “ **Geography of Internal Conflicts: A Case Study of Darfur**” submitted by me for the award of the degree of **Master of Philosophy** of Jawaharlal Nehru University is my own work. The dissertation has not been submitted for any other degree of this University or any other university.

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CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation.

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Krishnendra Meena
Supervisor

In the loving memory of

My mother

Late Smt. Shakuntala Devi

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ABBREVIATIONS

AMIS	African Union Mission in Sudan
CAR	Central African Republic
CPA	Comprehensive Peace Agreement
DPA	Darfur Peace Agreement
DRC	Democratic Republic of Congo
EC	European Commission
EIA	Environmental Impact Assessment
ESPA	Eastern Sudan Peace Agreement
GEF	Global Environment Facility
GIS	Geographical information system
GOS	Government of Sudan
GOSS	Government of Southern Sudan
GRID	Global Resource Information Database (UNEP)
IDP	Internally Displaced Person
IGAD	Inter-government Authority on Drought
INGO	International Non-Governmental Organization
IOM	International Organization for Migration
IWRM	Integrated Water Resource Management
JEM	Justice and Equality Movement
LRA	Lord's Resistance Army
MoAF	Ministry of Agriculture and Forestry
MoAR	Ministry of Animal Resources
MEA	Multilateral Environmental Agreement
MIWR	Ministry of Irrigation and Water Resources
MOU	Memorandum of Understanding
NCP	National Congress Party
NDVI	Normalized Difference Vegetative Index
NEPAD	New Partnership for Africa's Development

NGO	Non-Governmental Organization
NPEM	National Plan for Environmental Management
NSWCO	New Sudan Wildlife Conservation Organization
NWA	Nile Water Agreement
OLS	Operation Lifeline Sudan
SPLA	Sudan People's Liberation Army
SPLM	Sudan People's Liberation Movement
SSCSE	South Sudan Centre for Statistics and Evaluation
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNDPKO	United Nations Department of Peacekeeping Operations
UNEP	United Nations Environment Programme
UNHCR	United Nations High Commissioner for Refugees
UNMIS	United Nations Mission in Sudan

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CHAPTER 1

INTRODUCTION

The end of the Cold War removed the most important source of inter-state rivalry and the attention of researchers has increasingly turned to civil conflicts. Knowledge about the potential impact of geography on conflicts is probably as old as the art of war. The geographic perspective, especially the emphasis on context, scale linkages, diffusion, and spatial analysis, offers a vital and innovative supplement to dominant approaches. Political geographers as well as theorists of international relations have for long claimed climate, topography and location to be important determinants of state behaviour. Over a decade ago, in the early 1990s, O'Loughlin and Anselin intended to bring back geography to the study of international relations. The authors had modeled a state's civil war behavior as "related to their domestic attributes, spatial dependence (neighboring effect), and spatial heterogeneity (regional effect)". Geographical elements like natural resources, location, territory, terrain, demographic attributes and environmental factors show the crucial role of geographic factors affecting the risk of conflict. Geographic proximity facilitates conflict and also acts as catalyst for being a source of conflict. Geography and conflict have been subject to either of the following two approaches: the first one deals with micro-level analyses of battlefield effectiveness, typically from a military point of view. On the other hand, there are the studies which explore the role of geographical factors in causing the conflict. The influence of geographic attributes on conflict zones identifies three factors i.e. geography, ideology and ethnicity. The geography as the central theme includes how geography interacts with ethnicity and ideology, and for example how this interaction affects the distance between rebels and government, and how distance enables a rebel group to expand. In this research domestic factors will be analyzed for their impact on civil wars. Political geographic examination of countries and regions in conflict analysis is two fold- first, conflicts do not happen in a vacuum, and it seems logical to account for surrounding context and secondly, evidence from the spread of international conflict has emphasized the role of neighbors and regions. This research will analyse the linkages between conflict in Darfur and geographical attributes. Greater Darfur, a territory composed of three states (North, South, and West Darfur), is located in the north-western region of Sudan, bordering Chad to the

west, Libya to the northwest, and Central African Republic to the southwest. The people living on both sides of the 1,000 kilometre-long borders between Chad and Sudan have much in common. This border region is divided into three ecological bands: desert in the north, which is part of the Sahara and the least densely populated and most ecologically fragile zone; a central, fertile belt which includes the Jebel Mara mountains and is the richest agriculturally; and the southern zone, which, although more stable than the north, is also prone to drought and sensitive to fluctuations in rainfall. The amount of rainfall determines the character of the population in broad bands going from north to south.

DARFUR: BACKGROUND

Sudan's westernmost province bordering on Libya and Chad, Darfur is very large (almost 400,000 square kilometres) and quite populous in comparison with other regions of the Sudan (with around eight million people). Darfur is an enormous region about the size of France, with an estimated population of about four to five million people. Greater Darfur, a territory composed of three states (North, South, and West Darfur), is located in the north-western region of Sudan, bordering Chad to the west, Libya to the northwest, and Central African Republic to the southwest. The people living on both sides of the 1,000 kilometre-long border between Chad and Sudan have much in common. This border region is divided into three ecological bands: desert in the north, which is part of the Sahara and the least densely populated and most ecologically fragile zone; a central, fertile belt which includes the Jebel Marra mountains and is the richest agriculturally; and the southern zone, which, although more stable than the north, is also prone to drought and sensitive to fluctuations in rainfall. Several of the region's ethnic groups straddle both sides of the frontier between Chad and Sudan, and historically there has been significant migration and trade across the border. Geographically, the province is centred on the Jebel Marra volcanic massif. The amount of rainfall determines the character of the population in broad bands going from north to south: camel herders in the northern arid zone, settled peasants in the centre, cattle nomads in the south bordering on the Bahr-el-Ghazal Province. The black African Fur tribe makes up over half of the population, hence the name of the province Dar (home) of the Fur, and the rest is divided between over fifteen different ethnic/linguistic groups. All the inhabitants are Sunni Muslims. While the region's peoples are mostly Muslims, they are diverse ethnically,

linguistically, and culturally. Two ways are often used to describe the ethnicity of the people of Darfur: by language and by occupation. The indigenous non-Arab or African peoples historically do not speak Arabic at home and came to Sudan from the Lake Chad area centuries ago; those claiming Arab descent are Arabic speakers. Another classification distinguishes between agriculturalists and pastoralists. While there is some overlap between the two descriptions, there are also important nuances. Darfur's sedentary agriculturalists are generally composed of non-Arab or African ethnic groups known as "*Zurga*" or blacks, and include groups such as the Fur, Masaalit, Tama, Tunjur, Bergid, and Berti, who live and farm in the central zone. The region's pastoralists are mainly of Arab descent, and the northern belt, the most arid zone, is inhabited by nomadic and semi-nomadic camel herding tribes, including Arab ethnic groups such as the northern Rizeigat, Mahariya, Irayqat and Beni Hussein, and the African Zaghawa. The southern and eastern zones are largely inhabited by the cattle herding Arab tribes known as the southern Rizeigat (of the Baggara), Habbaniya and Beni Halba.

Historical Patterns of Conflict

Darfur has been affected by intermittent bouts of conflict for several decades. Pastoralists from the north, including the northern Rizeigat, Mahariya, Zaghawa, and others, typically migrate south in search of water sources and grazing in the dry season (typically November through April). The region was home to the independent Sultanate of Kayra between the mid-17th century and in 1916 when it was finally annexed to the Anglo-Egyptian Sudan. This long tradition of independence from the center of power in the distant Nile Valley has been a continuing source of alienation between Darfur and the rest of Sudan's Muslim North. At independence in 1956 the province soon became a bastion of the Mahdist religious movement and a stronghold of its political wing the Umma Party. Twice in the history of the Sudan (in 1958 and in 1986) it was a solid bloc of Umma voters in Darfur that gave the Umma Party and its leader Sadiq al-Mahdi victory at the polls.

Beginning in the mid-1980s, when much of the Sahel region was hit by recurrent episodes of drought and increasing desertification, the southern migration of the Arab pastoralists provoked land disputes with agricultural communities. These disputes generally started when the camels and cattle of Arab nomads trampled the fields of the non-Arab farmers living in the central and southern areas of Darfur.

Often the disputes were resolved through negotiation between traditional leaders on both sides, compensation for lost crops, and agreements on the timing and routes for the annual migration. In the late-1980s, however, clashes became progressively bloodier through the introduction of automatic weapons. By 1987, many of the incidents involved not only the Arab tribes, but also Zaghawa pastoralists who tried to claim land from Fur farmers, and some Fur leaders were killed. The increase in armed banditry in the region also dates from this period, partly because many pastoralists lost all their animals in the devastating drought in Darfur of 1984-1985 and, in turn, raided others to restock their herds. There were also contentious political issues in the region. In Darfur, Arab tribes considered they were not sufficiently represented in the Fur-dominated local administration and in 1986, a number of Arab tribes formed what became known as the “Arab alliance” (*Tujammo al Arabi*) aimed at establishing their political dominance and control of the region. Meanwhile, Fur leaders distrusted the increasing tendency of the federal government to favour the Arabs. Arabs from the northern Nile Valley controlled the central government since independence. This fear of Arab domination was exacerbated by the Sadiq El Mahdi government (1986-89) policy of arming Arab Baggara militias from Darfur and Kordofan known as “muraheleen.” Similar to the militias currently involved in the Darfur conflict, the muraheleen were a militia based in Darfur, employed by the El Mahdi government and its military successors for almost twenty years as a counterinsurgency force against the southern-based rebels, the Sudan People’s Liberation Movement/Army (SPLM/A). The muraheleen primarily focused on raiding, looting, displacing, enslaving, and punishing the Dinka and Nuer civilians living in SPLA territory—from which communities the SPLA forces were in part drawn. One of the differences in the fighting was that the Sudanese government recruited volunteers to fight in the south on the basis of “jihad,” or a religiously-sanctioned war against the largely non-Muslim southerners. In Darfur, in contrast, the communities under assault are Muslim, but that has not proved to protect them from the same abusive tactics. In 1988-1989, the intermittent clashes in Darfur evolved into full-scale conflict between the Fur and Arab communities. The situation also developed a more political character for a number of reasons. In a pattern that was to be repeated numerous times throughout the 1990s, rather than working to defuse tensions and implement peace agreements, the Khartoum government inflamed tensions by arming the Arab tribes

and neglecting the core issues underlying the conflict over resources: the need for rule of law and socio-economic development in the region.

Conflict in 2003: Widening the Divide

The current conflict in Darfur has deep roots. It is but the latest configuration of a protracted problem, yet there are key differences between the 2003-2004 conflict and prior bouts of fighting. The current conflict has developed serious racial and ethnic overtones and clearly risks shattering historic if fragile patterns of co-existence. A number of ethnic groups previously neutral are now positioning themselves along the Arab/African divide, aligning and cooperating with either the rebel movements or the government and its allied militia. Remaining neutral and outside the conflict is becoming impossible, though some groups have tried to do so.

Overtly, the conflict in Darfur pits the government of Sudan and allied militias, the “janjaweed” against an insurgency composed of two groups, the Sudan Liberation Army/Movement (SLA/M) and the Justice and Equality Movement (JEM). Initially, the rebel groups were mainly composed of three ethnic groups: Zaghawa, Fur and Masaalit. Over the past months however, members of some smaller tribes such as the Jebel and Dorok peoples have also joined the rebellion following janjaweed militia attacks on their communities. Additional Arab tribes and even some non-Arab tribes have also joined the government-backed militia. The SLA emerged in February 2003. Initially called the Darfur Liberation Front, it captured the town of Gulu, and shortly thereafter changed its name to the SLA. Early political demands included socio-economic development for the region, an end to tribal militias, and a power share with the central government. Khartoum called the group “bandits” and refused to negotiate. In April 2003, the SLA launched a surprise attack on El Fashir, the capital of North Darfur, and damaged several government Antonov aircraft and helicopters and looted fuel and arms depots. The rebels required a captured Sudanese air force colonel to give an interview on the Arab satellite TV news station El Gezira. This was followed by another major attack on Mellit, the second largest town in North Darfur, where the SLA rebels again looted government stocks of food and arms. In May 2003, the Sudanese government dismissed the governors of North and West Darfur and other key officials and increased military strength in Darfur.

The conflict escalated in July 2003, with fighting concentrated in North Darfur. The government launched offensives against the SLA in Um Barou, Tine, and

Karnoi, North Darfur, in response to the SLA attacks on El Fasher, Mellit, around Kutum, and Tine (the latter on the border with Chad and an important trade route to Libya). Government response consisted of heavy bombing by Antonov aircraft plus ground offensives of government troops and heavy equipment, including tanks. Government armament has improved substantially since 1999 when it began to export oil, and it was available for full deployment in the west after it agreed with the southern-based SPLA to a ceasefire in the south in late 2002. Janjaweed militias were also used, but on a lesser scale than later in 2003 in both North and West Darfur. The bombing raids in North Darfur prompted thousands of civilians to flee the area for Chad, which by August 2003 was host to more than 65,000 Sudanese refugees.

Current situation

The conflict between the Sudan government and rebels started three years ago. Since then it has been estimated by the United Nations that almost 200,000 people have been killed and 2.2 million have been displaced from their homes. Many of these people are living in squalid conditions in overcrowded refugee camps. Atrocities continue to be committed, with villages being looted and women being raped.

Many factions have not signed up to the recent peace deal, and even amongst rebel groups, there is disagreement and fighting. As a result more villages have been destroyed, more people displaced from their homes and more families are unable to access the humanitarian aid they desperately need. The escalation in violence has also pushed displaced people across the border into refugee camps in eastern Chad. In 2004, the African Union force (AU) was set up as part of the African Union Mission in Darfur (AMIS) to protect vulnerable communities from the ongoing conflict. However, since its inception it has been unable to fulfil its role. The 7,000 strong force has not been effective due to its lack of resources and limited mandate. Often all the force can do is to monitor the conflict because it lacks the necessary equipment and manpower to intervene and protect communities under attack. At the same time, an agreement has not been reached between Sudan and the international community for UN led forces to take over from the AU.

REVIEW OF THE LITERATURE

Since the end of the Cold War about 1991, the most dramatic development in the nature of conflict is the shift from international to civil wars. The available literature

on the subject does not take into account the significance of the geographic attributes of conflicts. Work that examines the diffusion of conflict and the locational attributes of civil war has primarily focused on three different themes -- absolute location of wars, relative location of wars, and territory as a “container” of salient factors. Absolute location perspectives contend that civil war prone states disproportionately occupy the periphery of the world economy. Decolonization, superpower proxy wars, and impoverished conditions have created an environment of endemic, poverty, poor governance, and a fundamental disjoint of state ideology and nation, which in turn has fostered discontent and violent conflict (O’Loughlin 1989). Strategic geopolitics — fostered by resource and strategic location considerations — has continued to create “Shatter belt” regions well past the end of the Cold War (Klare 2001, Cohen 2003). Shatter belt regions, such as the Caucasus, are defined as areas with a globally-significant natural resource, ethnic diversity, external intervention and a history of local conflict.

Relative location work focuses on the position and process of both the state and the internal conflict. Similar work on interstate conflict stresses the relationships of alliances and borders as explanations of conflict diffusion and proliferation (Siverson and Starr 1991; Starr and Thomas, 2002). Countering the atomistic nature of the usual type of study, Ward and Gleditsch (2002), Sambanis (2001) and Salehyan and Gleditsch (2004), show that regional conditions in neighboring communities also influence the initiation of civil violence. Challenges to central rule are assumed to come from distinctive areas that have been ignored in weakened or failed states (Herbst 2000); further, conflict location relative to state capitals, borders, communities, and resources often provide tacit explanations of intent and positionality (Buhaug and Gates 2002, Buhaug and Lujala 2005). The involvement of outside players in a civil war has recently prompted speculations of “aggressive symbiosis” (Le Billon 2001), where the conflict has become beneficial to certain criminal elements of war-torn societies. The creation of spaces and networks of illegal activity is redrawing political boundaries and overtaking governance in failed states, presenting local, national, and possibly global risks (Keen 1998, O’ Tuathail 2000).

The external diffusion of conflict, or the escalation of parallel conflicts, is rooted in the questionable legitimacy of many state borders and the frequent inability to control territories and the people within them. Diffusion and escalation are important and understudied features of civil war because entire regions can escalate

into a series of civil wars feeding off each other (e.g. West Africa in the late 1990s). The salience of borders in civil war study highlights the mismatch of nation and state territories (Englebert, Tarango and Carter 2002).

“Geography as Container” work focuses on salient features of the environment (human or physical) that may be associated with war in a particular territory. Among key variables are measures of minorities at risk, per capita income trends, environmental stress that might be partly due to climatic change, income inequality, urbanization, and population migrations. Incorporating such measures pose additional challenges because of the paucity of data that continues to be a major stumbling block to such analyses. The linkage of the environment and security began in the 1980s, and case studies, focusing particularly on scarcity of resources (water, forests, fish), and violent domestic and international conflict, are able to construct a causal pathway. The link between peace and security on one hand and environmental changes on the other has been an important area where strategic studies have been fused with the studies of geography and natural resources. Thomas Homer Dixon (1999) was the one who pioneered these studies. His case study focused upon three types of conflicts: simple scarcity conflicts, group-identity conflict and relative-deprivation conflicts (Homer-Dixon 1999). The environmental perspective is dominated by resource arguments, which contends that features of particular resources, especially the use of resources by easily lootable resources by rebels as funds for their cause, make conflict more feasible. Research on resource scarcity as conflict encouraging has been challenged by a growing body of research focusing on the proliferation of conflict in resource abundant areas (de Soysa 2000, Auty 2004). Natural resource endowment is linked to poor economic growth and governance since “resource rents provide political leaders with a classic means of staying in power by establishing a regime organized through a system of patronage” (Le Billon 2001). Research details the dual role of resources; the revenue of precious materials that support corrupt governments also provides conflict incentives and a much-needed source of income for rebel groups (Collier, 2000). While oil has received most attention as a war-inducing resource (Collier 2000, Fearon and Laitin 2003, Le Billon 2004), other resources including diamonds (West and Central Africa), timber (Cambodia), minerals (Congo), and drugs (Colombia, Afghanistan) have been implicated in civil war proliferation (Auty 2004). The spatial dispersion of resources (diffused throughout the state or in certain point locations) has been incorporated into theories of relative conflict location

(Le Billon 2001, Buhaug and Gates 2002, Ross 2004). In general, resources and civil war are related by a variety of mechanisms and we need to separate them by group and regional context before we can conclude that the “resource curse” hypothesis (resources increase the risk of civil war) is supported.

Recently, political scientists have made tentative attempts to consider the influence of physical geographic factors in civil wars. De Rouen and Sobek (2004) conclude that “borders, war type, Africa, UN intervention, forest cover, and mountain cover” all help to determine civil war outcomes but that the effects are varied and contradictory. Their research indicates that forest cover helps the government cause, whilst mountainous terrain helps rebels. Whereas Fearon and Laitin (2003) find evidence for the influence of terrain in conflict onset, Collier and Hoeffler (2004) and Buhaug and Gates (2002) dismiss this argument preferring an economic explanation as incentive to rebellion. Nevertheless, terrain is considered a contributing factor in conflict proliferation (Collier *et al.* 2003, Fearon and Laitin 2003). Studies detailing the role of terrain are useful, but inconclusive, partly because of uncertainties in definition and measurement of rough terrain. More careful mapping of insurgencies and rebel movements is a way to understand this correlation. Regional conflicts are, per definition, a mixture of intra-national, intra-regional, and extra regional conflicts. Considering that most conflict is currently intra-state and regional conglomerations of weak states are at internal risk because of conflict diffusion, international interests exacerbate tensions and power relationships inside regions resulting in shatter belt-like scenarios. Of course, the opposite is also true. Systems that experience a great degree of stability are at a lesser risk of internal conflict because of the stability of the larger region. The European Union is an example of such a region where stable democracy, favorable economic environment and a location in the core of the world-economy allow for change through peaceful measures. Spatial analysts, on the other hand, offer two different strategies to place political actions in their regional contexts (O’Loughlin, 2003). On the one hand, SISS (spatially integrated social science) approach which views space as integrating social processes and sees social science dynamics as processes in place. This approach uses GIS (Geographic Information Systems) to integrate data by geo-referenced location and applies spatial statistical analysis to integrate multidisciplinary approaches. The second stream of the spatial analysis approach revisits the decades-old notion of the “ecological triad” (social entity or actor, environment, and entity-environment relationship) from the Sprouts

(Sprout and Sprout 1965). Here the emphasis is on the place of politics, the context in which political actions happen. It dovetails well with the traditions of political ecology and pays special attention to local cultural and material traditions (Robbins 2004). Careful consideration of contextual elements can disabuse us of ideas that certain global regions, such as the Middle East, are intrinsically “conflict-prone”. As Sorli *et al.* (2005) show, economic growth and development, ethnic dominance and regime type explain the distribution of conflict in the Middle East (but not oil or Islam); thus, a general model fits this region as well as the global case and there is no reason to resort to (regional) exceptionalist explanations.

Only a few studies have taken into account geography explicitly, doing so within the limited context of geographic proximity and distance. Four approaches are available for examination of possible significant geographic differences in social, political and economic predictions of civil war involvement in states. Anselin’s GeoDA program offers a spatial econometric approach that combines exploratory spatial data analysis and models that mix structural predictors and spatial (geographically weighted) elements. One important option in this approach allows the calculation of spatial regime-specific models for regions when there is evidence that the relationship has a non-stationary form. This spatial econometric approach has been used in a study of the distribution of terrorism (Braithwaite and Li 2004). A second approach called the spatial expansion method has not really taken hold despite its evident appeal of disaggregating the global parameters by allowing the parameter estimates to be functions of other attributes, such as latitude and longitude. One key reason for the relative lack of interest in this method is that it is restricted to displaying trends in relationships over space with the complexity of the measured trends being dependent upon the complexity of the expansion equation, thus possibly covering up some important local variation (Fotheringham, Brunson, and Charlton 2002). A third option, multi-level modeling, has achieved less attention in geography than might have been expected given its ability to combine multiple scales in one analysis. While most applications have been for examining individual behaviors and attitudes in nested settings (precincts, cities, counties), some applications are now available for aggregate data with a recent re-analysis of the data using a multi-level approach. This is how political geographers have recently approached analysis of war and conflict, how geographical factors are currently being considered in conflict studies, and in what ways, a spatial analytical perspective can add to these studies. So,

spatial analytical approach is only one of the possible ways of understanding civil wars. Spatial analysis offers the most promising of avenues especially because it connects the discipline of geography to the main strands of social scientific work on the causes and consequences of domestic conflicts.

Geographical analysis can be undertaken in a number of ways. The discipline of geography has a long and checkered legacy in its relationship with war and violence. In the twentieth-century, geographers have moved away from their earlier practice of the art and science of geopolitics to an increasingly critical view of the military and the conduct of war. Careful mapping of the depredations of military actions such as the bombings of the dikes in North Vietnam by the U. S air force and the allied destruction of German cities in World War II (Hewitt 1983) are dramatic examples of the power of the simplest and most accessible of spatial methods, that of cartographic display. At a larger scale, similar mappings of the locations of contemporary conflicts clearly demonstrate the variable distribution of war violence across the globe (Buhaug and Gates 2002, O'Loughlin 2004) and recall the long-standing distinction between stable zones of peace and zones of war (Boulding 1978, Gleditsch 2002). While the "democratic peace" hypothesis (that democratic states do not fight each other) has received a lot of attention in political science, the empirical data show that democratic states, especially France, the U.K. and the U.S., have been heavily involved in wars of decolonization, democracy-promotion, and in the 1990s against tyrannical regimes in Iraq, Afghanistan and former Yugoslavia.

As well as the descriptive accounts of the reasons why wars are geographically concentrated in certain world regions? Geographers have turned to specialized methods developed for the analysis of spatially-distributed phenomena to try to understand and model the conflicts. In doing so, geographers are getting closer to the kinds of approaches that are dominant in the ancillary disciplines of political science and economics with their emphasis on large-N studies and regression-type explanations. The spatial analytic approach argues that the location of a country relative to other countries (neighboring, near, distant, remote, connected by transport links, sharing minorities across borders, etc) is an important consideration in understanding the distribution and diffusion of conflict. Political science work, typically, does not pay much attention to these connections, rather seeing countries somewhat like "atoms" floating in space (Agnew, 1994). One of the most important

predictors of whether a country will experience a civil war is whether its neighbors have internal strife, the so-called spatial lag effect.

In statistical analyses, this contagion variable is often as important as the usual political and economic predictors, such as the autocratic nature of the government, the ethnic fractionalization of the population, the level of poverty, income inequality, and years since independence. Further, countries are frequently involved in a complex nexus of conflict as wars ebb and flow across borders due to the sanctuaries offered by neighbors, the placement of rebels in areas occupied by sympathetic minorities, the actions of refugees to undermine the forces that caused their flight, and the access of extra-territorial bases to external supporters and sources of income (Väyrynen 1984, O'Loughlin and Anselin 1991). Recent examples of these formations include the Great Lakes area of Africa (Democratic Republic of Congo, Uganda, Rwanda, Burundi, and Tanzania), West Africa (Sierra Leone, Liberia, Guinea, and Senegal), the Middle East (Israel, Lebanon, Syria, Egypt, Jordan and Palestine) and parts of former Yugoslavia (Croatia, Serbia, Bosnia-Herzegovina, Kosovo and Macedonia).

The difference in the geographic and political science approaches can be seen in the typical civil war studies of each field. While civil war is ultimately created by interplay of domestic structures and domestic contexts, geographers contend that the effects (identified by political scientists) of domestic structures (GDP, government type, ethnic makeup, etc) and domestic contexts (population growth, terrain, weak state institutions, and resources, etc) are shaped by the nature of the regional context. Current explanations point to state strength as determining the propensity for civil war onset. The spatial clustering of weak states, and subsequent clustering of conflict in weak states, allows for conflict to penetrate borders, infecting already vulnerable states. Therefore, the geographic position of a state is not simply an attribute, but another potential cause of conflict. High risk countries are subject to increased risk because:

- 1) Civil wars exacerbate volatile domestic conditions inside bordering states by forcing a reevaluation of military spending, and
- 2) Neighboring wars can (and frequently do) spread into nearby states, through the actions of government and opposition fighters, refugees, and cross border supporters. Weak states cannot effectively mitigate conflict diffusion and escalation from outside state borders (Raleigh, 2004). -

The literature on civil war has a long legacy and is characterized by an approach that is best described as piecemeal. For example, there is a considerable literature that separately examines the onset, escalation, and termination of civil wars. Most of the literature has also looked at civil wars as self contained and homogenous phenomena, ignoring the external connections of civil wars. As a result, almost all the existing data on civil war are collected and organized at the country level.

The question of whether there is a larger (regional or global) or smaller (local) scale in which the wars are embedded has, heretofore, largely been ignored. In briefly reviewing these studies, there are some of the shortcomings that result from geographical aggregation of local processes to national attributes in existing cross-national studies and show how studying the processes across scales can contribute to our understandings of the dynamics and consequences of civil war.

Two key variables, often summarized as “creed” (ethnicity) and “greed” (income generating resources), dominate the analysis of civil wars. That increasing national income lessens the risk of civil war onset remains undisputed (Collier, et al. 2003, Fearon and Laitin 2003). But how does poverty increase the odds of civil war? Higher rates of per capita income increase a government’s ability to retain control of the state apparatus by redistribution of state tax revenues. In countries with lower GDPs, by contrast, securing power and maintaining civil order become government priorities. The ratio of government monies on military spending typically doubles during conflict (Collier, et al. 2003), producing a downward cycle of conflict as social expenditures (education, health, social welfare) is cut, and income further declines. Elbadawi and Sambanis (2002) find that conflict is “disruptive to capital or transaction intensive activities (such as roads, production of manufactures, or financial services); it can divert expenditure and the society’s resources from economic services (growth enhancing activities) to war efforts; and it can divert portfolios from domestic investment into capital flight”. Fearon and Laitin (2003) concluded that higher income is associated with a more developed infrastructure, and therefore better control of the state apparatus and population. Collier and Hoeffler (2004) note that neighboring war has a considerably larger impact on a bordering country’s GDP than on domestic GDP (presumably, domestic GDP is very low to start). In later work, Collier, Hoeffler, and Soderbom (2004) assert that low per capita income, high income inequality, and a moderate degree of ethnic division lengthen conflict, whilst a decline in primary commodity exports shortens it because the state

loses critical revenue for its war-making capabilities. Much of the recent work on civil war has emphasized the role of private incentives and rent-seeking activities as predictors of civil war onset. Individuals are more likely to take up arms when they can benefit materially from war through looting, extracting valuable commodities, and extortion (Collier 2000, Le Billon, 2001, Murshed 2002, Mueller 2003, Collier, Hoeffler and Soderbom 2004).

An intersecting paradigm, the effects of ethnic composition and weak state, underpins the role of political factors in civil war. Weak state literature focuses on the legitimacy and sovereignty of the state as contributing to the outbreak of war (Holsti 1996, Herbst 2000). Governance explanations (about autocracies, democracies, and anocracies) look for associations between political structure and rebellion (Hegre *et al.* 2001). If states and governments have a complex of control, either through the validation of the government as the voice of the state in a democracy or a well-instituted infrastructure of fear and domination in an autocracy, the probability of civil war is lowered. Ethnic diversity as a cause of conflict is based on the assumption that increased fractionalization makes it difficult to create a unified national community, because of alternative competing allegiances. Power relations are not assumed to be equal in fractionalized societies. Ethnicity's relationship to conflict is quite variable, as noted by a number of studies finding diversity linked to conflict (Connor 1973, Horowitz 1985, Fox 2004), diversity not significantly linked to conflict (Collier and Hoeffler 1998, Fearon and Laitin 2003), diversity lessening conflict (Collier, *et al.* 2003), ethnic dominance exacerbating conflict (Gates 2002, Collier, *et al.* 2003), religious affiliation causing conflict (Huntington 1996, Fox 2004) and ethnic elites acting as catalysts for conflict (Lake and Rothschild 1998, Brown 2001). Ethnic fragmentation's relationship to conflict proliferation is thus quite varied (Horowitz 1985, Gurr 1993). Recent studies with more nuanced analysis of the connection of poverty and ethnic diversity do not simply show increased risk of conflict. Poverty alone cannot provide a reasonable explanation of why groups resort to violent conflict since poverty is ubiquitous, but only some countries see violence. The key might be the relative status of ethnic groups since relative deprivation and economic inequality are common elements in poor societies that experience civil war (Gurr 1970). Ethnic dominance (45-90% of the population) can increase the risk of rebellion. This argument is based on the notion that the effects of ethnic diversity depend on the opportunities for profiting from primary commodity exports and taxing opportunities

(Collier and Hoeffler 2004). A dominant group also has a considerable number of potential recruits and hence, improves the chance of retaining control of the state apparatus. Ethnic ties, strengthened by perceived ethnic grievances, lessen the costs of recruiting and sustaining a fighting force because perceived benefits are shared throughout the ethnic group. This economic perspective on the nature of ethnic wars has detractors who regard conflicts the outcome of the interplay of ethnic diversity and economic grievance. Grievances (based on the distribution of resources) and ethnic identification as a basis for rebellion are grounded in the impression that modernity does not lead to more democracy. Elbadawi and Sambanis (2002) find similar results to Collier and Hoeffler (2004)--economic and political underdevelopment are the root causes of conflict (specifically in Africa)--but they also find that ethnic fragmentation may lead to poor economic prospects through the implementation of bad economic policies. The studies showed that geographically-disaggregated conflict-specific measures of resources yield much better predictions of civil war duration than national level data (Buhaug and Lujala 2005; Buhaug and Rod, 2006). Many studies of civil war perpetuate the mismatch between the national level at which data are collected and the regional and local elements of the actual conflict. Buhaug and Gates (2002), however, show that the geographic location of a civil war within a particular country is fundamental for understanding conflict dynamics. Civil wars that develop in the periphery of countries tend to last much longer than those occurring close to national capitals, for example. Governmental capabilities are typically not homogenous, but neither are they geographically fungible. Extensive state power may be present in some locales, but virtually absent a few kilometers away, especially in weak or failing states. One of the seminal works in the field of assessing the geographical factors in internal conflicts has been that of Collier, Hoeffler, and Soderbom (2004). They assert that low per capita income, high income inequality, and a moderate degree of ethnic division lengthen conflict, whilst a decline in primary commodity exports shortens it because the state loses critical revenue for its war-making capabilities. Buhaug and Gates (2002), however, show that the geographic location of a civil war within a particular country is fundamental for understanding conflict dynamics. Civil wars that develop in the periphery of countries tend to last much longer than those occurring close to national capitals, for example. Governmental capabilities are typically not homogenous, but neither are they geographically fungible. Extensive state power may be present in some locales, but

virtually absent a few kilometers away, especially in weak or failing states. Regional conditions in neighboring communities also influence the initiation of civil violence. Challenges to central rule are assumed to come from distinctive areas that have been ignored in weakened or failed states (Herbst 2000); further, conflict location relative to state capitals, borders, communities, and resources often provide tacit explanations of intent and positionality (Buhaug and Gates 2002, Buhaug and Lujala 2005).

The conflict in Darfur has spawned a variety of academic responses: some focusing upon the responsibility of the international community, while some on the humanitarian intervention idea. Some works have focused upon crimes against humanity being committed while other pointing out the conflictual pattern in African history. According to Marchal (2006), the conflicts in Chad and Darfur have begun to merge producing even more catastrophic conditions. It concludes that such deterioration will occur unless account is taken of the transnational aspects of these crises, which are also to be seen in the destabilisation of the Central African Republic. Some of the other literature on the subject of Darfur conflict has pointed out the responsibility of the international community in failing to respond to this humanitarian crisis, thereby leading to crimes against humanity in many parts of Darfur amongst the fighting rebels. For instance, Bellamy and Williams (2006) point out the debate in the UN Security Council on whether or not to conduct a humanitarian intervention in Darfur. However there exists a dearth of literature on Darfur that explores the connection between geography and conflict. This critical gap in literature is all the more significant because Darfur represents a unique case in the sense that nowhere on earth have all the conditions fuelling conflict come together than in Darfur. The most prominent among the literature available however is the report submitted by the United Nations Environmental Programme (UNEP) on Darfur crisis. The report decisively pointed out the linkage between environment and conflict. This linkage has been two fold: Sudan's government has had significant impact on its environment either in a direct or indirect manner. On the other hand, environmental issues have been fuelling and will continue to fuel conflict. Competition over oil and gas reserves, Nile waters and timber, agricultural land etc. can be termed as intermediate causes. Confrontations over rangeland and rain-fed agricultural land in the drier parts of the country are a particularly striking manifestation of the connection between natural resource scarcity and violent conflict.

As the report states that there is a very strong link between land degradation, desertification and the conflict in Darfur (UNEP 2007).

DEFINITION, RATIONALE AND SCOPE OF THE STUDY

My research aims to analyse the phenomenon of civil war by including certain geographic aspects in a systematic manner. This research work seeks to delineate the geographical factors and their role in mitigating the civil conflicts with a specific focus on Sudan's Darfur crisis. Disaggregated data beyond the level of the nation state have not yet been widely explored in the study of civil war violence. Study of civil war, both its development and aftermath, has been hindered by a paucity of data and a reliance on secondary published sources, government and non-governmental agency reports, and newspaper accounts. There is relatively little primary data collection, either through questionnaire surveys, remote sensing from satellites, interviews or census taking. A clear need exists to link thematic data for a wide range of important actors and institutions: data for geographic units derived from government sources, data on individuals whose addresses are geo-referenced and gathered through a survey questionnaire as well as satellite image data on the physical environment that can be geo coded and matched. In this regard, further development of methodologies that link social science approaches to the physical environment are warranted. To organize data collection and to overlay and integrate the spatial coverage for the three types of data, GIS offers a solution to efficiently display the information collected. An integrated database can thus contain the geo-referenced data from satellite imagery, digital line graphs, GPS data, socio-demographic data and infrastructural and environmental information gathered from fieldwork and from international agencies (e.g. UNDP) working in the war zones. This kind of information will allow a different kind of research thrust, one that is avowedly geographic, to supplement the (increasingly) stale stable of existing reports on civil war violence. This research work will take following geographical factors as independent variables to understand the dependent variable i.e. Darfur conflict:

- a) Demographic attributes;
- b) Land use and land cover changes;
- c) Climatic conditions

The focus is on events in Darfur since February 2003 when the conflict began. However, events of the past are used to understand the present events i.e. analysis is done in a particular space and time frame work.

RESEARCH QUESTIONS/HYPOTHESIS

Research Questions

- 1) To what extent are geographic factors like demographic attributes, natural resources, climate as key determinants of course and outcome of internal conflicts?
- 2) What role do geographic factors have in Darfur conflict?

Hypothesis

- 1) The spatial pattern of internal conflict is determined by the distribution of geographic factors.
- 2) The conflict in Darfur is an outcome of demographic, land use and climatic changes.

RESEARCH METHODOLOGY

Most research in contemporary political geography is highly descriptive and increasingly ideological. Meanwhile, within quantitative geography, important developments and innovations are being pushed for both polygon and point pattern analysis, usually within a GIS framework. Descriptive political geographic work takes a place-based approach, like a case study in comparative politics that has a strong historical foundation and a policy-oriented focus. Most applications of the techniques of spatial analysis are in physical geography and in data-rich specialties such as climatology, environmental analysis, and remote sensing image analysis. A merging of the interests of political geographers interested in war and peace study and spatial analysts is still not fully developed and need a long way to travel.

My intention in this thesis is to point out some of the ways in which the local turn in quantitative geography, complemented with an array of methods that disaggregate global-level measures, can offer insights into the nature of civil war. Specific methods have been developed for point and areal analyses and in the absence of theory-driven hypotheses, most of the approaches are of an exploratory nature. Thus, assumptions of randomness are made rather than specific expectations of certain types of pattern (clustering, regular etc). Hundreds of studies have tackled the

causes of civil wars, their locations and durations, their settlements, and the potential for long-term effects. My work involves collection of more location specific data and the application of the methods of spatial analysis. In understanding the spatial dynamics of a given phenomenon, GIS software tools such as Arc View will be used. Study of civil war, both its development and aftermath, has been hindered by a paucity of data and a reliance on secondary published sources, government and non-governmental agency reports, and newspaper accounts. In particular, the Darfur conflict lacks the literature which is academic in nature. There is relatively little primary data collection, either through remote sensing from satellites, interviews or census taking. To organize data collection and to overlay and integrate the spatial coverage for data, GIS offers a solution to efficiently display the information collected. Within the scope of spatial analysis, researches usually proceed from ESDA (Exploratory Spatial Data Analysis) techniques and cartographic exploration with attribute and locational data (latitude/longitude) organized in a GIS (Geographic Information System). Within the past decade, there has been an integration of cartographic display and spatial statistical analysis within the same software packages. The latest version of Arc Map ver.9 from ESRI (Environmental Systems Research Institute), for example, includes routines for geo-statistical analysis. While cartographic display can offer some possible hypotheses about the geographic association of the variable of interest the location of civil wars. An integrated database can thus contain the geo-referenced data from satellite imagery from GLCF (Global Land Cover Facility), digital line graphs, GPS data, socio-demographic data and infrastructural and environmental information gathered from different agencies.

RESEARCH DESIGN

This research work is divided into two substantive chapters. The second chapter entitled "Darfur Conflict: An Overview" takes a broad overview of the conflict in Darfur. Since its independence, Sudan has been plagued by many conflicts. Understanding the history of conflict becomes important for analysing causes of the present conflict. The third chapter entitled "Geographical Factors and Darfur Conflict" examines the interplay of geographical factors in Darfur conflict. In particular, the emphasis is on three factors: demographic, natural resources and climatic conditions. The fourth chapter as conclusion summarises the findings of this research.

CHAPTER 2

DARFUR CONFLICT: AN OVERVIEW

INTRODUCTION

Although many new states in Africa have experienced in varying degrees the problem of integrating minorities and/or sub-national groups, the history of the struggle between the Muslim north and the non-Muslim Sudanese in the three southern provinces is considerably more complex and significantly different from that of many new nations in Africa. Several observers have rightly mentioned the socio-cultural differences between the north and south as the major factor for the long civil war between the Sudanese national army and southern rebel group called *Anyanya* (or poisonous insect). Very little is therefore said about the complex physiographic heterogeneity and historical developments of Sudan. So it is necessary to know the spatial characteristics of the region to understand the conflicting history of Sudan.

PHYSIOGRAPHY OF SUDAN

Very often, political analysts and other social scientists get excited about social, political, and economic changes and, therefore concentrate almost all their efforts in studying them. To some extent geography influences the nature and type of political, economic, and social activities. Although man has achieved levels of technology high enough to modify aspects of his environment, his activities are still subject to the influences and limitations posed by geography and ecology. It is, therefore, necessary to relate the political history of the Republic of Sudan to the regional geography—particularly, the physiography of the country.

Northern Sudan, lying between the Egyptian border and Khartoum, has two distinct parts, the desert and the Nile Valley. East of the Nile lies the Nubian Desert and to the west lies the Libyan Desert. They are similar--stony, with sandy dunes drifting over the landscape. There is virtually no rainfall in these deserts, and in the Nubian Desert there are no oases. In the west, there are a few small watering holes, such as Bir and Natrun, where the water table reaches the surface to form wells that provide water for

nomads, caravans, and administrative patrols, although insufficient to support an oasis and inadequate to provide for a settled population. Flowing through the desert is the Nile Valley, whose alluvial strip of habitable land is no more than two kilometers wide and whose productivity depends on the annual flood.

Western Sudan is a generic term describing the regions known as Darfur and Kurdufan that comprise 850,000 square kilometers. Traditionally, this has been regarded as a single regional unit despite the physical differences. The dominant feature throughout this immense area is the absence of perennial streams; thus, people and animals must remain within reach of permanent wells. Consequently, the population is sparse and unevenly distributed. Western Darfur is an undulating plain dominated by the volcanic massif of Jabal Marrah towering 900 meters above the Sudanese plain; the drainage from Jabal Marrah onto the plain can support a settled population. Western Darfur stands in contrast to northern and eastern Darfur, which are semi-desert with little water either from the intermittent streams known as wadis or from wells that normally go dry during the winter months. Northwest of Darfur and continuing into Chad lies the unusual region called the *jizzu*, where sporadic winter rains generated from the Mediterranean frequently provide excellent grazing into January or even February. 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 and *hafri* (sing, *hafir*) than does the north. A unique feature of western Sudan is the Nuba mountain range of southeast Kurdufan in the center of the country, a conglomerate of isolated dome-shaped, sugarloaf hills that ascend steeply and abruptly from the great Sudanese plain. Many hills are isolated and extend only a few square kilometers, but there are several large hill masses with internal valleys that cut through the mountains high above the plain.

Sudan's third distinct region is the central clay plains that stretch eastward from the Nuba Mountains to the Ethiopian frontier, broken only by the Ingessana Hills, and from Khartoum in the north to the far reaches of southern Sudan. Between the Dindar and the Rahad rivers, a low ridge slopes down from the Ethiopian highlands to break the endless skyline of the plains, and the occasional hill stands out in stark relief. The central clay plains provide the backbone of Sudan's economy because they are productive where

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settlements cluster around available water. Furthermore, in the heartland of the central clay plains lies the *jazirah*, the land between the Blue Nile and the White Nile (literally in Arabic "peninsula") where the great Gezira Scheme (Jazirah Scheme) was developed. This project grows cotton for export and has traditionally produced more than half of Sudan's revenue and export earnings.

Northeast of the central clay plains lies eastern Sudan, which is divided between desert and semidesert and includes Al Butanah, the Qash Delta, the Red Sea Hills, and the coastal plain. Al Butanah is an undulating land between Khartoum and Kassala that provides good grazing for cattle, sheep, and goats. East of Al Butanah is a peculiar geological formation known as the Qash Delta. Originally a depression, it has been filled with sand and silt brought down by the flash floods of the Qash River, creating a delta above the surrounding plain. Extending 100 kilometres north of Kassala, the whole area watered by the Qash is rich grassland with bountiful cultivation long after the river has spent its waters on the surface of its delta. Trees and bushes provide grazing for the camels from the north, and the rich moist soil provides an abundance of food crops and cotton.

To the Northward beyond the Qash lies the most formidable Red Sea Hills. Dry, bleak, and cooler than the surrounding land, particularly in the heat of the Sudan summer, they stretch northward into Egypt, a jumbled mass of hills where life is hard and unpredictable for the hardy Beja inhabitants. Below the hills sprawls the coastal plain of the Red Sea, varying in width from about fifty-six kilometres in the south near Tawkar to about twenty-four kilometres near the Egyptian frontier. The coastal plain is dry and barren. It consists of rocks, and the seaward side is thick with coral reefs.

The southern clay plains, which can be regarded as an extension of the northern clay plains, extend all the way from northern Sudan to the mountains on the Sudan-Uganda frontier, and in the west from the borders of Central African Republic eastward to the Ethiopian highlands. This great Nilotic plain is broken by several distinctive features. First, the White Nile bisects the plain and provides large permanent water surfaces such as lakes Fajarial, No, and Shambe. Second, As Sudd ("The Sudd"), the world's largest swamp, provides a formidable expanse of lakes, lagoons, and aquatic

plants, whose area in high flood waters exceeds 30,000 square kilometres, or approximately the size of Belgium. So intractable was this Sudd as an obstacle to navigation that a passage was not discovered until the mid-nineteenth century. Then as now, As Sudd with its extreme rate of evaporation consumes on average more than half the waters that come down the White Nile from the equatorial lakes. These waters also create a flood plain that provides grazing when the flood waters retreat to the permanent swamp and sluggish river, the Bahr al Jabal, as the White Nile is called here.

The land rising to the south and west of the southern clay plain is referred to as the Ironstone Plateau (Jabal Hadid), a name derived from its laterite soils and increasing elevation. The plateau rises from the west bank of the Nile, sloping gradually upward to the Congo-Nile watershed. The land is well watered, providing rich cultivation, but the streams and rivers that come down from the watershed divide and erode the land before flowing on to the Nilotic plain flow into Sudd. Along the streams of the watershed are the gallery forests, the beginnings of the tropical rain forests that extend far into Zaire. To the east of the Jabal Hadid and the Bahr al Jabal rise the foothills of the mountain ranges along the Sudan-Uganda border — the Imatong, Didinga, and Dongotona — which rise to more than 3,000 meters. These mountains form a contrast to the great plains to the north that dominate Sudan's geography. Although Sudan lies within the tropics, the climate ranges from arid in the north to tropical wet-and-dry in the far southwest. Temperatures do not vary greatly with the season at any location; the most significant climatic variables are rainfall and the length of the dry season. Variations in the length of the dry season depend on which of two air flows predominates dry north-easterly winds from the Arabian Peninsula or moist south-westerly winds from the Congo River basin.

From January to March, the country is under the influence of the dry north easterlies. There is practically no rainfall countrywide except for a small area in north-western Sudan in where the winds have passed over the Mediterranean bringing occasional light rains. By early April, the moist south westerlies have reached southern Sudan, bringing heavy rains and thunderstorms. By July the moist air has reached Khartoum, and in August it extends to its usual northern limits around Abu Hamad, although in some years the humid air may even reach the Egyptian border. The flow becomes weaker as it spreads north. In September the dry north easterlies begin to

strengthen and to push south and by the end of December they cover the entire country. Yambio, close to the border with Zaire, has a nine-month rainy season (April-December) and receives an average of 1,142 millimetres of rain each year; Khartoum has a three-month rainy season (July-September) with an annual average rainfall of 161 millimetres; Atbarah receives showers in August that produce an annual average of only 74 millimetres. In some years, the arrival of the south-westerlies and their rain in central Sudan can be delayed, or they may not come at all. If that happens, drought and famine follow. The decades of the 1970s and 1980s saw the south-westerlies frequently fail, with disastrous results for the Sudanese people and economy.

The key to the physiographic differences in the Sudan is rainfall, which varies enormously within the country. North of latitude 10°N, fluctuations occur from year to year. This leads to crop failures in areas that depend on rain for agriculture. The result is that commercial farming (as in the Gezira area) has to depend on perennial irrigation. In the north a true desert extends from the Egyptian border to about latitude 17°N. To the west of the Nile it is known as the Libyan Desert, and to the east as the Nubian Desert. Here vegetation is virtually nonexistent, except along Wadis (seasonal streams) basins. Between latitude 16° and 17°N, the true desert merges into semi desert acacia scrub in areas where the annual rainfall ranges from 2 to 6 inches. The central area that lies between latitudes 10° and 16°N has many rivers. In this zone the average annual rainfall ranges from 6 to 30 inches. Consequently, it is possible to develop major irrigation projects and agriculture. The people living in this region are on the average wealthier than those living in other parts of the country. This has, in combination with other factors, fostered the concentration of political power in this region. The natural vegetation, which is short grass and low, wooded savanna, has been cleared for farming in most places. In the southern regions the total annual rainfall averages between 30 and 60 inches. Swamp grasses cover the Sudd region in the east; the west is high, wooded savanna and tropical rain forest that has yet to be commercially developed on a large scale.

SOCIO-CULTURAL COMPOSITION

Although in northern Sudan the majorities of the people are of mixed Arab and African origin and are generally descendants of nomadic people, the south is almost entirely made up of black Africans, and there are no clear lines of racial distinctions between the stocks of population in the two major regions of the Sudan. Whereas many people in north central Sudan are Muslims and Arabized, the Nubians are only partially Arabized, and the Beja in the northeast are non- Arabs.

The Islamic invasion of northern Africa and the Arab migration into the area during the Middle Ages led to a great deal of racial intermingling, at which time Africans were completely assimilated in western Sudan by the Hamar and Mesiriya. New immigrants were not only allowed to settle in northern Sudan, they were integrated into local communities with minimum or no objection at all. Today, many northern Sudanese trace their genealogy to Arabia, sometimes to the Holy Prophet Mohammed himself. Sudanese Arabs became progressively darker because of further miscegenation. It is very important to note that even in the Northern provinces, not every African was Arabized. For example, the Nuba mountain areas of Kordofan province are the home of the Nubas who, although partially Islamized, retained much of their African beliefs and culture. In addition, the differences between religious sects such as the Khatmiyya, predominant in the east, and the Ansar in the west, and the strong ethnic feelings among such groups as the Beja and the Nuba have had the effect of further subdividing northerners into several, often ideologically irreconcilable units.

Islamization and Arabization or the peaceful acceptance of the Muslim religion and the Arabic culture by Sudanese, were not only responsible for the predominance of Muslims among northerners, they also encouraged more Arabs to immigrate to the region. The three southern provinces were protected from the Islamic invasion and the processes of Islamization and Arabization by such physiographic barriers as the hot and humid climates and the almost impenetrable tropical vegetation. Without the Arabic influence southerners retained their traditional African religious beliefs and cultures.

From the above analysis it is obvious not only that the north is physiographically different from the south, but culturally the differences between and within the two major regions is significantly different and very complex. The pluralistic and culturally diverse

nature of the population of the Republic of Sudan and the complexity of the situation has made it very difficult for the country's leaders to significantly integrate the two regions.

SUDAN AFTER INDEPENDENCE

The continued British occupation of Sudan fueled an increasingly strident nationalist backlash in Egypt, with Egyptian nationalist leaders determined to force Britain to recognise a single independent union of Egypt and Sudan. With the formal end of Ottoman rule in 1914, Husayn Kamil was declared Sultan of Egypt and Sudan, as was his brother Fuad I who succeeded him. The insistence of a single Egyptian-Sudanese state persisted when the Sultanate was re-titled the Kingdom of Egypt and Sudan, but the British continued to frustrate these efforts. The first real independence attempt was made in 1924 by a group of Sudanese military officers known as The White Flag Association. The group was led by first lieutenant Ali Abdullatif and first lieutenant Abdul Fadil Almaz. The latter led an insurrection of the military training academy, which ended in their defeat and the death of Almaz after the British army blew up the military hospital where he was garrisoned. This defeat was (allegedly) partially the result of the Egyptian garrison in Khartoum North not supporting the insurrection with artillery as was previously promised. Even when the British ended their occupation of Egypt in 1936 (with the exception of the Suez Canal Zone), Sudan remained under British occupation. The Egyptian Revolution of 1952 finally heralded the beginning of the march towards Sudanese independence. Having abolished the monarchy in 1953, Egypt's new leaders, Muhammad Naguib, whose mother was Sudanese, and Gamal Abdel-Nasser, believed the only way to end British domination in Sudan was for Egypt to officially abandon its sovereignty over Sudan. Since Britain's own claim to sovereignty in Sudan theoretically depended upon Egyptian sovereignty, the revolutionaries calculated that this tactic would leave Britain with no option but to withdraw. Their calculation proved to be correct, and in 1954 the governments of Egypt and Britain signed a treaty guaranteeing Sudanese independence on January 1, 1956.

Afterwards, the newly elected Sudanese government led by the first Prime Minister Ismail Al-Azhari, went ahead with the process of Sudanisation of the state's government, with the help and supervision of an international committee. Independence

was duly granted and on January 1, 1956, in a special ceremony held at the People's Palace where the Egyptian and British flags were lowered and the new Sudanese flag, composed of green, blue and yellow stripes, was raised in their place.

First Sudanese Civil War (1955 – 1972)

In 1955, the year before independence, a civil war began between northern and southern Sudan. The southerners, anticipating independence, feared the new nation would be dominated by the north. Historically, the north of Sudan had closer ties with Egypt and was predominantly Arab and Muslim while the south was predominantly a mixture of Christianity and Animism. These divisions had been further emphasized by the British policy of ruling the north and south under separate administrations. From 1924, it was illegal for people living above the 10th parallel to go further south and for people below the 8th parallel to go further north. The law was ostensibly enacted to prevent the spread of malaria and other tropical diseases that had ravaged British troops, as well as to facilitate spreading Christianity among the predominantly Animist population while stopping the Arabic and Islamic influence from advancing south. The result was increased isolation between the already distinct north and south and arguably laid the seeds of conflict in the years to come.

The resulting conflict, known as the First Sudanese Civil War, lasted from 1955 to 1972. In 1972, a cessation of the north-south conflict was agreed upon under the terms of the Addis Ababa Agreement, following talks which were sponsored by the World Council of Churches. This led to a ten-year hiatus in the national conflict.

Second Sudanese Civil War (1983 – 2005)

In 1983, the civil war was reignited following President Gaafar Nimeiri's decision to circumvent the Addis Ababa Agreement. President Gaafar Nimeiry attempted to create a federated Sudan including states in southern Sudan, which violated the Addis Ababa Agreement that had granted the south considerable autonomy.

Foreign interventions

In September 2001, former U.S. Senator John Danforth was designated Presidential Envoy for Peace in the Sudan. His role is to explore the prospects that the US could play

a useful catalytic role in the search for a just end to the civil war, and enhance humanitarian services delivery that can help reduce the suffering of the Sudanese people stemming from war related effects. Following an internal outcry, the Sadiq al-Mahdi government in March 1989 agreed with the United Nations and donor nations (including the US) on a plan called Operation Lifeline Sudan (OLS), under which some 100,000 tons of food was moved into both government and SPLA-held areas of the Sudan, and widespread starvation was averted. Phase II of OLS to cover 1990 was approved by both the government and the SPLA in March 1990. In 1991, Sudan faced a 2-year drought and food shortage across the entire country. The US, UN, and other donors attempted to mount a coordinated international relief effort in both north and south Sudan to prevent a catastrophe. However, due to Sudan's human rights abuses and its pro-Iraqi stance during the Gulf War, many donors cut much of their aid to the Sudan. In a similar drought in 2000-01, the international community again responded to avert mass starvation in the Sudan. International donors continue to provide large amounts of humanitarian aid to all parts of the Sudan. The US government's Sudan Peace Act of 21 October 2002 accused Sudan of genocide for killing more than 2 million civilians in the south during the civil war since 1983. Peace talks between the southern rebels and the government made substantial progress in 2003 and early 2004, although skirmishes in parts of the south have reportedly continued. The two sides have agreed that, following a final peace treaty, southern Sudan will enjoy autonomy for six years, and after the expiration of that period, the people of southern Sudan will be able to vote in a referendum on independence. Furthermore, oil revenues will be divided equally between the government and rebels during the six-year interim period. The ability or willingness of the government to fulfill these promises has been questioned by some observers, however, and the status of three central and eastern provinces was a point of contention in the negotiations. Some observers wondered whether hard line elements in the north would allow the treaty to proceed. A Comprehensive Peace Agreement was signed on 9 January 2005 in Nairobi.

The terms of the peace treaty are as follows:

- The south will have autonomy for six years, followed by a referendum on secession.

- Both sides of the conflict will merge their armed forces into a 39,000-strong force after six years, if the secession referendum should turn out negative.
- Income from oilfields is to be shared 50 to 50.
- Jobs are to be split according to varying ratios (central administration: 70 to 30, Abyei/Blue Nile State/Nuba Mountains: 55 to 45, both in favour of the government).
- Islamic law is to remain in the north, while continued use of the sharia in the south is to be decided by the elected assembly.

Social effects:

The ongoing civil war has displaced more than 4 million southerners. Some fled into southern cities, such as Juba; others trekked as far north as Khartoum and even into Ethiopia, Kenya, Uganda, Egypt, and other neighbouring countries. These people were unable to grow food or earn money to feed them, and malnutrition and starvation became widespread. Approximately 500,000 Sudanese are believed to have fled Sudan. The lack of investment in the south resulted as well in what international humanitarian organizations call a "lost generation" who lack educational opportunities, access to basic health care services, and low prospects for productive employment in the small and weak economies of the south or the north. The agreement reached to end this war in 2005 has also played a role in the build-up to the Darfur conflict.

STUDY AREA: DARFUR

Geography

Darfur consists of an immense rolling plain that has an area of approximately 170,000 square miles (440,000 square km). The volcanic highlands of the Marrah Mountains dominate the central part of this plain. The Marrah Mountains have an average elevation of 7,200 feet (2,200 metres), with the highest peak, Mount Marrah, rising to 10,131 feet (3,088 metres). Elsewhere the sparsely populated plains of Darfur are relatively featureless and arid, particularly in the north, where they merge into the Libyan Desert. Soils, which are generally stony or sandy, support some seasonal grass and low, thorny shrubs with tropical maquis vegetation. The Marrah highlands receive heavier rainfall

than other parts of Darfur, and a number of large wadis (seasonal watercourses) rise in the mountains and flow southward across the plains.

Arabs have long constituted the majority of the population in the northern part of Darfur, while Arabs and Fur have predominated in the southern portion. Other ethnic groups have included the Beja, Zaghawa, Nubian, and Daju peoples. Heavy rainfall in the Marrah highlands permits the intensive cultivation of cereals, rice, and fruits. Crops grown at other locations in the southern part of Darfur include sorghum, millet, sesame, peanuts (groundnuts), other root crops, and vegetables. In the arid north, camels, sheep, and goats are raised. Traditional handicrafts include leatherwork, wood carving, and carpet weaving. Nyala and Al-Fāshir are the principal towns.

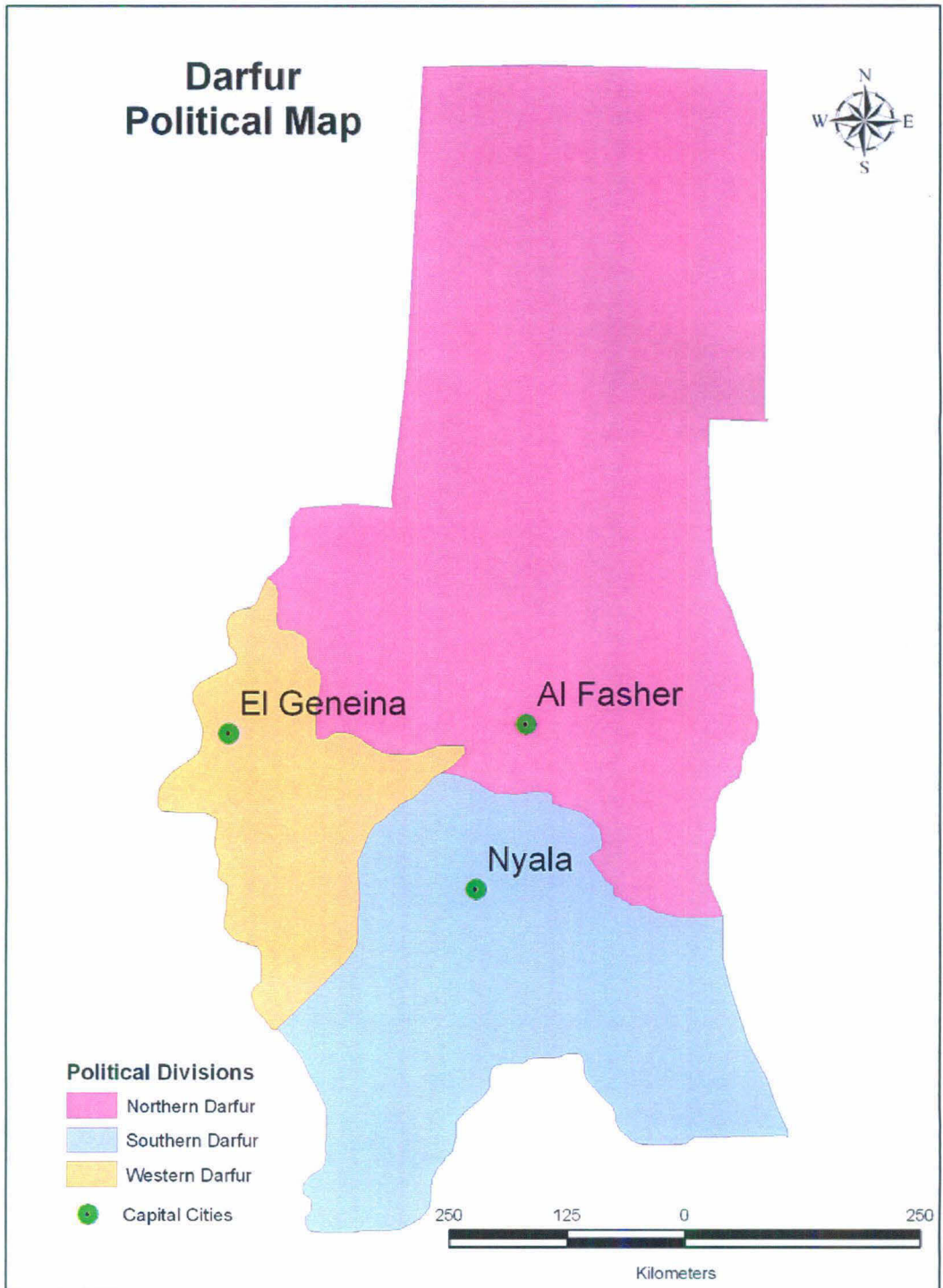
History

In prehistoric times the northern inhabitants of Darfur were related to the predynastic peoples of the Nile River valley. From roughly 2500 B.C. Darfur was probably within the sphere of the Egyptian caravans that traded southward from Aswan. Its first traditional rulers, the Daju (Dagu), may have been connected with ancient Egypt, and trade was no doubt conducted from Darfur both with Egypt during the New Kingdom and with the cities of Napata and Meroe in the kingdom of Cush (Kush; now in northern Sudan). The rule of the Daju in Darfur was eventually followed by that of the Tunjur, or Tungur.

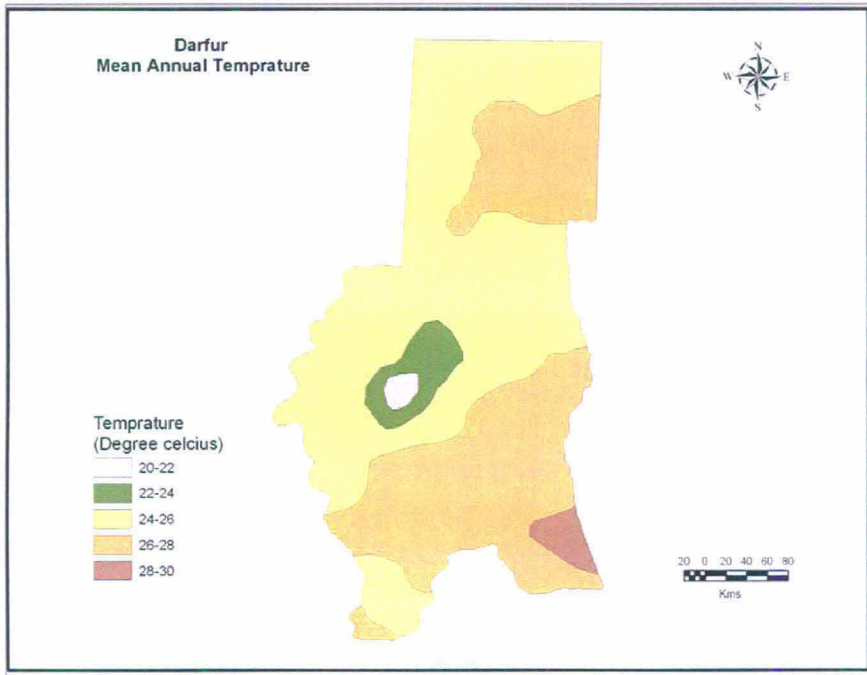
The Christian period, which probably lasted from 900 to 1200 in Darfur, was ended by the advance of Islam eastward from the empire of Kanem-Bornu (centred on Lake Chad). By 1240 the king of Kanem was claiming control of a trade route with Egypt that extended eastward as far as Sai, and it is from this date that the influence of Kanem and Bornu on Darfur probably derived. Indeed, Darfur may have been a province of either Kanem or Bornu at one time or another during their great periods.

The Keira, a chiefly clan affiliated with the Fur, ruled Darfur from approximately 1640 to 1916. The first historic mention of the name Fur occurred in 1664. During that period the kings of the Keira sultanate of Darfur apparently used the term Fur to refer to

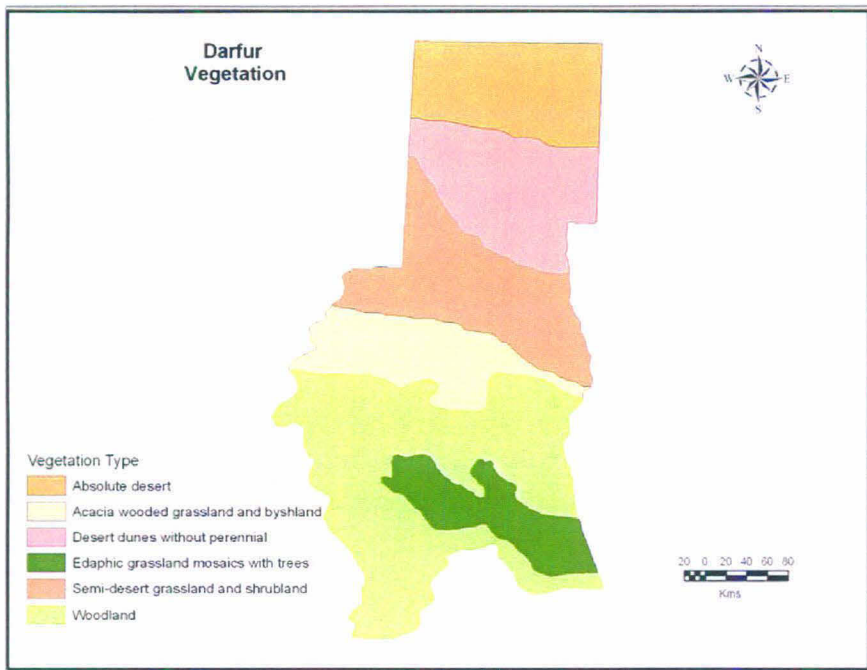
Map: 2.2



Map: 2.3



Map: 2.4



the region's dark-skinned inhabitants who accepted both their Islamic religion and their rule. As the Keira dynasty itself intermarried, its members also became known as Fur. The inhabitants of Darfur were completely Islamized under the rule of the Keira sultans. The sultans fought intermittently with the Wadai kingdom and also tried to subjugate the semi-independent Arab tribes who inhabited the country. In the 1870s Darfur came under Egyptian rule and was given provincial status. Various revolts were suppressed by the Egyptians, and in 1881 Rudolf Karl Slatin was appointed governor. Though he defended the province against the forces of al-Mahdī, a religious reformer and Sudanese political leader, he ultimately was obliged to surrender to him in December 1883. Darfur was thereafter incorporated into al-Mahdī's dominions. Following the overthrow of al-Mahdī's successor, the *khalīfah* ("caliph") Abdullah, in 1898, the new (Anglo-Egyptian) government of the Sudan recognized Ali Dīnār as sultan of Darfur (1899). A rebellion led by Ali Dīnār in 1915 provoked the British to launch a punitive expedition, in which he was killed (November 1916). Thereafter Darfur became a province (and later three provinces) of the Sudan.

War in Darfur

The War in Darfur called the Darfur Genocide is a military conflict in the Darfur region of western Sudan. Unlike the Second Sudanese Civil War, the current lines of conflict are seen to be ethnic and tribal, rather than religious. One side of the armed conflict is composed mainly of the Sudanese military and the Janjaweed, a militia group recruited mostly from the Arab Baggara tribes of the northern Rizeigat, camel-herding nomads. The other side comprises a variety of rebel groups, notably the Sudan Liberation Movement and the Justice and Equality Movement, recruited primarily from the land-tilling non-Arab Fur, Zaghawa, and Massaleit ethnic groups. The Sudanese government, while publicly denying that it supports the Janjaweed, has provided money and assistance to the militia and has participated in joint attacks targeting the tribes from which the rebels draw support. The conflict began in February of 2003.

The combination of decades of drought, desertification, and overpopulation are among the causes of the Darfur conflict, because the Baggara nomads searching for water have to take their livestock further south, to land mainly occupied by non-Arab farming communities. There are many casualty estimates most concurring on a range within the

hundreds of thousands of people. The United Nations estimates that the conflict has left as many as 400,000 dead from violence and disease. The conflict taking place in Darfur has many interwoven causes. A rebellion started in 2003 against the Arab-dominated Sudanese government, with two local rebel groups - the Justice and Equality Movement (JEM) and the Sudanese Liberation Army (SLA) - accusing the government of oppressing non-Arabs in favour of Arabs. The government was also accused of neglecting the Darfur region of Sudan. In response, the government mounted a campaign of aerial bombardment supporting ground attacks by an Arab militia, the Janjaweed. Literally translated, Janjaweed means 'devils on horseback'. The government-supported Janjaweed were accused of committing major human rights violations, including mass killing, looting, and systematic rape of the non-Arab population of Darfur. They have frequently burned down whole villages, driving the surviving inhabitants to flee to refugee camps, mainly in Darfur and Chad; many of the camps in Darfur are surrounded by Janjaweed forces. By the summer of 2004, 50,000 to 80,000 people had been killed and at least a million had been driven from their homes, causing a major humanitarian crisis in the region. On September 18, 2004, the UN Security Council passed Resolution 1564, which called for a Commission of Inquiry on Darfur to assess the Sudanese conflict. On January 31, 2005, the UN released a 176-Page report saying that while there were mass murders and rapes, they could not label it as genocide because "genocidal intent appears to be missing". In May 2006 Minni Minnawi's faction of the main rebel group, the Sudanese Liberation Movement, agreed to a draft peace agreement with the Sudanese government. The other faction of the SLM, led by Abdel Wahid Mohammed Ahmed El-Nur, the founding leader of SLM, refrained from signing the agreement. On May 5th, the agreement, drafted in Abuja, Nigeria, was signed by Minnawi's faction and the Sudanese government.

In early 2007, a High Level Mission on the situation of human rights in Darfur was set up to look into reports of ongoing violations and to try to work with the Government of the Sudan to put a stop to the atrocities. The Mission was led by Nobel Prize Winner Jody Williams and included a number of diplomats and human rights practitioners. The Mission travelled to Ethiopia and Chad but it was never admitted into Sudanese territory itself because the Government refused to issue visas to the Mission. As

a result, the High Level Mission could only collect information and in its report of March 2007, it underlined the Government's responsibility to protect civilians in Darfur, noting with regret the Government's abject failure to fulfil this responsibility.

ANALYSIS OF CURRENT SITUATION

Primary Stakeholders

Darfur Internally Displaced People (IDPs), Refugees and Civilians: Since the conflict erupted in 2003, over 2.0 million Darfurians have been internally displaced. This stakeholder group is interested in gaining land security, access to water and food, and some kind of compensation for the atrocities committed against them. Once the conflict has been resolved, they will want to return to their lands. While they have the right to return to their property, they face several key problems. First of all their lands have been destroyed in the conflict by scorch and burn tactics. Secondly, illegal squatters have occupied the land with the blessing of Government of Sudan (GOS). Finally, landscape alteration, through chopping down trees, creates an impossible identification of their lands. This presents a significant problem for refugees and IDPs. Additionally, the rights of women must be considered in any environmental governance regime, for their livelihoods depend on access to natural capital. Due to the conflict, many women have become widows. If they do not have access to property rights, they and their children will become impoverished and landless. Overall the IDP, refugees, and civilians have very low influence and power with the central government for gaining any reform and conflict resolution.

Government of Sudan: The main political party, the National Congress Party (NCP), controls the decision-making in the central government. They want to maintain their centralized power and exclude competing groups. Furthermore, the GOS has significant interests in the lands of Darfur, particularly for potential oil resource access; for mechanized agriculture purposes; strategic positioning for the proxy war against Chad; and for maintaining general chaos in the region. They want to maintain their centralization of political power, decision-making, and control of natural capital. After the peace settlement with Southern Sudan (now called Government of South Sudan-GOSS), they do not want to re-distribute any more natural resources with non-NCP

members, especially oil revenues and territory. They face two important elections in 2009, which include a nation-wide election and the 2011 referendum with GOSS. The NCP does not want to lose political power.

Rebel Groups: Initially, this group of mostly ethnic Furs mobilized in 1987, responding to the Arab militias organized and armed by Khartoum. The triggering event was caused by a food crisis from a severe drought and political changes in the central government. In 2003, the main grievances cited by the SLA for rebellion were the marginalization of Africans from modern development, wealth, and political power; the lack of proper infrastructure and water management; and the protection of their land rights from the central government and opportunistic Arabs. Furthermore, they are interested in gaining more political power, security from the Janjaweed attacks, compensation from the government for their atrocities, and maintaining military strength in the region. Importantly, in 2005, the SLA split along tribal lines. The two leaders, Minni Arkou Minawi (ethnic Zaghawa and military leader) and Abdel Wahid Mohammed Ahmed el-Nur (an ethnic Fur political leader) disagreed on political issues such as power sharing.

1. Sudan Liberation Army/Movement (SLA/Minawi): The major difference between the SLA/M and other SLA factions is that the SLA/M group signed the DPA. Minawi is concerned with the implementation of the agreement since his reputation as a rebel leader depends on its success. Both groups have very high importance and influence in the problem.

2. Justice and Equality Movement (JEM): Dissatisfied with the SLA, this coalition of rebel factions is interested in protecting their land rights, realigning political structures in Khartoum, particularly in establishing Darfur as an autonomous state. They want to increase their political power, as well as their military strength. Furthermore, JEM wants to maintain their mutually beneficial relationship with Chad. Their influence in the problem is medium, due to their weaker stance among the Darfurians. However, their importance is very high to resolving the problem due to their potential as spoilers, their relationship with Chad, and their necessary participation in any Darfur peace agreement.

3. National Redemption Front (NRF): This limited military coalition between the JEM and other splinter rebel factions are interested in increasing their military presence in the region, as well as their political power. Currently, they have some influence in the region, but are of high importance for any successful resolution of the problem.

4. Other Rebel Factions

The divide and rule tactic practiced by the GOS, as well as differences in ideology, have split the rebel movement into several different groups that have their own agenda. So far, about 26 different groups have been counted. At this point, the rebel groups should be considered potential *spoilers* in the peace process due to the significant fractionalization.

Popular Defense Force, aka “Janjaweed”: This Arab militia group is very interested in gaining territory for their pastoralist society, and maintaining their military power over the non-Arab Darfurians. Their influence with the GOS is low due to their “non-affiliation” status with the NCP. However, their inclusion in peace negotiations is crucial, as well as for determining land rights. The Janjaweed should also be considered a potential spoiler in the peace process.

Secondary Stakeholders

Sudanese Political Opposition Parties: The Minority Political Parties in Sudan consist of the Umma Party, the Communist Party, and the Popular Congress Party. They are interested in government reform, ousting the NCP from power, and peace negotiations. Their importance is medium, due to their weaker political power. However, they are key players in negotiations since they are sympathetic to some rebel causes. If any type of land regime is proposed, they must be included in order to ensure implementation.

Sudanese People’s Liberation Movement (SPLM): Initially, before 2004, the SPLM supported the rebellion in Darfur but ended before the signing of the Comprehensive Peace Agreement with Khartoum. However, they are showing signs of reintroducing support for Darfur rebels.

Government of South Sudan (GOSS): Entered into a power sharing arrangement with the GOS in 2005. As part of the agreement, the provision included wealth-sharing agreements from oil exports and elections in 2009 with a possible secession in 2011. They could be potential ally for environmental efforts.

Smaller Arab tribes (landless): Recent developments in the conflict have shown that an Arab-Arab fractionalization is occurring, such as between the Terjem and the Mahria tribes. They are both interested in the Fur lands gained from the conflict. Both want to maintain the integrity of their territorial claims. However, greed over the spoils of war drives them to fractionalization. As a disenfranchised group, they are highly important for peace negotiations (potential spoilers) but their current influence is low.

Arab Tribes: The Baggara tribe is the main pastoralist tribe in the region, but has refrained from participating in the conflicts. They have land rights and access to resources. Their interests will need to be considered in any negotiations process.

External stakeholders

People's Republic of China: Out of the external stakeholder group, China bears the most influence with the GOS and supports their policies. Currently, China is working closely with the GOS to develop their oil interests, as well as improving basic infrastructure and building dams. China has massive oil investments in Sudan (specifically Petrodar Operating Company), buying two-thirds of GOS oil. Additionally, the untapped oil in southern Darfur poses an ethnical problem for the rapidly developing nation. China is interested in the land rights for oil fields, and they want the NCP to remain in control. However, international pressures for China to nudge the GOS towards reform in Darfur are significant, especially with the 2008 Olympics approaching. China understands the international political consequences of their involvement with oil in Darfur.

Recently, China broke with their tradition of non-interference with sovereign rights of nation by warning the GOS; "the world is running out of patience over what's going in Darfur." China can play a very important role in ending the conflict in Darfur. Any negotiations for environmental governance will need to include China due to their high influence. Most importantly, China is highly influential with the GOS both politically and economically.

African Union: The African Union is still improving their capacity as a major political institution on the continent. In the Darfur conflict, the AU has tried to increase their influence in the region as the main peacekeeping force. However, the scope of the conflict and their lack of capacity have made peacekeeping a challenge. Also, the GOS's

stubbornness to accept UN peacekeeping troops has boosted the significance of the AU in the region. This position has placed the AU in a medium level influential position with the GOS but has increased their importance on the international scene to a higher level than in other African conflict situations. However, in a post-conflict setting, they will be crucial for stabilizing the region and prevent any conflicts from erupting over land tenure issues. The AU will have a vested interest in a sustainable peace in Darfur and would aid in land reforms.

USA: The Bush Administration considers Sudan a high foreign policy priority. The US wants to end the Darfur crisis “through a political settlement, providing humanitarian assistance to vulnerable populations, enabling the deployment of an international peacekeeping force, and promoting democracy in Sudan.” While the US remains a strong presence in the international scene, it lacks significant sway with the GOS, especially when compared to China. This lack of influence with GOS is mostly due to the US position on the crisis in Darfur, labelling of the conflict as “genocide.” Such policy position has significant consequences, which includes polarizing the interest groups and creating an Anti-Arab sentiment that further alienates Arab countries. This sentiment is not helped by the current war in Iraq and Bush’s position on Israel. As a result, the US has imposed economic sanctions against individual Sudanese and government-owned companies that to pressure Khartoum to end the violence in Darfur. However, the US will continue to collaborate with the GOS on counter-terrorism issues, since fighting the “War on Terror” is paramount for the Bush administration. The US faces domestic pressures to intervene in Darfur as well. Numerous US-based NGOs remain active in preventing further genocide and atrocities in Darfur. US have strong domestic pressure to divest in Sudan, intervene to prevent further genocide, and encourage Khartoum to accept an international peacekeeping force in Darfur.

Neighbouring Countries

1. Chad: The conflict in Darfur has involved Chad along ethnic and political lines. Chad has used the rebellion as a proxy war with the NCP by arming the JEM Arab militias consistently attacking the camps. The nation is a key player in negotiating a peace treaty, since it may act as a spoiler. Also, Chad can help represent the Zaghawa tribe in their desire for land rights. Chad has significant influence in the area, particularly with the

JEM and can help persuade the rebels into either escalating the war or a ceasefire. However, Chad is facing a crisis on their own soil, as rebels attacked the capital earlier in February.

2. Egypt: As Sudan's neighbour, Egypt is concerned with regional stability, water resources from the Nile River basin, and maintaining a working relationship with Khartoum. The country has a bilateral agreement with Sudan for water resources in the Nile River Basin. They want to maintain a working relationship with Sudan to protect their water resources. With the discovery of the underground lake, Egypt has pledged to drill the first 50 wells. Additionally, Egypt also has concerns about Darfurian refugees entering into their country and the threat to national security. As a result, Egypt has medium influence but high importance in the negotiating process.

3. Libya: This neighbour of Sudan has attempted to mediate between the GOS and rebel groups. Libya opposes the use of UN peacekeeping troops in the region. However, they are open to the presence of an AU force, especially for patrolling the borders. The country has a high influence and high importance with the GOS and the rebels.

4. Eritrea: In the region, Eritrea plays an important role in initiating negotiations to end the violence. Eritrea is interested in maintaining a stable relationship with Khartoum since it sees Ethiopia as a more significant threat. Also, the country is interested in Sudan's oil exports. This could complicate any land rights negotiations for the indigenous groups, since their lands could be on potential oil fields.

5. Central African Republic (CAR): Similar to their neighbours, the CAR is interested in regional stability, and their own country's stability. The influx of refugees and occasional rebel skirmishes on their borders heightens the tensions with the GOS. In order for any kind of land rights negotiations to occur, CAR will need to meet with other regional actors to stop the violence. CAR has high influence and high importance in this situation.

Japan: Sudan exports almost 50% of its products to Japan, significant trading partner. Japan could be persuaded by the US government to comply with environmental initiatives. Their economic relationship with Sudan could convince the GOS to comply.

United Nations (UN): The UN has tried, on numerous occasions, to send in peacekeeping troops into Darfur to end the violence. A joint UN-AU peacekeeping force

will be deployed in early January to help stabilize the region and protect civilians from attacks. However, since the arrival of UN troops, the violence has not stabilized. In this case, the UN has high importance but medium influence in the current situation.

World Bank (WB): This financial institution has interests in a joint effort with the UN to pinpoint urgent and long-term sustainable development goals in Sudan. Key development policies include: increased transparency, reduce corruption, and sustainable development. With the Comprehensive Peace Agreement (CPA) between the GOS and the Government of South Sudan (GOSS) government, the WB has a financial interest in the success of this agreement. The World Bank could also fund and provide technical assistance for land reform any programs in Darfur. They are key players in any post-conflict reconstruction efforts.

Major Donor Countries: The major donor regimes: EU, France, Netherlands, Norway, and Switzerland: all have significant economic, political, and social sway over the conflict in Darfur. Switzerland has economic interests in the GOS oil company. Their influence is high and their importance is medium, but should be considered as potential allies for advocating for indigenous land rights.

Oil Corporations: Swiss company Clivenden and China National Petroleum Corporation (CNPC), India's Oil and Natural Gas Corporation (ONGC), Malaysia's Petronas, Marathon Oil Corporation, and the Kuwait Foreign Petroleum Company all have oil interests in Sudan and want to maintain good relations with GOS. They will resist any reforms if their economic interests are jeopardized, especially with the oil concessions in Southern Darfur. Through outside pressures, MNCs could be convinced to negotiate with the GOS for better practices in Darfur. However, the CNPC, as a state-owned company, is beholden to the Chinese government's interests.

Arab League: With the conflict, the Arab league has played a limited role in bringing about peace. Sudan, as the gateway between North Africa and East Africa, has decided to align themselves with the Arabs. As a result, the GOS wants to strengthen their connection to the Arab league for political, social, economic, and ideological reasons. The Arab League should not be isolated from the peace process. In particular, Saudi Arabia, being another majority Sunni Muslim country and an import and export partner, could have significant influence with Khartoum.

CONCLUSION

From the history and geography of Sudan and Darfur it can be concluded that there are many ups and down in the history and physiography of the area is highly diverse and complex. Environment of Darfur is highly vulnerable to the climatic changes, demographic changes and land use changes. The continuing natural resource depletion due to climatic changes such as rainfall variability is of major concern in the Darfur conflict. The decreasing grasslands, forest cover and grazing lands; increasing rain-fed agriculture due to water scarcity and increasing population of both human beings and livestock have put immense pressure on the environment of the region making it more vulnerable. These scarcities of resources have led to large scale migration of the people in search of food, fodder and water. Such large scale migration have led to competition between the migrant and native members over the sharing of natural resources so making the situation ideal for the conflict to take place. These all factors are discussed extensively in the third chapter. The Darfur conflict becomes more complex due to the ethnic diversity, political marginalization, regional inequalities and international, regional & local stakeholders along with the probable above mentioned environmental causes.

CHAPTER 3

GEOGRAPHICAL FACTORS AND DARFUR CONFLICT

The environment is central to people's lives in Darfur. The region of Darfur in Sudan provides an interesting crossroads of environmental changes intersecting with socio-economic, political, and ethnic manipulations for inciting conflict. Recently, connecting climate change and the Darfur conflict gained scholarly and media attention. In 2007, UN Secretary General Ban Ki Moon released an editorial in the *Washington Post* highlighting the connection between climate change and the conflict in Darfur. To quote him

“...amid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate change.”

The impacts from climate change, such as the 20 year Sahelian drought, altered resource usage and access among the different stakeholders. Desertification increased significantly in northern and central Darfur, availability of fresh water resources declined, and farmland and grazing areas deteriorated. What political, social, economic, and environmental conditions in Sudan initiated the violent conflict in Darfur? The following conflict analysis attempts to highlight the environmental aspects of the Darfur crisis.

This section presents a rationale for the importance of environment in Darfur by describing:

- the particular vulnerability of the natural environment in Darfur
- the role of environment in the Darfur Crisis.

ROLE OF REMOTE SENSING

Remote sensing means measuring at a distance without physical contact. When the sun's electromagnetic energy reaches the earth's surface, it will be reflected, absorbed or transmitted. The radiation that is used to identify objects with different remote sensing techniques is either reflected or emitted energy (Lillesand *et al.*, 2004). The proportions accounted for by each process depend upon the nature of the surface, wavelength of the energy and angle of illumination (Campbell, 2002). Remote sensing uses the knowledge that radiation intensity within different wavelengths is often typically emitted by different objects, thus giving different objects different spectral signatures (fig: 3.1). For example, at a certain wavelength, sand reflects more

energy than green vegetation while at other wavelength it absorbs more (reflects less) energy. Therefore, these spectral signatures can be used to distinguish one object from another or to obtain information about shape, size and other physical and chemical properties (Campbell, 2002). When the radiation passes through the atmosphere it will be scattered by aerosols and clouds. This may lead to error in the data collected by remote sensing (Campbell, 2002).

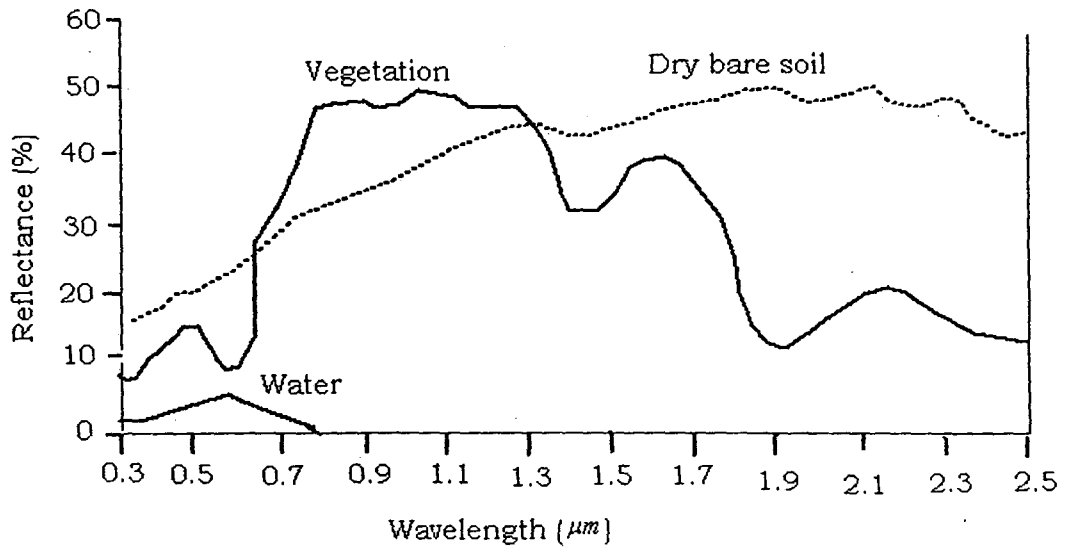


Fig: 3.1 Spectral signatures for vegetation, dry bare soil and water (Tso & Mather 2001)

Remotely sensed data derived from satellites have successfully being utilized for decades in assessment of pastureland productivity, predicting biomass and monitoring the vegetation health status (Reeves *et al.*, 2001; Lillesand *et al.*, 2004) in temporal and spatial scales. It was also proved to be economically feasible to make routine measurements. Many researchers use coarse to high resolution satellite and aerial images with a ground scale of 0.2 to 60 meters (Wylie *et al.*, 1995; Yool *et al.*, 1997; Weber, 2001) for pastureland assessment. High temporal resolution (for over 20 years), wide area coverage, availability and affordability make NOAA / AVHRR (National Oceanic and Atmospheric Administration / Advance Very High-Resolution Radiometer) satellite images very attractive for application in pasture assessment. However, the barriers to the use of high resolution data are the data availability and high cost of processing.

The role of remote sensing in land use changes

Monitoring of land degradation over large areas is difficult resulting in a lack of reliable data that has even caused questions to be raised about the existence of land degradation. However, Dregne (1983) argued that without convincing data the level of commitment to programmes to combat desertification will remain low. By combining image analysis with Geographical Information Systems (GIS) models that take into account both environmental and human impacts, the ability to monitor land degradation will be extended (Burrough, 1986). GIS and remote sensing play an important role in the linkage and analysis of soils, physiography, climate, vegetation and land use data, in particular for detection (direct or indirect), extrapolation and interpretation, as well as area calculation and monitoring. More specifically, GIS and/or remote sensing have been used in assessment of different kinds of soils degradation and conservation; to map temporal and spatial changes in land cover and land use; and to identify areas of degradation. Rangelands are often too extensive, heterogenous and inaccessible to effectively make an inventory or to be monitored by ground surveys. The ground survey method involves intensive measurement of soil or plant community properties. These techniques are either too slow or too expensive for use at more than a few points in the landscape yet many locations must be surveyed to represent the highly diverse landscapes. Less intensive techniques such as aerial photograph interpretation can provide better coverage but with far less accuracy (Pickup and Chewings, 1994). Furthermore, these techniques are not sufficiently repeatable. Therefore, they are of little use in monitoring change over time. Hence remote sensing and GIS are perfect tools to determine land use changes.

LandSat:

The Landsat program is the longest running enterprise for acquisition of imagery of the earth from space. The first Landsat satellite was launched in 1972; the most recent, Landsat 7 was launched on April 15, 1999. The instruments on the Landsat satellite have acquired millions of images. The images, archived in the United States and at Landsat receiving stations around world, are a unique resource for global change research and applications in agriculture, geology, forestry, regional planning, education and national security (Lillesand *et al.*, 2004) Five different types of sensors have been included in various combinations on the Landsat missions. These are the Return Beam Vidican (RBV), the Multispectral Scanner (MSS), the Thematic Mapper

(TM), the Enhanced Thematic Mapper (ETM) and the Enhanced Thematic Mapper Plus (ETM+). These sensors were launched into repetitive, circular, sun-synchronous and near-polar orbits (Lillesand *et al.*, 2004).

LandSat Thematic Mapper

Landsat 4 and 5 carrying the Thematic Mapper (TM) sensor were launched in 1982 and 1984 respectively. The TM sensor is an upgrade of the MSS sub-system on which efforts were made to incorporate improvements into a new instrument. The TM instrument is thus based on the same technical principle as the MSS but with a more complex design as it provides finer spatial resolution, improved geometric reliability, greater radiometric detail and more detailed spectral information. The MSS has only four broadly defined spectral regions whereas the TM has seven spectral bands, customized to record radiation of interest to specific scientific investigations (Campbell, 2002).

Moderate Resolution Imaging Spectro-radiometer (MODIS):

MODIS (Moderate Resolution Imaging Spectro-radiometer) is a payload scientific instrument launched into Earth orbit by NASA in 1999 on board the Terra Satellite, and in 2002 on board the Aqua satellite. The instruments capture data in 36 spectral bands ranging in wavelength from 0.4 μm to 14.4 μm and at varying spatial resolutions (2 bands at 250 m, 5 bands at 500 m and 29 bands at 1 km). Together the instruments image the entire Earth every 1 to 2 days. They are designed to provide measurements in large-scale global dynamics including changes in Earth's cloud cover, radiation budget and processes occurring in the oceans, on and in the lower atmosphere.

TECHNIQUES OF ANALYSIS:

The Normalized Difference Vegetation Index (NDVI): Many natural surfaces are about equally as bright in the red and near-infrared part of the spectrum with the notable exception of green vegetation. Red light is strongly absorbed by photosynthetic pigments (chlorophyll) found in green leaves, while near-infrared radiation either passes through or is reflected by live leaf tissue, regardless of their color. This means that areas of bare soil that have little or no green plant material will

appear similar in both the red and near-infrared wavelengths, while areas with green vegetation will appear bright in the near-infrared and very dark in the red part of the spectrum. By using these wavelengths, different vegetation indices can be produced. The NDVI is the most widely used vegetation index and many studies have demonstrated its ability to describe vegetative phenology.

NDVI is calculated from atmospherically corrected reflectance from the visible red (RED) and near infrared (NIR) channels as:-

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

The resulting index value is sensitive to the presence of vegetation on the land surface and can be used to address issues of vegetation type, amount and condition. The NDVI values range from -1.0 to 1.0, where areas with vegetative cover have values greater than zero and negative values indicate non-vegetated surface features such as water, bare soil or the presence of clouds (Justice *et al.*, 1985).

The main advantages of the use of the NDVI for monitoring vegetation are:

- i) The simplicity of the calculation;
- ii) The high degree of correlation of the NDVI with a variety of vegetation parameters;
- iii) The extensive area coverage and high temporal frequency of NOAA-AVHRR data

Multi-spectral techniques:

Classification of digital imagery involves grouping together pixels on the basis of similar spatial reflectance values in order to identify the areas or information of interest (Harrison and Jupp, 1990; Lillesand *et al.*, 2004; Richards and Jia, 1999; Tueller, 1989). Classification is achieved by two basic methodologies. These are supervised, unsupervised or a mixture of both. Tueller(1989) states that on rangelands unsupervised classification appears to produce the most accurate results. O'Neill (1989) found that in the heterogeneous areas of high variability unsupervised classification was far more accurate than a supervised approach but that a combination of both produced the best results.

Unsupervised classification:

Unsupervised classification involves algorithms that examine the unknown pixels in an image and aggregate them into a number of classes based on the natural groupings or clusters present in the image value. The basic premise is that values within a given cover type hold close together in the measurement space, whereas data in different classes should be comparatively well separated.

Supervised classification:

A supervised classification consists of three basic steps: (1) In the training stage, the analyst identifies representative training areas and develops a numerical description of the spectral attributes of each land cover type of the interest in the scene. (2) In the classification stage each pixel in the image data set is categorized into a land cover classes most closely resembles. If the pixel is insufficiently similar to any training dataset, it is usually labeled 'unknown'. The category label assigned to each pixel in this process is then recorded in the corresponding cell of an interpreted data set as an output image. Thus, the multi-dimensional image matrix is used to develop a corresponding matrix of interpreted land cover category types. (3) After the entire dataset has been categorized, the results are presented in the output stage.

GEOGRAPHICAL FACTORS OF CONFLICTS

CLIMATIC CHANGES

Climate affects man in a multitude of ways and is probably the most important of all geographic factors. It is an important control over the distribution of plant and animal life and consequently largely determines the industries and activities of man, the foods produced in any area, and the material available for shelter and clothing. Climate may act as barrier to the migration of humans, animals and plant life, and it markedly affects man's health and energy levels. Climate variability means the fluctuation between the normally experienced climate conditions and a different, but recurrent, set of the climate conditions over a given region of the world and also refers to a shift in climate, occurring as a result of natural and/or human interference. Climate variability and climate change have gone on throughout time; but has now become a pressing issue on the world's agenda.

Climate variability in Africa:

Climate variability and climate change contribute to the vulnerability via economic loss, hunger, famine and relocation in Africa. The African Sahel provides the most dramatic example worldwide of climate variability that has been directly and quantitatively measured. Precipitation is much more variable in both time and space than other climate factors. The year-to-year variability is a dominant characteristic of the rainfall record and this variability becomes more pronounced if a smaller region is examined. Precipitation varies in a number of its characteristics from total annual precipitation through precipitation seasonality to variability in characteristics of storms (duration, temporal, spacing, total storm precipitation) and variability in the intensity of instantaneous and daily precipitation.

African rainfall has changed substantially over the last 60 years; this change has been notable as rainfall during 1961-1990 declined by up to 30% compared with 1931-1960 (Sivakumar *et al.*, 2005). A long-term change in rainfall has occurred in the semi-arid and sub-humid zones of West Africa, the rainfall during the 30 years (1968-1997) has averaged some 15-40% lower than during the period 1931-1960. Averages over 30 year intervals, showed that the annual rainfall in the Sahelian region fell by between 20-30% between 1930s and 1950s and the decades post 1960s (Hulme, 2001). Kidson (1977) suggested that the low rainfall was associated with a weaker meridional circulation and warmer temperatures over much of Africa. Newell and Kidson (1984) link the Sahelian rainfall variability to a modulation of the general circulation. Haile (1988) linked the drought in Ethiopia with ENSO and Sea Surface Temperature (SST) anomalies in the southern Atlantic and India Oceans combined with anthropogenic activities. Statistical analysis by Attia and Abulhoda (1992) shows that ENSO episodes are negatively teleconnected with flooding of Blue Nile and Atbar Rivers that originate in Ethiopia due to reduced total rainfall in the Ethiopian highlands. Eltahir (1996) used two extensive data sets describing SST of the Pacific Ocean, and the flow of water in the Nile River. The analysis suggests that 25% of the natural variability in the annual flow of the Nile is associated with El Niño oscillations. The primary natural forcing factors are linked to the change in solar output and they conclude that an ENSO event effects flows of the Nile River (El Niño indicates a drought in the highland of Ethiopia). Nicholson (1999) discussed the hypothesized role of surface-atmosphere interaction in the inter-annual variability of the Sahel rainfall. Climate variability has been, and continues to be, the principal

source of fluctuations in global food and production in the arid and semi-arid tropical countries of the developing world. In conjunction with other physical, social and political-economic factors, many African countries have experienced severe drought and higher flood frequently in the 20th century. Extensive droughts have afflicted Africa, with serious episodes namely 1965-1966, 1972-1974, 1981-1984, 1986-1987, 1991-1992 and 1994-1995 (WMO, 1995). The aggregate impact of drought on the economies of Africa can be large; for example 8-9% of GDP in Zimbabwe and Zambia in 1992 (Benson and Clay, 1998). A small change in variability has a stronger effect than the small change in the mean of the climate factors. Elagib and Mansell (2000) reported that the mean annual temperatures in Sudan have increased significantly by 0.076° – 0.2° C per decade specifically in the central and the southern regions. They also concluded that inter annual variability of the rainfall ranged from 13.8-122.9%.

Darfur and Climate Change:

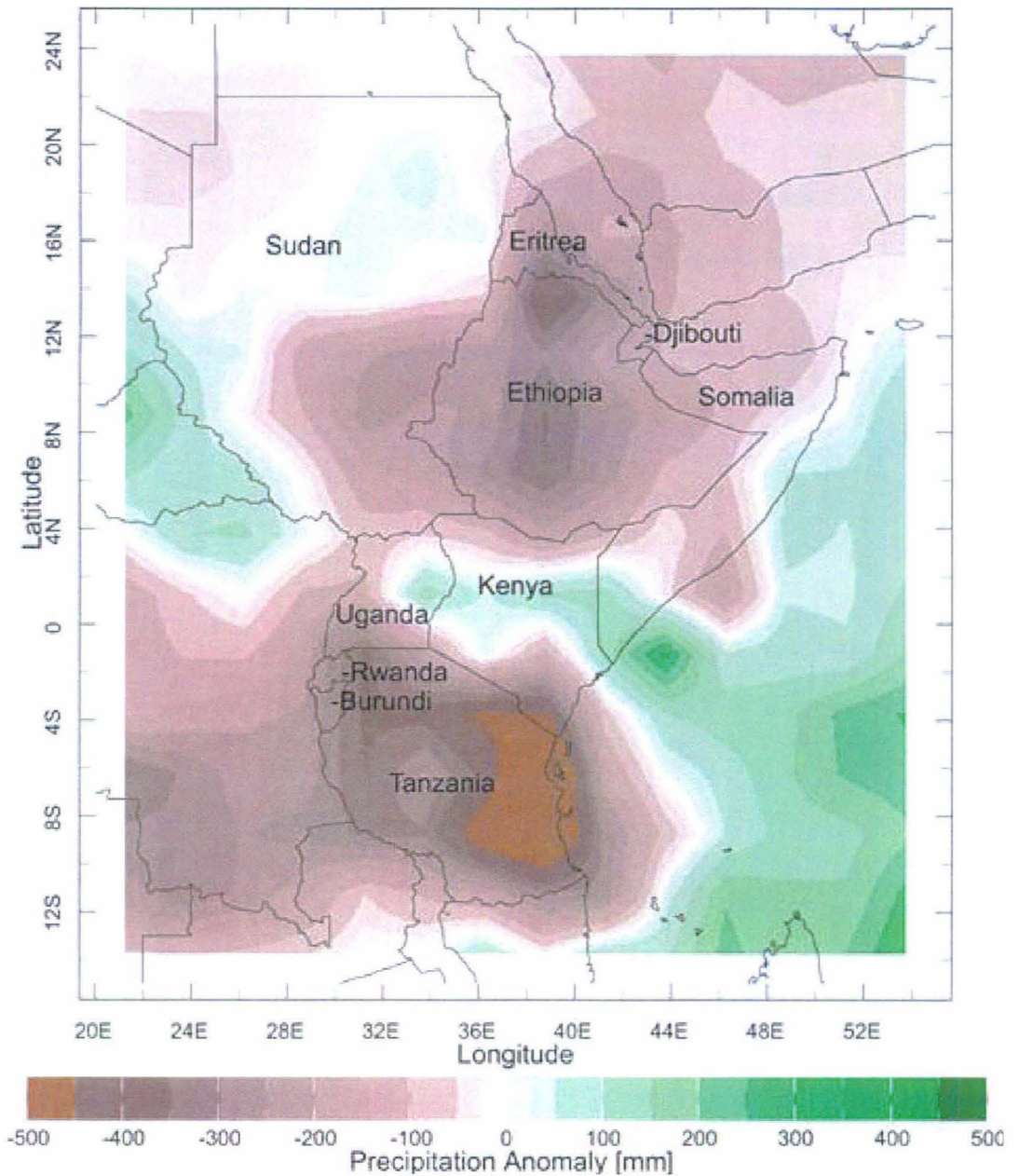
Darfur lies in a region that suffers and will continue to suffer significant impacts of climate change. It is a physically marginal area already subject to considerable climatic variability and unpredictability. It is at the centre of a large continent which reduces the stabilizing effect of the sea currents on temperatures. Globally temperatures have risen by 0.7°C since around 1900. A rise of between 1.4°C and 5.8°C is predicted between 1990 and 2100. Climate models predict that in Darfur the length of growing periods will reduce and the percentage of failed harvests will increase. Predictions include a reduction in the length of growing period ranging from five per cent to 20 per cent from South to North Darfur by 2020 compared to 2000 levels and more than 20 per cent for most of central Darfur by 2050. Increasing variability is causing a rise in the percentage of failed harvests. UNDP have analyzed the impact of climate change on cereal productivity and predict an impact of reduction of greater than 25 per cent across the whole of central Darfur by 2080.

Rainfall variability:

Annual climate variability and drought:

Insufficient and highly variable annual precipitation is a defining feature of the climate of most of Sudan. Annual variability and relative scarcity of rainfall– in the north of Sudan in particular– have a dominant effect on agriculture and food security,

Map: 3.1 Annual precipitation anomalies for 2003 across the N-E region of Africa (Anomalies are departures from the 1979–95 base periods)



Source: (NOAA)

and are strongly linked to displacement and related conflicts. Drought events also change the environment, as dry spells kill otherwise long lived trees and result in a general reduction of the vegetation cover, leaving land more vulnerable to overgrazing and erosion. Together with other countries in the Sahel belt, Sudan has suffered a number of long and devastating droughts in the past decades.

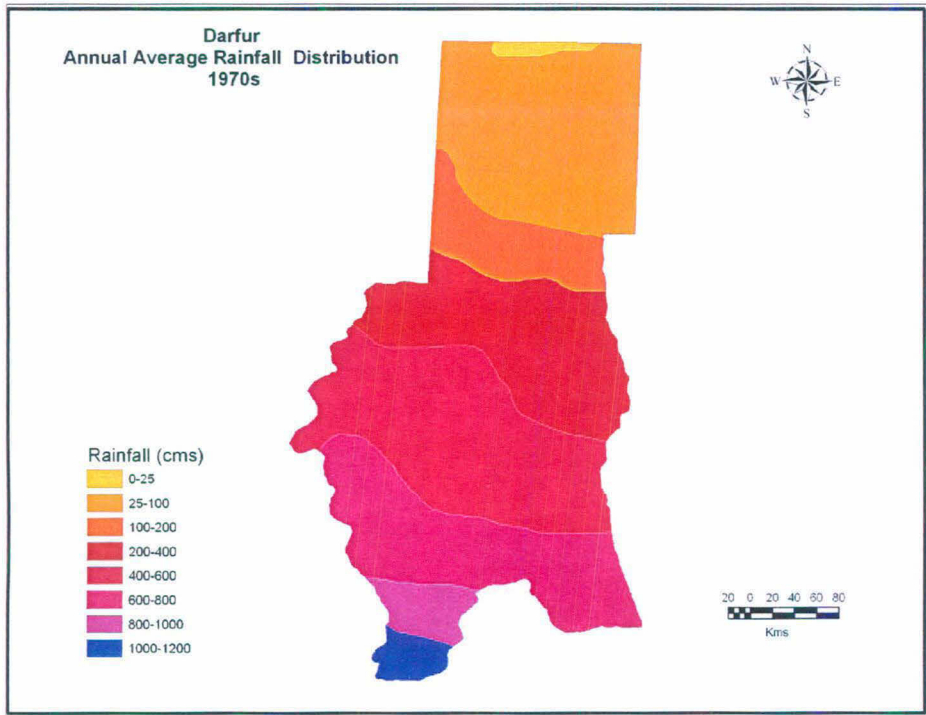
All regions have been affected, but the worst impacts have been felt in the central and northern states, particularly in Northern Kordofan, Northern state, Northern and Western Darfur, and Red Sea and White Nile states. The most severe drought occurred in 1980-1984, and was accompanied by widespread displacement and localized famine. Localized and less severe droughts were also recorded in 1967-1973, 1987, 1989, 1990, 1991, 1993 and 2000. Isolated drought years generally have little permanent effect on the environment. In the case of central Sudan, however, the eighteen recorded years of drought within the last half-century are certain to have had a major influence on the vegetation profile and soil conditions,

Recent research has indicated that the most likely cause of these historical droughts was a medium-term (years) change in ocean temperature, rather than local factors such as overgrazing. Therefore, the potential for such droughts to occur again remains.

Long-term regional rainfall reduction

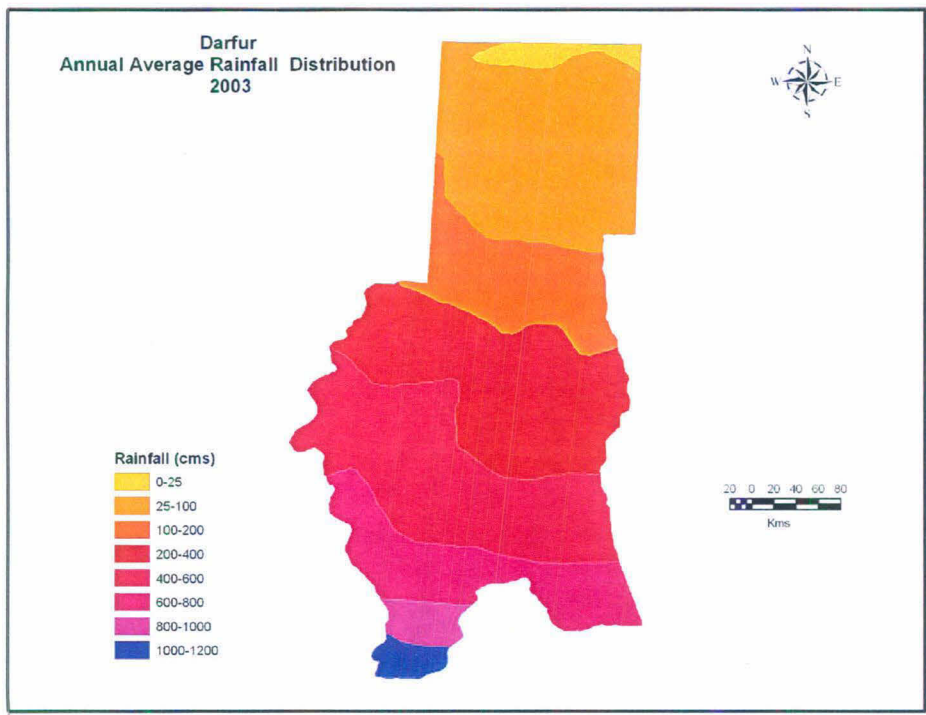
In addition to and separately from the variation in precipitation, there is mounting evidence of long-term regional climate change in several parts of the country. This is witnessed by a very irregular but marked decline in rainfall, for which the clearest indications are again found in Darfur states. Table 3.1 below summarizes the long-term trends noted, as indicated by thirty-year moving averages of annual precipitation for three locations in Darfur. Precipitation records have been kept in Darfur since 1917. However, there are still only three continuously monitored stations for an area of over 0.8 million km². The data below shows an over all trend of declining rainfall, with the most marked decrease on the northern edge of the Sahel in Northern Darfur. Since records began, the ten year moving average for El Fasher has declined from 300 mm per annum to approximately 200mm, while the last time rainfall exceeded 400

Map: 3.2



Source base map: (UNEP 2007)

Map: 3.3

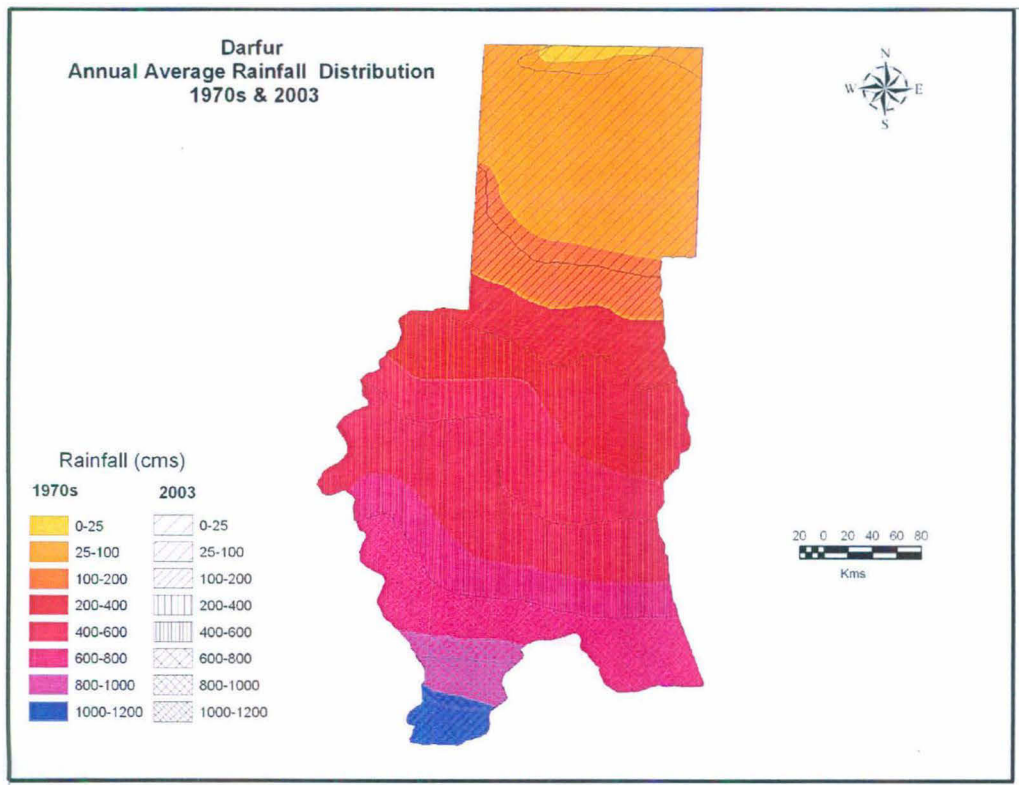


Source base map: (UNEP 2007)

Table 3.1
Long-term rainfall reduction in Darfur (Bromwich 2007)

Rain gauge location	Average annual rainfall (mm) 1946-1975	Average Annual rainfall (mm) 1976-2005	Reduction	(-) Percentage
El-Fasher, Northern Darfur	272.36	178.90	-93.46	-34%
Nyala, Southern Darfur	448.71	376.50	-72.21	-16%
El-Geneina, Western Darfur	564.20	427.70	-136.50	-24%

Map:3.4



mm was in 1953. The scale of historical climate change as recorded in Northern Darfur is almost unprecedented: the reduction in rainfall has turned millions of hectares of already marginal semi-desert grazing land into desert. The impact of climate change is considered to be directly related to the conflict in the region, as desertification has added significantly to the stress on the livelihoods of pastoralist societies, forcing them to move south to find pasture.

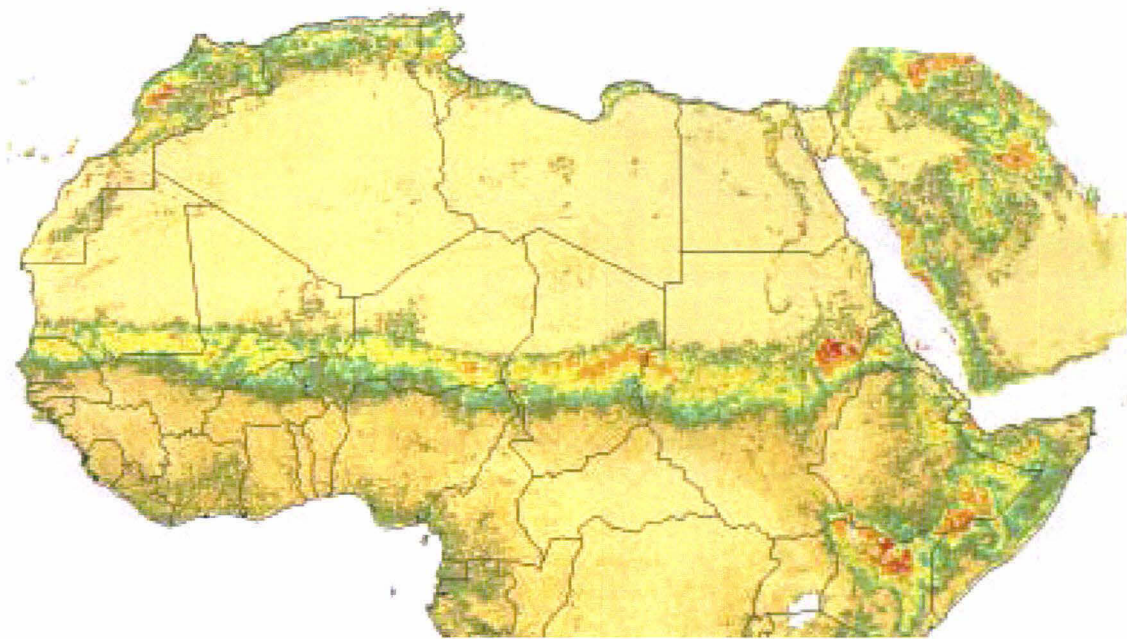
The overlapping of the rainfall data of 1970 and 2003 in Darfur clearly indicates south ward shift of the isohyets mainly 200,400 and 600 cm. this southward shift has great implication on the vegetation of the region. This variability of rainfall enhances the frequency of draught occurrence in the region. These belts also cover the most populated regions of the Darfur so making the population vulnerable to the frequent draughts.

LAND USE CHANGES

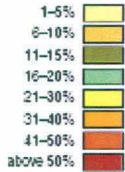
The erratic rainfall patterns, continuing population increase, increasing livestock have put the pressure on the natural resources of the region. There are drastic changes in the land use changes in the Sahel region of the Africa. An analysis of the variability of NDVI shows areas where livelihoods are particularly susceptible to failure of rains and harvests. These are marginal and particularly vulnerable environments. This type of environment runs across the Sahel between 11° and 17° N, through Darfur, around the Horn of Africa, through Eritrea, Somalia, Eastern Ethiopia and Northern Kenya. Map: 3.5 below show the variability of yearly maximum NDVIs for northern Africa.

Both the Sahara and sub-Saharan Africa have relatively consistent maximum vegetation year by year. There is very little variation in the Sahara which consistently has virtually no vegetation, and there is very little variation south of the Sahel which is consistently highly vegetated. The variation in vegetation is less than 5 or 10 per cent in these areas. However, between these, the transition zone south of the desert has variability reaching over 30 percent, and correspondingly unpredictable livelihoods. The impact of variability on livelihoods in these areas is expected to increase over coming decades as a result of climate change. Increasing variability is causing a rise in the percentage of failed harvests. This transitions zone where livelihoods are unpredictable, leads to the unstable settlement pattern and continuous movement to and fro from region to region. This transition zone often dissects international boundaries and creates situation of political crisis in this zone. Large

Map: 3.5
Annual maximum NDVI for the years 1982 to 2003



Vegetation variability (1982-2003)



Source: (Bromwich 2007)

scale migrations have made these international borders the breeding ground of poverty, hunger and conflict. This pattern is clearly shown in the Map: 3.15.

Darfur land use change

Changes in vegetation cover

UNEP's Post-Conflict Environmental Assessment supports the premise that there has been widespread deforestation, an increase in rain-fed agriculture and a reduction in open rangeland since the 1970s. In the Jebel Mara site the proportion of land covered with closed forest fell from 50.7 percent in early 1973 to 35.8 per cent in late 2001. This is a loss of 29 per cent of the forested area over 29 years, or 1.2 per cent per year. The land use switched to open forestry which refers to open deforested land, i.e. there was not a new land use to replace the forestry. There was no rain-fed agriculture recorded in this area. In the South Darfur, the proportion of land use for rain-fed agriculture rises from 5.8 per cent in May 1973 to 15.4 per cent in November 2005. The combined percentages of forest and wooded grassland for the same dates are 70.9 per cent, to 49.4 per cent. The combined analysis across geographically similar areas in Sudan is informative of the processes of land use change taking place more widely.

Table 3.2

The pattern of Land use changes 1973-2005 (Bromwich 2007)

Bush and shrub	23.8	1	17.5	2	-6.3	-26.5%
Rain-fed agriculture	22.7	2	34.4	1	+11.7	+51.5%
Wooded grassland	11.8	3	7.1	4	-4.7	-39.8%
Closed forest(natural)	10.7	4	7.9	3	-2.8	-26.2%
Grazing / pasture	9.0	5	6.8	5	-2.2	-24.4%

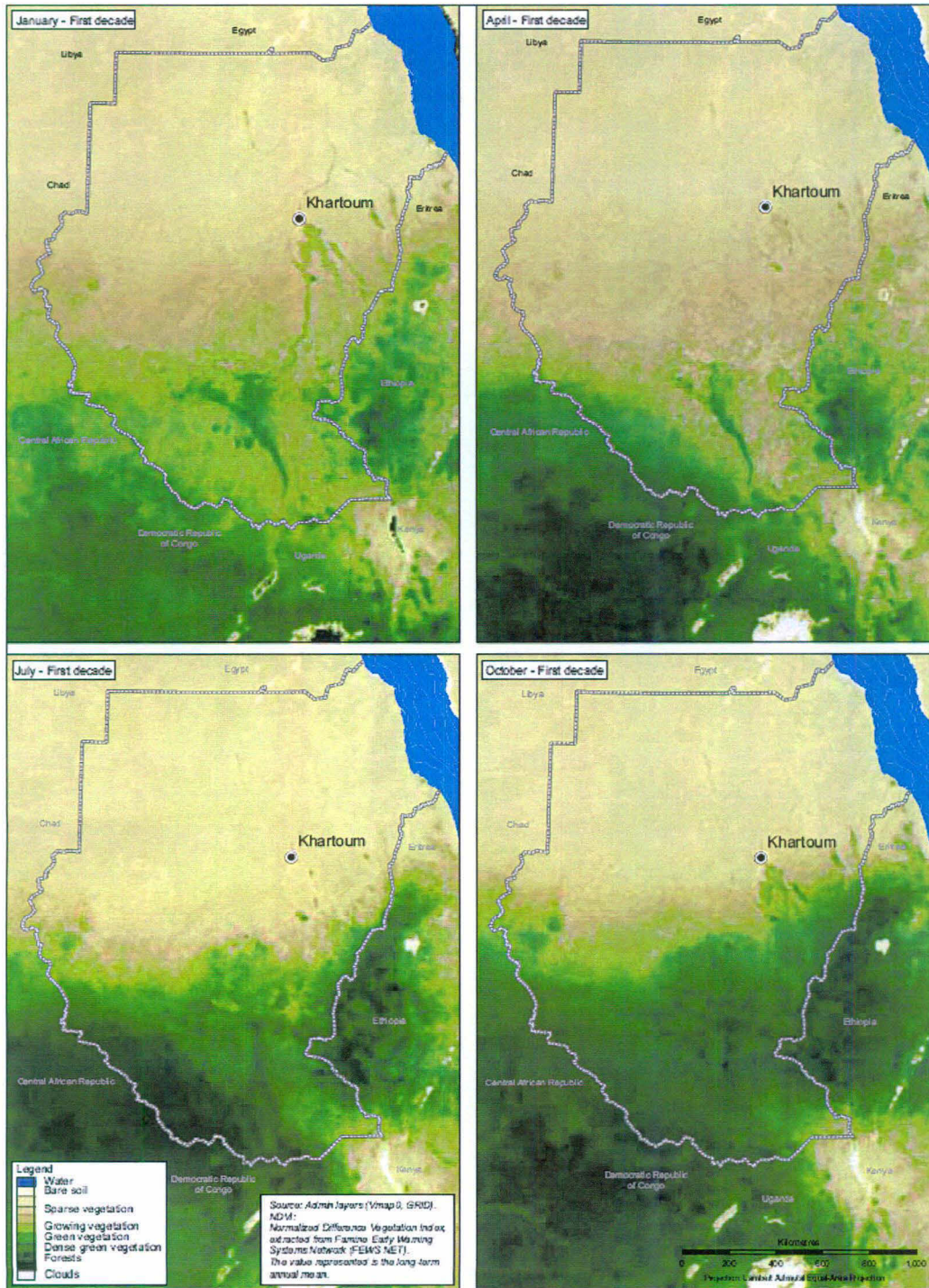
Vegetation changes from satellite imagery

NDVI

The six Land Sat mosaic images of 1984 and MODIS image covering the study area have been downloaded from the global land cover facility (GLCF) provided by the NASA, USGS and University of Maryland collaboration. From these images AOI (area of interest) i.e. Darfur was cut.

Map: 3.6

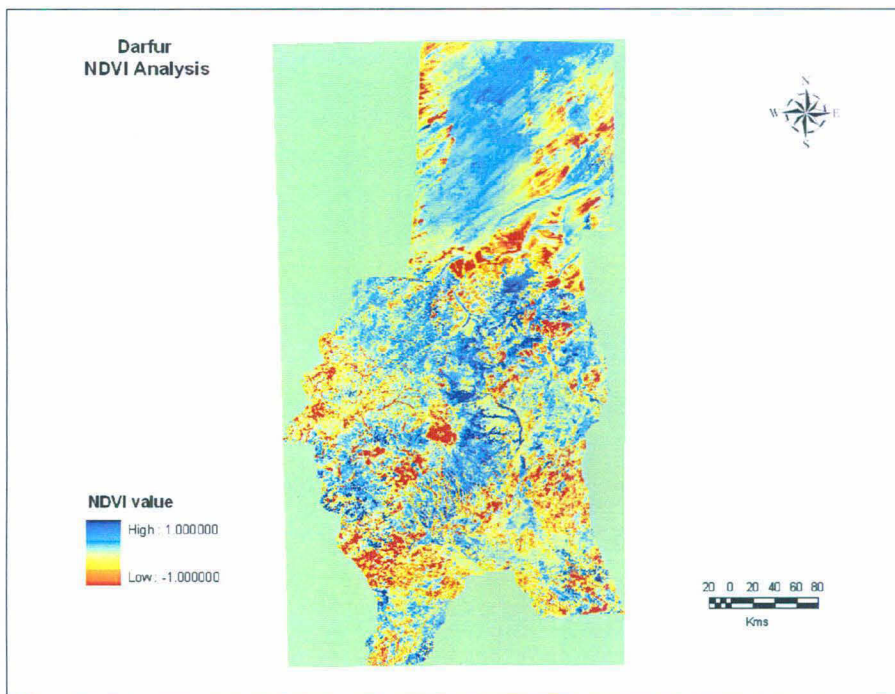
The NDVI images showing seasonal variations in the vegetation cover



Source: (UNEP 2007)

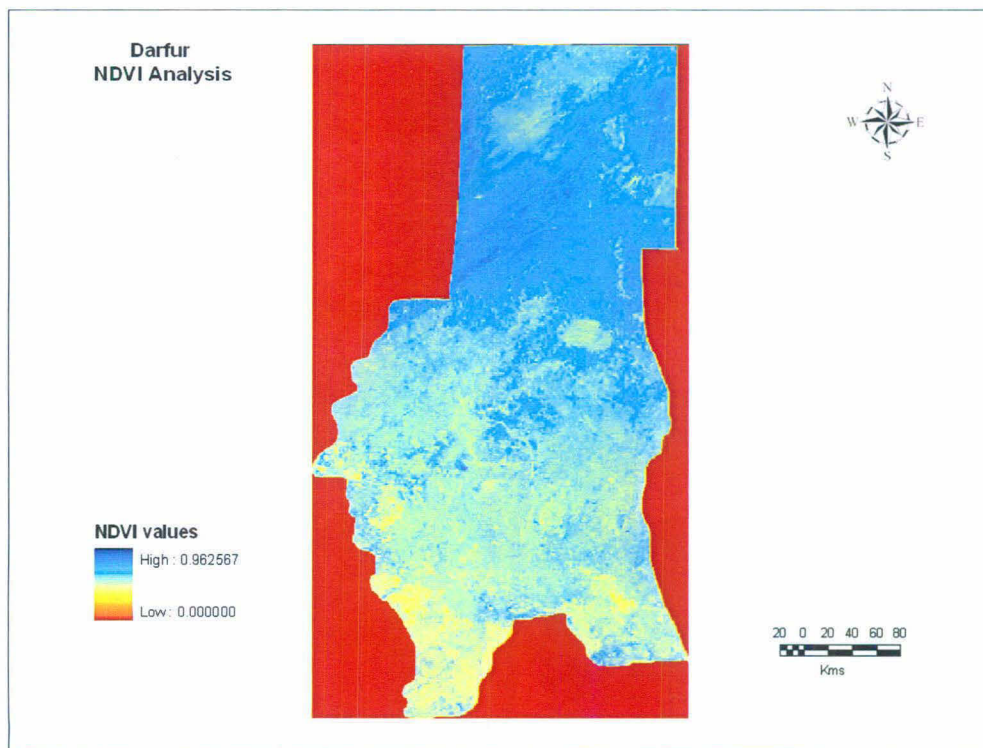
Map: 3.7

LandSat image of the Darfur area showing the NDVI



Map: 3.8

MODIS image of the Darfur area showing the NDVI



NDVI images clearly show large seasonal variation in the vegetation cover especially in the Darfur region. The variability is particularly high in the grasslands and open forests. Desert like conditions develop in the January in the northern and western Darfur and adjoining areas of southern Darfur, except in the hilly regions. This depletion of pastures is responsible for large scale exodus of pastoralists in search of food, fodder and water, creating pressure on the shrinking pasture land in the in-migration regions, thereby heightening the conflict probabilities.

Data processing

The NDVI value was calculated by using the ERDAS imagine software. The NDVI value varied from 1 to -1. The value of 1 (dark blue color) denotes the area of highest moisture i.e. a water body or a very lush green vegetation having high moisture content and the value of -1 (red color) denotes areas which are almost barren with least moisture. The yellow color having value around zero denotes open forests, grasslands and scrublands.

Data analysis

In the land sat image of Darfur the dark blue color denotes the water body and light blue color denotes the lush green vegetation i.e. dense forests. This type of vegetation is found on the high altitude areas of Jabel Mara Mountains and other adjacent ranges. Western Darfur and Southern Darfur constitutes most of the dense vegetation. Even in the Northern Darfur image shows the lush green vegetation but actually this is not vegetation this is due to the presence of cloud cover over that area while taking the imagery by the satellite. Northern Darfur constitutes mostly of the great Saharan desert so there is almost no vegetation cover. A belt of grassland and the open forest is present between the desert in the north and the Jebel mountains in the south. The main cities of the Darfur i.e. Al Fasher, El-Geneina, Nyala are located in this belt of the grassland and open vegetation. In the MODIS image the blue cover shown in the Northern Darfur shows the presence of dense clouds over the region when the image was taken. The areas having the dark blue color which shows the presence of water bodies have greatly reduced in comparison to the areas shown in the land sat images. The light blue cover is greatly reduced which shows the change in the dense forest cover. The yellow color showing the grasslands and the open forest has greatly

reduced in comparison to the land sat image. This change is of major concern as most of the population of Darfur is dependent on this forest for food, fodder and other livelihood necessities. These areas are the principle grazing fields of the tribal communities of the Darfur and the reduction in this area shows the increasing pressure on the pastureland of the area and which will eventually lead to the migration of the people far south in search of pastureland in the draught conditions.

Multispectral analysis

Landsat and MODIS images are downloaded from the GLCF. The image processing tool used is ERDAS IMAGINE 8.5, and ArcMap 9.1 software, therefore the methods used in obtaining multi-spectral classifications will be taken from ERDAS. The Landsat data covering the same area from the different dates were geometrically corrected to each other in order to cut out areas of interest and get the same size and exactly the same area. Every pixel in the Landsat TM data from 1987 was converted to the projection of the MODIS data. Finally subsets of areas that surround the study areas were cut out.

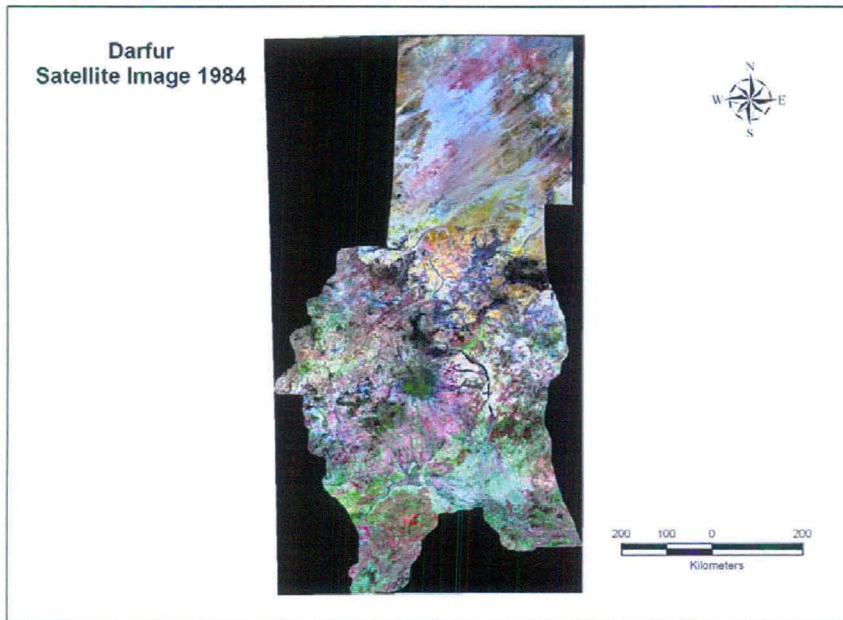
True Color Composite (TCC)

Bands 2, 3 and 4 which represent the green, red and infrared respectively, were used to develop True Color Composite (TCC) image. The colors assigned to each of the bands are in the same order blue, green and red. This combination of colors gives various shades or tones of green for the healthy chlorophyll-rich vegetation in a TCC image. The richness of green color is dependent on the vigor as well as on the size of leaves.

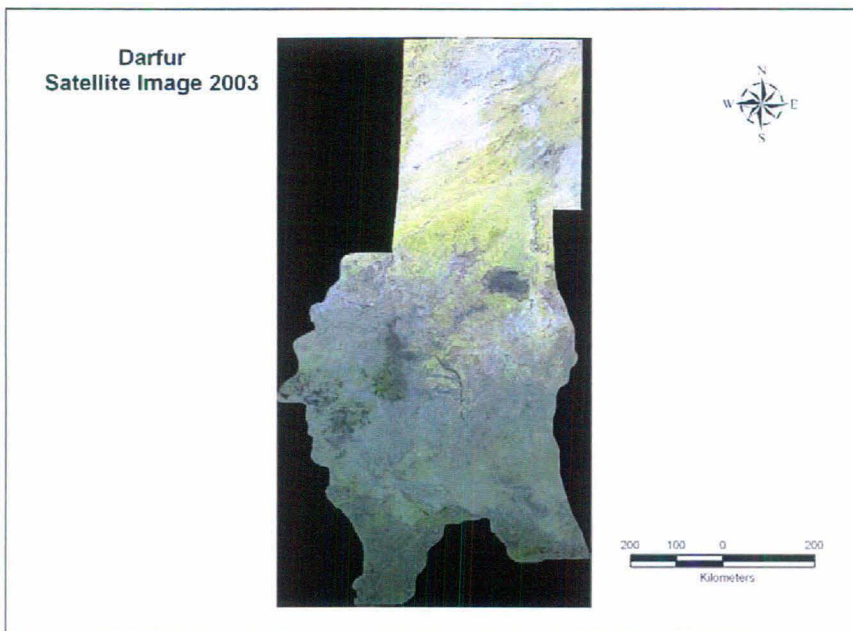
Image classification

An unsupervised classification is performed using the ERDAS Imagine ISODATA algorithm. ISODATA stands for "Iterative Self-Organizing Data Analysis Technique." It is iterative in that it repeatedly performs an entire classification (outputting a thematic raster layer) and recalculates statistics. "Self-Organizing" refers to the way in which it locates the clusters that are inherent in the data. The ISODATA clustering method uses the minimum spectral distance formula to form clusters. It begins with either arbitrary cluster means or means of an existing signature set, and each time the clustering repeats, the means of these clusters are shifted. The new cluster means are used for the next iteration. The ISODATA utility repeats the

Map: 3.9
Darfur (LandSat Image)



Map: 3.10
Darfur (MODIS Image)



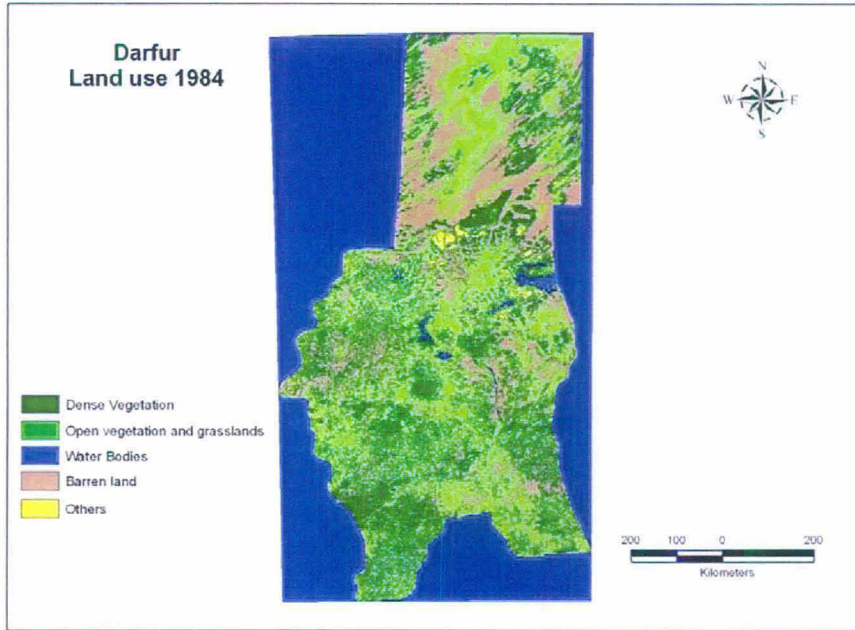
clustering of the image until either a maximum number of iterations has been performed, or a maximum percentage of unchanged pixels has been reached between two iterations. The output file will have a grey scale color scheme if the initial cluster means are arbitrary. If the initial cluster means are from an existing signature set, then the output file will use the colors of this signature set.

Unsupervised classification

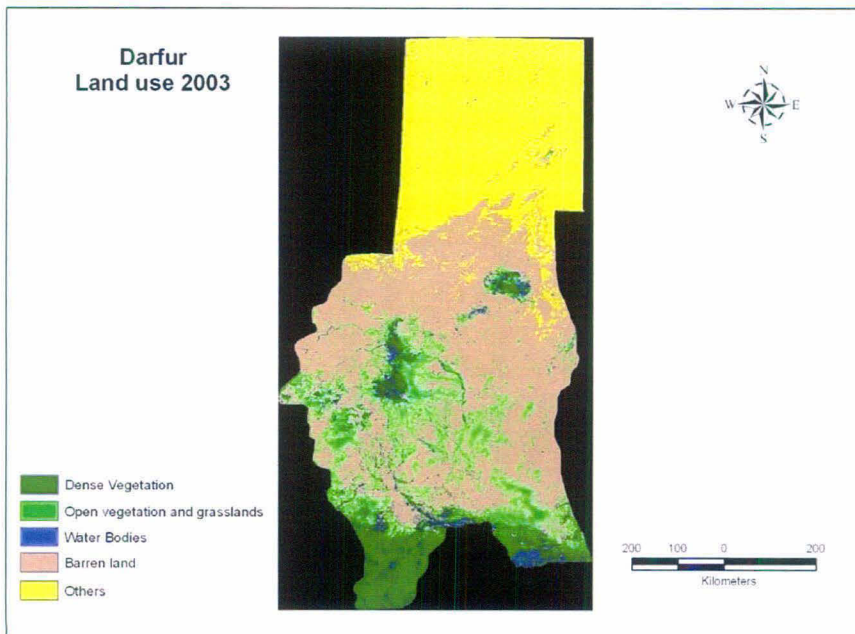
The unsupervised classification of bands 2, 3 and 4 produced a good result for land use classification in the area. Five classes that were mapped using the unsupervised classification agreed strongly with those produced by the TCC. Map: 3.11 and Map: 3.12 show the different classes of land use in the Darfur area. The parcels containing vegetation in the open and dense vegetation area were classified differently.

In total five classes have been created. Dense and open vegetation with grasslands constitutes the separate classes. The visual comparison of classes on the two dates indicates that the bare and eroded soil increased from 1984 to 2003. The bare soil was associated with a high reflectance. The most severe erosion is associated with high reflectance of Landsat MSS bands. To study the differences in the land use and land cover between the different dates of the Landsat image and MODIS, the image difference techniques in GIS software (ArcMap 9.1) are used. Based on the comparison between image classification and image difference results, it could be noticed that the eroded and bare soil increased by about 10 - 20% during the period from 1984 to 2003. While the vegetation cover decrease by about 30 - 60% for the same period. This also illustrates that the degradation of the vegetation cover around Nyala, Al-Fasher, El-Geneina areas has increased. To study the effect of the high variability of the rainfall on this degradation of vegetation, the 30 years average rainfall changes from 1947-76 and 1976-2005 from the three stations of Darfur shows a direct correlation of rainfall variability and vegetation change. The approximate location of the 25, 100, 200, 400, 600, 800 cm isohyets from the Map: 3.4 show that the isohyets shifted toward the south by about 15, 54, 89, 62, 46, 20 km respectively between 30 year periods. This led to a shift in the vegetation belt towards the south and more prominent around the areas around the 200,400,600 cm isohyets. It can be concluded that the climate induced a boundary shift of extended useable pasture in the

Map: 3.11
Land uses in 1984 from Landsat TM



Map: 3.12
Land uses in 2003 from MODIS



Darfur area by about 300 km southward which ultimately led to the migration of pastoralist community southward in search of pastures. As a result they engaged in the conflict with the settled agriculturalist living southward.

DEMOGRAPHIC CHANGES

Population growth

In Darfur, most traditional livelihoods are a direct function of the environment. Environmental resources are livelihood assets, both for sedentary and pastoralist communities. So the distribution of resources and the efficiency with which they are managed are keys to understanding Darfur's demography, economy and the resource-based dimension of the conflict. The UN generally cites population figures of about 6.5 million for Darfur in 2003 based on the 1993 national census and an estimated yearly population growth of approximately 2.4 per cent. Population densities have been increasing over the decades preceding the current crisis as shown in Table 3.3.

Table 3.3

Population densities in Darfur prior to the conflict

Year	Population	Population density (persons/ km ²)
1956	1,080,000	3
1973	1,340,000	4
1983	3,500,000	10
1993	5,600,000	15
2003	6,480,00	18

Source: (Bromwich 2007)

The marked increase in population density since the mid 1970s has put pressure on both sedentary and pastoralist livelihood systems. The UN University of Peace conference 'Environmental Degradation as a Cause of Conflict in Darfur' (Khartoum, December (2004) describes the following processes taking place due to population increase:

- the increase in population density causes an intensification of cropping and grazing, both on fertile wadi lands and more marginal grazing lands.

- herders and farmers compete for access to resources, which leads to conflict.

There has been a long-term increase in demand for resources caused by the growth in population, but poor environmental management has caused significant depletion in the resource base. Intensive open grazing fails to allow grasses to reach maturity and reseed.

The farmland closest to the village was over cultivated and exhausted, with active farming moving out from the village concentrically over a number of years. The environmental pressure on livelihoods due to climatic extremes triggers major shifts in livelihood strategies and this is frequently accompanied by conflict. Following the drought of the mid 1980s, 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. While local conflict over resources is a recurring feature in the region's history, over time Darfur's various communities had developed a common vision of how the land and its riches should be shared, based on the twin concepts of *hakura* (landholding) and *dar* (tribal homeland). The resulting consensus among Darfur's land-holding tribes both Arab and non-Arab allowed for a significant degree of political stability from the 16th century onwards. The demographic and environmental pressure since the 1970s has put pressure on this system. However, also starting around the early 1970s, the power of local traditional leaders has diminished – sheikhs, omdas, shartais and so on, who were key to managing conflicts over land, pasture and water. Over the same period little investment flowed to Darfur, complicating the political scene and developing a shortfall of infrastructure against the needs of the increasing population. In the 1980s, influence from Chad's wars and droughts – migrants, weapons, violence – further destabilised Darfur. The influx of pastoral migrants from the Northern Darfur into the central part of the region exacerbated tensions between the current occupants and the newcomers by increasing the number of people competing for land, water, and grazing rights. With the migration of pastoralists from north to south combined with an increase in population density, increased the competition for scarce resources and ultimately leading to the conflict.

Displacement and Relief:

The most significant environmental impact of the crisis is associated with the new concentrations of population as a result of the massive displacement of 1.97 million people. There has been a stepwise displacement from villages to market towns and administrative centers and from these centers to the large camps on the outside of the state capitals. The displacement has often left only the principal administrative and market town as an area of habitation for the farming community in a given area. Examples of settlements that have grown are shown in Table 3.4.

This has created unprecedented concentrations of demand for natural resources. The humanitarian effort is dependent on natural resources of local area and external finance for wood to cook food with, timber for construction, sticks and grasses for shelter and water itself. The local resources are not properly managed which result in scarcity of resources. This makes the camps unsustainable and result into further migration to another and same process is repeated so a vicious cycle develops and results into further intensification of the conflict.

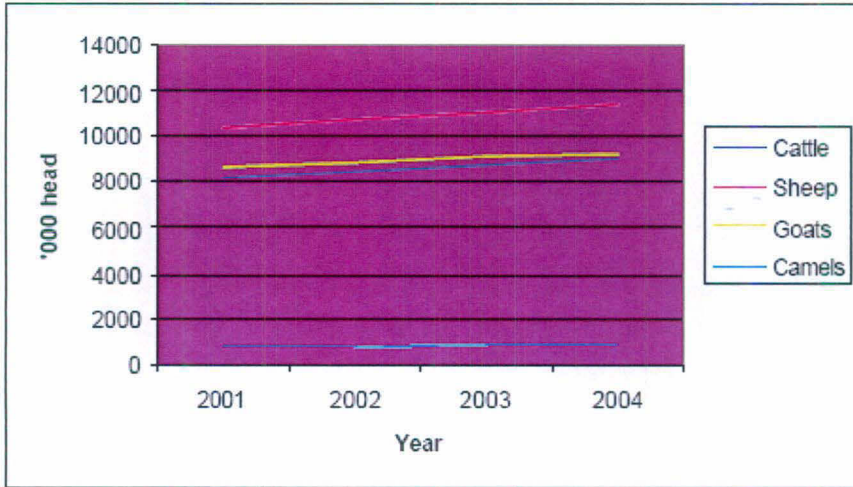
Livestock changes

The Livestock Resource in Sudan

Livestock production provides livelihoods for some 20 per cent of the population and remains one of the major resource bases in Sudan. The livestock population in Sudan was estimated, in 2002, at 39,479,000 head of cattle, 48,136,000 sheep, 41,485,000 goats and 3,342,000 camels. The Ministry of Animal Resources (MoAR) projects the annual growth rate in livestock population at 3.2 per cent for cattle, 3.3 per cent for sheep, 2.5 per cent for goats and 2.3 per cent for camels, despite an estimated off- take rate of 16 per cent for camels, 37 per cent for goats, 45.7 per cent for sheep and 20 per cent for cattle per annum, which is considerably higher than in the regional countries. The projected annual growth estimate shows Sudan as having the highest livestock population in Africa. The growth trend in the last five years is represented in the figure 3.2. Livestock is reared in all the 26 states of Sudan, although camels are not reared in some southern States. However, Blue Nile, El Gedaref, El Gezira, the Greater Darfur, Greater Kordofan, White Nile and Sennar states account for 56 per cent of Sudan's Livestock used to generate 20 per cent of the national foreign exchange earnings. However, after the discovery of oil, this contribution has declined to below 8 per cent.

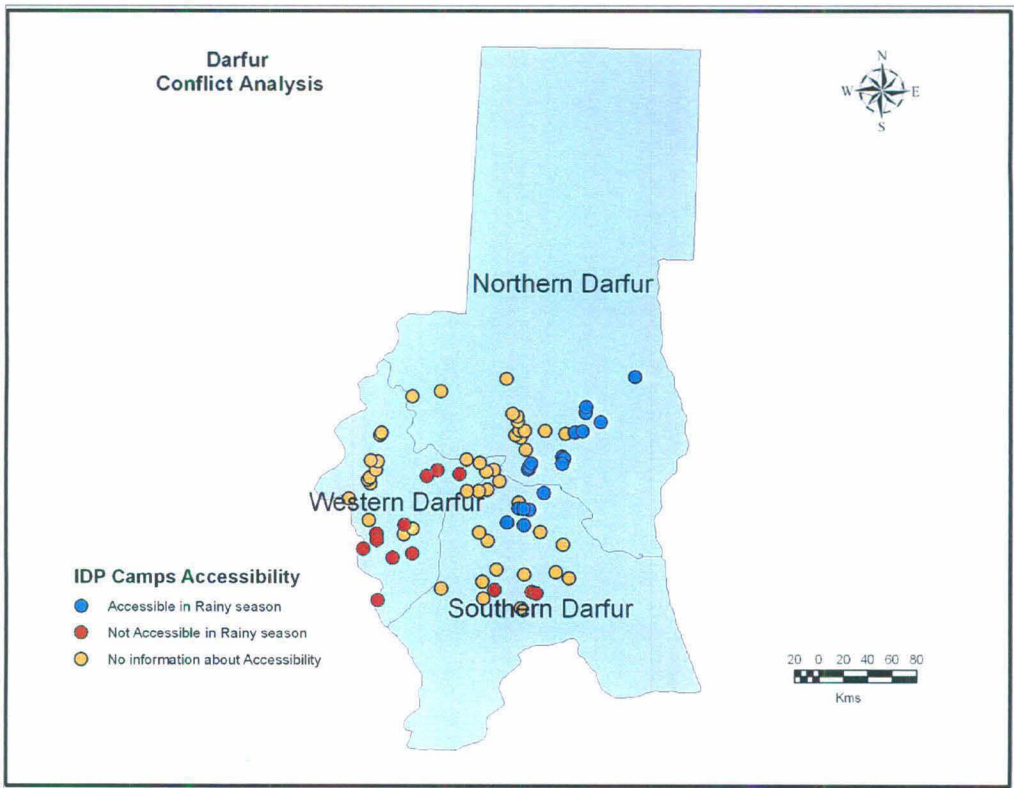
Fig: 3.2

Increase of livestock population in Darfur



Source: (MoAR 2002)

Map: 3.13



Source base map: (UNEP 2007)

Table 3.4
Concentration of population during the crisis

Masterei	West Darfur	3,595	20,574
Morne	West Darfur	11,216	72,250
Gereida	South Darfur	12,466	140,466
Kebkabiya	North Darfur	15,000	57,926
Kutum	North Darfur	22,199	43,939
Kass	South Darfur	25,000	114,895

Source: (Bromwich 2007)

Livestock Resources and Migration Patterns in Darfur

Livestock production in Sudan is predominantly pastoral and a significant proportion of the livestock population is owned and managed by pastoralists. The Ministry of Animal Resources (MoAR) figures show that 18 per cent of Sudan's livestock are from the Greater Darfur region. With Greater Kordofan, the two regions account for one-third of Sudan's total livestock resources. The bulk of the country's live sheep and camel exports, and cattle and sheep for domestic consumption are sourced from these two regions. Livestock species in Darfur include camels, cattle, donkeys, goats, horses and sheep. According to MoAR (2001), Darfur accounts for 21 per cent of the cattle, 22 per cent of the sheep and goats, 24 per cent of the camels, 31 per cent of the donkeys and 63 per cent of the horses in Sudan.

In Darfur, livestock production is interspersed with crop production resulting in pastoralism, agro-pastoralism and crop farming. Economic activities in turn differ (overlapping in some cases) with the varying agro-ecological zones. The Baggara (cattle rearing) and the Abbala (camel rearing) are the two main pastoral groups of Darfur. They are traditionally nomadic but are increasingly becoming agro pastoralists. The majority of these groups claim to be of Arab descent but there are also non-Arab Baggaras and Abbalas who, by adapting similar livelihoods, have assimilated with them over time. Such groups include the Fellata Arabs and Gimir in

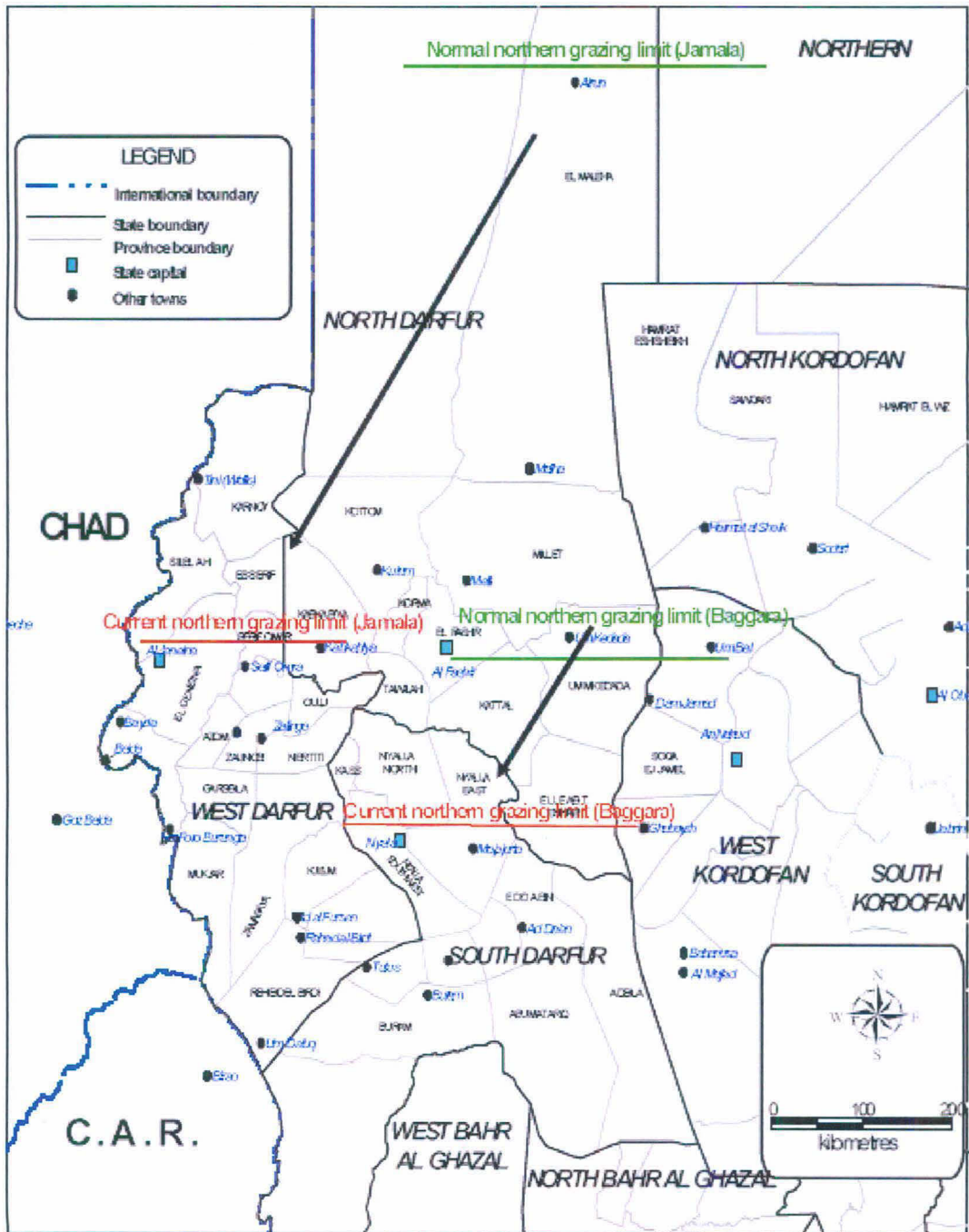
Table 3.5
Estimates of livestock population in Darfur

	Cattle	Sheep	Goats	Camels	Donkeys	Horses
N. Darfur	628,530	3,396,505	2,656,808	397,172	700,293	16,907
S. Darfur	3,851,663	3,471,773	2,756,688	74,950	535,129	233,986
W. Darfur	3,702,195	3,528,225	3,236,112	286,989	805,997	175,828
Total	8,182,388	10,396,503	8,649,608	759,111	2,041,419	426,721
Percent of national herd population	21 percent	22 percent	22 percent	24 percent	31 percent	63 percent

Source: (MoAR 2002)

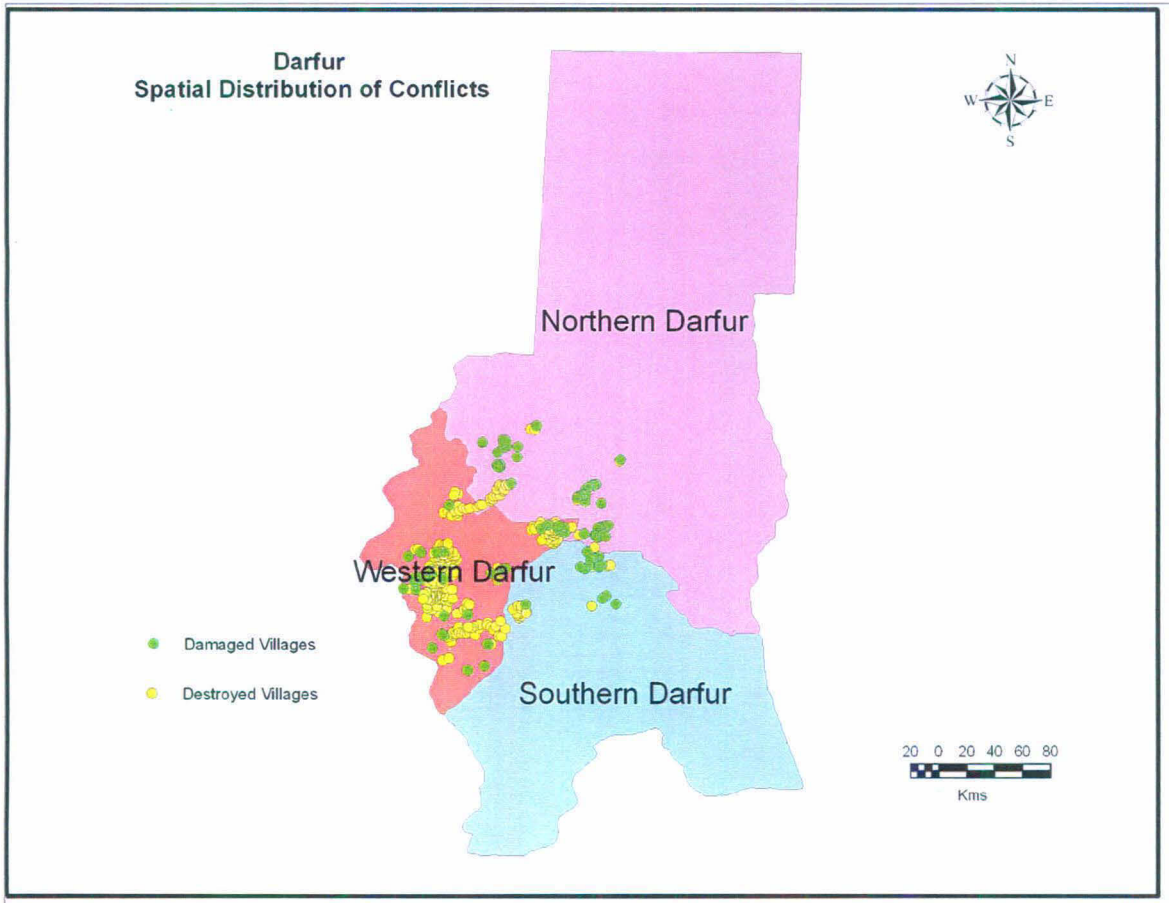
the Baggara group and the Zaghawa and Meidobs of the Abbala. The distribution of the Baggaras and the Abbalas within and outside Darfur relates to the particular needs of the livestock species they rear amongst other things. Thus, the Abbalas inhabit the semi-arid north and the Baggaras occupy the higher precipitation areas in the center and the south. The major Abbala groups in the north are the Meidob and Zaghawa and the dominant Baggara groups are the Beni Halba, Habbaniya and Rizeigat in the south. The livestock migratory routes of both groups follow a general north (wet season) and south/southwest (dry season) direction. The continuous change in the grasslands due to the erratic rainfall pattern leads to the migration of these communities to the far areas and there by putting the pressure on the resources of the destined areas. This induces a state of conflict due to resistance by the residents of destined areas and the need of the migrating community forces them to exploit the resources resulting in the conflicts with the natives.

Map: 3.14
 Normal and Crisis Migration Limits for Pastoralists



Source: (MoAR 2002)

Map: 3.15



Source base map: (UNEP 2007)

Table 3.6
Causes of conflicts in Darfur

No.	Tribal groups involved	Year	Main cause of conflict
1	Kababish,Kawahla,Berti and Medoub	1932	Grazing and water rights
2	Kababish,Medoub and Zyadiya	1957	Grazing and water rights
3	Rezeigat,Baggara and Maalia	1968	Local politics of administration
4	Rezeigat,Baggara and Dinka	1975	Grazing and water rights
5	BeniHelba,Zyadiya and Mahriya	1976	Grazing and water rights
6	NorthernRezeigat(Abbala) and Dago	1976	Grazing and water rights
7	N.Rezeigat(Abbala) and Bargo	1978	Grazing and water rights
8	N.Rezeigat and Gimir	1978	Grazing and water rights
9	N.Rezeigat and Fur	1980	Grazing and water rights
10	N.Rezeigat(Abbala) and Bargo	1980	Grazing and water rights
11	Taasha and Salamat	1980	Local politics of administration
12	Kababish,Berti and Ziyadiya	1981	Grazing and water rights
13	Rezeigat,Baggara and Dinka	1981	Grazing and water rights
14	N.Rezeigat and Beni Helba	1982	Grazing and water rights
15	Kababish,Kawahla,Berti and Medoub	1982	Grazing and water rights
16	Rezeigat and Mysseriya	1983	Grazing and water rights
17	Kababish,Berti and Medoub	1984	Grazing and water rights
18	Rezeigat and Mysseriya	1984	Grazing and water rights
19	Gimirand and Fallata(Fulani)	1987	Administrative boundaries
20	Kababish,Kawahla,Berti and Medoub	1987	Grazing and water rights

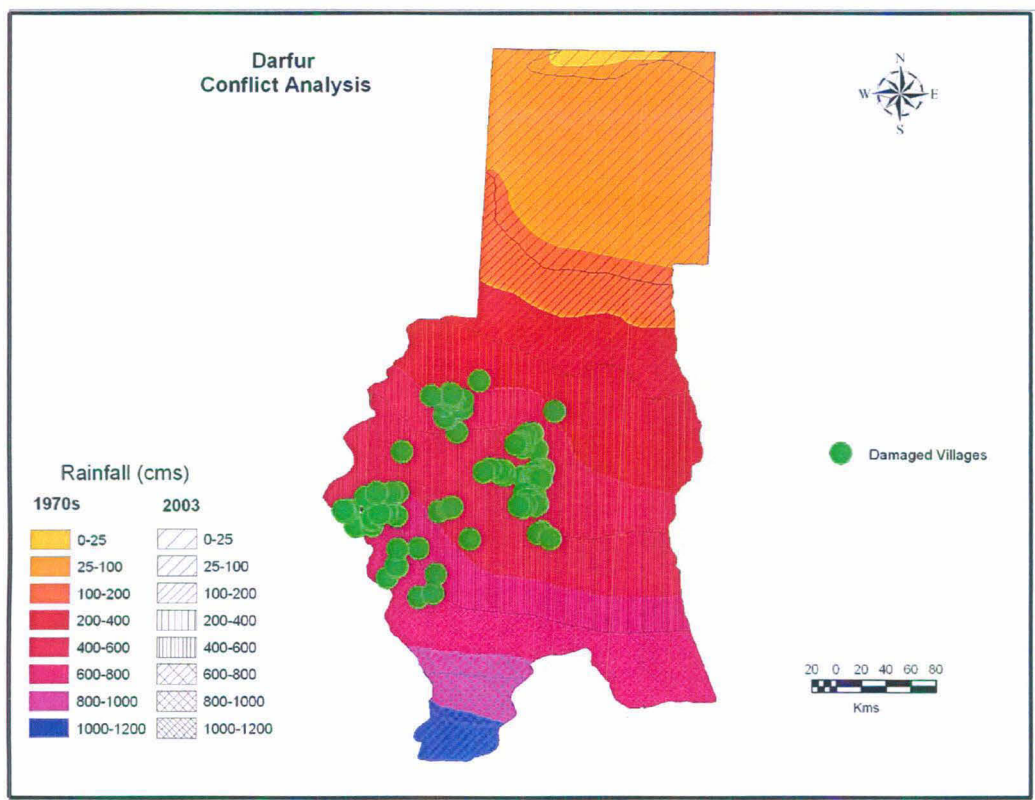
Source: (MoAR 2002)

Table 3.6
Causes of conflicts in Darfur

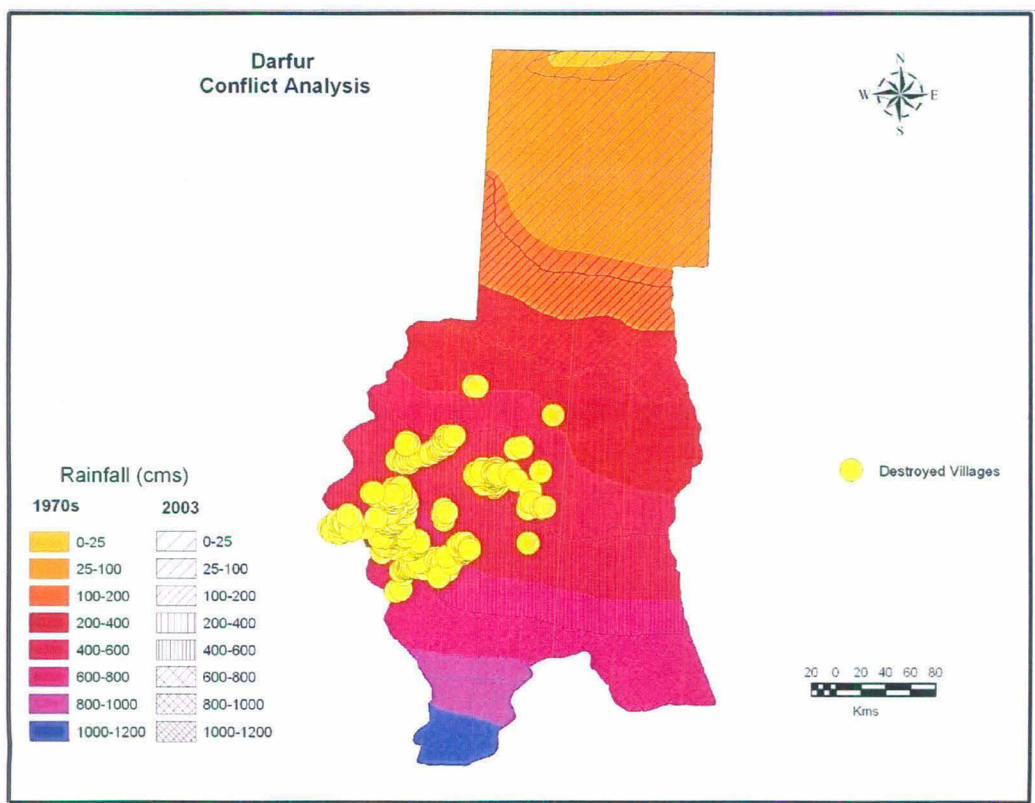
No.	Tribal groups involved	Year	Main cause of conflict
21	Fur and Bidayat	1989	Armed robberies
22	Arab and Fur	1989	Grazing, cross-boundary politics
23	Zaghawa and Gimir	1990	Administrative boundaries
24	Zaghawa and Gimir	1990	Administrative boundaries
25	Taaisa and Gimir	1990	Land
26	Bargo and Rezeigat	1990	Grazing and water rights
27	Zaghawa and Maalia	1991	Land
28	Zaghawa and Marareit	1991	Grazing and water rights
29	Zaghawa and Beni Hussein	1991	Grazing and water rights
30	Zaghawa, Mima and Birgid	1991	Grazing and water rights
31	Zaghawa and Birgid	1991	Grazing and water rights
32	Zaghawa and Birgid	1991	Grazing and water rights
33	Fur and Turgum	1991	Land
34	Zaghawa and Arab	1994	Grazing and water rights
35	Zaghawa and Arab	1994	Power and politics
36	Masalit and Arab	1996	Grazing, administration
37	Zaghawa and Rezeigat	1997	Local politics
38	Kababish Arabs and Midoub	1997	Grazing and water rights
39	Masalit and Arab	1996	Grazing, administration
40	Zaghawa and Gimir	1999	Grazing, administration
41	Fur and Arab	2000	Grazing, politics, armed robberies

Source: (MoAR 2002)

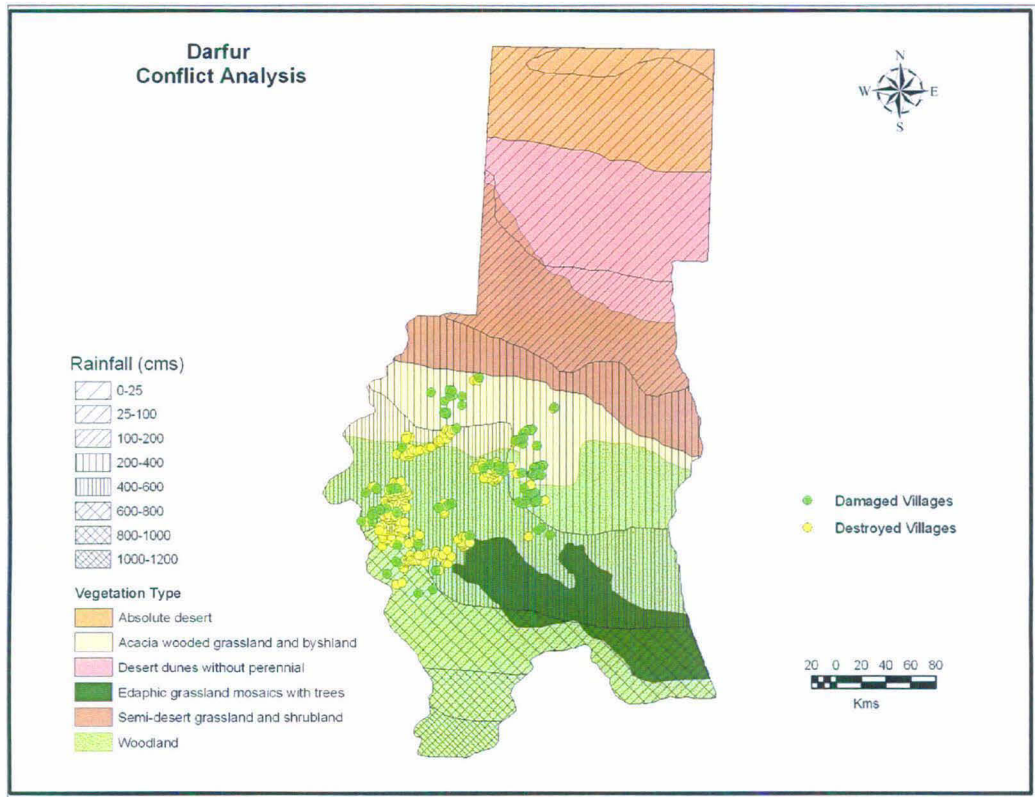
Map: 3.16



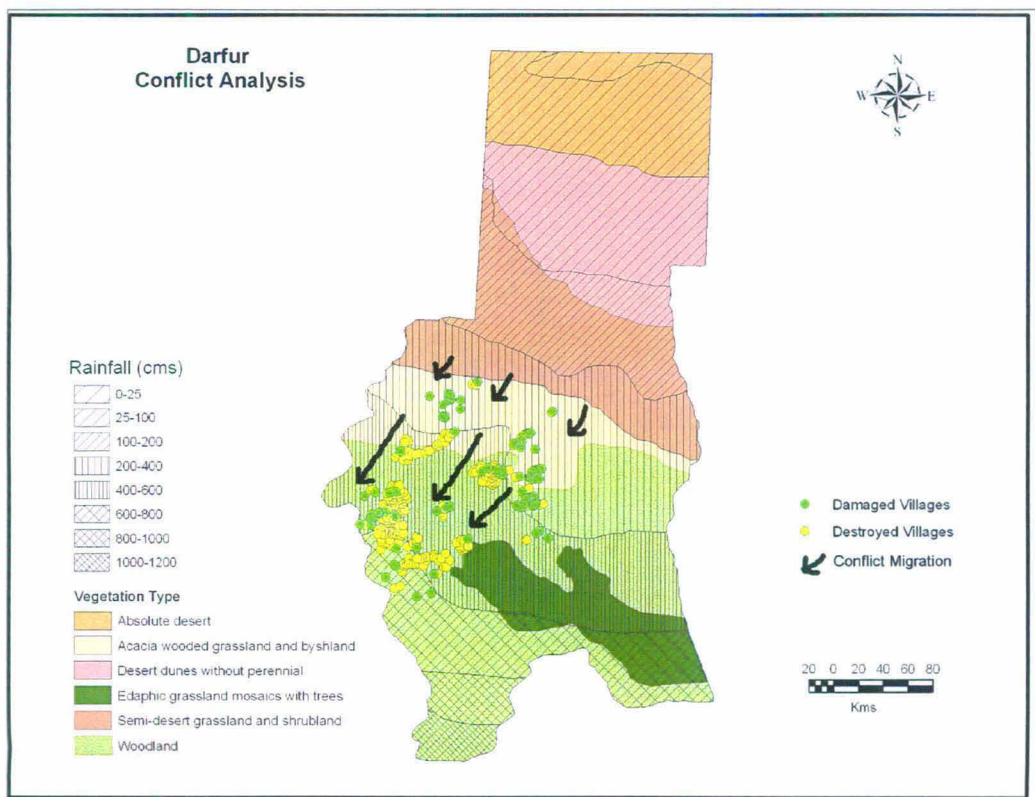
Map: 3.17



Map: 3.18



Map: 3.19



CONFLICT ANALYSIS

Spatial distribution of conflict

The above analysis of the geographical factors clearly describes the spatiality of conflict distribution. Remote sensing and GIS have come as an important aid in analyzing the geographical variables, especially the change detection in vegetation cover, land use and migratory patterns. By overlaying of various maps of vegetation change, land use change, demographic attributes and spatial distribution of conflicts gives us a clear cut pattern which shows the greater degree of concentration of this phenomenon.

From the Map 3.15 below it can be said that there is concentration of conflict in the outskirts of the main capital cities of Darfur. These areas are the most populated regions of the Darfur and represents faces severe competition for survival. This shows that there is a positive correlation between the population density and conflict pattern of the Darfur. This distribution of conflict also coincides with the areas showing rainfall and vegetation changes. This is clearly indicated in Map3.16 & 3.17 and Map3.18 & 3.19 showing overlapping of distribution of conflict over rainfall variability and the vegetation distribution maps respectively along with possible migration due to the conflict in Map 3.19 therefore producing a concentration of the conflict in the destined areas. From the table 3.6 it is discernible that possible causes of conflicts in the past 75 years are the grazing and water rights. These conditions lead to the migration of people to the south in search of food, fodder and water. The southward movement of pastoralists intensifies the struggle for the already scarce resources in the region thereby making the conflict more intense and severe. We can conclude that the scarcity of natural resources induced by the climatic changes, land use changes, demographic changes are the major causes, triggering the conflict in the Darfur region. This conflict has been further complicated due to the ethnic diversity, political marginalization, regional inequalities, and international, national and local stakeholders.

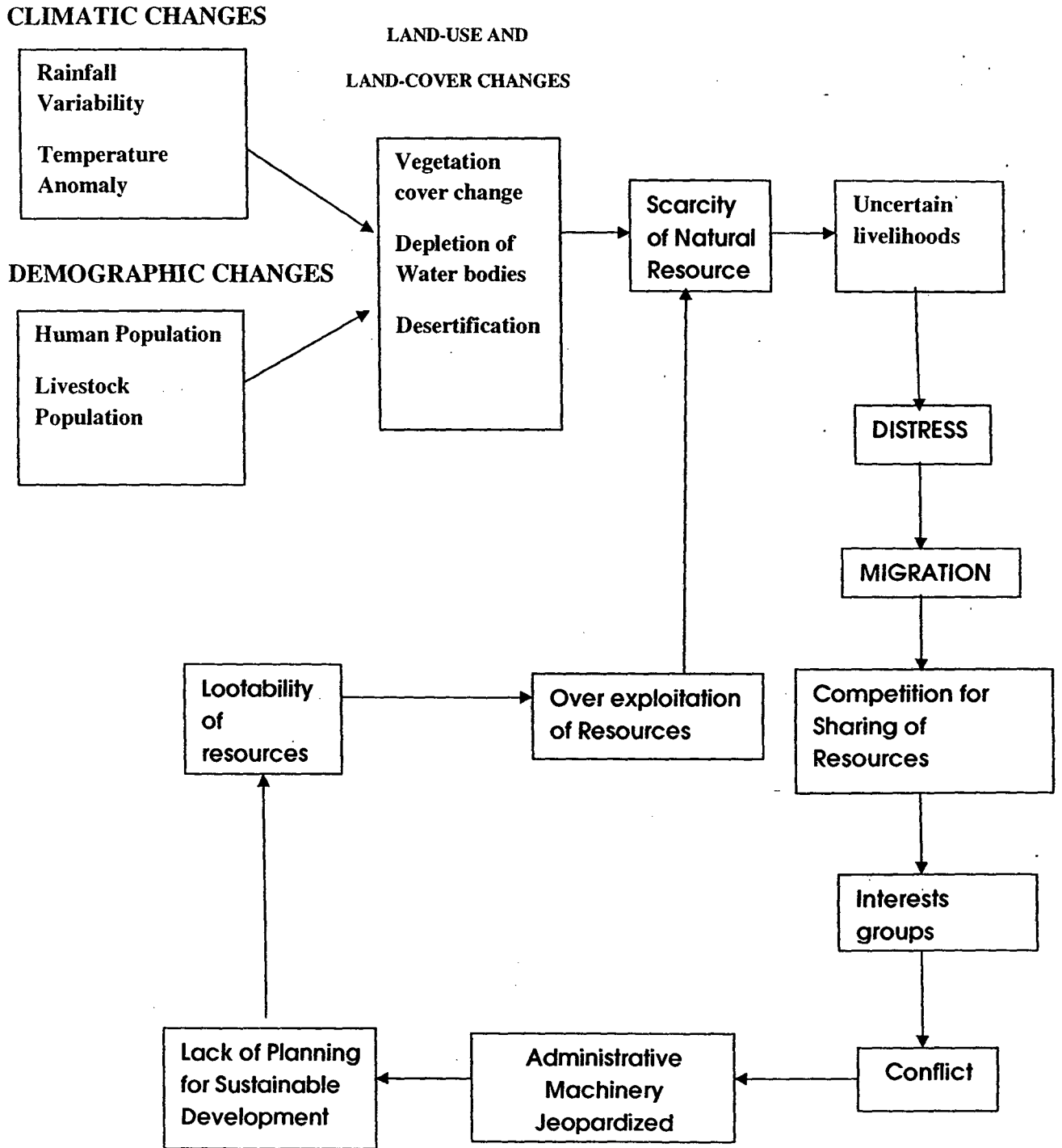
CHAPTER 4

CONCLUSION

The analysis of the geographical factors in the third chapter clearly describes the spatiality of conflict distribution. Remote sensing and GIS was used in analyzing the geographical variables, especially the change detection in vegetation cover, land use and migratory patterns. By overlaying of various maps of vegetation change, land use change, demographic attributes and spatial distribution of conflicts gives us a clear cut pattern which shows the greater degree of concentration of these geographic phenomenons with the conflict distribution. The growing potential for conflict associated with climate change and the resulting rise in insecurity in society are increasingly a subject of discussion. Environmental stresses caused by climate change exacerbate competition for soil and water resources; they place high demands on disaster risk management and on planning and systematically prioritizing the allocation of limited public funds. Furthermore, there is the threat of new regional and international crises and conflicts as well as the escalation of existing clashes over local resources. Due to their geographical location, however, it is the fragile states, less developed states and those already marked by conflict that will be affected first and most severely. Developing countries are especially affected whose geographical situation, dependency on agriculture and lack of financial or institutional resources and capacities make it considerably more difficult to cushion the negative impacts of climate change. Thus, in the first instance climate change poses a threat to human security, particularly in societies that are already marginalized. Climate change will lead to resource scarcity and environmental degradation over the long term. As climate change impacts upon all levels of social life, it can adversely affect the entire spectrum from human security to regional stability. This can heighten existing social and political tensions or can lead to new ones. State institutions already overstretched will come under additional pressure, and will find it increasingly difficult to perform elementary state tasks. Combined with growing environmental stress, this will impact the adaptive capacity of societies adversely and will thus also limit their capacity to engage in peaceful conflict resolution. This means that an increasing use of violence to

Fig: 4.1

Complex dynamics of Darfur Crisis: Causes and Effects



resolve conflicts could already be expected, as well as escalating security risks in the affected societies and in neighboring regions. This is amplified further by an array of other global trends, notably rising levels of resource consumption due to economic development, population growth and urbanization, which will make the adverse effects of climate change more severe.

Most of the population of Africa is rural and depend heavily on the natural resources for food, fodder and water. With the rural populations' livelihoods tied so closely to the natural resource base, any changes in environment can cause stresses between competing users. The conflicts in Sudan particularly in Darfur stem from environmental degradation resulting from unsustainable land use and climate change. The erratic rainfall patterns, continuing population increase, increasing livestock have put the pressure on the natural resources of the regions. There are drastic changes in the land use in the Sahel region of the Africa. An analysis of the variability of NDVI shows areas where livelihoods are particularly susceptible to failure of rains and harvests. These are marginal and particularly vulnerable environments. This type of environment runs across the Sahel between 11° and 17° N, through Darfur, around the Horn of Africa, through Eritrea, Somalia, Eastern Ethiopia and Northern Kenya. As a result, Darfur suffers with several environmental factors: environmental variability, reoccurring droughts, desertification, food shortages, biodiversity loss, and water shortages: that are very vulnerable to climate change. In case of Darfur the approximate location of the 25, 100, 200, 400, 600, 800 cm isohyets have shifted toward the south from 1970. This led to a shift in the vegetation belt towards the south and more prominent around the areas around the 200,400,600 cm isohyets. It can be concluded that the climate induced a boundary shift of extended useable pasture in the Darfur area by about 300 km southward which ultimately led to the migration of pastoralist community southward in search of pastures. This continuous change in the grasslands and desertification in the north due to the erratic rainfall pattern leads to the migration of these communities to the far areas and there by putting the pressure on the resources of the destined areas. This induces a state of conflict due to resistance by the residents of destined areas and the need of the migrating community forces them to exploit the resources resulting in the conflicts with

the natives. This has created unprecedented concentrations of demand for natural resources. As a result they engaged in the conflict with the settled agriculturalist living southward. Further the increase in population density caused an intensification of grazing both on fertile wadi lands and more marginal grazing lands leading to depletion of pasturelands at fast rate. Intensive open grazing fails to allow grasses to reach maturity and reseed. The influx of pastoral migrants from the Northern Darfur into the central part of the region exacerbated tensions between the current occupants and the newcomers by increasing the number of people competing for land, water, and grazing rights. With the migration of pastoralists from north to south combined with an increase in population density, increased the competition for scarce resources. The GOS understood these livelihood and demographic tensions between Arab and African groups and exploited them by creating the Janjaweed. For their reward, the Janjaweed, typically landless, can seize lands from the predominantly non-Arab agriculturalists. Also complicating matters is the population increase from the west, due to the influx of Chadian refugees. So the population increase in Darfur and the decreasing amount of quality resources deepens the conflicts between groups.

A significant problem in the Darfur crisis is the lack of accessibility to potable water resources for domestic, livelihood and humanitarian uses. A particular concern is the water resources underlying the refugee and IDP camps in West Darfur. Darfur experiences rainfall during four months of the year and the geology is unfavorable for groundwater storage. The water resources are not properly managed which result in scarcity of water. Control over these sources of water has been a source of contention between rebel groups, janjaweed, local tribes, towns, and humanitarian camps. This makes the camps unsustainable and result into further migration to other places which are already resource-deficient and same process is repeated so a vicious cycle develops and results into further intensification of the conflict. Also due to Darfur's remote location, marginalization from the central government, and lack of development, the region was ill prepared to deal with the climate change impacts over the past 20 years. We can conclude that the scarcity of natural resources induced by the climatic changes, land use changes, demographic changes are the major causes, triggering the conflict in the Darfur region.

These conditions lead to the migration of people to the south in search of food, fodder and water. The southward movement of pastoralists intensifies the struggle for the already scarce resources in the region thereby making the conflict more intense and severe. This conflict has been further complicated due to the ethnic diversity, political marginalization, regional inequalities, and international, national and local stakeholders.

The crisis in Darfur presents a tough challenge for peace initiatives due to the complexity of the conflict and the sensitivity of the environment. The fluid socio-political identities does not allow for a one-size fits all approach. A wide breadth of stakeholders must be involved in order to improve dialogue and incorporate multiple interests in the peace building process and include a wider breadth of stakeholders that will include additional rebel groups, Arab tribes participating in militias, non-violent tribes who have traditional rights, civilians, refugees, and IDPs in the rounds of negotiations. Additionally, the environmental aspects of the conflict should not be pushed aside for political initiatives. The government of Sudan failed to address the environmental root causes of the current conflict: droughts, water access, deforestation, pasturelands, and human and livestock population. The environment plays a central role on the local and national scales. Any peace building solutions must incorporate environmental components into policymaking. Traditionally, environmental measures are not considered in traditional peacemaking initiatives. However, with the onslaught of climate change, environmental aspects in conflicts are gaining more importance for resolving violent situations. In addition, adaptation strategies to climate change and peace-building initiatives are not mutually exclusive. They can be incorporated into one another due to the fact that they have similar goals: poverty alleviation, improves adaptability of communities, and manages the environment effectively thereby reducing the human insecurity by making the region peaceful.

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