

DRAFT REPORT

ENVIRONMENTAL IMPACT ASSESSMENT

KASSALA – HAMASHKHOREIB INTEGRATED ASSISTANCE PROGRAMME

KASSALA STATE – SUDAN



i. TABLE OF CONTENTS

i	Table of contents	1
ii	Table of figures	2
iii	Table of acronyms	3
iv	Executive Summary	4
I	INTRODUCTION	7
1.1	Context of operations	7
1.2	Sudan Red Crescent Society	7
1.3	Relevance to the present study	8
1.4	Methodology	9
1.5	Description of the programme	10
1.6	Environmental and vulnerability screening	12
1.7	Environmental scoping	12
II	ENVIRONMENTAL ASSESSMENT	13
2	GENERAL CONTEXT	13
2.1	Climate change	13
2.2	Desertification	14
2.3	National insurgency	15
2.4	Regional Conflict	16
3	PROJECT INTERVENTIONS	17
3.1	<i>DRINKING WATER</i>	17
3.1.1	Rehabilitation of hand-dug shallow wells	17
3.1.2	Borehole drilling and pumping systems	20
3.2	<i>SANITATION</i>	21
3.2.1	Hard waste	21
3.2.2	Latrines	22
4	<i>FLOOD RESPONSE</i>	23
5	<i>LIVELIHOODS RESILIENCE</i>	25
5.1	Mesquite, a foe or a friend?	25
5.2	Fuel wood efficiency and health hazards	26
5.3	Improved physical security	28
5.4	Income generating activities	29
6	<i>MITIGATION MEASURES</i>	30
6.1	General recommendations	30
6.2	Mitigation of environmental effects	31
7	<i>ACKNOWLEDGEMENTS</i>	33
III	ANNEXES	
1	Terms of reference	35
2	List of documents	40
3	Mission schedule	41
4	Rapid environmental screening sheet	43
5	Rapid environmental vulnerability screening sheet	48
6	Rapid environmental scoping sheet	52
7	Check list for interviews with male and female community members	54
8	Time-line historical analysis conflicts and interventions	55

9	WHO Water Quality Monitoring Sheet	56
10	Recommended literature	59
11	Satellite Images Hamashkhoreib, 1973, 1984, 2000 and 2008	61

ii. TABLE OF FIGURES AND PICTURES

1	Area of operations KHIAP	11
2	Cumulative rainfall Kassala town	13
3	Weather hazard impact assessment for East Africa	17
4	Wells Hamashkhoreib town	18
5	Lining the well in Oudi	19
6	Dismantled lining still needs to be disposed off	19
7	Child drinking from animal basin	19
8	Unfenced well, a safety risk	19
9	Three years old diesel pump, leaking oil	20
10	Testing the solar-power submersible pump	20
11	Garbage in Darasta	21
12	Plastic, a "silent" killer	21
13	Garbage in HK	21
14	VIP household latrine in Darasta	22
15	Inappropriate use in HK	22
16	Dry riverbed of the Gash, downstream of Kassala bridge	24
17	Mesquite, foe or friend?	26
18	Preparation of a Mesquite charcoal pit	26
19	Three stones fire place in Darasta	27
20	Improved clay stove	27
21	Mine clearing operation	28
22	Mine-affected communities	28

iii. TABLE OF ACRONYMS

ARC	Austrian Red Cross
AWD	Acute watery diarrhea
CIDA	Canadian International Development Agency
CRC	Canadian Red Cross
EC	Electrical conductivity
EEBC	Eritrea – Ethiopia Border Commission
FEWS	Famine Early Warning System
GPS	Geographical positioning system
GRC	German Red Cross
HK	Hamashkhoreib
ICRC	International Committee of the Red Cross
IDP	Internally displaced persons
IGA	Income generating activity
KHIAP	Kassala – Hamashkhoreib Integrated Assistance Programme
LPG	Liquefied petroleum gas
NAPO	National Authority for Prostheses and Orthotics
NLRC	Netherlands Red Cross
NMAS	National Mine Action Service
O&M	Operation and maintenance
PHC	Primary Health Care
PVC	Polyvinyl chloride

SRCS	Sudanese Red Crescent Society
TDS	Total dissolved solids
TSZ	Temporary Security Zone
UN	United Nations
UNEP	United Nations Environmental Programme
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Emergency Fund
UNMAS	United Nations Mine Action Service
UNMEE	United Nations Mission in Eritrea and Ethiopia
USAID	United States Agency for International Development
UXO	Unexploded ordnances
VIP	Ventilated improved pit
WatSan	Water and sanitation
WES	Water, Environment and Sanitation Department
WHO	World Health Organization

iv. EXECUTIVE SUMMARY

1. INTRODUCTION

Since the mid-eighties, eastern Sudan has suffered from repetitive droughts, flash floods, regional and national conflicts. During the Eritrean independency struggle and the 1998-2000 border war between Eritrea and Ethiopia, important numbers of refugees have fled to East Sudan. From 1995 to 2006, an insurgency took place between the Eastern Front and the Sudanese Armed Forces. This conflict has caused the displacement of part of the population from the Hamashkhoreib area to IDP camps. Environmental stress in the region has caused a movement of people across the border and from northern areas threatened by drought to the south of Kassala State.

SRCS aims to reduce the risks facing vulnerable communities and to improve the life of the most vulnerable groups. However, with the possible exception of the new GRC programme on Mesquite, SRCS's emphasis on risk reduction for vulnerable communities and on environmental sustainability is confined to interventions in health and water, which obviously are part of SRCS's core competences. Whereas the present study is expected to emphasize the risk to the environment posed by the water and sanitation component of the Kassala – Hamashkhoreib Integrated Assistance Programme, the magnitude of environmental effects on the context of operations appears even more relevant. For that reason, the initial overall objective of the study has been enlarged by including the following specific objective: *To assess environmental effects on the context in which the programme operates and which are critically impacting on vulnerable segments of the population and on the sustainability of programme interventions.*

The development of an assessment methodology proved to be a challenge. Qualitative methods as emphasized in Community and Organizational Assessments needed to be complemented by locally available research data and statistics, in order to go beyond perceptions only. Within the extremely short time-span, while in the field, these data proved to be difficult to obtain, in spite of assuring commitments. It is therefore that intensive literature review was needed upon return from Sudan to complement these mainly qualitative results. This had as a result that Screening, Vulnerability and Scoping tools were finalized upon completion of the field assignment. Notwithstanding this drawback, NLRC/CRC/SRCS team members have been very helpful in setting up community meetings, meetings with resource persons and an organizational assessment workshop, which altogether provided the raw material for the present study.

2. ENVIRONMENTAL ASSESSMENT

2.1 General context

Although total rainfall in southern Kassala has not diminished over time, the northern part increasingly suffers from a lesser magnitude and a higher variability in precipitation. Between 1950 and 2004, the 100, 300 and 500 mm isohyets have shifted to the south by about 89, 46 and 23 km respectively. Hamashkhoreib is situated between the 100 and 125 mm isohyets. This year only 18.5 mm were measured. It may be too early yet to speak about a persistent drought (which needs three successive years of considerably decreased rainfall) but the signs are alarming: decreased pastures, decrease in vegetation cover and invasive Mesquite replacing indigenous drought-resistant tree species. The changing climatic conditions diminish the space for livestock husbandry and the productivity of rain-fed crops and thereby contribute to increased vulnerability. The environmental stress is compounded by

blockage of cattle migration corridors caused by the development of mechanized agricultural schemes, and by the increased pressure on the scarce resource base, caused by refugees and IDPs.

2.2 Programme Interventions

No noticeable negative environmental impacts have been observed of interventions in the fields of water and sanitation on the biophysical environment. Given the density of hand-dug shallow wells in HK it is, however, recommended to pay more attention to an active monitoring of water quality. This should be done in a direct manner (by project staff itself), as well as in an indirect manner (by linking up to already existing water quality monitoring databases of specialized agencies). A critical distance is respected between latrines and wells. There is, however, a need to pay more attention to well protection (fences, lids). Oil leakage of diesel pumps is a frequently observed problem which might contaminate groundwater. This problem can be explained by weak water committee management. The recent introduction of solar-power generated submersible pumps appears promising because hardly any operation and maintenance is needed and the recurrent costs are practically non-existent. On the other hand, without outside subsidy this technology does not appear to be accessible.

Clinical waste is being disposed off through incinerators provided by the project. In spite of training in hygiene promotion and ad-hoc cleansing campaigns, hardly any signs of improved hard waste disposal are visible. Although home-latrines are well appreciated, collective latrines are not respectful of *pardah*. In both cases, activities supporting hard waste disposal and latrine construction and utilisation, awareness raising does not appear to provide sufficient incentives for voluntary adoption. The study has developed a number of alternatives with in-built incentives, like recycling of organic waste and plastic and the construction of compost latrines. These alternatives are not only respectful of environmental sustainability, they equally contribute to the development of income-generating activities.

At several occasions, SRCS has intervened in case of flooding of the Gash river. In the last 87 years, Kassala has been affected by floods eighteen times. Floods have become increasingly violent. The study makes a short analysis of the phenomenon and comes to the conclusion that the amplitude of the floods is expected to increase, unless at the medium-term costly protection measures will be taken. This is only justified if, at the long-term, the degradation of the upper-watershed (situated in Eritrea) can be halted.

2.3 Livelihoods Resilience

Particular attention is given to the environmental threat of the Mesquite tree. Given its rapid propagation, in 1996 the government has decided to eradicate this invasive species. This decision takes abstraction from the fact that Mesquite is of a big importance as a shelterbelt species (halting desertification) and, even more important, that this “poor man’s tree” increasingly has its place in coping strategies of the vulnerable population in the programme area. The study recommends partnering with the GRC-supported Mesquite project, which courageously tackles prejudice and which seeks to maximize value addition from pods and wood.

It has been observed that the local population generally cooks on “three stone” fire places. This practice has a very low fuel wood efficiency. The smoke from burning wood fuels inside of the homes was found to be a major cause of sometimes deadly respiratory tract infections. Given the low purchasing power of the population, switching to alternative fuel does not appear feasible. It is recommended to introduce fuel-wood efficient and smoke reducing wood stoves.

Mine Risk Education, supported by the project, needs to be complemented by ongoing advocacy in favour of continued mine clearing operations and funding of assistance to victims of landmines and UXOs.

In spite of the evolution of environmental conditions, as discussed here above, livestock husbandry remains the most suitable livelihoods system for the area of operations. However, given the semi-sedentarization of nomads, caused by reduced rangeland, the current trend of diversification of economical activities needs to be actively supported. The further development of income generating activities needs to be based on locally available natural resources, such as found in the cattle, small livestock, agriculture, horticulture, waste management, wood energy and farm-forestry sub-sectors and their produce and derivatives. A number of options have been mentioned which do not only generate additional cash income but which equally contribute to a more sustainable management of the environment. Income thus generated, can potentially contribute to a decrease in vulnerability and thereby to increased self-sufficiency. It is recommended to check the viability of these options for IGA and to consider long-term technical backstopping arrangements with agencies specialized in rural development.

2.4 Mitigation of effects

A set of recommendations has been developed pertaining to methodological assessment issues, SRCS's future role and specific programme-oriented issues. Annex 10 contains references to websites and documents on waste recycling, environmental sanitation, improved wood stoves and the use of Mesquite. These opportunities have all in common that they kill two birds with one stone by addressing, at the same time, environmental sustainability and income generation.

CHAPTER 1: INTRODUCTION

1.1 CONTEXT OF OPERATIONS

Since the mid-eighties, eastern Sudan has suffered from repetitive droughts (since 1984), flash floods (throughout the previous and present century but at increased magnitude and at shorter intervals), regional and national conflicts (successive Eritrea-Ethiopian independence and border wars, a decade long regional insurgency against the central government, as well as the ongoing insecurity situation in Somalia), and poor government policies (e.g. the development of mechanized agriculture schemes) which, altogether, have led to massive displacements. This has contributed to a rapid deterioration of the natural resource base and of the thereon dependent livelihoods.

From 1967 onwards, many Eritrean and to a lesser degree Ethiopian refugees have been, and still are, living in this part of the country. These refugees have escaped fighting during the 30 years Eritrean freedom struggle, followed by the 1998-2000 Eritrea-Ethiopia border war. For 1991, UNHCR reported a peak of over one million refugees. Most of these have been repatriated at the cessation of the armed struggle. Presently, their number is estimated at 136,000, whereas the monthly number of asylum seekers from these two countries, and now also from Somalia, increases at a rate of 1,300 per month. During the first semester of the current year, this number had doubled as compared to the same period during the previous year and it is expected to rise to 1,500 per month.

The insurgency at the eastern front, which has started in 1995 in the “border area” (the region between the Kassala-Port Sudan road and the Eritrean border) between, on the one hand, the Sudanese Armed Forces and, on the other, the Beja Congress and the Free Lions, came to an end by the signature of the Eastern Sudan Peace Agreement, in October 2006. By 2002, as many as 90,000 people from the Hamashkhoreib area fled the zone and spontaneously settled in the vicinity of the Kassala-Port Sudan highway. These settlements were transformed into IDP camps.

Another massive movement of migrants took place at the occasion of the development, in the sixties of a number of large-scale agricultural schemes (New Halfa, Gash Delta), which has blocked major cattle corridors and which has thereby contributed to sedentarization of nomads. The decreasing rainfall and ongoing desertification in the northern parts of Kassala state have equally led to a southward movement of herds contributing to overgrazing in an increasingly confined geographical space. Last but not least, repetitive flash floods of the Gash river increasingly cause devastation and the displacement of hundreds of thousands from Kassala town and the Gash Delta to “higher grounds”.

1.2 SUDAN RED CRESCENT SOCIETY

As a first strategic direction, SRCS’s Strategic Plan for 2007-2011 mentions *vulnerability reduction* which aims to strengthen the livelihoods of “those at risk from situations that threaten their survival or their capacity to live with a minimum of socio-economic security and dignity”. The Plan further states that SRCS will ascertain programmes related to, among others, environmental sustainability¹. “The priority will be given to the most vulnerable communities in post conflict areas and to those threatened by

¹ SRCS: Strategy 2007-2011; P.11.

natural disasters”². Relevant to the present study is that SRCS intends to “*Reduce the risks facing vulnerable communities and improving the life of the most vulnerable groups*” (among others through disaster management).

Based on its core competencies, SRCS is prioritizing support to health services and to water and sanitation facilities to vulnerable communities in post-conflict or post-emergency settings. Although in certain programmes income generating activities are being developed (e.g. in the *Kassala Hamashkhoreib Integrated Assistance Programme - KHIAP*) such activities serve in the first place the sustainable continuation of initially subsidized basic WatSan and health services. Exceptionally, the German Red Cross (GRC) is presently starting up a new project which directly impacts on the environment by valuing the positive impacts of the *Proposis juliflora* tree, also known as Mesquite, (perceived as an invasive species) on the livelihoods of the vulnerable population in eastern Sudan.

From the above it can be concluded that in spite of SRCS’s declared emphasis on risk reduction for the vulnerable communities and on environmental sustainability, such is, with the possible exception of the GRC Mesquite project, confined to health and WatSan interventions. This is in line with both, the organization’s core competencies, as well as with its emphasis on life saving linked to providing relief in post-conflict and post-emergency situations. However, now that the transfer is gradually being made from relief to rehabilitation and development, there is an obvious opportunity to expand activities into mitigating the effects of the biophysical dimension of the environment, which at the medium and long term appear to constitute the main reason for increased vulnerability of ever larger groups of the population (and thereby for increased conflict). This constant and creeping increase of vulnerability needs a long-term institutional presence and corresponding security of funds and one should be proactive and not simply wait for new resource-based conflicts to erupt.

A correct understanding of the evolution of above mentioned biophysical and human dimensions of the environment is a necessary condition for placing relief, rehabilitation and development actions in perspective and to link them. Whereas the present study is expected to emphasize the risks to the environment posed by the water and sanitation component of the Kassala-Hamashkhoreib Integrated Assistance Programme (hereafter mentioned: KHIAP), the reverse appears to be just as relevant, if not even more relevant: To assess and reduce negative environmental effects on the context in which SRCS operates, critical to impact and sustainability of local livelihood systems and coping mechanisms.

It goes beyond the scope of the present study to recommend to what extent SRCS should be involved in natural resources-based vulnerability reduction and conflict prevention, or whether it should rather continue to confine itself to ad-hoc disaster management. The recently started GRC project will provide a good opportunity to obtain first-hand experience with tackling a number of long-term vulnerability issues, directly linked to the degradation of the bio-physical environment.

1.3 RELEVANCE TO THE PRESENT STUDY

According to the ToR, the overall objective of the present study is “*To assess risks to the environment posed **by** the water and sanitation component of the integrated programme and to propose a strategy to mitigate those risks*” (see annex 1). Given the interdependency between, on the one hand, the biophysical and human environment and, on the other, the project interventions themselves, the scope of

² Idem, p.12.

the study has been enlarged by including the following objective: *“To assess environmental ³ effects on the context in which the programme operates and which are critically impacting on vulnerable segments of the population and on the sustainability of programme interventions”*. ⁴

Another reason for enlarging the scope of the study is that WatSan projects usually have more positive than negative impacts on the environment and that in the prevailing working environment ⁵ in the area of operations the impact of WatSan interventions on the environment can mainly be based on qualitative assessments only.

It is the working hypotheses of the current study that relatively significant environmental stress conditions, which over the last two decades have prevailed in East Sudan, have contributed to an increase in environmental degradation and thereby in livelihoods vulnerability and have equally influenced health conditions and the availability and quality of drinking water.

1.4 METHODOLOGY

Data for the study have been gathered through:

- ✓ A review of literature and documents, relevant for a better understanding of the evolution of the environment and of WatSan interventions in the area of operations (see annex 2);
- ✓ Meetings with government institutions at national and state level, international NGOs, as well as with Kassala-based UN organisations, operating in the field of environment, livelihoods, refugees, health and water and sanitation (see annex 3);
- ✓ Field visits to communities and IDP camps in the KHIAP area of operations;
- ✓ Focus group discussions with community leaders and individual women (the latter through the services of a female colleague);
- ✓ Rapid Environmental and Vulnerability Screening and Scoping (see annexes 4, 5 and 6);
- ✓ A one day’s workshop with Kassala-based staff of SRCS’s, NLRC/CRC, GRC and selected resource persons, active in fields relevant to the study;
- ✓ A two hours debriefing meeting at the national SRCS office in Khartoum, with participation of SRCS, NLRC/CRC, GRC and ARC staff;
- ✓ Fine-tuning of findings by further exploration of literature;
- ✓ Development of a final rapid environmental assessment tool.

³ The definition of environment used in the present study includes both, its human and bio-physical dimensions.

⁴ This is in line with the Screening Form, annexed to the ToR (i.e., chapter 3).

⁵ It has proven to be extremely cumbersome to obtain quantitative data on the water quality of hand-dug wells, which have been improved through programme interventions and on the degree of water contamination caused by poor sanitation practices (waste water and hard-waste management).

During the study, a variety of tools have been used:

- ✓ Visual support: detailed topographic maps (Russian, in Cyrillic), satellite images (Landsat images 1972, 1984 and 2000 and Google Earth 2008), ILWIS GIS software v3.4, Geographical Positioning System (Garmin GPS-60), Map Source (Garmin GPS database software v6.10.2) and geographical coordinates converter (Franson CoordTrans v2.30);
- ✓ Semi-structured check lists for interviews with community focus group meetings and individual women (see annex 7);
- ✓ Use of PowerPoint presentations during workshop in Kassala and final debriefing in Khartoum;
- ✓ Historical analysis of conflicts/emergencies and corresponding SRCS interventions with the help of timelines (group work during Kassala workshop – see annex 8);
- ✓ Environmental Screening Form (attachment to ToR).

1.5 DESCRIPTION OF THE PROGRAMME

In 2003, the NLRC started supporting the implementation of a SRCS programme in primary health care for IDPs in Kassala State in seven camps. In mid 2006, the NLRC started supporting SRCS in an HIV/AIDS mainstreaming programme, among others, implemented in Kassala. In December 2007, CRC and NLRC undertook a joint country assessment which resulted in a joint proposal for support to the SRCS Kassala branch in WatSan and health care. This proposal was handed in to CIDA and the Dutch Ministry of Foreign Affairs for funding which met with approval. In July 2007, the project was initially started up with Canadian funding and concentrated on two communities, Hamashkoreib and Oudi, as well as on four IDP camps. From the outset of the project in 2008 onwards, the NLRC joined the project and Telkook/Darasta was added to the area of intervention. Support to the IDP camps is expected to be phased out towards the end of the present year. Consequently, during 2009, the project will entirely focus on the three here above mentioned communities. As stated in the programme proposal (p.17) and as substantiated during visits to the camps, the assumption that IDPs are willing to move back to their communities of origin appears not to be valid. This jeopardizes the strategy to exit from support to the camps from the end of this year onwards.

The project's WatSan strategy emphasizes support to communities particularly with regards to capital costs for water supply systems, whereas cost for operation and maintenance is to be covered through user fees. Emphasis is on the rehabilitation of hand-dug shallow wells (in total 27) and the construction of a water adduction system connecting a distant well to the Hamashkoreib town centre. In the same communities, sanitation activities are undertaken (latrine construction, solid waste management) and hygiene is promoted.

In line with Ministry of Health strategies, the health component supports the Primary Health Care system in the context of post-conflict rehabilitation and development. Given the high rate of malnutrition, the project is equally providing supplementary feeding for vulnerable categories of the population (school children, pregnant and lactating women).

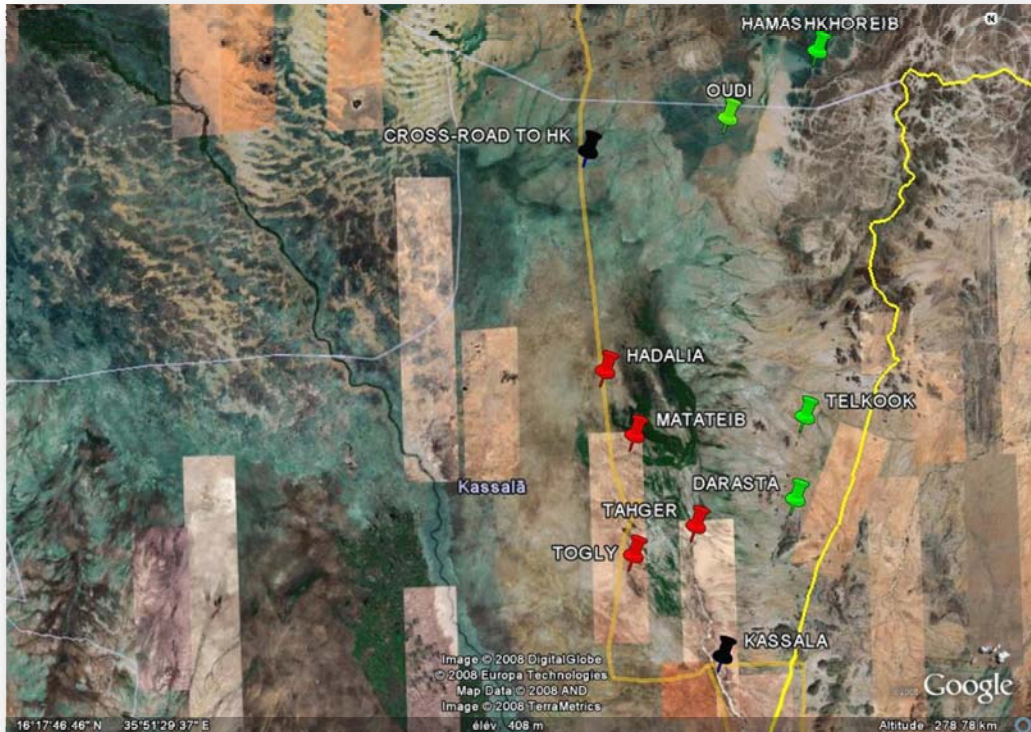
Another programme component aims to generate income for the vulnerable segments in the communities through the establishment of small-scale businesses through the sustainable use of a

revolving fund. The underlying thought is that increased income will be spent on user fees for basic services.

Though awareness campaigns, the project equally addresses landmine / UXO awareness.

Last but not least, the SRCS branch is involved in quickly responding to outbreaks of endemic diseases (in 2007 an outbreak of meningitis, dengue fever and AWD were reported⁶) and in disaster preparedness (e.g. in providing emergency support during the repetitive floods of the Gash river).

Fig. 1: Area of operations Kassala-Hamashkhoreib Integrated Assistance Programme (1cm = 17.25 km)



The Programme Proposal briefly addresses environment as a cross-cutting issue.⁷ It is stated that, according to UNEP's *Sudan Post-conflict Environmental Assessment*, in the area of operations of Telkook, Hamashkhoreib and Oudi a decline has been noted in the precipitation due to climate change. This would have been a significant stress factor on pastoralist communities which could contribute to new conflicts in the area.

It is equally stated that: (1) the issue of poor environmental sanitation and contamination of water sources will be addressed by developing culturally acceptable and environmentally safe latrines; (2) all waste resulting from construction work will be disposed properly; (3) clinic waste management will be addressed by the introduction of incineration; and (4) the design of latrines and water points will take into account environmental consequences.

⁶ Source : Project Proposal

⁷ Idem, p.30

1.6 RAPID ENVIRONMENTAL AND VULNERABILITY SCREENING

Annex 4 shows an initial rapid environmental screening of project activities stated in the programme proposal. The screening emphasizes a rating of (1) potential negative or positive effects of project activities on the bio-physical and human environment, and (2) potential negative or positive effects of the bio-physical and human environment on the context of operations, as well as on the project activities themselves.

Numerical ratings are based on field observations and interviews and their range of precision depends on the degree of reliability of findings at that early stage of the study. The use of the widest possible range (-5 / +5) simply means that there is an apparent need for supportive data. At the other extreme, a score of -5 means that there is a high probability that the effects are strongly negative, whereas a score of +5 means that there is a high probability that the effects are strongly positive. The use of an environmental screening is of a great help to focus our attention to what is perceived as essential, it helps us to prepare scoping on what is significant.

Since the environmental screening assesses planned outcomes and activities, as stated in the logical framework, it is well possible that certain contextual information or possible solutions have been overlooked during the planning stage, or that this was not deemed relevant for action, because it was outside of the institution's core competencies. It is therefore that before starting with a Rapid Environmental Scoping, the Rapid Environmental Screening will be completed with an assessment of environmental factors which carry a risk for increased vulnerability. In this stage particularly environmental vulnerability issues should be addressed which have not been (or not sufficiently been) addressed in the programme proposal. A vulnerability screening can be based on additional information based on one's own judgement based on field observations and literature review but it should equally be based on discussions with project staff, resource persons and beneficiaries (see annex 5).

1.7 ENVIRONMENTAL SCOPING

The Rapid Environmental Scoping sheet (see annex 6) provides a prioritised structure for the study. In principle, all major contextual issues which contribute to increased environmental vulnerability but also all major project activities which might impact on the environmental vulnerability ought to be covered. The Scoping Sheet provides the structure for the second part of the study, and serves as the red wire for the environmental assessment.

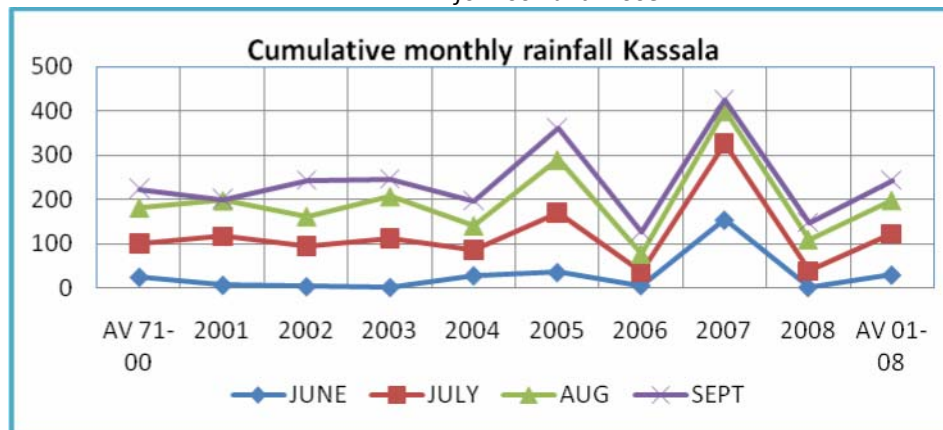
CHAPTER II: ENVIRONMENTAL ASSESSMENT

2. GENERAL CONTEXT

2.1 CLIMATE CHANGE

Annual precipitation in Sudan is highly variable. This is particularly true for the desert and semi desert zone. UNEP shows that the variation in annual precipitation for the northern parts of northern Kordofar was 65% and 15% in the southern parts of Southern Kordofar. At a similar latitude as Northern Kordofar, the historical climate change in Northern Darfur is unprecedented: the reduction in rainfall (34% between 1946 and 2005) has turned millions of hectares of already marginal grazing land into dessert.⁸ Rainfall figures for Southern Kassala do not show a decrease over time, as can be seen from the following figure:

Fig 2: Cumulative rainfall Kassala town; averages for 1971-2000 and 2001-2008 and yearly averages for 2001 until 2008



Source: based on figures Metrological Department, Kassala, 2008.

The averages of total yearly rainfall in Kassala town for the periods 1971-2000 and 2001-2008 are not significantly different. Since 2000, important yearly fluctuations can nevertheless be observed. From reliable sources it was understood that rainfall becomes increasingly intensive. Whereas in the past rainfall used to be spread over as many as 25 days, there are now years that almost half of the yearly precipitation falls in one or two days. This has as a consequence that surface run-off is rapid and abundant which does not serve the purpose of agriculture and rangeland regeneration. Unfortunately, no official figures were made available for the Hamashkhoreib locality. Observations from interviewed population in this area confirm the data from Northern Kordofar and Northern Darfur and even closer by, and also at the same latitude, the results of a study done in 2006 in the Butana area⁹. Also here the variability in rainfall increases with decreasing annual rainfall amount. The Northern part of Butana bordering the Gash Delta (just west of HK) is on the verge of being absorbed by the desert.

This particular year has been catastrophic. Whereas in Southern Kassala the total rainfall was only 147 mm., (34% less than the yearly average for 2001-2008), in HK 18.5 mm of rain was measured, which fell

⁸ UNEP: Post Conflict Environment Assessment (2007)

⁹ Muna Mohamed Elhag : Causes and Impact of Desertification in the Butana Area of Sudan; 2006.

in two days¹⁰ (for an estimated yearly average between 100 and 125 mm). According to recent data¹¹ the most impacted area on the entire continent was North-eastern Sudan, to which Northern Kassala belongs.

2.2 DESERTIFICATION

Desertification, as defined in the UN Convention to combat Desertification, is the *degradation of land in arid, semi-arid and dry sub-humid areas, caused by climatic change and human activities*.¹² UNEP considers that three compounding desertification processes are relevant to Sudan, which are difficult to distinguish in the field: (1) climate-based conversions of land types from semi-desert to desert, (2) conversion of land types from semi-desert to desert by human action, and (3) degradation of existing desert environments. For this study of the HK area, only the two first mentioned processes are relevant since it is part of the semi-desert area.

“The 100, 300 and 500 mm isohyets have shifted towards the south by about 89, 46 and 23 km respectively during the period 1950-2004”¹³. In the entire Northern belt of the semi-desert eco-system under influence of these climatic conditions, pastures have degraded seriously in quality and quantity. This pushes nomads increasingly into new southern or south-western direction to find pastures or agricultural residues. As we shall see here below, they are confined to increasingly smaller spaces because of migration corridors being blocked by mechanised agricultural schemes.

Recent climate models developed by UNEP predict for Northern Kordofan a 70% drop in Sorghum production by 2030. In the semi-desert area small increases in temperature and minor reductions in precipitation could tip the balance towards desert-like conditions.¹⁴

In 1989, the average standing stock of woody biomass in HK was about 0.34 m³/ha (as compared to 131 m³/ha in the Southern part of the state, following the rainfall pattern).¹⁵ According to farmers and nomads interviewed in the field, in the area under purview part of the scarce vegetation dies off or fails to reproduce, resulting in an ever lower diversity and density in the composition of the species. In the Telkook/Darasta area, 120 km to the South, common drought-resistant species as *Acacia seyal* and *A. nilotica* have now disappeared. In the entire boarder area, only Mesquite (*Prosopis juliflora*) seems to resist to extremely dry conditions, especially in the riverbeds of seasonal streams (*Khors* or *Wadis*) and especially more to the West, alongside the river Gash, where aerial photos show an eighty-fold increase in standing stock of Mesquite in agricultural fields between 1962 and 1996.¹⁶ This is a good indicator of starting desertification: wherever trees have been removed for either the establishment of agricultural schemes or for fuel-wood collection, or where persistently lacking precipitation has dried out less-drought resistant species, extremely drought-resistant Mesquite, with its lateral and deep root system, has taken over.

¹⁰ Based on interviews with community members in HK.

¹¹ USAID FEWS NET, Hazards Impact Assessments for Africa, 10 September 2008.

¹² UNEP: Post Conflict Environment Assessment (2007); p.62.

¹³ Idem: p.146.

¹⁴ UNEP, 2007; p.61.

¹⁵ A. Tageldin: Wood fuel in the Sudan; 1983.

¹⁶ Elsadig E. et al: Socio-Economic, Environmental and Management of Mesquite in Kassala State; 1998.

Grazing is only practised in the HK area after the watercourses have received flash floods and in extremely dry years, like the present one, most herds are found around the Gash delta where there are water ponds (*Hafirs*) and where cattle is fed on crop residues. During consecutive years of drought, the grass production is reduced by about 60%.¹⁷ Moreover, wet season pastures have decreased due to the expansion of agricultural schemes. The introduction of mechanised agriculture has blocked the traditional cattle corridors, which has contributed to a semi-sedentarization and an economical diversification of the livelihoods of the nomads (as agro-pastoralists) and, most of all, to overgrazing of range land. According to UNEP, between 1972 and 1999, 37% of the original pasture land in Gedaref and Kassala states have been lost, which is the main reason for increased vulnerability and thereby for conflicts.

2.3 NATIONAL INSURGENCY

The insurgency at the eastern front, which has started in 1995 in the “border area” (the region between the Kassala-Port Sudan road and the Eritrean border) between, on the one hand, the Sudanese Armed Forces and, on the other, the Beja Congress and the Free Lions, came to an end by the signature of the Eastern Sudan Peace Agreement, in October 2006. The agreement addresses longstanding grievances of the three eastern Sudan states (Kassala, Red Sea and Gedarif) regarding sharing of political power and resources with central government. During the insurgency, vast areas along the border have been infested with landmines and unexploded ordinance devices, blocking the movement of cattle herds by the nomads. At the occasion of the occupation of Telkook and Hameshkhareib towns, in 2002, more than 90,000 persons from these areas fled the fighting in western direction where they were settled in camps in the vicinity of Kassala and Aroma. According to recent estimations from the UN, presently there would still be 68,000 IDPs living in camps. Until 2006, the border area, where state services had been suspended and basic services in health, education and supply of drinking water had been partially destroyed, remained inaccessible to humanitarian organizations. The presence of landmines, non favorable livelihood conditions and the lack of basic services in HK locality have prevented most IDPs from definitely returning to this area.

A relative calm has returned to the area but a sustained peace will depend on progress in the DDR process and in making peace dividend available to the Eastern Front coalition members. Even more relevant, it is of utmost importance that claims on ending the marginalisation of Eastern political interests will be finally granted¹⁸. This appears to be more a matter of effectively addressing social injustice that has produced the insurrections in the first place¹⁹. From a political point of view it would be important to note that the first cracks have been noticed in the coalition between factions of the Eastern Front. The latter, composed of Beja, Rashaida and Benni Ammer, “is witnessing a power struggle that could split the coalition and threatening the implementation of the peace deal. Observers accuse the groups of the Eastern Sudan of waging a tribal war and say every faction tries to strengthen its position...”²⁰

¹⁷ Muna M. M. Ahmed et al.: Dryland husbandry in the Sudan; 2004.

¹⁸ In June 2008, there have been peaceful demonstrations in Kassala by ex-combatants to protests delays in the DDR programme. Under the Eastern Sudan Rehabilitation and Development Fund by June 2008, only USD 22.5 million (out of USD 700 million for the period 2007-2011) has been received by the three Eastern states.

¹⁹ John Young: The eastern front and the struggle against marginalization; 2007.

²⁰ Sudan Tribune : Ruling party to mediate between eastern Sudan factions; 22 September 2008.

From a point of view of emergency preparedness it appears important that SRCS continuously monitors the evolution of political developments. There still is a chance that, for reasons mentioned here above, the fragile peace process will slide off again into conflict.

2.4 REGIONAL CONFLICT

The Eritrean war of independence went on for 30 years from 1961 until 1991 and frequently led to tens of thousands to flee the conflict areas. In April 1993, in a referendum the Eritrean people voted almost unanimously in favour of independence. Formal international recognition followed later that same year. By 1998, however, relations between Ethiopia and Eritrea had degenerated and when in May of that year Eritrea had seized the disputed border village of Badme, the fighting quickly escalated into a full scale two years war, during which 100,000 were killed and one million displaced (most of which to Sudan). The May 2000 ceasefire agreement created a 25 km wide Temporary Security Zone (TSZ) patrolled by an UN mission (United Nations Mission in Eritrea and Ethiopia - UNMEE), as well as the creation of a commission to delimit and demarcate the border (Eritrea-Ethiopia Border Commission - EEBC), the determination of which was to be final and binding. However, when the EEBC ruled in favour of Eritrea, the Ethiopian government strongly objected. In October 2005, frustrated by the Ethiopian refusal to accept the border settlement, the Eritrean government banned UN helicopter flights which led to a withdrawal of UNMEE from almost half of its deployment sites. A UN Security Council threat of sanctions against both countries failed to be followed up.²¹ After in November 2007 the EEBC dissolved it self in absence of adequate UN Security Council support, in January of the present year, Eritrea forced out the UNMEE altogether from the TSZ by blocking fuel supplies. For the time being, the dangerous stalemate is maintained because of Western concerns with counter-terrorism priorities in Somalia, where both countries continue their war by proxy (Eritrea supporting insurgents that battle Ethiopian troops supporting the Transitional Federal Government).

“The departure from the scene of the EEBC and the de-facto expulsion of UNMEE has made this conflict much more dangerous, removing the means of continuing dialogue between the parties. A miscalculation on either side could lead to a disastrous return to conflict”.²²

In July 2008, new refugee arrivals from Eritrea, Somalia and Ethiopia continued to enter Sudan, albeit in smaller numbers than in June. According to the UNHCR²³ smaller numbers are proof of the effect of the rainy season. From this it can be deducted that many refugees leave for environmental reasons. The following map (on next page) shows to what extent the entire Horn of Africa is being affected by drought and aridity.

The present number of refugees in Eastern Sudan is 136,000 with a monthly increase of 1,300 to 1,500 who are probably environmental refugees, a phenomenon expected to gain importance over time. It goes without saying that a return to the conflict in Eritrea/Ethiopia would again quickly inflate these numbers to hundreds of thousands (as during the previous wars).

²¹ International Crisis Group: Beyond the Fragile Peace between Ethiopia and Eritrea: Averting New War; June 2008; p.24.

²² Idem; p.i

²³ UNHCR: Sudan Operations Update, July 2008.

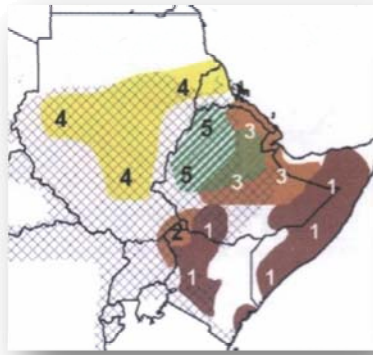


Fig. 3 Weather Hazard Impact Assessment for East Africa²⁴



1. Successive seasons of poor rainfall leading to a failure of seasonal crop production, deterioration of pastures and low availability of drinking water.
2. Poor rainfall has led to a failed crop season for localized areas on the border of Sudan, Uganda, Kenya et Ethiopia
3. Below-average rainfall has resulted in dryness across Ethiopia and Somalia (p.e. Tigray)
4. Below-average across Sudan; most affected area is north-eastern Sudan and northern Eritrea; Too early yet to speak about drought, (= dryness over more than 3 successive seasons)
5. Above average rainfall but many floods

3. PROJECT INTERVENTIONS

3.1 DRINKING WATER

3.1.1 Rehabilitation of hand-dug shallow wells

In the Gash delta groundwater aquifers are yearly recharged by flash floods. Variation in groundwater levels is a function of the magnitude of rainfall and flash floods. There is no evidence in the delta that aquifers would be decreasing over time. According to UNEP, certain studies on the evolution of groundwater levels in *khors* and *wadis* in the HK area would report falling aquifer levels. According to project staff and community members, during this particularly dry year groundwater levels would have dropped by a few meters, sometimes just above the well bottom. No wells have been observed which have completely run dry, although in the dry season the relatively small yield capacity of most shallow wells carries an increased risk for contamination. Most wells are located just alongside the *wadis* or in fissures in the rocky basement complex.

Project staff measure the sustainable water yield levels through measuring the recharging up to the initial level following water abstraction over a certain period of time. No testing of the water quality takes place, since all water from rehabilitated wells is systematically chlorinated through the support of Samaritans Purse, working in strategic partnership with SRCS.²⁵ As shall be shown here below, chlorination is not always effective and therefore it is of an utmost importance that water samples from shallow wells are regularly tested, especially during the dry season when the risk for outbreak of water-bound diseases is most important.

Unfortunately, the project is not linked to water system monitoring data bases, initiated by either the WES²⁶-UNICEF or by WHO. Both, the downloadable and online version of the WES-UNICEF database system are still under development and for that reason they are not functional as yet: data on GPS coordinates and water quality have not yet been entered²⁷. The WHO database indicates both coordinates as well as a number of chemical water quality measurements (see annex 9). Since the

²⁴ Based on USAID FEWS NET – Weather Hazards Impacts Assessment for Africa; September 2008.

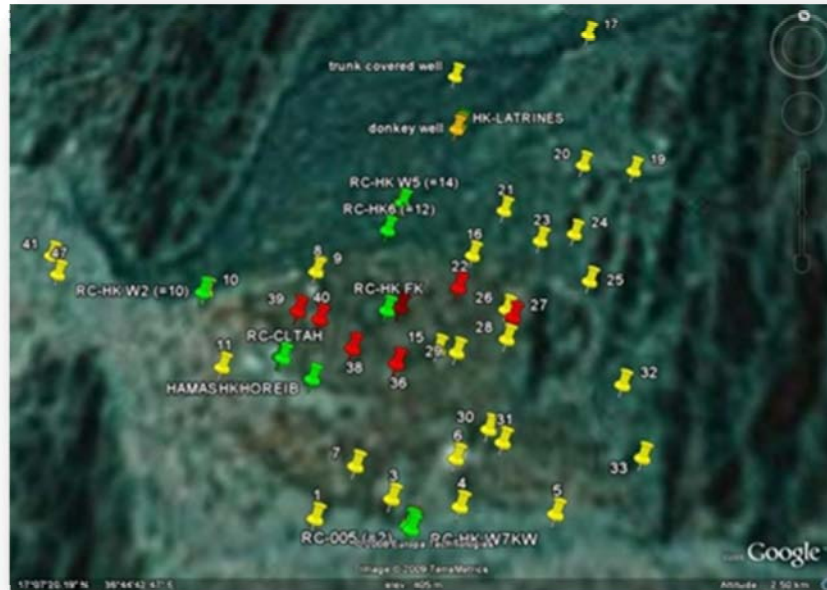
²⁵ This is different for water quality testing of boreholes, which systematically tested against bacterial and chemical parameters.

²⁶ Water, Environment and Sanitation Department

²⁷ See: <http://wes-sudan.org/database.aspx>

coordinates of the SRCS-improved wells have been registered in Garmin GPS database, both databases have been combined and the result has been fed into a Google Earth satellite map.

Fig.4: Wells HK town



■ SRCS
 ■ WHO: suitable
 ■ WHO: non suitable
 Source: based on dBase SRCS and WHO (annex 9); Scale: 1 cm = 266 m

From this it can be seen that the density of wells in HK town is considerable. For an area of 3 km² the total count is 44 or almost 15 per km².²⁸ Four out of nine SRCS-wells are equally registered in the WHO dBase²⁹. None of these are unsuitable for human consumption, but as can be seen on the image here above, a number of SRCS wells may be as close as 40 m distance to those who are.

As can be seen from annex 9, in the present study seven WHO-monitored wells are classified as unsuitable for human consumption. Because of elevated TDS (Total Dissolved Solids) and corresponding EC (Electrical Conductivity) values³⁰ the water becomes unpalatable and chlorination will not have any effect on that. For that reason and for reasons of precaution it is advised that drinking water from wells in the direct vicinity of water points known to be extremely saline will be subject to monitoring,

²⁸ This excludes the water adduction from the distant Drondron well, which is situated at 4.6 km distance. As long as the shallow wells produce water, a majority of the population prefers to use them. Well-water is free of charge and the wells are situated in the direct vicinity of the houses, which for cultural reasons are more accessible to women.

²⁹ Their respective coordinates find themselves within 5 m distance.

³⁰ The total TDS in drinking water reveals the saline behavior of water, which indicates the organic pollution level of water (it does not indicate a health hazard). According to WHO, TDS should be between 500 and 1,500 mg/l. EC indicates the amount of TDS in water. When TDS levels exceed 1,500 mg/l it is generally considered unfit for human consumption. A high level of TDS is an indicator of potential concerns, and warrants further investigation. Most often, high levels of TDS are caused by the presence of potassium, chlorides and sodium. These ions have little or no short-term effects, but toxic ions (lead, arsenic, cadmium, nitrate and others) may also be dissolved in the water.

especially during the dry season. Moreover, also in the case of shallow well-improvement, water quality needs to be regularly tested on chemical and bacterial parameters. This is even more necessary as long as dBases from specialised agencies are still under development, not complete and these organisations are often concentrating on borehole management.

Technically speaking, the rehabilitation of shallow wells is well done. Once the lining finished, the site is said to be cleared from construction material and earth.



Fig.5: Lining the well in Oudi



Fig.6: Dismantled lining still needs to be disposed off



Fig.7: Child drinking from animal basin



Fig.8: Unfenced well, a safety risk

In all observed cases, separate drinking places have been made for cattle. Unfortunately, hardly any wells or animal drinking basins have been seen which correspond to safety and protection standards. The improved water points are well drained. Ground water abstraction is based on effective yield which can mean that during the dry season insufficient drinking water is available and that people need to rely on public taps or “donkey chart water sellers”. As soon as the yield in shallow wells allows for it, people prefer those for financial reasons, in spite of commonly poorer quality and taste. Where latrines are constructed, a safe minimum distance of at least 20 m is respected to water points. A problem is that

women are not allowed far away from their dwellings and therefore defecation is practised in the living quarters, where there is a relatively dense network of shallow wells.

3.1.2 Borehole drilling and pumping systems

Site selection is done based on outsourced hydro-geological surveys. Drilling is done by specialized companies selected through a tender procedure. Water from boreholes is systematically tested in the MoH laboratory in Kassala against bacterial and chemical parameters.³¹ The MoH equally intends to cover the inspection of all shallow wells in the state but for the time being boreholes get priority.

During the mission, the project staff just started experimenting with a solar powered submersible water pump. It goes without saying that the technology is very environmentally friendly; no polluting fossil fuel is used, solar energy is free, and the operation and maintenance cost are negligible. It goes without saying that the basic investment costs are high³² as compared to diesel-powered pumps but if one would compare the exploitation accounts of the two systems (O&M and depreciation included) with an assumed technical life-span of fifteen years, the solar-powered system can already reach its break-even point, as compared to a diesel-powered pumping system, in year five. It was impressive to observe to what extent the WatSan delegate mastered the solar technology during test pumping. Solar panels need to be well-protected against vandalism (risk of damage by stones) for which a certain supervision needs to be put in place. Community leaders say to be convinced of the advantages of solar technology but rather favour the option of the project paying for a watchman and for barbed wire (see below).



Fig.9: Three years old diesel pump leaking oil



Fig.10: Testing the solar-powered submersible pump

As has been observed at several occasions, in spite of training provided to diesel pump operators, the technical state of maintenance of most pumps is deplorable. Engines are leaking oil everywhere contaminating the soil and possibly the shallow groundwater. Apparently, the purchase of spares does not fit the plan, which is an indicator for weak management by the water committees. Apart from this, a number of (non SRCS) pumps have been observed which were over-dimensioned as compared to

³¹ In spite of a visit to the DG-Health and to the laboratory, in the end promises to share the MoH dBase of water quality testing have not been honored.

³² Roughly estimated at € 12,000 for the complete system, pump, panels and transportation costs included.

the sustainable yield capacity, or which did simply not have appropriate fittings (PVC pipes bursting because of too high pressure).

Lack of prevision seems to be embedded into the local culture and, as found out while in HK, the degree to which the local community leaders show ownership is simply disappointing. Implementing agencies can only blame themselves for having been skilfully played out against each others. A more effective coordination between implementing agencies at the field level is a must. For the sake of continuity and respect of previous commitments it is recommended to negotiate formal contracts with legitimate community representatives, rather than with self-perceived leaders looking for their own interest.

3.2 SANITATION

3.2.1 Hard waste

In spite of training in hygiene promotion and the organisation of ad-hoc cleansing campaigns, hardly any signs of improved hard waste disposal practices are visible. In Sudan, no research was found on the health risks of exposure to hard waste and on losses in cattle caused by indigestion of plastic bags. Research from West-Africa shows animal losses up to one third of the entire herd of, in particular, small ruminants and camels. Recent research shows that billions of kilograms of a number of chemicals used in the manufacture of different types of plastic can leach out of plastic products and cause harm to the brain and reproductive system when exposure occurs during fetal life or prior to weaning.³³



Fig.11: Garbage in Darasta



Fig.12: Plastic, a "silent killer"³⁴



Fig.13: Garbage in HK

The strong winds blowing in HK most of the year scatter the lighter material, like plastic, around everywhere. Esthetical considerations do not seem to serve as an incentive and voluntary action based on awareness raising campaigns hardly shows any result. As experience in other countries has shown³⁵, a strict legislative framework with sanctions is one option but sticks should be matched with carrots. In

³³ Frederick S. vom Saal, et al.: The plastic world: Sources, amounts, ecological impacts and effects on development, reproduction, brain and behavior in aquatic and terrestrial animals and humans, *Environmental Research*, 108 (2008), pp. 127 - 130

³⁴ Source : UNEP, 2008.

³⁵ See e.g. the example of Rwanda where in 2007 the use of plastic bags has been strictly forbidden.

the case of Sudan, recycling could provide such a carrot, provided that it proves to be profitable for those who are responsible for the production and disposal of waste. The cases of Senegal and Burkina Faso (plastic recycling in Ouagadougou and the reutilisation of recycled plastic in Bobo-Dioulasso³⁶) should serve as an example how to make recycling financially attractive to local government and to ordinary citizens (see annex 10). The success of recycling depends on a critical mass of waste which is produced in a certain region, on distances to urban centres as well as on market prices of recycled material which are subject to fluctuations mainly in the price of oil. It is therefore doubtful whether recycling of plastic has any sense in the area of HK, however feasible it seems in a town like Kassala. In smaller rural towns, like HK, one could imagine an incentive system for the collection of plastic by providing a small reward to school children (i.e., sports articles or goats). Collected material can be transported every once in a while to a town-based recycling centre for sale: "waste is money". In such a remote area, the recycling of organic material by composting provides a welcome opportunity to contribute to small-scale organic gardening or nursery management by e.g. groups of women or school children in the direct vicinity of water points like wells, taps and *hafirs* (e.g. by bucket irrigation).

3.2.2 Latrines

Different latrine systems are being constructed by the project for different clients. Latrines with windpipes are being constructed at a household level, which appear to be actively used and well appreciated. These ventilated improved pit - "V.I.P" latrines, offer improved sanitation by eliminating flies and smell, through air circulation. It has been observed that critical distance (20 to 30 m) to water points and wells is respected. Another category of latrines are the collective ones in schools and other public places like clinics. In some cases, a jar of water was available but that was not the case everywhere. Hand-washing arrangements are really needed everywhere, especially in common school latrines, in order not transform these places in potential sources of transmission of diseases. As observed in HK, a communal latrine block situated in the direct vicinity of the women area was not utilized in an appropriate way. Multiple excrements were found on the concrete floor in front of the latrine doors of the male section and since no hand-washing facilities were available, the division wall was used instead.



Fig.14: VIP household latrine in Darasta



Fig.15: Inappropriate use in HK

³⁶ See annex 10, for documents on recycling and reutilization of plastic in Burkina Faso (both undertaken by NGOs).

As in the case of hard waste, activities promoting hygiene have apparently not led to visible results everywhere and one has to accept that training is apparently not a panacea for change in attitude and practices³⁷ without in-built incentives. Is the VIP latrine already providing several advantages like less odour and flies, one could consider experimenting with the introduction of Ecosan or compost-toilets.

Ecological sanitation is a new paradigm in sanitation that recognizes human excreta and water from households not as a waste but as resources that can be recovered, treated where necessary and safely used again. Ideally, ecological sanitation systems enable a complete recovery of nutrients in household wastewater and their reuse in agriculture. In this way, they help preserve soil fertility and safeguard long-term food security, whilst minimizing the consumption and pollution of water resources.³⁸

In a crowded village like HK, the wells and latrines lie close together. Even if pit-latrines would be used, this would signify a high risk for contamination of the ground water which puts people at high risk of cholera, dysentery, diarrhoea, jaundice, typhoid, polio and intestinal worms. A dry composting toilet protects water and soil and therefore helps to protect people in the community.

Ecosan and/or compost toilets have another big advantage which is the production of organic manure for fertilizing the soil. One could imagine to organize IGA for women and, rather for educative purposes (school garden), for school children³⁹ based on composted organic horticulture and nursery management close to water points. Yes indeed, also “excrements are money” and just as important, it can serve the education of the future generation on ecological basics. As shown in annex 10, experiences from countries like Kenya, Uganda and Burkina Faso can serve as useful examples.

4. FLOOD RESPONSE

At several occasions SRCS has intervened in case of flooding by the Gash river. In the last 87 years, Kassala town has been attacked by eighteen devastating floods recorded in 1921, 1926, 1927, 1929, 1931, 1939, 1941, 1950, 1952, 1973, 1974, 1975, 1983, 1988, 1992, 1998, 2003 and 2007; an average of once in four year. The 2003 flood was particularly damaging as almost half of the city was devastated, with a total loss of USD 150 million.⁴⁰

The Gash (in Eritrea named *Mareb*) has its source south of Asmara. Its length is approximately 250 km of which 75 in Sudan (of which 30 years upstream to Kassala). The fluctuation in total annual discharge is remarkable with a minimum of 140 million m³ recorded in 1921 and a maximum of 1,430 million m³ recorded in 1983 (the year just before the big drought), whereas the average annual flow from 1907 to 2003 was 680 million m³. A flood wave passing the border takes approximately four hours to reach Kassala. Because of such a short time-span, flood warning and preparedness are rather based on metrological outlook with the help of satellite imagery.

From the picture on next page it can be seen how shallow the riverbed of the river really is, especially around bottlenecks like Kassala bridge. Caused by desertification, deforestation and erosion in the Eritrean upper-watershed area, the Gash river carries an exceedingly large charge of sediment. Recent

³⁷ It is recommendable to implement KAP studies on beforehand and after the hygiene promotion campaign in order to substantiate (or deny) above observations.

³⁸ Source : <http://www.watsanuganda.watsan.net/page/264>

³⁹ See e.g. UNICEF school garden programme in South Sudan.

⁴⁰ Bashkar K. E.: Gash River Flash Floods Challenges to Kassala Town: Mitigation and Risk Management; undated.

measurements indicated a maximum sediment load of 70,000 ppm ($70\text{kg}/\text{m}^3$)⁴¹. During a flash flood the instantaneous discharge can reach 870 m^3 per second⁴² and the maximum sediment transported could therefore be as high as 60 tons per second ($70\text{ kg} \times 870\text{ m}^3$). But even if it would be half as much, it would need 360 five-ton trucks per “minute of flash-flood” to remove that much sedimentation. Dragging and river bed deepening do therefore not provide any solution. It is reported that between 1936 and 1974 at the downstream side of the bridge the river bed has risen by 3.8 m (10 cm per year) and that presently at that same spot the river bed is already 10 cm higher than the ground level of Kassala town.

In order to direct the flow of the river and to protect the town, since the 1930s, spurs and dykes have been constructed but given the high sedimentation and enormous pressure on the dyke bodies during flash floods, the risk of bank failure is important. Notwithstanding the high 2007 flood wave, the earthen embankments, strengthened after the 2003 floods, have managed to turn the danger. During an interview with staff of the Gash Control Unit, it was understood that at the medium term, costly dike-strengthening measures are needed to avoid consequences even worse than experienced in 2003 (approximate cost USD 100 million)⁴³. Until then, SRCS should be prepared to repeat what it has done so effectively at many previous occasions. A trans-boundary approach to mitigate the rapid degradation of the upper-Gash watershed and important investments appear urgently needed. Unfortunately, part of the Mareb watershed lies in the heavily mined Temporary Security Zone. This is a good example of how conflict and environmental degradation can go hand in hand.



Fig.16: Dry riverbed of the Gash downstream of Kassala bridge

⁴¹ Bashar K.E.

⁴² The carrying capacity under the bridge is only $400\text{ m}^3/\text{s}$; Therefore it is a major bottleneck in the evacuation of flash flood water..

⁴³ The equivalent of about 2/3 of the total damage registered during the 2003 flood.

5. LIVELIHOODS RESILIENCE

5.1 MESQUITE, A FOE OR A FRIEND?

In HK energy for cooking entirely depends on firewood and charcoal. Kerosene is only very rarely used by a few privileged households for lighting.

After a number of successive dry years, most of the indigenous species (especially *Acacia spp.*) have dried out. This phenomenon is compounded by over-cutting of fuel-wood and for charcoal production. As we have seen here above, Mesquite (*Prosopis juliflora*) appears to be adapted to these arid conditions. This tree, originating from South America has been introduced in 1917 by the British as a shelterbelt species, in order to halt further desertification. Scientists report that one can not think of any other species which performs so well as a shelterbelt species in desertification mitigation and control.⁴⁴

However, one of the very big disadvantages of Mesquite is its extremely rapid propagation to areas where groundwater is found at relatively accessible depth. Root systems have been reported until 20 to 25 m of depth but also the lateral root-system has an impressive size. Seeds find themselves in pods which are eaten by cattle which form the major reason for a rapid propagation. As already stated here above, the standing stock of Mesquite increased eighty-fold between 1962 and 1996, in the Gash Delta. This has caused root competition with agricultural crops for nutrients and water which has contributed to crop failure. In 1996, the central government has decided to fully eradicate Mesquite from its national territory⁴⁵. In practice this appears to be a gigantic uphill task, especially if full grown trees need to be removed manually (the species is self-coppicing and therefore also its deep and large root-system needs to be fully eradicated). Mesquite presently serves as the scapegoat for the failure of mechanised agriculture as well as livestock husbandry in the East. The real causes seem to be much more complex and rather refer to the massive removal of the indigenous vegetation cover, which has contributed to erosion and the deterioration of soil fertility and, with regards to livestock, to overgrazing. Young Mesquite plants in the neighbourhood of agricultural fields or pastures can be easily removed manually. However, an active management of common lands appears to be the last of the farmers' and herdsman's priorities.

Livestock keepers complain on the negative effects on animal health after consuming Mesquite beans. The signs of the disease, jaws and tongue trouble, develop gradually, usually after cattle has been eating beans for two or more months. Afflicted cattle may salivate, chew continuously, sometimes with nothing in their mouth, and hold their heads to one side.⁴⁶ Animals may lose 50% of their body weight and finally die.

In spite of all these disadvantages, in Sudan, with limited means available, grown Mesquite species are practically in-eradicable. However, there are also clear advantages. As to the latter: the tree works

⁴⁴ Jorn Laxén: Is Proposis a curse or a blessing: "Without a bufferzone of Proposis between the riverine vegetation and the sand invasion area those landscapes will be difficult to maintain sustainably".

⁴⁵ Also in other countries national eradication policies exist (e.g. Australia) but there Mesquite does not occupy a central role in the coping strategies of such large parts of the population and, moreover, financial and technical means are available for eradication.

⁴⁶ Mesquite (*Prosopis glandulosa*) website: Mesquite beans have a high sugar content that, together with inadequacy in other dietary factors, alters rumen micro-flora, inhibits cellulose digestion and contributes to rumen stasis and impaction and, in severe cases, to ketosis and starvation.

perfectly against desertification. Being a *Leguminosae*, it fixes nitrogen from the atmosphere to the soil and thereby it is important as a biological fertilizer. Most important, it can be qualified as the “poor man’s tree”. In the HK area and in the IDP camps, in years of drought, income from Mesquite charcoal production and trade provides the only source of cash income for the majority of households, next to remittances from family members working as unskilled labour in town.

With the support of the German Red Cross, in Kassala SRCS has recently started a Mesquite project which courageously challenges a number of prejudices. Acknowledging that the simplest option to constrain spreading would be through its utilization, the “foe is transformed into a friend” by valuing viable economic products like: Prosopis gums, pod fibre and flour meals, timber and flooring materials.



Fig.17: Mesquite, foe or friend?



Fig.18: Preparation of a Mesquite charcoal pit

There is an obvious opportunity to link the two, the Kassala-HK and the Mesquite projects, when it comes to the development of income generating activities for women. These activities would not only generate a constant stream of cash income, they would equally serve major ecological functions by an active management of the commons (by e.g. selective pruning or by grinding pods for fodder – reducing the dispersal of seeds and preventing its invasion in unwanted places). Apparently also “shrubs are money”.

5.2 FUEL-WOOD EFFICIENCY AND HEALTH HAZARDS

In the communities visited it has been observed that the local population generally cooks on the so-called “three stones fire” (fig.19). This practice has a very low fuel-wood efficiency (approximately 6-8% when wet wood is used). Fireplaces may be inside or outside of the house. It goes without saying that cooking inside causes big problems with inhaling smoke. This problem was discussed during interviews with women and confirmed by statistics and observations from the PHCs on the frequency of respiratory tract problems with women and young children. The smoke from burning these fuels inside of the homes is one of the four leading causes of death and disease in the world’s poorest countries. The most recent figures from the WHO show that in developing countries where mortality is high, the four greatest risks leading to death, disease and injury are: underweight, unsafe sex, unsafe water, sanitation and hygiene and smoke from solid fuel.⁴⁷

⁴⁷ ITDG, Practical Solutions: Smoke – the killer in the kitchen.

A great number of options are available to use more fuel-wood efficient stoves or even to replace the fuel with alternative sources of energy. Most of the international NGOs have their own fuel-wood efficient models but intensive introduction campaigns over the last three decades have only met with moderate success. Again one could argue whether this is only a matter of lacking awareness. Seen the evidence, it appears more plausible to explain persistent failure in acceptance rates by a lack of affordable and sustainable options. A good example is the replacement by LPG in certain refugee camps which simply proved to be too costly. Another factor is the relatively high investment cost and dependence on locally non available production material and skills. Moreover, there are rational explanations for favouring cooking inside, like: keeping away mosquitoes and termites and respecting *purdah*.



Fig.19: Three stones fire place in Darasta



Fig.20: Improved clay stove

For that reason, any acceptable alternative in the rural areas should be based on locally available material like e.g. clay ⁴⁸. Improved clay stoves will not exceed a fuel-wood efficiency of 15-20% (provided that fuel-wood will be sun-dried first) but as compared to the three-stone fireplaces this will signify a saving of up to 100% of wood and thereby much less time dedicated to collection. With half of the wood needed to obtain the same cooking efficiency and for reasons of time saving and environmental sustainability, this option is worthwhile exploring, however, it does not yet solve the problem of excessive exposure to smoke.

Through a design of open clay-based stoves with improved combustion chamber one can already expect a certain reduction in smoke. A more important reduction needs the additional construction of hoods and/or chimneys which makes the stove more expensive, although expensive metal sheets can be avoided by using clay hoods and brick-lined chimneys. These additions do not make the stove suitable for indoor use in houses made of vegetative material, which implies the majority of them. Outdoor use, which is highly preferable from a point of view of reducing smoke exposure, equally needs protection against the strong winds and shelter for protecting *purdah*.

⁴⁸ Mixed with a.o. donkey dung.

Clay stoves have been tested in Sudan with mixed results. Whereas experiences in Darfur are rather conclusive, other experiences ⁴⁹ show that not all clay found in Sudan is suitable for making stoves (e.g. clay containing *montmorillonite* instead of *kaolinite*).

It is strongly recommended that SRCS will explore further options for the production of affordable improved stoves by contacting experienced organizations like CARE, OXFAM, Practical Action or the Sudan Energy Research Council.

5.3 IMPROVED PHYSICAL SECURITY

The presence of landmines and unexploded ordinances does not only provide a danger for the general population, it equally denies pastoralists and farmers from having access to large stretches of land. This seriously impacts on recovery and development in many areas of high vulnerability. Two main roads leading to HK have been cleared and UXOs have been cleared along safe roads from Kassala to HK. Mine clearance and Mine Risk Education (among others by the project) have raised awareness among the population thus helping them to recognize and to avoid the mined areas. From interviews in Darasta and HK the population gave proof of knowledge about such areas.

According to information from the Resident Coordinator for the UN in Kassala, in 2007 two victims programmes have been set up and a total of 401 landmine victims were identified. A landmine impact survey (LIS) was conducted in all three north-eastern states and in Kassala state alone an area was identified of 26.8 million m² (2,682 ha) of contaminated land. Due to access restrictions, the LIS was not conducted in HK and Telkook until early 2008. A lack of sufficient funding is not only slowing down the demining by the National Mine Action Centre, it is also influences victim assistance: only 31 out of 401 victims identified received direct assistance by mid-2008. There might be an opportunity for the SRCS to monitor the present level of landmine clearance (by NMAC) and victim assistance (by the National Authority for Prostheses and Orthotics - NAPO) and to advocate for urgent action. If deemed necessary the ICRC could play a facilitating role.



Fig.21: Mine clearing operation (source: UNMAS)

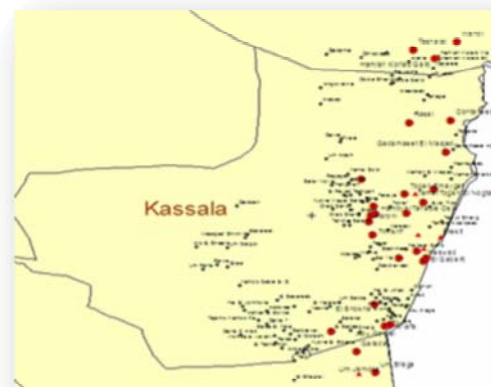


Fig.22 ● = mine-affected communities ● = no evidence

⁴⁹ Sosan Elhassan: The Sudanese « Muddy » Stove ;

5.4 INCOME GENERATING ACTIVITIES

The programme document mentions that SRCS acknowledges that in view of the general economic situation, additional support is needed to assist the communities transiting from husbandry to “new ways of livelihoods”. Given the environmental conditions, as discussed here above, it is not obvious whether that change would be judicious. A number of scientific publications rather adhere to the view that amongst other land-use options the area is most suitable for livestock husbandry. It should be acknowledged as well, that under conditions of drought and within an ever restricted space, pastoralism in its pure form would not appear feasible any longer. Under conditions of vulnerability, pastoralists have become agro-pastoralists; a diversification of livelihoods is already well on its way.

Alternative ways of further diversifying livelihoods in the area (other than remittances from outside) are all based on value addition to primary produce from the area. It goes without saying, and that is also acknowledged in the programme document, that such activities should be reliant on locally available resources or raw material. However, the availability of water remains a critical factor to the availability of these resources. Apart from the so-called *teras* water harvesting practices⁵⁰ in *wadis* during the rainy season, not many opportunities are availed as yet. No other activities than the ones already undertaken in livestock, agriculture / horticulture (particularly watermelon) seem ecologically speaking feasible, with the possible exception of forestry around water points and in seasonal streams, as well as of poultry. Economic opportunities equally include possible value addition to produce or derivatives from any of these sub-sectors.

So far the development of income generating activities for women still needs to take off. The programme document mentions possible interventions as: mat making, sewing, flower mill and domestic livestock (goats/chickens). The underlying thought of developing IGA is (1) to address the extremely marginal status of women in an already extremely vulnerable environment and (2) to generate additional income that can be used to sustain, at the medium term, basic services set up under the auspices of the project. The idea to initially provide seed money which should be transformed into a revolving fund is laudable but under such extremely difficult circumstances hard to realize, unless SRCS would have one or more qualified and experienced female agents residing in the area. The degree of community organization among both men and women in HK was found to be virtually non-existent, which is a major hurdle for setting up any development activity.

In the previous chapters, a number of activities have been identified which address, at the same time, environmental sustainability, as well as an opportunity for value addition. They can be summarized as follows:

- Collection (HK), recycling (Kassala town) and re-utilization (HK) of plastic; (see annex 10);
- Collection and re-utilization of organic matter (household waste, Ecosan / compost toilets – see annex 10);
- Organic gardening (e.g. watermelon) and nursery management for women groups and school children (in the vicinity of water points – see FAO Kassala);⁵¹

⁵⁰ See e.g. Johan van Dijk et al.: Opportunities for Expanding Water Harvesting in Sub-Saharan Africa; The Case of the Teras of Kassala”; IIED, undated.

⁵¹ See e.g. the Samaka Guide, based on an entirely different agro-ecological zone but the principle of ecological and organic farming is clearly described; available for download (after free registration) on: <http://www.scribd.com/doc/3946995/The-Samaka-guide-to-homesite-farming>

- Value addition to the Mesquite tree (e.g. gum, pod fibres, seed flower, timber plantation, etc. see SRCS/GRC); In case the *Prosopis juliflora glandulosa* variety is found (to be checked with GRC), this variety is excellent for honey production (in the United States known as *Texas Honey Mesquite*);
- Active management of mesquite tree propagation on common land (probably for men only; see SRCS/GRC);
- Production of fuel-wood efficient and smoke reducing stoves based on locally available material (see Practical Solutions/ITDG, OXFAM, CARE or Sudan Energy Research Council);
- Poultry and small livestock raising (see FAO Kassala);
- Mat production (as mentioned in the programme document) seems to provide very marginal income only but should by no means be excluded from consideration; Sorghum production appears to be too irregular to afford investments in the purchase of a flower mill (as suggested); Sewing will not be profitable in a market flooded with cheap ready-made cloth from Asia.

It is recommended to check the viability of above mentioned options with specialized institutions as indicated in the text. In case SRCS would avail one or the other opportunity, it is recommended to recruit specialized staff and to consider long-term technical backstopping arrangements with specialized agencies. This is also valid for community development, extension, and the management of seed-money and revolving funds for which SRCS apparently does not possess comparative advantages.

6. MITIGATION MEASURES

6.1 GENERAL RECOMMENDATIONS

- The methodology for the present study has been modelled in an iterative manner. In order to avoid a purely qualitative assessment from community and organisational assessments, the availability of local statistics was deemed indispensable. Although existing and repetitively promised by numerous organisations, in the end only very few statistics were made available. Failing to obtain statistics in a timely manner, the present study had to rely much more on secondary data than what was initially foreseen which had to be done upon termination of the field assignment.
- Environmental impact assessments should not only address the effects of project interventions on the environment but equally address the impacts from the environment on the context in which the projects are implemented, as well as on the projects themselves.
- In case SRCS should decide to involve it self in natural resources-based vulnerability reduction, without any doubt the major cause for increased vulnerability and conflict in the region, it will have to recognize that this will exceed its core competences. If such is deemed judicious, it is recommended that strategic partnerships will be developed with institutions and agencies specialized in rural development.
- In order to play a more effective role in *reducing the risks facing vulnerable communities and improving the life of the most vulnerable groups*, there is an obvious opportunity to more effectively participate in apprehending which contextual issues cause vulnerability. This particular mission provided an excellent opportunity to widen the scope of staff beyond the implementation of project activities. The consultant is confident that this has set a precedent in developing an attitude of curiosity and an increased motivation to better capture the context of operations. This being said,

there is an opportunity to participate more actively in learning exercises and *knowledge management*⁵² between development actors.

- Linking relief to rehabilitation and development needs a long-term horizon in project cycle planning and at least a medium-term donor commitment to funding.
- Given the particularly difficult weather conditions this year and thereby the vulnerable position of IDPs, it is recommended to monitor the effects of cessation of support to the camps foreseen for the end of the year. In case the withdrawal would cause distress, a temporary bridging period could be considered until mid-2009. In majority, IDPs are reluctant to return to their communities of origin and a clear decision needs to be taken by the authorities on the future status of the camps and on supportive measures for either enabling return, or on the transformation of camps into permanent settlements.
- SRCS is invited to continuously monitor the evolution of political developments as long as there is a chance that the fragile peace process will slide off again into conflict.
- SRCS is invited to remain in close contact with the UN system, monitoring the political developments and climatic conditions in neighbouring countries, in order to be well prepared in case of sudden influx of political and environmental refugees.
- SRCS is equally invited to follow, in close contact with the local authorities and the UN system, the evolution of the bio-physical environment, in particular climatic trends and degree of desertification, in order to better predict land-use based conflicts, food shortages and outbreaks of diseases.

6.2 MITIGATION OF ENVIRONMENTAL EFFECTS

- It is recommended to regularly test the bacterial parameters of drinking water of shallow wells, particularly during the dry season when yields are low and the risk of contamination high.
- It appears that SRCS has not yet availed the opportunity to access databases on drinking water monitoring, managed by WES-UNICEF, WHO and the MoH. It would be of benefit for all, if SRCS would actively contribute to and benefit from these databases.
- In the case of well-improvement through lining, it is recommended that removed material will be disposed off in a correct manner.
- Since women are not allowed far away from their dwellings, it is recommended to construct appropriately sealed latrines in the direct vicinity. The density of low yielding shallow hand-dug wells in HK needs particular attention and a critical distance between latrines and wells of 20 to 30 meters should be respected.
- Poor maintenance and operation of pumps needs primary attention. Environmental pollution caused by oil leaking is common. This reveals a weakness in technical and financial management. Frequently, collected user fees do not allow for changing spare parts in a timely manner and

⁵² A systematic monitoring on the impact of experiences, their validation, dissemination, sharing and institutional learning.

therefore the pumps will show all kind of technical deficiencies. Next to technical training, particular attention should be given to sustainable financial management by water-committees.

- It is recommended to use technical solutions in which the risk for human error can be reduced to a minimum extent. In this respect, first experiences with solar-powered submersible pumps are promising. Cost for operation and maintenance are practically nil. Notwithstanding this, the challenge will be to get the communities adjusted to depreciate the initial investment, in order to enable replacement of the entire system over time.
- Particular attention needs to be paid to community development, the strengthening of management systems and accountability mechanisms and technical support in livelihood activities. This seems only possible if SRCS disposes of a permanent institutional presence in the area.
- Experiences elsewhere in collecting, recycling and reutilization of plastic should be considered for application. Affordable recycling facilities should be based in town. Collection and reutilization can be done in the rural areas as well and can contribute to income generation.
- Hand-washing facilities are sometimes lacking in common latrines and this problem should receive primary attention in order to avoid the transmission of diseases.
- Without in-built incentives, training in hygiene promotion is not a sufficient condition for changed attitudes and practices. From an economical and an environmental point of view, ecological sanitation provides multiple incentives. Ecosan and/or compost toilets (especially the so-called dry composting toilets) protect the water and soil against contamination and enable a reuse in agriculture, helping to preserve soil fertility and safeguard food security. It is recommended that SRCS will study experiences from other African countries and consider introduction of these improved practices, which can equally contribute to income generation.
- Mitigation measures for flood control necessitate important mid-term investments in river protection measures which in the long-term are only justified if a costly trans-boundary watershed management programme will be developed between Eritrea, Ethiopia and Sudan. Until conditions for the implementation of either or the other will be met, SRCS can only continue to be prepared until the next flood will occur. It is highly probable that the ongoing deforestation in the upper-watershed, the permanent rise of the riverbed (particularly at Kassala bridge) and the occurrence of increasingly intensive rainstorms will increase the magnitude of the floods.
- The Mesquite tree (the “poor man’s tree”) plays an important role as a coping mechanism under conditions of severe environmental stress. It is recommended that the project will partner with the GRC supported Mesquite project in order to increase livelihood options for women groups and to emphasize the tree’s ecological functions as a leguminoses and as a shelterbelt species.
- Given the high exposure of women and children to kitchen smoke, it is strongly recommended that SRCS will introduce the local fabrication of improved smoke-reducing and fuel-wood efficient stoves. This equally provides women groups with an opportunity for income generation. SRCS should contact any of the specialized organizations mentioned in annex.

- It is simply unacceptable that so many landmine victims (92%)⁵³ have not yet been taken care off for reasons of lacking funds. For the same reason, landmine clearance by NMAC is said to have slowed down. There is an obvious opportunity for SRCS to advocate for action and support.
- A number of possible options for income generation by women groups have been developed which are respectful or contribute to the environment. It is recommended to check the viability of the mentioned options with specialized institutions. It is judicious to recruit specialized and resident field staff and to consider long-term technical backstopping arrangements with specialized agencies in community development, technical extension and financial management, for which SRCS does not possess apparent comparative advantages: “Step out of your core competences but don’t do it in isolation”.

7. ACKNOWLEDGEMENTS

The consultant would like to express his sincerest appreciation to the SRCS direction and staff at national and the Kassala-branch levels, as well as to NLRC office and field staff and national counterparts for their continuous support during the entire mission. A special word of appreciation also goes to all government line-departments, UN organisations and NGOs visited in Khartoum and in Kassala and, most of all to beneficiaries interviewed during individual and community meetings in IDP camps, in HK, Oudi and Darasta for sharing their valuable time and views.

The mission provided all of us with a unique learning experience. I hope that this has helped you to break out of your relative isolation in which you appear to be operating in an extremely challenging and complex environment.

John F. A. Krijnen
Geneva, Switzerland
23 December 2008.

⁵³ Figures might be slightly outdated and need to be checked with NAPO.

ANNEXES

ANNEX 1: TERMS OF REFERENCE

The Netherlands Red Cross and Canadian Red Cross

TERMS OF REFERENCE

ENVIROMENTAL IMPACT ASSESSMENT

WITH FOCUS ON WATER AND SANITATION

1. INTRODUCTION

In July 2007, the Netherlands Red Cross (NLRC) and Canadian RC (CRC) began working in partnership with the Sudanese Red Crescent (SRCS) in a programme funded by the Canadian International Development Agency, the CRC and NLRC. Additional funding for this programme has been granted by both CIDA and the Netherlands Ministry of Foreign Affairs for continuing work in the region until December 2009. The Sudanese Red Crescent programme is entitled "Kassala - Hamash Koreib Integrated Assistance Programme with focus on water and sanitation"

Kassala State shares a border with Eritrea and is one of three states that makes up an area known as Eastern Sudan, the other two being Gedarif and Red Sea State. Kassala has had a long history of insecurity and disaster, accommodating waves of refugees and IDPs fleeing wars, droughts, famine and natural disasters in the region.

The total population in Kassala State is 1,550,000 people. More than 62,000 people are currently displaced from the area overstretching already inadequate state services and local coping capacity. In addition there are 78,000 refugees. The presence of landmines in the area has resulted in significant economic stagnation. Internally displaced persons and many rural communities in areas close to the border continue to suffer on a disproportional basis.

There are 143 health facilities in the State and 473 primary schools.

The purpose of the environmental impact assessment is to identify critical environmental issues and propose mitigation measures to reduce significant negative environmental effects of the water and sanitation programme.

The starting point for the environmental assessment are the two proposals submitted to CIDA in 2007 and 2008, which detail activities to be undertaken that may have an impact on the environment.

2. OBJECTIVES OF THE ASSESSMENT

2.1. The overall objective is

To assess risks to the environment posed by the water and sanitation component of the integrated programme and to propose a strategy to mitigate those risks.

The assessment will focus on the following:

2.2 Specific objectives:

- Evaluation of the extent to which the SRCS programmes on water and sanitation (water supply, water management and waste management) may have an immediate or potential impact on the environment;
- Identification of potential negative and positive environmental consequences of the water and sanitation programmes;
- Identify with all the relevant stakeholders mitigation measures to eliminate, reduce, control or compensate for any potential significant negative effects;
- Provide a comprehensive support to SRCS in terms of tools to conduct future environmental impact assessment;
- Assess the training needs and capacities of the SRCS and its partners to apply/respond the report's recommendations;
- Propose and validate future directions of the SRCS Environmental programs with focus on water and sanitation.

Recommendations will be made against all of the objectives;

2.3 Deliverables

A report, based on the above objectives, on the findings and recommendations arising from the assessment, which includes a section detailing the methodology undertaken to reach the recommendations. The report is to be no longer than 15 pages, including an executive summary. Additional background materials may be added as appendices.

3. AN ASSESSMENT METHODOLOGY

Data will be gathered from a wide a range of sources as possible through:

- ❖ An organizational Level Assessment
- ❖ A Community-level Assessment, where view points are solicited from people on the ground who have experienced the conflict and subsequent environmental threats such as droughts and flooding.
- ❖ A review of any relevant reports and other literature for the region, with particular attention to any previous, related assessments.
- ❖ Meetings with the Kassala State Department for Drinking Water, the Ministry of Health and any other officials such as HAC, as determined in consultation with the SRCS and the NLRC/CRC programme team.

The assessment will use the following methods.

3.1 Semi-structured interviews

Semi-structured interviews will be conducted with key informants (to be identified). Targeted interview questions will be formulated based on discussions with key SRCS and NLRC/CRC informants, and issues arising through provisional desk research undertaken by the consultants.

These questions will form the guiding interview questions which the consultants will use during interviews. Follow-up questions will be developed as the interview process develops.

3.2 Programme history

Key to a thorough and rigorous assessment will be a clear understanding of the country situation pre and post NLRC/CRC funding as perceived by internal and external stakeholders. This understanding will be obtained through interviews and time-line exercises with programme staff and other key stakeholders, in addition to desk research.

3.3 Desk research

The consultant will review documentation relevant to the inquiry, identifying qualitative and quantitative data as appropriate. These shall include, but not be limited to: programme evaluations, country reports, log-frames, budgetary data, in-house publications, strategic plans, donor reports etc.

3.4 Focus Group and Field Visits

Field visits are planned within this evaluation. The field visits will focus on obtaining data relevant to the assessment objectives. The approach will be one of accompanied visits (with National Societies programme staff) to NLRC/CRC funded programme sites to interview key informants and other identified stakeholders. Additional empirical data (either quantitative or qualitative) will be recorded if relevant to the evaluation. The consultant will incorporate perspectives from the country programs by discussions, interview with key informants and or targeted focus group discussions;

4. IMPACT ASSESSMENT TEAM

The Impact Assessment will be conducted by an external consultant. The consultant will be supported by key personnel within the NLRC and the SRCS in Sudan;

5. IMPACT ASSESSMENT PERIOD

The assessment will take place between May and October for a period of 12 days. During this period the field visits plus a visit to SRCS and NLRC headquarters will be undertaken. The final draft report will be submitted by October 2008. In July and August it is not possible to undertake the assessment because of weather conditions.

Appendix: Example of an Environmental Screening Form

The following form aims to provide some guidance and examples of considerations to take into account.

The main objectives of an environmental screening are to:

- identify the potential environmental effects of the proposed project;
- determine the likely significance of any potential negative effects;
- identify ways (mitigation measures) to eliminate, reduce control or compensate for any potential negative effects;
- determine whether or not a follow-up program is required;
- determine local legal requirements for assessing the potential effects of the project and meet these requirements.

1. Provide a description of the project for the purposes of the environmental assessment.

Describe the type of project, its size, scope and location, as well as planned project activities and planned implementation time frame. This section may also include the project's purpose and objectives, any environmental objectives, the alternative approaches considered to reach the project's objectives and the rationale for selecting the proposed option. Maps, drawings, and photos may be provided, to show, for example, the project location, the arrangement of any structures, the site and its surroundings.

2. Describe any host country legal requirements with respect to the environment that pertain to the project. Describe what methods is used or (should be used) to meet these requirements.

3. Describe the environment in which the project is being carried out.

Provide an overview of the features of the environment, specifying the extent to which the environment has already been disturbed or is particularly fragile. The following areas should be covered, where relevant to the project:

- the biophysical environment (e.g., type of environment, such as tropical forest, savanna; main features of the landscape; characteristics of soils, hydrographic network and groundwater; topography; air quality; natural resources; climate; features that are particularly fragile, sensitive or important from an ecological or socio-economic point of view) and
- the human environment (e.g., human settlements, such as villages, roads, utilities; land use and planning; socio-economic activities; quality of life; population density; sanitary conditions; social structure; cultural values; customs and ways of life; sites of spiritual, heritage, historical, cultural or archaeological importance). Maps, drawings and photos are often useful.

4. Describe the environmental assessment methodology.

Describe sources of information used for the environmental screening, information gathering methods and methods of assessing effects. Describe the process, if any, for involving the public in the environmental assessment.

5. Provide an analysis of potential environmental effects.

Describe the project's potential environmental effects and their significance, particularly:

- the positive and negative effects on the biophysical and human environments (for example, increased soil erosion; health problems due to air or water pollution; improved sanitation and cleaner or more abundant drinking water);
- any effects the environment may potentially have on the project (for example, negative effects due to flooding, erosion, earthquakes, water level fluctuations);
- any cumulative effects; and,
- potential effects should there be any accidents or malfunctions.

6. Describe mitigation measures that will be implemented to avoid or reduce adverse environmental effects and increase the positive effects of the project.

Mitigation measures should be technically and economically feasible under the project's circumstances. Here are some examples of mitigation measures: locating the project far from sites that are fragile or of particular value, using environmentally friendly waste management practices, protecting waterways from siltation, implementing erosion reduction measures, implementing measures to increase or improve services to adversely affected populations, implementing economic development measures, conducting environmental awareness programs, etc.

7. Taking into consideration the proposed mitigation measures, describe any residual effects that may remain. Would these negative residual effects be significant? Describe any areas of uncertainty about potential effects or their significance. Describe mitigation measures that will be implemented to avoid or reduce any significant adverse residual effects.

8. Describe and discuss any public input received.

It is up to the project manager to decide whether it is appropriate to seek public input to the environmental assessment, and how best to do this. If public input was sought, describe any concerns or expectations with respect to the project that were expressed by the public, and any controversial points that were raised. Describe whether or not public concerns will be dealt with through mitigation measures, or if they remain unresolved.

9. Describe any follow-up program that will be implemented.

If mitigation measures are proposed to reduce negative effects, then a follow-up program must be developed to ensure that the mitigation measures will be implemented and that they are effective. The follow-up program should include a description of the elements to be monitored, the methods to be used and roles and responsibilities.

ANNEX 2: LIST OF DOCUMENTS

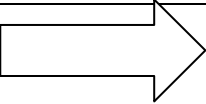
AUTHOR	TITLE	YEAR
Ahmed, Muna A. A. et al.	Dryland Husbandry in the Sudan	2004
Bashkar K. E.	Gash River Flash Floods Challenges to Kassala Town; Mitigation and Risk Management	
Dijk, Johan van et al.	Opportunities for Expanding Water Harvesting in Sub-Saharan Africa; the Case of the Teras of Kassala (IIED)	
Elhag, Muna Mohammed	Causes and Impact of Desertification in the Butana Area of Sudan	2008
Elhassan, Sosan	The Sudanese "Muddy" Stove	
Elsadig E. et al.	Socio-Economic, Environmental Management of Mesquite in Kassala State	1998
International Crisis Group	Beyond the Fragile Peace between Ethiopia and Eritrea: Averting New War	2008
ITDG / Practical Solutions	Smoke – the Killer in the Kitchen	
Laxén, J.	Is Proposis a Curse or a Blessing; An Ecological-Economic Analysis of an Invasive Alien Tree Species in Sudan; Tropical Forestry Reports 32	2007
NLRC/CRC	Project Proposal Summary Sheet	2008
Saal, S. vom, et al.	The Plastic World : Sources, Amounts, Ecological Impacts and Effects on Development, Reproduction, Brain and Behavior in Aquatic and Terrestrial Animals and Humans (in Environmental Research; no. 108)	2008
Samaka Service Centre	The Samaka Guide to Homesite Farming	1973
SRCS	Strategy 2007-2011	2006
Sudan Tribune	Ruling Party to Mediate between eastern Sudan Factions	2008
Tageldin A.	Wood Fuel in the Sudan	1983
UNEP	Post Conflict Environment Assessment	2007
UNHCR	Sudan Operations Update	2008
UNICEF	Evaluation of School Garden Programme in South Sudan	
USAID-FEWS net	Hazards Impact Assessments for Africa	2008
Young, John	The Eastern Front and the Struggle Against Marginalization	2007

ANNEX 3: MISSION SCHEDULE

DATE	ACTIVITY	REMARK
3 November 2008	Travel Geneva – Khartoum	Flight by Egypt Air
4 November 2008	Briefing NLRC/SRCS	Khartoum
	Meeting Fatah Rahman, water engineer SRCS	Khartoum
	Meeting Abu Bakar El Tigani Mahmoud, director international cooperation SRCS	Khartoum
	Meeting Hans Janssen, GRC	Khartoum
5 November 2008	Meeting with Samuel Raik, Sampath Kumar, UNICEF	Khartoum
	Meeting with Mirghani Tag El Seed, Institute of Environmental Studies	Khartoum
	Meeting with A. K. Abdalla, Sudan Metrological Authority	Khartoum
6 November 2008	Meeting with Salah Mohamed, CARE	Khartoum
	Meeting with Clive Bates, UNEP	Khartoum
	Review of documents	Khartoum
7 November 2008	Travel to Kassala by road	Travel KHT-Kassala
8 November 2008	Meeting Hassan, Branch Director SRCS	Kassala
	Briefing NLRC/CRC/SRCS team	Kassala
9 November 2008	Meeting Mohammed Ali Mohamed Alamin, DG MoH	Kassala
	Meeting Yakub Vaid, WHO	Kassala
	Meeting with HAC	Kassala
	Meeting with Mohammed A. Elhai Ali, Groundwater Dep.	Kassala
	Meeting Sudanese Environment Conservation Society	Kassala
10 November 2008	Meeting with Commissioner Telkook	Kassala
	Meeting with Ahmed M. Beitay, Commissioner HK	Kassala
	Meeting with State Drinking Water Corporation	Kassala
	Meeting with WES, Mrs Fatma	Kassala
	Meeting with Clifford Mbizi, RCO-UN	Kassala
11 November 2008	Travel to Oudi by road	Travel Kassala - Oudi
	Meeting Community members Oudi (and separately with women)	Oudi
	Meeting PHC staff	Oudi
	Field visit Oudi to two wells; discussion with water committee	Oudi
	Travel to HK by road	Travel Oudi-HK
12 November 2008	Attendance of solar panels testing	HK
	Field visit to Drondron well, ten wells in HK, latrines, etc.	HK
	Meeting Community members HK (and separately with women)	HK
	Discussion with Mohammed Ali Amin, nutritionist SRCS	HK
	Travel from HK to Kassala by road	Travel HK to Kassala
13 November 2008	Travel from Kassala to Darasta	Travel Kassala to Darasta
	Field visits to pumps and wells	Darasta
	Interview with Mohamed Isa, medical assistant at clinic	Darasta
	Meeting Community members (and separately with women)	Darasta
	Travel from Darasta to Kassala	Travel Darasta to Kassala
	Meeting with Gazin Ahmed, Metrological Department	Kassala
14 November 2008	Review of notes and documents	Kassala
15 November 2008	Travel to Tahgar IDP camp	Travel Kassala to Tahgar
	Meeting Community members (and separately with women)	Tahgar

	Travel to Metateib IDP camp	Travel from Tahgar to Metateib
	Meeting Community members (and separately with women)	Metateib
	Travel back to Kassala	Travel Metateib – Kassala
	Meeting with Mrs Wegman Abdul Rahman FAO	Kassala
16 November 2008	Meeting with Andelquadir Haj Ali Kalid and Abdullah Ali Elshareef, Ministry of Agriculture	Kassala
	Meeting with Alberto X. P. Carlos, UNHCR	Kassala
	Meeting with Isam Abdel Kareem, FNC	Kassala
17 November 2008	Morning: Instructed to stay in hotel because of presidential visit	Kassala
	Meeting with Nor Eldaim Qasm Elseed , Gash Control Unit	Kassala
	Meeting with Mrs Joanna Bryden, Samaritan's Purse	Kassala
18 November 2008	Workshop EIA	Kassala
19 November 2008	Travel to Khartoum by road	Travel Kassala to Khatoum
20 November 2008	Debriefing meeting with NLRC/CRC	Khartoum
	Presentation of results to NLRC, GRC, ARC, SRCS	Khartoum
21 November 2008	Travel Khartoum to Geneva	Flight by Egypt Air

ANNEXE 4: RAPID ENVIRONMENTAL SCREENING SHEET

OBJECTIVES		POTENTIAL NEGATIVE OR POSITIVE IMPACT ON / FROM ENVIRONMENT			+5=High positive to -5=High negative ?=Unknown NR=Not relevant
Goal / Purpose					
Goal: Improved health status of vulnerable people in targeted IDP camps and post-conflict areas; Telkook, Oudi and Hamashkhoreib Purpose: Contribute to improved health status and maintenance of well-being of vulnerable people in targeted IDP camps and post-conflict areas					
Outcome	Activities	DIRECTION OF CAUSALITY		EXPLANATORY REMARKS	
		PROG →ENV	ENV→ PROG	ON : PROG → ENV	FROM : ENV → PROG
1. To provide sustainable safe water supply sources to the communities and four IDP camps per SPHERE standards by 2009	1.1 Water source drilling in Telkook	-3 / +3	-4 / +4	Site selection, abstraction & distribution methods, depletion groundwater, competition with agriculture and livestock, site clearance, hygiene, contamination	Rainfall, size aquifer, water quality & quantity, affordable capital/recurrent costs
	1.2 Changing diesel-powered pumping to solar in IDP camps	+5	-3	Very environmentally friendly technology, easy maintenance and low recurrent costs	High initial investment and replacement costs; alternative with low rate of replicability without outside support
	1.3 Rehabilitation of hand-dug wells in HK & Oudi by lining, aprons, pulleys, etc.	-4 / +2	-4 / +4	Depletion of groundwater, protection, abstraction, hygiene, contamination (particularly in dry season or during years with low rainfall), separation for cattle	Water quality assumed sufficient since chlorination is applied by SP; not linked to dBases MoH, WHO and WES on water quality; possible contamination to be actively monitored
	1.4 Construction of gravity adduction over 4.6 km from pumping site Drondron (HK) to 8 waterpoints in town	+1	-1	Replacement of an already existing adduction system, following the same lining, not risky from an environmental point of view	Deep borehole situated at the foot of rocky outcrop with sufficient yield also in dry season; no replacement of corroded storage tank and polluting and costly diesel pumps
	1.5 Training of water committees, responsible	-1 / +1	-3 / +3		Traditional hand-dug wells are low

	for O&M, fee collection, management of environmental hygiene around water points			Environmental hygiene still has an opportunity for improvement; in general improved elevated lining of wells is practised and separate drinking basins for cattle are constructed but in general protective lids and fences are still lacking; fee collection pushes vulnerable people to traditional non-protected hand-dug wells	yielding and thereby have a relatively high potential for contamination in the dry season; chlorination appears to be less effective in water with high TDS values (> 3,000 mg/l); hence the need to more actively monitor possible chemical contamination
	1.6 Training of pump operators, artisans and mechanics in water supply systems maintenance	-3	-3	Training is ongoing but notwithstanding this in the field it has been observed that the level of machine maintenance is very modest with frequent break downs and oil leaking (potential risk of contaminating shallow ground water)	Fund collection for purchase of spare parts is not satisfactory caused by extreme poverty levels; none of the diesel pumps inspected (provided via other programmes) were not properly maintained; this mainly appears to be a question of lacking incentives
2. To improve the sanitation standards of the targeted project areas as per national standards	2.1 Construction of 150 family / communal latrines in Telkook and 50 in HK and Oudi	-2 / +2	-3	Family latrines with wind pipes are technically well implemented and kept physically apart from wells; communal latrine blocks are deprived of hand washing facilities	Communal latrines are under- or inappropriately utilised, especially in schools they might become a source of transmission of diseases; For cultural reasons women's mobility is very limited and therefore preference is continued to be given to defecate in the direct vicinity of the house (risky in densely populated areas with many hand-dug shallow wells, e.g. HK)
	2.2 Implementation of hygiene promotion and sanitation by training with the help of PHAST; organisation of cleaning activities (e.g. hard waste disposal through periodic community cleaning)	-1 / +1	-5	Positive feedback from women trainees on hygiene promotion; periodic cleaning actions do not provide a systemic answer to an extraordinary high degree of	As observed in the field, especially in HK there is an extremely high lack of consciousness on waste disposal; This appears to be the last of priorities; The problem of plastic bags needs to be urgently

				anarchic hard waste disposal	tackled causing high losses in cattle
3. To improve the hygiene practice towards water and sanitation in the targeted communities by 2009	3.1 Hygiene promoters involved in community education of best practices and bi-weekly clean up campaigns	-2	-4	No visible results; in the best case hard waste is dumped on open, none protected heaps of garbage (including rotting carcasses) and garbage which has not been blown away by the strong winds is burnt every once in a while (Darsala, HK)	Extremely low consciousness of potential detrimental effects of lack of appropriate hard waste disposal on health
	3.2 Refresher courses for hygiene/health promoters, water committees and pump operators how to manage water systems in IDP camps	+2	0	Water management in the camps runs relatively smoothly even although people have to pay a nominal fee	Water in visited Metateib and Togley camps is pumped over big distances (e.g. Togley is connected to the Kassala-Aroma water adduction system). Locally there is no groundwater at exploitable depth; Lesson learned: more directive settlement criteria for camps to be respected (these are spontaneous settlements, which were "formalized" in a later stage)
	3.3 Training of community hygiene facilitators; organisation of orientation sessions and bi-annual review meetings for 140 community leaders; Provision of hygiene and sanitation billboards; Provision of cleaning equipment; Promotion of hard and liquid waste disposal	-3	-5	Results are hardly visible; KAP studies not implemented at outset and during implementation; One cleaning campaign organized by programme in March 2008; no incentives and sanctions built in	In HK there is a lack of continuity, accountability and legitimacy of self-profiled community leaders; agreements are not respected because self-interest prevails over collective interest; with support of the locality-based authorities the programme must negotiate and develop a more institutionalized and formal approach (written contracts to be negotiated and signed on behalf of the community); HK has become dependent on foreign donors are there is not the slightest ownership; coordination at a field level between implementing organisations is strongly recommended

<p>4. Provide essential health service to the IDP populations as well as to plan to handover the services to MoH by end of 2008</p>	<p>4.1 Support and supervise 4 PHC units until the phasing out process has taken place (drugs, incentives, staff training)</p> <p>4.2 Develop a sustainable exit strategy with MoH and local authorities</p> <p>4.3 Promote health awareness and healthy living among IDPs</p>	<p>+1</p> <p>NR</p> <p>NR</p>	<p>-2</p> <p>NR</p> <p>-5</p>	<p>Incinerators in all 8 health centres are being constructed; Support provided leads to effectiveness in tackling multiple infectious and water bound diseases; Well coordinated with MoH; Clinics closed during the weekends</p> <p>Exit strategy under development</p> <p>No apparent bearing on the environment</p>	<p>The bio-physical environment takes it toll: especially during the wet season, water bound diseases are common (AWD, malaria, cholera); this is amplified by poor hygienic practices; Fuel wood smoke provokes respiratory tract problems</p> <p>In principle, the MoH does not supply drugs free of charge, a transfer from subsidized drugs to user fees might exclude vulnerable people from access</p> <p>Healthy living is not only a question of awareness but equally an indicator of stable living conditions and thereby sufficient income</p>
<p>5. Improve access to primary health care activities in communities focussing on the wellbeing of mothers and children</p>	<p>5.1 Support and supervise 3 PHC units and outreach activities in the 3 communities with focus on maternal and child health</p> <p>5.2 Promote health awareness and healthy living among the 3 communities</p>	<p>NR</p> <p>+2</p>	<p>-5</p> <p>-5</p>	<p>No apparent bearing on the environment</p> <p>No apparent bearing on the environment</p>	<p>See 4.3 Degradation of the environment contributes to increased malnutrition; Supplementary feeding of pregnant and lactating women and school children is of an utmost importance</p> <p>See 4 and 5.1</p>
<p>6. Improve the livelihood resilience, with a special focus on women in the target areas, with the intention to establish profitable activities so that people can afford health services</p>	<p>6.1 Construct 3 women and community centres in the three communities; Initiate IGAs for women; Encourage the creation of women groups; Market analysis</p>	<p>+3</p>	<p>-5</p>	<p>Although this activity has not yet really taken off, there are several opportunities for women groups to generate income in a sustainable and environmentally friendly manner (e.g. small livestock and poultry raising, plastic & organic material recycling, forestry nursery with drought-resistant multiple-use species for</p>	<p>The position of women in this traditional area is extremely marginal but as experience in comparable traditional Islamic societies (e.g. Afghanistan, Pakistan) has shown, the male population can be convinced through increased household income; A necessary condition for success is to avail of the services of specialised services of institutions</p>

				livestock, fuel-wood, light construction material and fruit (e.g. dates), organic horticulture with human excrements (latrines); both horticulture and forestry with drip and/or bucket irrigation, fabrication of fuel-wood efficient clay stoves (see FAO Kassala)	like FAO through outsourcing
7. Improve the capacity of branch and communities to respond to outbreaks and disasters in order to support the MoH in outbreak preparedness and response	7.1 Carrying out a retrospective surveillance, as a mapping and an early warning system (EWS) to prepare a response plan identifying the most likely affected areas and risk factors	-5 / +5	-5 / +5	Although the existence of an EWS appears essential for intervening in a rapid and efficient manner, there are no signs as yet on the development of such a plan; A valid response plan must take into account which risk factors cause vulnerability and outbreaks; This is a highly complex matter which goes well beyond health monitoring only;	The magnitude of the slowly creeping degradation of the environment (because of increasingly repetitive floods, drought and probably regional conflict) needs to be apprehended and mitigation measures need to be undertaken to impact on their causes; Without appropriate development activities repetitive humanitarian catastrophes in the region seem unavoidable; While remaining focussed on its core objectives, there is nevertheless an obvious opportunity that SRCS will analyse, coordinate and outsource efforts to reduce the increased vulnerability of an ever important part of the population
8. Increase the branch capacity and support aimed at strategic planning and self-reliance	8.1 Training of SRCS staff in organizational development, community mobilization and assistance in initiating IGAs	+3	-5	See 6.1	See 6.1
9. Improve the physical security through mine education activities	9.1 Dissemination to community on danger of landmines, training 35 ToTs on MRE, general disasters and community-based first aid	+2	-2	Highly relevant for increasing mine awareness, people in visited communities now exactly where the no-go zones are situated; Unfortunately only a small number of victims (30 out of 350) is rehabilitated because of lacking funds	Very unfortunately, during every conflict and regional war landmines and UXOs are still massively used; International actions should be supported which promote a global prohibition on production and use of landmines

ANNEX 5: RAPID ENVIRONMENTAL VULNERABILITY SCREENING

Cause of vulnerability		Effect of vulnerability on:			Vulnerability Rating L=1 H=10	Explanatory remarks
Bio-physical	Human	Bio-physical Environment	Human Environment	Programme Outcomes		
<p>Climate change</p> <p>Decreased rain fall in northern Kassala but higher intensity in shorter time</p>		<p>Desertification, increased run-off and water erosion, lowered ground water table, decreased vegetation cover and exposure to wind erosion, decreased soil fertility</p>	<p>Less fuel wood, lower agricultural production, less pastures, less drinking water available during dry season and thereby increased risk for contamination and corresponding health risks, increased migration and dependence on remittances → Over-utilisation of natural resources leads to downward spiral</p>	<p>Reduced community resilience to external shocks, reduced number of livelihoods coping mechanisms to deal with increased vulnerability;</p> <p>Decreased ground water level and low yields during dry season necessitate a strict monitoring of water quality and quantity</p>	<p>9</p>	<p>Better utilisation of traditional "teras" water harvesting practices is an opportunity to increase soil moisture</p> <p>Fuel wood management is another opportunity, preferably with drought-resistant wind breakers</p> <p>Reseeding of pastures needed</p> <p>Water quality monitoring in shallow hand-dug wells needed i.p. during the dry season</p> <p>It would be useful if the SRCS early warning system would be linked to that of the Gash Control Unit and metrological department</p>
<p>Repetitive flash floods of the Gash river by intensive rainfall in deforested highlands of upper-watershed in Eritrea</p>		<p>Gradual raise in level of river bottom through considerable sedimentation, particularly where there are bottlenecks like at Kassala bridge: River bed is too narrow and shallow to allow the flash flood to remain inside the embankments</p>	<p>Massive suffering, displacement and contamination of wells; major risk for outbreak of water-bound disease in Kassala town and in Gash delta</p>	<p>Relevant to outcome 7 in terms of disaster preparedness and response</p> <p>In the medium-term the effectiveness of protection measures (higher earthen embankments to protect Kassala town) appears to be doubtful.</p>	<p>7</p>	
	<p>Regional conflict Ongoing regional conflict has transformed Kassala into a major recipient area of Eritrean, Ethiopian and Somali refugees. This has substantially amplified the already existing environmental</p>	<p>A longitudinal comparison of satellite images shows to what extent especially the vegetation cover around the camps has suffered. This deforestation has contributed to erosion, decreased soil moisture and fertility</p>	<p>Refugees' livelihood systems depend on remittances from unskilled labour and especially charcoal production for the urban market</p>	<p>Monthly arrival of refugees is around 1,500 persons. (18,000 per year) which transforms the camps in both quasi permanent and, at the same time, transit settlements.</p>	<p>5</p>	<p>How should, in the future, the government and INGOs deal with increasing numbers of refugees? Who are victims of conflict and who are "environmental refugees"?</p> <p>How to mitigate undesired environmental effects (pressure on fuel wood and water) and competition for unskilled labour?</p>

	vulnerability					
	<p>National insurgency Internal displacement of around 90,000 persons (presently 62,000) from former HK locality, settled in IDP camps has amplified the already existing environmental vulnerability</p>	See regional conflict	<p>See regional conflict</p> <p>IDPs are reluctant to return to their communities because of landmines and UXOs but especially because in the IDP camps a higher level of basic services is found (schooling, health clinics, drinking water, food help, etc). One important positive effect of the camps is girls schooling. In the communities of origin only 4% of the girls attend school.</p> <p>The presence of IDPs has led to many land conflicts</p>	<p>Although SRCS is pulling out from the camps, there is no guarantee that in the future basic services will be subsidized. Food support by WFP has stopped since 3 months, MoH will not subsidize drugs, a user fee is charged for drinking water. During the present extremely dry year, IDPs mainly depend on remittances (80%), charcoal production and a few heads of small livestock. Food and cattle reserves are exhausted and another dry year will undoubtedly lead to another humanitarian catastrophe.</p>	7	<p>For understandable reasons the government appears to be reluctant to either close the camps (jeopardising livelihoods of extremely vulnerable population) or to transform them into permanent settlements (e.g., land conflicts with authentic population).</p> <p>In the meantime, during extremely difficult years (as the present one) humanitarian organizations should prevent from withdrawing from support without any viable exit strategy in place.</p> <p>The proportion of landmine victims which is effectively taken care of is about 10%. Funds have to be made available for both mine clearance and for the rehabilitation of victims.</p>
	<p>Hard waste disposal Hard waste is indiscriminately scattered around in the communities. The hard wind blows away the lighter material (plastic) everywhere. Rotting carcasses are dumped with household waste. This appears to be a problem of culture and lacking incentives and sanctions.</p>	The hazards of contamination by poor waste disposal to the quality of air, water and soil are unknown by the population.	<p>Cattle suffocates or cannot digest and collapses by eating plastic; ground water is polluted by chemical and bacterial contamination, not to speak about the smell.</p>	<p>The problem is of such a magnitude that voluntary strategies as awareness raising and ad-hoc cleaning campaigns will not make much of a difference.</p> <p>A complete overhaul of the followed strategy is needed. There is an obvious opportunity to build in positive incentives by valuing hard waste for environmental purposes and also the use of sanctions should not be excluded</p>	10	<p>In the first place one can think of using compost latrines and practising composting of organic waste (combined with bucket irrigation for small scale organic horticulture for women or school garden) or even the recycling and reutilisation of plastic (although for reasons of profitability a certain critical mass is needed; therefore it seems rather more appropriate for towns like Kassala).</p> <p>An assessment needs to be made on quantities and categories of hard waste, in smaller communities like HK before imagining practical and attractive solutions (e.g. plastic collection for a nominal fee or non monetary incentive by children)</p>

	<p>Questionable policies Establishment of mechanised agriculture schemes in Gash delta</p> <p>Government decision to systematically eradicate all <i>Prosopis juliflora</i> (Mesquite) because without proper management it has proven to be an invasive species propagating itself very rapidly and competing with agriculture for water.</p>	<p>Biodiversity has been considerably reduced. As can be seen on satellite images, drought has led to a rapid deterioration of soil conditions in this area.</p> <p>Under the extreme dry conditions of the semi-desert Mesquite is the only tree species which can effectively serve as a drought-resistant windbreaker halting desertification. On the other hand, it strongly competes with agricultural crops for water.</p>	<p>Cattle corridors have been blocked leading to more sedentary forms of livestock keeping on reduced space and thereby to overstocking and over utilisation, and thereby rapid degradation of range lands.</p> <p>It is now generally recognised that extensive range land management is the land use system which is best adapted to the environmental site conditions.</p> <p>Mesquite can be perceived as the "poor-men's-tree". Under extreme climatic conditions it enables to produce reasonable quality fuel-wood which is transformed into charcoal for cash income. Eradication would mean that poor people will not any longer have access to energy and cash.</p>	<p>Conflicts on land use between agricultural settlers, agro-pastoralists and nomads occur very frequently</p> <p>The apparent preference of mechanised agriculture over extensive livestock has jeopardised the capacity for environmental resilience and coping mechanisms of a large part of the most vulnerable population.</p> <p>GRC's new programme courageously tackles a number of prejudices and aims to transfer a "public enemy" into a friend. The added value is timber, fuel-wood, pod flower for human and animal consumption and veterinary and pharmaceutical use.</p>	<p>8</p> <p>8</p>	<p>An environmentally friendly integration of rain-fed agriculture with extensive range-land management needs a well-coordinated approach between different tribes. Failing to do so, ongoing land degradation might again fuel conflict with central government.</p> <p>The basic assumption for success is that active management of undesired tree propagation (e.g. in agricultural areas) is feasible. This is not yet a common practice. The local population rather has the habit of "extracting" natural resources without actively intervening in order to manage possible damage to the environment.</p>
	<p>Energy With the exception of camps (where LPG is used) the entire rural population cooks with fuel-wood. This is done by the so-called "three stones" fire-places, which are highly fuel-wood inefficient (appr.</p>		<p>Over time, multiple experiences have been implemented in Kassala with fuel-wood efficient stoves: FAO improved clay stoves; Practical Action improved clay stoves developed at Wau Nour camp cuts fuel use in half.</p>	<p>Highly important to address the vulnerability of households on increasing time consuming collection of fuel wood and to cut down the speed of deforestation.</p>	<p>9</p>	<p>There is an obvious opportunity to contact FAO and Practical Action Kassala (Wau Nour camp) and to integrate lessons learned into the intervention package.</p>

	8% fuel wood efficiency)		<p>According to WHO, with 2.1 million death per year acute lower respiratory infections is the world's leading killer of children under five. Indoor smoke is a major "killer in the kitchen".</p>	<p>Statistics from the PHC show confirm complaints of women on extensive exposure to kitchen smoke.</p>	<p>There is an obvious opportunity for the programme to address this critical issue.</p>	10	<p>Although cooking with a cleaner fuel would be preferable the purchasing power of the population is too low to allow for alternative fuels as kerosene, not to speak about LPG (practised by Practical Action in Kassala). Improvements as smoke hoods and chimneys seem to be the only viable alternative but also here it is doubtful whether the rural population can afford it without outside financial support. This issue should be subject to further investigation.</p>
--	--------------------------	--	--	---	--	----	--

ANNEX 6 : RAPID ENVIRONMENTAL SCOPING SHEET

RANK	PRIORITISED SUBJECTS		ASSESSMENT BASED ON					SRCS FUTURE INVOLVEMENT	
	VULNERABILITY (VU)	PROGR → ENV ENV → PROGR (EN)	Community discussion	Field observation	Interview 3rd organizations	Organizational review	Literature review	DIRECT	INDIRECT
VU-1	Climate change Rainfall pattern, aquifer size, groundwater tables, risk of contamination, water harvesting, flash floods Gash river		√	√	√	√	√	Collect data, document experiences, and disseminate them; outsource more practical interventions to specialized agencies	Don't work in isolation, many data which are important for your work are out there
VU-2	National insurgency Coping mechanisms of IDPs, exit strategy from IDP camps, consequences for access to basic services,		√	√	√	√	√	Reassess the capacity of IDPs to cope with basic services and food security	Either reconsider decision to withdraw from support or renegotiate with basic service providers on modalities of support
VU-3	Regional conflict Degradation of direct environment of refugee and IDP camps, mitigation, future status of camps,			√	√	√	√	Assess the magnitude of environmental damage	Advocacy needed for convincing UNHCR to remain involved in environmental mitigation measures
VU-4	Energy Low fuel wood efficiency, kitchen smoke as a health risk			√	√	√	√	Consider to introduce fuel wood efficient stoves	In collaboration with FAO and "Practical Action"
VU-5	Waste management Management of hard waste, problems for cattle and human beings, lack of incentives and sanctions, plastic, organic waste, liquid waste		√	√	√	√	√	See EN-5 A complete overhaul of hard waste strategy is needed in favor of building in incentives	See EN-5
VU-6	Questionable policies Mechanised agriculture schemes, eradication of Mesquite		√	√	√	√	√	Remain informed on ongoing land conflicts and serve as a facilitator for conflict solution	Contact INGOs like e.g. Search for Common Ground.
EN-1		Rehabilitation hand-dug wells	√	√	√	√	√	To be more involved in water	Closer link to major players

		Depletion of groundwater, water abstraction, yield, safety, water quality, separation, O&M, costs, respect of SPHERE standards						quality monitoring of improved wells	and their water quality dBases
EN-2		Response plan outbreak and disasters Floods, epidemic outbreaks			√	√	√	Continued involvement in flood and outbreak response (response plan)	Closer link to EWS of major players (Metrological Dpt. and Gash Control Unit)
EN-3		Improved physical security Dissemination on danger of landmines and UXOs	√	√	√		√	Might add victim rehabilitation to programme	Possible link with Handicap International
EN-4		Borehole drilling Site selection, water abstraction, yield, groundwater depletion, site clearance, safety, water quality, hygiene, O&M, costs, respect of SPHERE standards	√	√	√	√	√	Disseminate relevant experiences to other actors	To be more involved in sharing lessons with major actors
EN-5		Sanitation: hard waste Degree of pollution, categories of waste, risk for contamination, effects of hygiene promotion and cleaning campaigns	√	√		√	√	Build in incentives for waste collection, recycling and utilization	Support Kassala municipality with plastic recycling (see model Ouagadougou) and NGOs reutilization of plastic
EN-6		Sanitation: latrines Model, household, communal utilization, risk soil & water contamination, effects of hygiene promotion, respect of SPHERE standards		√		√	√	Introduce composting latrines and support organic horticulture for women/schools	Contact "Practical Action" for introduction of compost toilets
EN-7		Changing diesel to solar O&M and replacement costs, environmental friendliness, sustainability	√	√		√	√	Carefully monitor and document the performance of the solar powered system	Share lessons with major actors in the drinking water sector
EN-8		Improvement livelihoods resilience Cultural barriers, staff training, potential of IGA to finance basic services, ecological alternatives		√	√	√	√	Introduce environmentally friendly IGA for women	SRCS not being specialized in many of the opportunities it needs an attitude of actively looking for relevant information

ANNEX 7

CHECKLIST FOR INTERVIEWS WITH MALE AND FEMALE COMMUNITY MEMBERS

Local history

- Evolution of the environment over time (rainfall, vegetation, soil)
- Evolution of livelihood conditions (livestock husbandry, agriculture, forestry, distribution of tasks)
- Evolution of basic services (shelter, water, food, energy, health, security, education)
- History of conflict (displacement, landmines, personal safety, relationships, social cohesion)
- History of natural disasters (displacement, floods, other)
- Evolution of coping mechanisms addressing environmental degradation and vulnerability

Livelihood assessment

- Assessment of natural, human, social, and economical capital
- Cost of food items and other basic needs

Project interventions

- Appreciation of health activities, WatSan activities, income generating activities
- Sustainability mechanisms (willing/able to cover the recurrent costs)
- Magnitude of replacement costs of capital goods and recurrent costs and service charges
- Mechanisms for community organization
- Organizational capacity of community (accountability, transparency, legitimacy)
- Gender sensitiveness
- Possible solutions and opportunities for mitigation of vulnerability (internal, external)
- Expectations from outside support vs capacity for self-reliance
- Need for capacity building.

ANNEX 8: TIMELINE HISTORICAL ANALYSIS CONFLICTS AND DISASTERS

INTERNALLY DISPLACED PERSONS	REFUGEES	YEAR
	From 1967: Refugees Eritrean Independence War	< 1975
Major flood Gash river		1975
	Refugees Independence War in Eritrea	1976
		1977
		1978
		1979
		1980
		1981
	Refugees Independence War in Eritrea	1982
	Refugees Independence War in Eritrea	1983
	General drought , Refugees Independence War in Eritrea	1984
	Refugees Independence War in Eritrea	1985
	Refugees Independence War in Eritrea	1986
Internal displacement from Gash scheme, Flood Gash river	Refugees Independence War in Eritrea	1987
Internal displacement from Gash scheme, Flood Gash river	Refugees Independence War in Eritrea	1988
		1989
	Refugees Ethiopia to Laffa	1990
		1991
		1992
		1993
	Repatriation refugees	1994
		1995
		1996

ANNEX 9: DATABASE WHO – SELECTED COMMUNITIES KASSALA STATE, 2008

#	Locality	Admin/Unit	Water Source	Coordination		Date Visit	pH	TDS	E.C	F
				Longitude	Latitude					
1	Hamshkorabe	Kagreit	O.H.D.W	N 17 06 96 4	E036 44 54 5	23/4/08	7.6	750	1489	1.1
2	Hamshkorabe	Sharma	O.H.D.W	N 17 06 96 4	E036 44 69 3	23/4/08	7.4	549	1093	1.05
3	Hamshkorabe	Aldakhelia	O.H.D.W	N 17 06 99 7	E036 44 66 3	23/4/08	7.6	475	953	1.25
4	Hamshkorabe	Abrgeit	O.H.D.W	N 17 06 99 0	E036 44 77 1	23/4/08	7.6	387	774	1.4
5	Hamshkorabe	Abou khashmain	O.H.D.W	N 17 06 98 5	E036 44 92 1	23/4/08	7.6	544	1089	1.25
6	Hamshkorabe	Aljame	O.H.D.W	N 17 07 06 0	E036 44 76 3	23/4/08	7.6	562	1124	0.95
7	Hamshkorabe	Eisa Abou Amna	O.H.D.W	N 17 07 04 3	E036 44 60 3	23/4/08	7.4	586	1177	1.25
8	Hamshkorabe	Mohammed Eisa 1	O.H.D.W	N 17 07 35 2	E036 44 51 3	23/4/08	7.6	1320	2600	1.25
9	Hamshkorabe	Mohammed Eisa 2	O.H.D.W	N 17 07 35 5	E036 44 51 4	23/4/08	7.4	1320	2640	1.05
10	Hamshkorabe	Hadab	O.H.D.W	N 17 07 31 1	E036 44 32 6	23/4/08	7.4	1.04	2090	1.2
11	Hamshkorabe	Sehreig no 1	O.H.D.W	N 17 07 18 7	E036 44 37 1	23/4/08	8.2	342	682	0.85
12	Hamshkorabe	Hawaneit	O.H.D.W	N 17 07 43 2	E036 44 63 2	23/4/08	7.6	744	1502	0.65
13	Hamshkorabe	Tetayat 1	O.H.D.W	N 17 07 48 1	E036 44 65 3	23/4/08	7.5	850	1699	0.85
14	Hamshkorabe	Tetayat 2	O.H.D.W	N 17 07 48 2	E036 44 65 6	23/4/08	8.2	1130	2270	1.1
15	Hamshkorabe	Akra dirar 1	O.H.D.W	N 17 07 22 9	E036 44 72 8	23/4/08	7.5	790	1578	1.15
16	Hamshkorabe	Akra dirar 2	O.H.D.W	N 17 07 39 0	E036 44 78 2					
17	Hamshkorabe	Edreisab	O.H.D.W	N 17 07 82 3	E036 44 99 2	23/4/08	7.7	432	861	0.9
18	Hamshkorabe	Mahmoud A. Ahmed	O.H.D.W	N 17 07 63 0	E036 44 75 2	23/4/08	7.6	605	1209	0.95
19	Hamshkorabe	Alshaikh Souliman	O.D.W	N 17 07 55 3	E036 45 06 7	23/4/08	7.6	261	523	0.55
20	Hamshkorabe	Mohammed Rdei	O.H.D.W	N 17 07 56 1	E036 44 97 7	23/4/08	7.6	426	848	0.95
21	Hamshkorabe	Basheetab	O.H.D.W	N 17 07 47 2	E036 44 83 6	23/4/08	7.7	502	1004	1.1
22	Hamshkorabe	Mohammed Taheir	O.D.W	N 17 07 33 3	E036 44 75 9	23/4/08	7.4	1840	3620	1.1
23	Hamshkorabe	Deeheity	O.H.D.W	N 17 07 41 9	E036 44 89 9	23/4/08	7.6	636	1276	1.25
24	Hamshkorabe	Nabtab	O.H.D.W	N 17 07 43 4	E036 44 95 9	23/4/08	7.1	1220	2440	1.1
25	Hamshkorabe	Mahmoud Mohammed Ahmad	O.H.D.W	N 17 07 35 2	E036 44 98 3	23/4/08	7.4	617	1325	1.4
26	Hamshkorabe	Kamalab	O.H.D.W	N 17 07 29 8	E036 44 84 1	23/4/08	7.4	825	1652	1.1

27	Hamshkorabe	Rahama Ali Oonour	O.H.D.W	N17 07 28 6	E036 44 85 2	23/4/08	7.4	1590	3190	1.3
28	Hamshkorabe	Yousab	O.H.D.W	N 17 07 24 9	E036 44 84 2	23/4/08	7.4	694	1393	1.25
29	Hamshkorabe	Barakt	O.H.D.W	N 17 07 22 5	E036 44 75 9	23/4/08	7.4	919	1836	1.15
30	Hamshkorabe	Baria 1	O.H.D.W	N 17 07 10 6	E036 44 81 4	23/4/08	7.4	1050	2100	1
31	Hamshkorabe	Aboudi	O.H.D.W	N 17 07 08 7	E036 44 83 7	23/4/08	7.4	757	1523	1.05
32	Hamshkorabe	Baria 2	O.H.D.W	N 17 07 18 3	E036 45 03 2	23/4/08	7.4	652	1300	1.1
33	Hamshkorabe	Almohajreen	O.H.D.W	N 17 07 0 72	E036 45 05 9	23/4/08	7.4	613	1228	1.1
34	Hamshkorabe	Mouscar Talkook 1	O.H.D.W	N 17 06 84 0	E036 45 36 2	23/4/08	7.3	1570	3120	1.45
35	Hamshkorabe	Mouscar Talkook 2	O.H.D.W	N 17 06 91 5	E036 45 49 8	23/4/08	7.4	760	1430	1.3
36	Hamshkorabe	Adam Mousa	O.H.D.W	N 17 07 20 4	E036 44 66 0	23/4/08	7.1	1570	3110	1.25
37	Hamshkorabe	Ali Hadab	O.H.D.W	N 17 07 29 6	E036 44 66 1	23/4/08	7.3	2440	4890	1.35
38	Hamshkorabe	Gar Aieba	O.H.D.W	N 17 07 22 6	E036 44 58 5	23/4/08	7.6	1580	3160	1.35
39	Hamshkorabe	Katioi	O.H.D.W	N 17 07 28 4	E036 44 48 8	23/4/08	7.5	2620	5310	1.5
40	Hamshkorabe	Shraaba	O.H.D.W	N 17 07 27 2	E036 44 52 6	23/4/08	7.4	2080	4120	1.3
41	Hamshkorabe	Husein Wad Alshaikh	O.D.W	N 17 07 36 4	E036 44 04 9	23/4/08	7.2	1110	2260	1.1
42	Hamshkorabe	Alshaikh Souliman Alsouge	O.H.D.W	N 17 07 58 0	E036 43 52 3	23/4/08	7.4	391	783	0.85
43	Hamshkorabe	Drondron	O.H.D.W	N 17 09 47 9	E036 45 77 5	23/4/08	7.6	332	669	0.95
44	Hamshkorabe	Hashayeabe	Borehole	N 17 08 13 4	E036 44 99 3	23/4/08	7.8	474	937	1
45	Hamshkorabe	Udee	O.H.D.W	N 16 56 45 5	E036 28 34 2	23/4/08	7.8	377	755	1.5
46		Udee Sehreeg	Borehole	N 16 56 40 8	E036 28 06 7	23/4/08				
47		Musa Krift	O.H.D.W	N 17 07 33 2	E036 44 06 6	23/4/08				
48	Talkook	Talkook (A)	O.D.W	N 16 05 .60 7	E 036 39 .7 33	05.03.2008	8	239	478	1.1
49	Talkook	Talkook (B)	Borehole	N 16 05 .26 7	E 036 39 .7 98	05.03.2008	8.2	392	786	1.5
50	Talkook	Talkook ©	Borehole	N 16 05 .38 9	E 036 39 .8 27	05.03.2008	7.6	245	483	1.1
51	Talkook	Talkook (D)	Borehole	N 16 05 .44 8	E 036 39 .8 80	05.03.2008	8	142	174	0.9
52	Talkook	Talkook (E)	O.D.W	N 16 05 .55 6	E 036 39 .7 59	05.03.2008	8	224	449	0.8
53	Talkook	Talkook (F)	H.P	N 16 05 .39 2	E 036 39 .8 12	05.03.2008				
54	Talkook	Talkook (G)	H.P	N 16 05 .50 4	E 036 39 .8 05	05.03.2008				
55	Talkook	Tahdai (A)	O.D.W	N 16 00 .70 6	E 036 33 .6 83	05.03.2008	7.6	222	444	0.2
56	Talkook	Tahdai (B)	O.D.W	N 16 00 .68 0	E 036 33 .7 37	05.03.2008	8.1	200	398	1.3

57	Talkook	Tahdai (C)	Borehole	N 16 00 .72 5	E 036 33 .7 82	05.03.2008				
58	Talkook	Yadroot (A)	O.D.W	N 16 00 .71 9	E 036 33 .7 82	05.03.2008	7.7	325	648	1.15
59	Talkook	Yadroot (B)	O.D.W	N 15 51 .93 5	E 036 37 .7 29	05.03.2008	7.8	343	683	0.95
60	Talkook	Haladiet (A)	H.P	N 15 45 .19 2	E 036 37 .7 50	05.03.2008	6.8	403	801	0.65
61	Talkook	Haladiet (B)	H.P	N 15 45 .25 9	E 036 32 .9 32	05.03.2008	7.3	265	535	1.4
62	Talkook	Haladiet (C)	H.P	N 15 45 .16 8	E 036 33 .0 20	05.03.2008	7.1	864	1706	1.1
63	Talkook	Haladiet (D)	H.P	N 15 45 .20 1	E 036 32 .9 53	05.03.2008				
64	Talkook	Darasta (A)	H.P	N 15 41 .88 3	E 036 31 .0 86	05.03.2008	7.8	214	428	1
65	Talkook	Darasta (B)	H.P	N 15 41 .81 1	E 036 31 .1 13	05.03.2008	7.7	302	604	1.3
66	Talkook	Darasta (C)	H.P	N 15 41 .78 9	E 036 31 .0 62	05.03.2008	7.6	286	564	1.5
67	Talkook	Darasta (D)	Borehole	N 15 41 .75 9	E 036 31 .0 91	05.03.2008				
68	Talkook	Darasta (E)	H.P	N 15 41 .79 6	E 036 31 .0 92	05.03.2008				
69	Talkook	Darasta (F)	H.P	N 15 41 .74 3	E 036 31 .0 91	05.03.2008	8.4	185	373	1.4
70	Delta South	Togole Alswoug	W.T	N 15 26 55.95	E036 13 55.2	16\4\08	7.8	176	352	0.55
71	Delta South	Togole Alabar	W.T	N 15 26 55.96	E036 14 06.4	16\4\08	7.8	179	358	0.5
72	Delta North	Matatabe A	O.D.W	N 15 26 55.111	E036 10 31.0	16\4\08	7.5	407	817	0.75
73	Delta North	Matatabe B	O.D.W	N 15 26 55.112	E036 10 31.9	16\4\08	7.1	452	905	1.1
74	Delta North	Hadalya	W.T	N 15 26 55.127	E036 07 74.3	18\4\08	7.3	543	1090	0.55

ANNEX 10: RECOMMENDED LITERATURE

1. EXAMPLES OF PLASTIC RECYCLING AND REUTILIZATION

Documents and websites in English

- <http://siteresources.worldbank.org/DEVMARKETPLACE/Resources/205097-1090596582429/103601.pdf>
- http://somebird.blogspot.com/2006_12_01_archive.html
- <http://www.womensenews.org/article.cfm/dyn/aid/3231/context/archive>
- http://www.ilo.org/public/english/employment/recon/eiip/download/waste_recycle/business_manual.pdf
- http://www.waste.nl/content/download/315/2521/file/CS-pla%20ind_ebook.pdf
- <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/0,,contentMDK:20294303~menuPK:181053~pagePK:210083~piPK:152538~theSitePK:244381,00.html>
- <http://www.unhcr.org/cgi-bin/teaxis/vtx/news/opendoc.htm?tbl=NEWS&id=4420002f4>
- http://www.waste.nl/content/download/560/4328/file/Pla-vogler_ebook.pdf
- <http://www.waste.nl/content/download/284/2234/file/UW2%20PLASTIC%20ebook.pdf>

Documents and websites in French

- <http://www.terra-economica.info/Le-plastique-c-est-fantastique.html> (needs free registration)
- http://www.pmie.org/epa/gdda/Actions/Action_D06/Enseignements_D06.pdf
- <http://www.gret.org/ressource/pdf/07766.pdf>
- http://gafreh.ouvaton.org/index.php?option=com_frontpage&Itemid=1
- <http://www.afrik.com/article15478.html>
- http://gafreh.ouvaton.org/images/stories/Prospectus_gafreh.pdf

2. EXAMPLES OF ECOSAN / COMPOST TOILETS / COMPOSTING

Documents and websites in English

- www.mtnforum.org/rs/ol/counter_docdown.cfm?fid=1895.pdf
- http://www.irc.nl/content/download/24282/273405/file/SSS_2006.pdf
- www.practicalaction.org/practicalanswers/product_info.php?products_id=237
- http://www.ecosanres.org/toilets_that_make_compost.htm
- <http://www.kwaho.org/t-ecosan.html>
- http://www.eawag.ch/organisation/abteilungen/sandec/publikationen/publications_swm/downloads_swm/diplomaThesis.pdf

3. EXAMPLES OF IMPROVED STOVES / WOOD SMOKE

Documents and websites in English

- www.practicalaction.org/docs/smoke/itdg%20smoke%20report.pdf
- www.practicalaction.org/?id=smoke_report_home
- http://ehs.sph.berkeley.edu/krsmith/publications/94_barnes_1.pdf
- <http://ww2.unhabitat.org/cdrom/wuf/documents/Networking%20events/Added%20material/Building%20Bridges%20with%20the%20Grassroots/Sudan.pdf>
- <http://www.hedon.info/ImprovedInstitutionalStovesForSudanSchools>
- http://journeytoforever.org/at_woodfire.html
- <http://www.paceproject.net/UserFiles/File/Energy/reducing%20kitchen%20smoke.pdf>
- <http://www.hedon.info/docs/BP50-6-Charron.pdf>
- <http://www.fao.org/docrep/006/AD546E/ad546e00.pdf>
- <http://www.energyandminerals.go.ug/DOCS/HOUSEHOLD%20Stoves%20Construction%20Manual.pdf>
- <http://www.hedon.info/BP22:TheClayTestingCentre-Sudan>
- http://www.oxfam.org/en/programs/emergencies/sudan/stoves_050505.htm
- http://www.usaid.gov/our_work/humanitarian_assistance/disaster_assistance/sectors/files/uganda_final_summary.pdf
- <http://www.humanitarianinfo.org/darfur/uploads/idp/Cooking%20fuel%20-%20helpdoc%20by%20UNJLC.pdf>
- <http://www.hedon.info/TheSudaneseMuddyStove>
- <http://www.unhcr.org/cgi-bin/texis/vtx/protect/opendoc.pdf?tbl=PROTECTION&id=406c368f2>

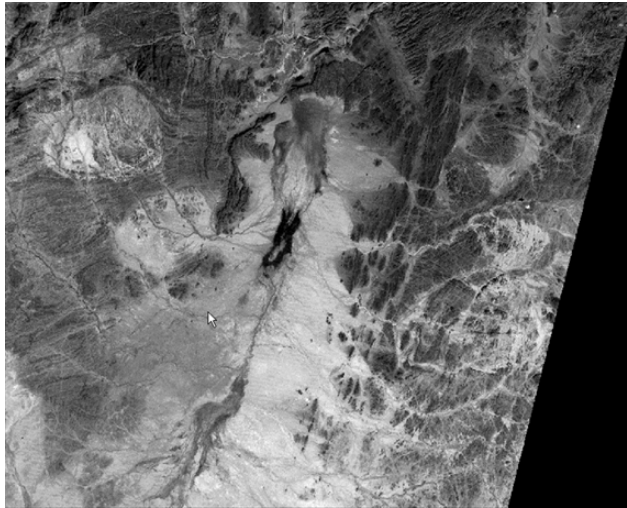
4. LITERATURE ON MESQUITE

- <http://www.dwaf.gov.za/wfw/Control/BioDossiers/11.Mesquite.pdf>
- <http://pr.hec.gov.pk/Chapters/679-1.pdf>
- http://bft.cirad.fr/cd/BFT_082_33-38.pdf
- http://www.gardenorganic.org.uk/pdfs/international_programme/CookingWithProsopisFlour.pdf
- http://plants.usda.gov/plantguide/pdf/cs_prgl2.pdf
- http://www.gardenorganic.org.uk/pdfs/international_programme/FloridaSynthesis.pdf
- http://www.southwestnrm.org.au/publications/downloads/17_mesquite-press.pdf
- <http://ag.arizona.edu/SRER/proceedings/Pease.pdf>
- http://en.sl.kvl.dk/upload/142_net.pdf
- http://www.gardenorganic.org.uk/pdfs/international_programme/ProsopisMonographMainText.pdf
- http://www.gardenorganic.org.uk/pdfs/international_programme/Prosopis-PolicyBrief-1.pdf
- http://www.gardenorganic.org.uk/pdfs/international_programme/Prosopis-PolicyBrief-2.pdf
- <http://www.ses-sudan.org/english/conferences/Environment/1/A%20G%20T%20Babiker.pdf>
- <https://oa.doria.fi/bitstream/handle/10024/4317/isprosop.pdf?sequence=1>

ANNEX 11: SATELLITE IMAGES: HAMASHKHOREIB 1973, 1984, 2000 AND 2008

LANDSAT: <http://www.landsat.org/ortho/index.php>

ILWIS FREE GIS SOFTWARE: <http://www.itc.nl/ilwis/downloads/ilwis32.asp>



1973



1984



2000



2008