Impact and Cost Benefit Analysis

A Case Study of Disaster Risk Reduction Programming In Red Sea State Sudan, 2009

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Executive Summary

Red Sea State in Sudan suffers regular droughts which have resulted in increased vulnerability of the indigenous nomadic Beja pastoralist community. Activities that were once coping strategies have become part of normal regular patterns of activity despite the fact that they are of an unsustainable nature.

The Norwegian and Danish Red Cross have supported the Sudanese Red Crescent Society, for over twenty years, to undertake longer term programming that aims to reduce the vulnerability of the Beja population to recurrent droughts and protect, where possible, the assets that communities have in order to build resilience to disasters.

With this support the Sudanese Red Crescent Society has been programming in five sectors:

- Food Security/livelihoods
- Health
- Water
- Education
- Women's Development

The Sudanese Red Crescent adopted an integrated, multi-sectoral approach to programming providing inputs in different sectors to the same communities over an extended period of time. This study:

i. Examined the impact of the interventions undertaken
ii. attempted to undertake a cost benefit analysis to determine whether the interventions undertaken were economically efficient.
iii. determined community based indicators of resilience by engaging with communities.

The Programmes
It was evident from discussions with communities and local Governments that the programmes implemented had considerable impacts on the targeted population. Examples such as the terraces and earthdams/embankments enabled households to undertake successful agricultural activities, providing both food for consumption and the possibility to diversify diets as well as the possibility to sell produce and earn an income. This was particularly the case in the example of the terracing in Al Manar where the intervention was targeted to internally displaced people that would otherwise have been destitute due to loss of livestock. Furthermore, cost benefit analysis indicated that these projects were economically efficient with a benefit to cost ratio of greater than 2:1.

Water interventions such as the installation of hand-pumps and the construction of hafirs have also impacted positively on pastoral communities. In Delai, the construction of the hafir may have prevented potential conflict, as well as improved an otherwise precarious water supply for nomadic pastoralists. Cost benefit analysis also indicated that the project was economically efficient with a benefit to cost ratio exceeding 2:1.

Perhaps the two most important interventions supported by the SRCS were the education inputs and women's centers. The impact of the education support is being realized through increased attendance at pre-school[1], while other activities such as classroom construction have facilitated primary and secondary education by providing enhanced learning environments which in turn has improved performance. The opportunity for education is likely to result in societal changes in behaviour and promote development.

The women centers are enabling women to gain new skills and knowledge including literacy, health and nutrition awareness which is being translated into their household practices, improving health and

[1] Pre-school attendance is mandatory prior to acceptance at schools.

hygiene of both women and children. These interventions have started to influence the Beja traditions and societal norms positively and will continue to do so in the future.

Sustainability and the level of "substitution" of Government services/responsibility occurring in the programme are two areas of concern. This is not a new issue for the programme[2] but does require noting as it is likely to have a considerable impact on the ultimate success of the programmes.

Lessons learned: Cost Benefit Analysis
It was only possible to do a cost benefit analysis for four interventions during the study; however a number of learning points about undertaking a cost benefit analysis have been recorded. These include:

- Where integrated multi-sectoral programming is undertaken it is difficult to compare cost efficiency between the different interventions, however it is possible to measure the cost efficiency of the whole programme.
- While doing CBA assumptions are regularly made and necessary to do the calculations. While these assumptions are noted as part of the description for the calculations undertaken it remains unclear at what stage the compound uncertainty of multiple assumptions and data issues faced render the confidence in the results too low for acceptance.
- Pastoralists rely heavily on social obligations/kinship for survival. Many respondents suggested that their ability to undertake social obligations was a key impact of the interventions. These are difficult to quantify particularly as they can often leave the direct target beneficiary community.
- Nomadic pastoralists are constantly on the move and this made verification of numbers difficult and sometimes meant that cost benefit analysis could not be calculated**.**

Without a clearer link between undertaking cost benefit analysis and programming decisions it is unlikely that national societies would as a routine undertake such studies. In addition, to do so would require technical support from analysts with the requisite skills. Increasing investment in basic monitoring and evaluation skills may be a more worthwhile investment since it is unlikely (as evidenced from this study) that cost benefit analysis is accurate enough in an "ex post" or "looking back" scenario.

There is however potential to use cost benefit analysis for future programming:

-To help design economically efficient programmes and activities, i.e. the traditional "ex ante" usage of cost benefit analysis.
-By including the necessary indicators for measuring cost and benefits from the beginning of a programme/activity, integrated in any baseline analysis, to enable more quantitative and efficiency driven monitoring.

Community Based Indicators of resilience
The study team identified, through community consultations, five context specific indicators to monitor resilience. These were then categorized into four potential global indicators for monitoring the strengthening of community resilience and safety. The proposed global indicators are:

- favourable market access
- lack of productive asset loss
- lack of distress migration
- social capital

[2] Please see Evaluation of the Sinkat Community Development Project and Port Sudan Organizational Development Programme, 2004 and Mid-Term review Derudeb and Haiya Integrated Rural Food Secuirty Programme, Red Sea State, 2006

1.0 Background

1.1The Sudan

Sudan is the largest country in Africa with approximately 2,500,000 square kilometers of land and a population of 39 million people. The population of Sudan consists of over 600 different ethnic groups, which are increasingly concentrated in urban centers of the country's 26 semi-autonomous states.

Since achieving independence in 1956 Sudan has been in a state of intermittent civil war. A situation that is unlikely to change in the foreseeable future. Conflict continues in Darfur but tensions are also rising in Southern Sudan with recent localized conflict. Problems are also emerging with the Beja Consortium of Kassala and Red Sea States.

Sudan ranks as number 150 of 182 countries based on the United Nations Human Development Index (HDI). Average life expectancy in Sudan is 57.4 years and child mortality (death before the age of five), despite a decreasing trend, remains high at 89/1000 live births.[3] Hundreds of thousands of people in Sudan continue to live below the poverty line without access to adequate safe drinking water, food, healthcare, education or shelter. High levels of poverty, combined with factors such as insecurity, population displacement and lack of social services have exposed the population to disease. The leading cause of morbidity and mortality in Sudan is malaria. Furthermore preventable diseases such as diarrhoea are common with 40% of the population lacking sustainable access to safe drinking water and only 24% having improved sanitation.

Sudan is also vulnerable to natural hazards, with frequent droughts and floods. There is also mounting evidence of long term regional climate change in parts of the country including Red Sea State. Projections suggest further decreases in rainfall which would have a devastating impact on the population.

1.2Red Sea State

Red Sea State is located in the east of Sudan and borders Egypt to the north, Eritrea and Kassala state to the south and River Nile State to the west. The north east of the state is flanked by the Red Sea Mountains, while the Red Sea lies to the east[4]. The State contains the country's main sea port, namely Port Sudan.

The 1993 census determined the population of the state to be 800,213 people. The indigenous tribe of Red Sea State is the Beja, which is composed of four sub-tribes, the Hadandawa, Busaharien, Amarar, and Beni Amir. The Beja are mainly nomadic agro-pastoralists.

The overall poverty rate in Red Sea State is 65% with the localities of Sinkat, Haya and Derudeb (the "triangle of hunger"), the poorest in the state, having an overall poverty rate of 90%.

"Beja pastoralists have over the years adopted a set of dynamic and flexible strategies aimed at facilitating survival by allowing for the exploitation of multiple resources. Such strategies, such as mobility, herd diversification and redistribution and a strict body of customary rules, have ensured the resilience of the Beja pastoral system for centuries and have allowed people to recover from the frequent droughts and outbreaks of famine which have repeatedly struck the region. However, these strategies have been fundamentally weakened by a range of external factors which have contributed to undermine the resilience of the Beja livelihoods system."[5]

[3] For further Statistics please refer to the UN Human Development Report 2009 and UNICEFs' State of the Worlds Children, 2008.
[4] See Map for identification of SRCS/DRC/NRC programme sites.
[5] Addressing chronic livelihood vulnerability in Red Sea State, HPN, 2006, M.Babiker and Sara Pantuliano

These factors have resulted in a shift from livestock keeping to an increasing reliance on a range of unsustainable activities such as charcoal making which were once used only as coping strategies at time of stress. These strategies once employed for coping have been incorporated into the normal patterns of activities and generate the majority of the cash income of the household.

The normal annual rainfall in Red Sea State ranges from 0-200mm. Table 1. below demonstrates rainfall data from Sinkat town in Red Sea State from 1994-2002.

Table 1. Rainfall in Sinkat town between 1994 and 2002

	Annual rainfall mm									
Location	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Sinkat	81.3	71.5	30.0	0	61.5	201.5	67.4	0	7.8	58

Source: Evaluation mission period 1997-2003, Sinkat 22 Feb-12 March 2004, Note more recent rainfall data was not available to the study team.

The Beja rely on rain for access to water and agricultural including the management of their livestock. Poor and irregular rainfall has lead to recurrent droughts with decreasing time between periods of lack of rain. As a result the Beja population has suffered from crop failures and the lack of pasture for animal grazing. Poor pasture coupled with the requirements for grazing animals has increasingly resulted in environmental degradation and desertification. The increase in environmental degradation and desertification has impacted negatively on the agro-pastoral livelihood of the Beja people, with many households losing their herds and migrating to settlements of internally displaced people located on the outskirts of urban centres.

Water resources are limited in Red Sea State. In addition cycles of drought have resulted in the drying of sources such as open wells, which in turn has impacted negatively on human and livestock health. The deterioration of livestock health impacts negatively on the livelihood of the Beja, who rely on livestock for milk and to sell in markets to source cereals and other food and non-food commodities. Unhealthy animals yield less milk and are less likely to become pregnant threatening the viability of the herd. Furthermore, the lack of water and pasture means that smaller livestock, such as goats, are sold in large numbers resulting in markets being flooded by goats reducing livestock prices and producing poor terms of trade for the Beja pastoralists.

These cycles of drought are intermittently interrupted by floods. These floods result from rains falling in the mountains and concomitant runoff carried by seasonal streams, known as Khors, building up and not draining into the sea. The fact that the flows of water are often uncontrolled means that the path of water flow can result in damage to crops and loss of livestock. Therefore these floods further exacerbate already vulnerable livelihoods.

1.3 The Sudanese Red Crescent

The Sudanese Red Crescent Society (SRCS) was established in 1956 and became a member of the Movement in 1957. A major revision of the constitution took place in 1996, when the general assembly approved a resolution passed by the central committee related to decentralization of the management and volunteer structure. Subsequently, the regional branches gained autonomy as the decision making process was transferred from headquarters.

The mission statement of the SRCS, adopted in 1999, is to “alleviate the suffering and strengthen the capacity of the most vulnerable groups of the community through emergency relief and development programmes, independently and in collaboration with public authorities, other components of the Movement, and non-governmental organizations in accordance with Red Cross Red Crescent Fundamental Principles and the Geneva Conventions”.

The national society's activities include disaster response (providing food, health and other forms of assistance to displaced and disaster-affected people in different areas of the country); Disaster preparedness (gives priority to six state branches situated in transitional zones bordering the troubled southern part of the country to allow them to respond more efficiently to the recurrent need for assistance by IDPs); Health where branch volunteers help in community mobilization, dissemination, training of first aid and primary health care, vaccinations and HIV/AIDS control programmes among others; as well as a number of community development programmes with the support of participating National Societies; and lastly institutional or organizational development.

The Sudanese Red Crescent has also recently developed a Five year Food Security Strategy (2009-2014). The food security strategy emphasizes three key focus areas that relate to work under review during the study. These are:

- Access to nutritious foods, new income or production options, healthy mothers, well supervised children, and engagement by elderly.
- Coherence with other Branch activities (health, hygiene, disaster preparedness)
- Competency to provide small, useful mitigation, relief and recovery food security support in times of acute crisis

The Red Sea State branch of the SRCS has a network of sub-branch offices, including those located in Sinkat, Haya and Duredeib towns. These sub-branch offices are staffed through paid staff and volunteers. In addition the branch offices have over twenty years experience of direct relief assistance as well as implementing programmes aimed at improving livelihoods and food security. The Sudanese Red Crescent Society programming in Red Sea State is therefore a suitable site for undertaking DRR impact and cost benefit analysis.

1.4 The Study

This study is intended to contribute to a Federation-wide effort to improve disaster risk reduction (DRR) performance measurement and impact analysis.[6] For this purpose, a draft cost-benefit analysis (CBA) methodology was piloted as a key feature of the assessment process. The methodology was based on lessons learned from conducting a community-based CBA with the British and Nepal Red Cross Societies[7], and lessons learned from a recently completed Impact and Cost Benefit Analysis in the Philippines. The case study in the Philippines[8] field tested a Cost Benefit Analysis tool that is currently under development by Oxfam America. This study has used the same tool as that used in the Philippines.

The objectives of the study were:

1. To identify both qualitatively and quantitatively the key aspects and outputs of the Sudanese Red Crescent Society's Greater Sinkat Community Development Projects (Sinkat, Haya and Derudeb) that have contributed towards increased and sustainable community safety and resilience.

2. To undertake a quantitative cost-benefit analysis of the programs.

3. To contribute to a broader Federation-wide effort to improve disaster risk reduction performance measurement and impact analysis[9]. This includes identification and definition of measurable and objective indicators of community safety and resilience as well as development of DRR impact

[6] The objective of this global initiative is "to globally map and quantify, on an on-going basis, International Federation DRR programmes and activities, including monitoring of performance, impacts and resultant increases in community safety and resilience."
[7] Measuring Cost benefits of community disaster risk reduction in Ilam, Nepal, 2008
[8] Case study of the Philippines National Red Cross Community based Disaster Risk Management Programming, Part 1 and 2, 2009
[9] The objective of this global initiative is "to globally map and quantify, on an on-going basis, International Federation DRR programmes and activities, including monitoring of performance, impacts and resultant increases in community safety and resilience."

assessment and CBA methodologies applicable by National Societies. Within this framework a similar impact and cost-benefit analyses has been performed in the Philippines in September-October 2009. This current Red Sea State study progresses from the Philippines study, refining and testing developed methodologies and lessons-learned.

Annex1. contains the full terms of reference for the study. Discussions prior to undertaking field work directed the study team to focus efforts in two specific aspects of the TOR, the Cost Benefit Analysis and the identification of community based indicators of safety and resilience.

2.0 Methodology

The methodology for the study consisted of review of secondary data, key informant interviews, focus group discussions and Cost Benefit Analysis. Interviewees included SRCS programme staff, NRC and DRC representatives, line ministries and community members in the different localities. See Annex 2. for the list of people interviewed. Attempts were consistently made to triangulate data in order to verify reliability and ensure that recall information over the project period was as accurate as possible, however due to time constraints this was not always possible.

2.1Selection of Study Areas

Derudeib, Haya, and Sinkat Localities were chosen as the study sites because they were the Localities covered by the DRC and NRC support to the SRCS disaster risk reduction activities. While many villages/towns were covered by the programmes in Derudeib and Haya, focus groups and key informant interviews were conducted at 8 sites that implemented disaster risk reduction interventions. In Sinkat focus groups were conducted in 3 sites that had implemented DRR activities. Table 2. below details the sites visited per locality. Key informant interviews were undertaken with SRCS staff and volunteers, health centre staff, and ministries involved in the programmes, as well as community members.

Table 2.Villages or Towns where data was collected in each Locality

Derudeib Locality	Haya Locality	Sinkat Locality
Derudeib town	Hamisiet	Tomsha
AlManar *	Sanganai	Halgiet
Delai	Solqibab	Ciet*
Leshob		
Algarada		

*These are IDP settlements in the surroundings of the main towns of Derudeib and Sinkat.

These sites were chosen for four reasons:

- They represent the broad range of activities undertaken in the two programmes.
- Some of the villages selected implemented more than one DRR intervention while others implemented a single intervention.
- The selected villages are spread across the geographical area covered by the two programmes.
- They represent the diverse population targeted by the programmes.

2.2 Definition of the project scenario

The programme scenario to be assessed, in order to analyze the costs and benefits of DRR activities, was the situation “without” and “with” DRR interventions. In other words the questions the study is trying to answer are:

• Without DRR interventions: What would have been the impact of the hazard (drought) on the community before the DRR intervention had taken place?

• With DRR interventions: What is the impact of the hazard (drought) on the community now that DRR interventions were implemented?

Using these two questions to guide data collection and the Draft Oxfam America Guidelines for Cost Benefit Analysis[10]; cost benefit analyses for different intervention types is presented. The study specifically compares these two scenarios to determine the impact of DRR on the community, calculating the net benefits and costs that accrue from the DRR initiative.

All projects can have macro and micro level impacts. Micro level impacts are defined as those that occur within the scope of the project itself, and have an impact on the community being assessed. Macro level impacts are those that affect the wider economy. This study does not include an analysis of macro level impacts, however where possible these are eluded to. The aim of this study was to identify all relevant qualitative and quantifiable impacts on the communities that undertook the DRR interventions.

3.0 Programme Descriptions

3.1 Programme Overview

NRC and DRC support to SRCS disaster risk reduction programming in Red Sea State began after the infamous 1984/85 famine. The NRC support began around 1987/88 while the DRC support began at the end of the eighties. Both the NRC and DRC supported programmes have spanned a considerable time period (20 years) and large geographical areas. The respective intended impacts of the two programmes are described in the programme objectives:

NRC[11]: "to re-establish the means of subsistence of 250,000 Beja nomads to prepare them and the environment to cope with future climatic extremes."

DRC[12]: "the vulnerability of drought affected rural population living in Derudeb and Haya administrative units, Red Sea State is reduced, human and animal lives are saved and livelihood systems are made sustainable."

The target population of the programmes is dispersed over wide geographical areas but can be grouped into 3 distinct groups. These are:

- Populations in permanent settlements
- Populations in semi-permanent settlements, resulting from pastoralists forced to settle as a result of loss of livelihood caused by recurrent droughts (IDPs)
- Agro-pastoralists populations where all or part of the household move in search of water and pasture

As a result of the complex nature of food and livelihood insecurity in Red Sea State both the NRC and DRC programmes had a diverse range of project activities. Activities were chosen through participatory processes with stakeholders. Table3. below lists the different project activities undertaken by SRCS within each of the DRC and NRC supported programmes.

Table 3. List of activities supported by DRC and NRC funding

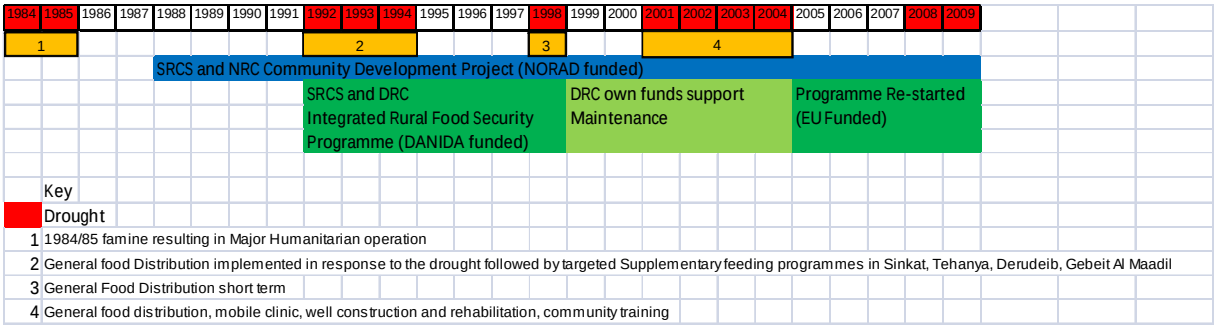
Activity	DRC	NRC
Terrace Construction/Rehabilitation	√	√
Earth Dam/Embankment	√	√
Rock filled Embankments	√	√

[10] Draft Oxfam America Guidelines for cost benefit Analysis.
[11] Evaluation of the Sinkat Community Development Project and Port Sudan Organizational Development Programme, 2004
[12] Mid-Term review Derudeb and Haiya Integrated Rural Food Security Programme, Red Sea State, 2006

Hafir Construction	√	√
Womens Centres	√	√
School Building Construction	√	√
Hand dug well construction & rehabilitation	√	√
Open Well Construction	√	√
Rehabilitation of handpumps	√	√
Communal Vegetable Gardens	√	√
Income Generation Activities	√	√
Health Centre Construction	√	√
Support to Education	√	√

It is important to note that both these disaster risk reduction programmes have been implemented during a number of drought periods. These droughts have required the Red Sea State Branch to respond through relief activities including food distributions. Diagram1. below provides a timeline of droughts, relief activities and the disaster risk reduction activities undertaken by SRCS from 1984 to 2009. The last substantial rains fell in the year 2006, therefore the current study is taking place at a time when the Beja population is under threat of another drought.

Diagram 1. Time line of events in the programme areas



3.2 Constraints on programme implementation

Programme implementation was challenging as a result of the large distances between beneficiaries and the migratory nature of at least part of the target population. These factors made it difficult to establish finite user groups to manage community assets during programming and made it more difficult for the study team to measure impact.

Furthermore the SRCS approach of engaging with communities over a long time period, (programming reviewed spanned over 20 tears), with intermittent periods of support to build ownership and a strong relationship with communities means that intervention sites have had repeated inputs over years. This meant that it was not always possible to track exactly what inputs happened when and at what cost.

Prior to field visits review of documentation and discussions with key informants suggested that the description of the programmes in the Terms of Reference (TOR) as having distinct phases does not accurately reflect implementation on the ground. In fact two issues have influenced the design and implementation of this study. These are:

- The Danish Red Cross (DRC) programme reviewed for this study began in the late 1980's. A long term development programme was funded by Danida from 1993 to 1998. This funding ceased in 1998. During the following period minimal funds were provided by DRC to maintain the activities already undertaken through Danida funding. In 2005 the DRC secured funding through European Union budget lines to support the SRCS to continue the same type of programming. More recently further EU funds have been secured to expand programming until 2012.

- The Norwegian Red Cross (NRC), NORAD funded programme has been less systematically planned and implemented and therefore cannot be adequately described by the phases used in the TOR, and while being extensive in nature it has suffered with regards to a lack of:

    - Clarity of decision by the NRC to support programming in Red Sea State, which has lead to funding insecurity.
    - Long term plans and programme direction resulting from annual or haphazard funding decisions

In addition the NRC programme was also initially implemented by Norwegian Red Cross delegates and therefore programme documents from the 1980s and early 1990's are not possessed by the SRCS branch office. This situation changed in the late 1990's early 2000's when the programme was fully implemented by the branch office of the SRCS.

As a result of these factors and time constraints the team focused data collection to determine cost benefit analysis on interventions supported by the DRC. However it was possible to provide qualitative impact analysis of both DRC and NRC supported interventions.

4.0 Impact and Cost Benefit Analysis

The following section contains a qualitative description of the impact of the interventions visited by the study team. Where data was available a cost benefit analysis of an intervention is presented. A CBA could not be produced for all interventions, therefore when a CBA is not presented an explanation is provided. Interventions from the different programme areas are grouped together based on their intended outcome. For the purpose of reporting interventions are grouped into Food Security/Livelihoods, Health, Water Interventions, Women's development, and Education. However, it is important to note that the integrated approach to programming adopted by SRCS, i.e. multiple interventions within the same community is likely to be a predominant factor in the realization of the impacts described below.

4.1 Food Security/Livelihoods

Three different food security/livelihoods interventions were visited by the study team. These were terrace construction, earth embankment/dam construction and communal garden development. These interventions were undertaken across both the NRC and DRC supported programmes.

4.1.1.Terrace[13] Construction, Al Manaar, Derudeib

The population targeted by this intervention were pastoralists that had lost their herd and were forced to settle on the outskirts of Derudeib town in semi-permanent settlements. Livestock are the most important asset for agro-pastoralists and the loss of complete herds meant the target population was destitute and without the means for a sustainable livelihood. In these circumstances, the displaced population relied on daily labour and the receipt of support from community members based on kinship practices. The photograph below shows the construct of terraces which are designed with inlets and outlets that allow water to enter and flow in controlled areas for agricultural production. The water sources are seasonal khors or rivers that form as a result of run-off from the mountains surrounding the area. SRCS supported the community in Al Manaar to construct the terraces and provided tools etc. for the farming to take place. The communities themselves undertook the construct of the terraces. In addition SRCS made available fuel for the use of the loader for shifting large quantities of sand. The result has been an expanse of terraces that now supports fruit and vegetable production and provides a cash income to 3680 otherwise destitute households. The community supported is now able to engage in a sustainable livelihood and undertake important social obligations of sharing. **In fact income from the terrace project is such that**

[13] Terraces is a term used by the Government of Sudan; technically these terraces refer to micro- catchments.

the key informant spoken to indicated that they have the ability to save money. The key informant also indicated that the area cultivated is now probably one of the main suppliers of fruit and vegetables to Duredeib. In fact his products in a very good production year (2006) reached Sinkat and Port Sudan markets.

Cost benefit Analysis Result

While the main hazard in Red Sea State is drought, the terrace intervention yields benefits every year and not just when droughts have an impact. In order to calculate the cost benefit ratio of the terrace construction project it was assumed that the terraces should be viable and bring benefits for the community for the next 10 years. A discount rate[14] of 10% is assumed. **Using these assumptions terraces were found to have a cost to benefit ratio of 1:61 indicating that the investment was economically efficient.** For the tables used to calculate the costs and benefits accrued please see Annex 2.

4.1.2. Earth Dam/Embankment Lashob

Earth embankments were constructed to control the flow of seasonal Khors (rivers) and trap water for agricultural cultivation. The embankments are larger structures than the terraces mentioned above and tend to be formed on the edges or sides of the Khors to prevent water from flowing in all directions and dissipating. The embankments visited in Lashob were made up of four packed earth structures that each stretched 2.5 km in length. The distribution of land for cultivation is controlled by traditional tribal committees of elders. Land within the embankment catchment is distributed annually according to the demand. All demands from community members are met i.e. no one is refused land. The different plot sizes are determined by the traditional tribal committees of elders.

Discussion with a key informant suggested that **the embankment was successful in increasing agricultural production. In fact it was noted that in a year with reasonable rain agricultural production can double.** The focus of production in Lashob is sorghum[15] and it is used for the households own consumption rather than for sale in the market. Even this year, which is a drought year, it was possible to produce some sorghum which would have been difficult prior to the construction of the embankment. Without the embankment, the little water run-off available from the rain in the mountains would have dissipated reducing access to sorghum. This increased access to sorghum is likely to make households more food secure, because despite reliance on rainfall even small amounts of rain in any given year enable sorghum production.

Cost Benefit Analysis Result

Sorghum production would take place annually with or without the embankment, however the embankment permitted additional agricultural production during drought periods, therefore an annual drought probability of 40% was used to estimate the likelihood of droughts. In order to calculate the cost benefit ratio of the earth dam/ embankment construction project it was assumed that they should be viable and bring benefits for the community for the next 10 years. A discount rate of 10% is assumed. **Using these assumptions earthdams/ embankments were found to have a cost to benefit ratio of**

[14]The **discount rate** is used to discount costs and benefits occurring in the future, as people place a higher value on assets provided in the present and a lower value on benefits that may accrue further into the future. The discount rate is normally equivalent to the average return one might expect if the same money was invested in an alternative project, and can be derived by looking at the rates used for similar projects within the country

[15] Sorghum is the staple grain in Red Sea State

1:2.4 indicating that the investment was economically efficient. For the tables used to calculate the costs and benefits accrued please see Annex 2.

4.1.3.Communal Vegetable Garden, Hamisiet

The SRCS supported the development of communal gardens in Hamisiet. The photograph below is of one communal garden in the village of Hamisiet. The garden, with a total cultivated area of 5 feddan[16] is able to produce vegetables and fruit for all twelve months of the year as a result of an irrigation system. Thirty of the 280 households in the village work on the communal vegetable garden at any given time of the year. Households rotate working on the garden throughout the year. The households working on the farm at a given point of time retain 70% of production either to earn an income through sales or for household consumption while providing 30% of production to other community members. This is a considerable impact of the project as social obligations of sharing are important traditional practices and allow for development of social capital which is an important coping strategy during times of crisis. **Communal gardens have therefore enabled households to build resilience to future disasters through increased social capital.**

Focus group discussions suggested that malnutrition had decreased as a result of the vegetable and fruit production secured through the communal garden. This could not be verified with nutritional status data for the area. However examination of the nature of the vegetables and fruits grown suggests an increase in diversity of diet has been achieved. This could contribute to improved health and nutrition through increased calorie and micronutrient consumption.

The area has also become recognized for vegetable production resulting in the establishment of a transport route to Haya, the closest market town. This has provided the villagers with easier access to Haya town where health and other services are available. The villagers also noted that production is so successful that they are able to support neighbouring villages, something they could not do prior to the development of the communal vegetable garden. This again extends the communities social capital, which can be drawn upon during crises, increasing their resilience.

During the team visit it was noted that the solar power used to pump water for irrigation of the communal garden was not functioning due to the damage to a solar panel. This was replaced by the standby arrangement of a diesel pump so that irrigation could continue, while the SRCS secured a new panel from the GoS (at a subsidized price). **In order for this project to be of a truly sustainable nature the community will need to reach a level of self sufficiency that allows it to purchase and maintain such key equipment.**

Cost Benefit Analysis Result

Due to the irrigation system in place benefits are realized annually from the communal garden intervention. In order to calculate the cost benefit ratio of the communal gardens project it was assumed that they should be viable and bring benefits for the community for the next 10 years. A discount rate of 10% is assumed. **Using these assumptions communal gardens were found to have a cost to benefit**

[16] 1 Feddan is equivalent to 0.42 Hectares.

ratio of 1:1800 indicating that the investment was economically efficient. For the tables used to calculate the costs and benefits accrued please see Annex 2.

4.2 Water

4.2.1 Hafir Construction , Delai

The photograph below shows a Hafir. Essentially a large whole dug out in the ground that holds runoff water, from surrounding mountains. Runoff water is caught through a catchment that feeds into the Hafir. This particular Hafir was reported to be able to hold water for 2-3 years following a good year of rainfall. Despite the current drought the study team observed that it appeared to hold considerable amounts of water. The Hafir was built by the SRCS to provide water for human and livestock consumption of nomadic pastoralists that undertake annual migration to North Kassala from an area known as the Sahel.

Delai village, which is nearby the hafir, has two wells however these contain insufficient water to support the large influx of pastoralists with their herds. This often resulted in problems (sometimes conflict) between the settled population of Delai and the pastoralists who used the villages water supply during their travels. During focus group discussions the pastoralists reported that they used to have to take turns using the wells in Delai village and therefore suffered losses of animals. In some cases they would be refused to water their animals which would mean the herd would have to travel for 50 days without the opportunity to secure water, thus increasing the risk of livestock losses.

The hafir has reduced the loss of livestock and increased the health of animals by reducing the time they must travel without access to sufficient water. It has also provided water for the pastoralists themselves reducing their suffering. They also reported a decrease in diarrhoeal diseases; however this could not be confirmed by morbidity data. Tensions between the settled population of Delai and the pastoralists have decreased since the pastoralists no longer need to use the wells in Delai. In fact the villagers of Delai now use the hafir as the capacity of the wells, to support the population living in Delai village, is limited.

The SRCS continues to improve the Hafir and more recently has provided fencing in order to prevent people and animals reaching the water edge and possibly contaminating the water. A pump now provides water at troughs for livestock watering and at a separate elevated tank for human consumption. Future plans include the development of further sand filtration structures (using appropriate low technology, indigenous methods) to prevent the silting of the hafir and to maintain its capacity to hold water.

Cost Benefit Analysis Result

The hafir provides water annually whether a drought year is being experienced or not. In order to calculate the cost benefit ratio of the Hafir project it was assumed that they should be viable and bring benefits for the community for the next 15 years. A discount rate of 10% is assumed. **Using these assumptions Hafir's were found to have a cost to benefit ratio of 1:2.7 indicating that the investment was economically efficient.**. For the tables used to calculate the costs and benefits accrued please see Annex 2.

4.2.2 Sub-surface water dam, Tomsha

In arid and semi-arid areas, sand and gravel deposits associated with streams and rivers can provide water for drinking purposes as well as for irrigation. Such watercourses are generally seasonal, but can be perennial. Riverbeds that are dry but have green vegetation along their banks and bed suggest that there must be a source of water below riverbed level.Natural subsurface dams are often the reason for such areas of accumulated water and the resultant greenery. An outcrop of bedrock lying across a river acts as a dam and prevents the downstream flow of the subsurface water within the sand bed of the river. Seasonal flood flow also saturates the riverbanks.

Using this knowledge the NRC and SRCS constructed a sub-surface dam in a river bed in order to recharge ground water which had all but disappeared in the area as a result of recurrent droughts. The sub-surface dam was constructed in a large seasonal river bed (Khor). Prior to its construction and as a result of recurrent droughts the population of Tomsha village had completely migrated to the peri-urban centre of Erkowitt and the town of Sinkat due to the lack of water.

After the sub-surface dam construction was complete groundwater was recharged and water was available. The displaced community returned to inhabit the village accessing water through wells that were constructed. Open wells now provide the water source for the village and water was available during the study teams visit. Some shortages do arise in the summer, but this is to be expected with a seasonal catchment and the recurrent droughts experienced. Villagers suggested that they would source water from Erkowitt, a three hour round trip, if shortages were to occur.

An interview with the community health worker suggested that the number of cases of diarrhoea has decreased from 15 cases per month to 5 cases per month since the increased access to water. This is important as access to free medicines to treat diarrhoea is limited to Oral Rehydration Salts. Other medicines to treat diarrhoea cost 3 SDG per treatment

Cost Benefit Analysis Result
It was not possible to undertake a cost benefit analysis of the sub-surface dam because the costs associated with the construction of the sub-surface water dam were not available to the study team. This was because the construction took place in 1989 approximately 20 years prior to the study. In addition, at the time of construction the NRC was implementing the programme through delegates and therefore the SRCS does not have records (budgets) pertaining to that period of the programme.

4.2.3 Hand pumps and protected wells, Al Garada

Al Garada is an isolated area that has a Khor or seasonal river running through it. Communities accessing the site are spread over a large geographical area and it is not possible to estimate the number of people and livestock that use the site. The area is used to access water for both human and livestock consumption. Prior to the construction of the handpumps and protected wells the practice was to dig hand-dug wells on an annual basis to access water from the seasonal river bed. These hand dug wells would often collapse when the Khor would fill with water and hence required re-building on an annual basis. With support from the SRCS improved and raised wells with hand-pumps were installed. These coupled with hand-dug wells that have protective lids have meant that there is no longer a need to dig wells on an annual basis and the time to dig wells has been reduced from one month to a few hours for hand-pump installation or maintenance work**. This reduced the work required by surrounding communities to access water and reduced the risks associated with digging hand-dug wells, i.e. possible injury or death, resulting from the unstable hand-dug well construction.**

Focus groups also suggested that the time to collect water was shortened since the hand-pump simplified water collection, which was traditionally done using a bucket and rope. Animal losses

have also been reduced because waiting time for water has decreased. This is particularly important as the wells are used by nomadic pastoralists.

During the visit it was observed that the hand-pump was lower than when inserted as a result of silting and the build-up of mud as a result of the flow of the Khor. While efforts have been made to dig around the hand-pump by the community it would appear mechanical digging will be required. This suggests that the hand-pump will require regular maintenance; furthermore an elevated concrete structure (curtain) may be required in order to reduce the effects of silting. The SRSC is aware of the issue and is seeking an appropriate solution to the problem.

Cost Benefit Analysis Result
It was not possible to do a cost benefit analysis for the hand-pumps and protected wells in Al Garada because it was not possible to estimate the number of people that use the site to access water. This was because communities that used the site were dispersed over a large area as well as being nomadic pastoralists.

4.3 Women's Centres

The following sections describe discussions held at different Womens Centres across the three administrative units of Haya, Duredeib and Sinkat. The concept of Women's centers was originally instigated by British Red Cross and was replicated by SRCS through the support of NRC and DRC. Three different Women's Centres were visited. The centre in Duredeib was in the town of Duredeib and was in fact attached to the SRCS sub-branch office. The centre visited in Sanganai was in a rural community some distance from any urban centre while the third centre visited was in the outskirts of Sinkat town in a displaced community (having lost all livestock). The centers all have a similar model of operation and input. The activities undertaken in the centres included:

- Income Generating Activities such as sewing and dom palm mat production.
- Nutrition and food preparation education
- Maternal and child health classes
- Literacy classes
- Kindergarden

The centres are supported by centre supervisors and animators to work with the women and children attending. As an example Section 4.3.1 below describes the activities and impact analysis of the Women's Centre of Sanganai.

4.3.1 Women's Centre Sanganai, Haya

The women's centre in Sanganai is located in a rural setting. This community is a livestock dependent community. The SRCS is well established in the area and has supported the community over many years. The women's centre originally started activities in a structure made of traditional materials of wood and woven palm leaves. More recently it has moved into a more permanent structure. Discussions were held with both men and women in the location in order to gain an insight into the perspectives of men and women on the centres. This was particularly important because of the conservative traditions of the Beja tribe.

It was evident through discussion with the community leaders and the women themselves that affording the opportunity to women to meet other women is perhaps the greatest achievement of the centre. Rural households are traditionally dispersed across large areas and therefore the opportunity to exchange knowledge, experience and information is restricted by these large distances and the tradition of women

to stay at home. The centre provides a trusted focal point for women to gather, overcoming practical and traditional inhibitors.

The activities undertaken in the centre include maternal health and hygiene education, home economics classes, maths and literacy classes. Underlying all the different activities in the Women's centers are literacy classes. The literacy classes have benefitted women by giving them the possibility to learn Arabic (the language used in towns and hence markets) and enabled them to do mathematics. A number of impacts can arise from literacy programmes. Those realized through the literacy classes in the Women's Centres include:

Cultural change: has resulted from challenges to attitudes and behavioural patterns and underlies many of the changes described below.

Human Benefits: including increased self esteem and empowerment which could result in socio-economic self reliance. It should be noted that during the visit a recital was read by one of the women attending the Women's Centre. This demonstrates an increase in confidence gained by women attending the Women's Centre. Traditionally women would be more reserved particularly in the presence of strange men.

Social Benefits: Hygiene and maternal health classes were held at the women's centre. The result has been improved health of women, including reproductive health; as well as improved child care resulting in healthy and educated children. Simple hygiene practices such as the use of soap were addressed. The need to bath and even cleanse oneself during menstruation was addressed alongside the provision of latrines and bathing areas. This was new information and knowledge for women in the community of Sanganai. Women did not bath prior to the efforts made through the women's centre. In addition maternal and child health classes enabled the prevention of harmful traditional practices. For example, usually the community would stop feeding pregnant women in the last trimester of pregnancy. Through maternal and child health classes this practice was reversed and it was realized that pregnant women should be fed energy enriched food in order to support the growth of the foetus. In addition, the home economics classes provided women with the knowledge of nutritionally adequate diets as well as exposing women to more diverse food stuffs.

Economic growth: Literacy has supported income generating activities including the sale of food products and dom palm mat production. While the latter activity produced an income it should be noted that this does not appear to be the activity where greatest impact was achieved despite the fact that women now work together and hence produce a mat faster than previously. Women in the community of Sanganai used to produce mats on their own. One mat could take 15 days to produce. Now working in groups of three they can produce a mat in 4 days. A mat is worth 8-9SDG in the local market. The earnings secured are then shared equally among the group of three women. The money is used by women to purchase commodities such as sugar and oil to improve the household diet.

It can therefore be concluded that the impact of Women's centers has been considerable. While not readily quantifiable in terms of a cost benefit analysis the fact that communities, through observation of neighbouring communities with Women's Centres, are requesting the construction of Women's Centres in their villages suggests that the impact is considerable and recognized by communities. The following paragraph, while not directly associated with women's centers, perhaps best summarizes the impact of the Women's Centres.

"*The spread of literacy has emerged as a major factor in economic and social development. In fact, the linkages between education, health and nutrition are mutual and complementary. The strong linkages between education, health, nutrition and reduced fertility result in synergies, which can*

transform vicious cycles of poverty, illiteracy, malnutrition and disease into virtuous cycles of learning and health, equity and sustainable development." [17]

Cost benefit analysis result

It was not possible to do a cost benefit analysis for the centres because the benefits, particularly those associated with less tangible impacts such as self-esteem, confidence, exchange of knowledge and experience were difficult to apply an economic value to. However these less tangible results are perhaps the greatest impact of the women's centres.

4.4 Health

4.4.1 Hospital, Duredeib Town

The hospital in Duredeib was previously supported by UNICEF, however this support was withdrawn and the SRCS has provided various support measures to the hospital from 1995 onwards. This has included the rehabilitation of the pharmacy, the building of a new laboratory and storage room, children's ward and a delivery room. In addition accommodation was built adjacent to the hospital for doctors to live in. This was done to attract doctors to come to work in Duredeib since it is often difficult to persuade doctors to work in such rural areas of the Sudan.

The construction of new facilities has resulted in key impacts. For example, the laboratory facility has enabled faster and more accurate diagnosis. Previously doctors were forced to rely on clinical diagnosis or in complicated cases request laboratory tests from Sinkat, which is some distance away and could result in delays in treatment of patients.

The delivery room has improved hygienic practices during delivery and enabled safer deliveries to take place by also including the provision of materials. While 15-20 deliveries are realized per month in the hospital many more occur in homes. In addition to support to the hospital 28 midwifes were trained in order to provide delivery assistance at home and were equipped in order to ensure hygienic practices. **The director of the hospital attributes these two actions to a reduction in complications resulting from pregnancy and birth and a reduction of maternal deaths.**

Volunteers have also been trained on first aid and home care follow-up. For example, in the case of TB patients, follow-up by volunteers ensured that patients were more likely to complete treatment. In addition money was provided to ensure that food was available to those undergoing treatment. This outreach was also used to control epidemics e.g. of malaria as well as provide nutrition education to pregnant women. As highlighted previously traditional practice means that pregnant women would be encouraged not to eat in the last trimester of pregnancy. This practice was discouraged through the nutrition education provided by volunteers.

SRCS also provided the hospital with financial support for the training of nurses. Nurse training is a four year long programme. Support to nurse training was provided to ensure that local nurses were trained able to return and practice in the Duredeib community. Similarly to doctors it is often difficult to recruit nurses to work in rural locations of Sudan.

Cost benefit analysis result

Due to lack of data available from the hospital it was not possible to undertake cost benefit analysis for this intervention. In addition, putting a monetary value to life would have proved culturally insensitive and probably inappropriate.

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[17] World Bank, Literacy and Primary Education, Kowsar P. Chowdhury

4.5 Education

4.5.1 Duredeib Town

The SRCS has contributed to education in the town and the surroundings of Duredeib. Two examples of support to education within Duredeib town are the addition (i.e. construction) of classes to two schools, one girl's school and one mixed school.

The girl's school supported was initially constructed in 1969. Extra classes were added to the school building in 1995. Prior to the addition of extra classrooms the number of girls attending the school was 238. This number increased to 360 girls after the new buildings were added. Table4. below details the performance of students and the number of students that graduated to secondary school in the last four years.

Table 4. Number of students graduating to secondary school and the pass rate for all students

Year	Pass Rate% for all grades	Number of students Graduating to Secondary School
2006	90	25
2007	95	28
2008	96	28
2009	98	30

In 1998 SRCS supported the construction of classes in a mixed school. The school initially only had 40 children attending. The additional classrooms expanded capacity to a total of 246 students today. Of these 159 are boys and 87 are girls. Discussions with Ministry of Education officials suggest that the increase of classrooms has enabled improved performance as evidenced by the increasing trend in pass rates noted in Table 4. above.

4.5.2 Haya Locality

Discussion with officials of Haya suggested that the SRCS/DRC programme has resulted in increased performance, particularly of girls. Table 5. below indicates the number of girls and boys getting into the first (top) class in secondary school.

Table 5. The number of Children entering the first (top) class of Secondary School.

Year	Number of girls	Number of boys
2003-2004	25	30
2004-2005	40	55
2005-2006	60	75
2006-2007	65	70

Furthermore, prior to 2003 no girls from Haya town had attended university. Since 2003 with the support of SRCS 35 women have attended university. See table 6. below for annual university admission numbers from Haya locality.

Table 6. Number of girls and boys attending University from Haya town since 2003.

Year	Number of girls	Number of boys
2003-2004	8	15
2004-2005	9	20
2005-2006	10	22

2006-2007	8	18

Other than the building of schools and the support provided to kindergarten, primary and secondary education; the SRCS provided a small one-off grant of 75SDG as pocket money to those accepted to university and 35SDG as a transport fund to port Sudan or Khartoum depending on where a University place was secured in order to support attendance.

Much of the education achievements in Derudeib, Haya and Sinkat can be traced back to the support of SRCS to kindergarden classes. For example in Haya, currently 1175 children are attending kindergarden, providing the opportunity for pre-school learning. Pre-school is now a compulsory requirement (by Government) prior to entering primary school. It provides the basis of child education, however the Government charges for attendance and to administer the required graduation certificate. At 45 SDG the certificate is too expensive to purchase for poor households. **The SRCS provides kindergardens (predominantly through women's centers) and subsidizes, for the poorest households, the administration fee to enable children to progress to primary education and eventually secondary education. The SRCS therefore ultimately facilitates access to university.**

In conclusion, the education support provided by the SRCS is likely to have a transformational impact on the Beja society and have widespread impact on economic opportunity, health and future livelihood strategies as well as development of the Beja in Red Sea State.

Cost Benefit Analysis Result
It was not possible to undertake a cost benefit analysis of any of the education interventions because of lack of budget information resulting from the time elapsed between implementation of the interventions and the current study. In addition, it was difficult to track exactly what inputs occurred at what time to the education system. However, as noted above this should not detract from the impact this intervention has had and is likely to have on the future of the Beja population.

5.0 Resilience and Safety Indicators

The third component of the terms of reference asked the study team to work with communities to define indicators for community resilience. This was done through focus group discussions and key informant interviews. The particular nature of these communities (agro-pastoralists) is such that the indicators developed may only be useable in similar agro-pastoral communities. For each indicator a measure is provided and an explanation of why the indicator has been chosen and how it relates to resilience. In addition section 5.2 categorizes these indicators under broader more globally applicable indicators to enable the measurement of progress being made in supporting communities to be more resilient and reduce disaster risk.

5.1 Indicators to Determine Resilience

Indicator 1. **Terms of trade.**

Measure: ratio of sale of livestock to purchase of cereal grain. (quantitative)

Example: Dureideib September terms of trade were 1:1

Current terms of trade are 1:0.64

Explanation: Pastoralists rely on the sale of animals to purchase grain/cereals and other cash based expenses. In order for this to be a viable trade the ratio of exchange between animal and cereal commodity needs to be favourable. In the example above 3 months prior to the study the exchange was 1 goat to a 90 kg bag of sorghum. However, the current exchange means that pastoralists can only

purchase 58kg of sorghum for the sale of 1 goat. This can be the result of two factors, firstly a rise in cereal prices and secondly a decrease in animal prices resulting from the increased availability of livestock in the market or the poor health of the animals. A household is likely to be more resilient to shocks if the terms of trade are favourable.

Indicator 2. **Involuntary slaughter of animals.**

Measure: no slaughter of animals apart from social and religious occasions. (qualitative)

Explanation: The Beja pastoralists only slaughter animals themselves when they are at risk or when there is a social or religious occasion. Therefore the lack of involuntary slaughter of animals indicates that pastoralists are resilient to hazards such as drought. It is unlikely that verifiable numbers of animals slaughtered can be collected as pastoralists are unlikely to divulge accurate numbers. It is therefore recommended that this information is collected on a qualitative basis.

Indicator 3. Household Migration to urban centers.

Measure: No increased settlement to urban centers (quantitative)

Explanation: Nomadic pastoralists view the migration to urban centers as the final step in the downward spiral to destitution. Initially migration to urban centers may mean that households are separated for long periods of time while part of the household seeks employment in urban centers as daily labourers. As the situation worsens and all animals are lost the whole family settles around urban centers and seeks different means of livelihood. Therefore the lack of household migration to urban centers is an indicator of resilience.

Indicator 4. Wage labour to cereal purchase ratio

Measure: ratio of daily labour wage to cereal price (quantitative)

Example: Daily wage labour is 3SDG and cereal price is 125SDG/90kg

Wage to cereal price ratio= 1:0.024

Explanation: While the Beja are a pastoralist community, years of repeated droughts have altered their way of life. Many households have had to settle either in urban centers or in villages and seek daily waged labour and other income earning opportunities. In order to determine the resilience of these households it is recommended that the ratio of wage to cereal price be calculated. This provides an indication of the viability of waged labour as the main income source of internally displaced populations. In the example above a days labour can purchase approximately 2kg of Sorghum. Any decrease in this ratio could be indicative of a loss of resilience.

N.B. This indicator was not mentioned during discussions at community level predominantly because communities reflected on their past means of livelihood (agro-pastoral) rather than the current situation their households faced. The author has extrapolated this indicator from general discussion with communities, which suggest that daily labour is a common livelihood strategy among the Beja.

Indicator 5. Social Obligations

Measure: Ability to meet social obligations. (qualitative)

Explanation: Traditionally among the Beja (and in the authors experience amongst pastoralists) there is a strong sense of meeting social obligations. This sense is perhaps heightened now in Red Sea State since so many depend on fellow community members social obligations for support due to the recurrent droughts. An inability to meet these social obligations puts households at risk and makes them less resilient if they require this social support in the future.

5.2 Categorizing community based indicators into Global Indicators for monitoring

The International Federation of Red Cross and Red Crescent intends to monitor the progress it is making in increasing community resilience and safety. In order to be able to monitor the progress made globally community indicators will be categorized into broader global indicators that would enable this process to take place. This section places each of the indictors mentioned in section 5.1 into a broader indicator category in an attempt to facilitate a global approach to monitoring.

Indicators 1 and 4 above could be placed within a broader indicator category of ***"favourable market access"***. In the case of indicator 1 it is essential that in addition to having access to the market the exchange of animal to cereal is at a favourable rate otherwise the means of livelihood (pastoralism) would be eroded and ultimately irrevocably damaged. Similarly without favourable employment wages and access to an employment market those households relying on this means of living would not be able to access enough food to sustain the household leading to undernutrition and increased risk of morbidity and ultimately mortality.

Indicator 2, the involuntary slaughter of animals can be placed within a broader indicator category of ***"lack of productive asset loss"***. In this case (i.e. a pastoralist livelihood) the slaughter of animals has the potential of reducing the viability of the herd since certain numbers of animals need to be maintained in order for herd size to be sustainable. In other livelihood examples productive assets such as seeds or draught animals may be lost resulting in decreased agricultural production.

Indicator 3 ,household migration to urban centres can be placed within a broader indicator category of ***"lack of distress migration"***. In this case it is important to emphasize the fact that it is distress migration that is likely to indicate a households lack of resilience. In other words the ability of a household to have some of its members seeking employment in urban centres can be seen as a sign of resilience, however the collapse of households into a state of destitution requiring the whole family to migrate often to peri-urban settlements indicates a lack of resilience.

Lastly indicator 5, social obligations could be placed within a broader indicator category of ***"social capital"***. In this case it is the ability to provide social obligations that enable households to draw upon accrued social capital should they need to do so as a result of future shocks. Many societies have strong traditional and cultural norms of support that can be called upon. For example, globally this can be seen through the increase use of remittances, a social obligation, in support of household members. Therefore social capital is often an important factor in ensuring the resilience of communities that have suffered a shock.

6.0 Lessons Learned

This section describes lessons learned from the programming undertaken and the lessons learned from undertaking the cost benefit analysis. These should be considered in future reviews of the programme and future endeavours with regards to Cost Benefit Analysis.

6.1 Programming

The SRCS, NRC and DRC have invested over twenty years of time, money and effort to work with the Beja communities of Red Sea State. This section attempts to capture some of the key points of the experience which have contributed to the success of the programming, as well as issues SRCS should be aware of and attempt to address.

- **The need to ensure multi-year funding** and commitment from donors for programming. Both the NRC and DRC have made efforts and succeeded to support the SRCS over a long time period, with most funds available for spend over multiple years. Where this was not followed consistently, i.e. in the Norwegian Red Cross supported programming, the result has been a less systematic approach to programming since planning and subsequent programme direction was difficult to manage when funding was not secured. This has undoubtedly resulted in inefficiencies and reduced the impact of interventions. However impacts have been realized due to the length, twenty years, of engagement of the SRCS with communities in Red Sea State.

- **The importance of community ownership and relationship development.** Sudanese Red Crescent staff are well known and trusted by communities that the interventions were implemented in. This can only be achieved through a long term engagement with the same communities. The SRCS approach to programming meant that engagement with the same communities happened over a long period but was interspersed with times when the SRCS would withdraw from communities for a few years to allow various projects to embed in a community and gain community ownership. This would ensure that communities were involved in decision making, maintenance and care for project outputs, i.e. the management of projects.

- **Sustainability** of the project outputs is demonstrated through the continued presence and maintenance of the various programme outputs. In some situations it is apparent that the cost of certain inputs such as the solar panels, for the communal farms, is beyond the capacity of communities and is likely to require the continued support of the SRCS. Sustainability in such cases can only be secured when a community is able to maintain project inputs independently of the SRCS. Further evidence of potential for sustainability emerged when funding to the SRCS for the DRC supported programmes was reduced to approximately, $45,000 per annum. This money while not allowing further development of the programme was enough to support the maintenance of existing programmes and running cost of SRCS support. This is predominantly a result of the use of local solutions and a limited use of external technologies throughout the programmes. In addition, the SRCS reported that it had withdrawn support from some intervention sites and that the outputs continue to function indicating that sustainability had been reached, however the study team did not visit any of these sites.

- **Partnering Government and acting as a safety-net.** Few organizations operate within Red Sea Sate. The SRCS and GoS collaborate closely at a local level to deliver the programme results. However, over the lifespan of the programmes it is evident that the GoS is unable or unwilling to fulfil its full governmental responsibility. This has meant that the SRCS has acted as a safety-net for the most vulnerable in Red Sea State. This is important to recognize as the removal of the safety-net (i.e.SRCS activities) could render the population vulnerable. This is particularly the case since few organizations work in Red Sea State.

6.2 Cost Benefit Analysis

A number of issues arose during the study that suggest undertaking retro-active or “ex-post” cost benefit analysis is complicated and may be unreliable as a study tool. These issues include:

- In the programmes under study the same community may be supported with one objective in mind e.g. increasing agricultural production. However the support can take a number of different forms simultaneously and can be multi-sectoral in nature. An example of this is the Earthdam/embankment in Lashob, where support was provided for construction of the dam alongside the provision of seeds and agricultural extension services. In order to undertake a CBA one of these interventions, the construction of the embankment, was taken as the primary intervention while the other two interventions were incorporated as costs to the intervention. This was done because it was quite possible that constructing the embankments without the provision

of seeds and/or the extension training would not have yielded the benefit accrued. In fact it is likely that the interaction of the three interventions together that has yielded the benefit accrued. Continuing with the above example, it was therefore possible to provide a CBA for the combined interventions with an objective to increase agricultural production, but comparison of cost efficiencies between the different interventions was not possible. This perhaps demonstrates a limit to cost benefit analysis use for programming decisions.

- It also became apparent during the study, that due to the long term nature of the SRCS engagement with communities; many interventions continue to receive assistance for small scale maintenance. While this tends to be small amounts of money over the 20 year period this can eventually involve considerable amounts. Estimating these costs is difficult as it often depends on the demand of communities. Furthermore staff turnover means that keeping track of these costs is difficult. There is therefore likely to be an underestimation of the true costs.

- While doing CBA assumptions are regularly made and necessary to do the calculations. While these assumptions are noted as part of the description for the calculations undertaken it remains unclear at what stage the compound uncertainty of multiple assumptions needed and data issues faced render the confidence in the results too low for acceptance.

- As an example; it proved impossible to split staff, and overhead cost budgets accurately based on each intervention. An assumption was therefore made that staff spent equal time across the different geographical locations of the programme and interventions. This is important to note as it means that CBA data in this study is only comparable with other data within the study since this assumption is consistent throughout the study calculations.

- It was evident from community engagement and discussions with SRCS staff that many of the interventions as well as having a direct benefit in terms of food or water access i.e. a physiological impact also had a psychological impact which it was impossible to quantify. However, this may be one of the greatest impacts of the programmes undertaken since the agro-pastoralist population suffers from marginalization and programming efforts are re-building self esteem.

- The study was unable to quantify the social benefits accrued as a result of interventions. This is because these social benefits can have a non tangible nature and on occasions are transmitted outside of the direct beneficiary community making it difficult to track the economic value. Social obligations and kinship are an important part of life among the Beja population of Red Sea State and therefore the inability to quantify social impacts severely under-estimates the benefit accrued as a result of the interventions. This is particularly the case because social obligations are called upon to cope with crises.

- Nomadic pastoralists by their nature are often on the move. This poses an additional complication as it is difficult to verify numbers of beneficiaries and or users of some of the programme outputs. This is likely to make the data less reliable than with an otherwise settled population.

- The progammes studied happened over a long period of time, i.e up to 22 years. Inevitably staff turnover occurred and resulted in loss of direct knowledge of the programme. This was further exacerbated by the fact that initially the programme supported by the NRC was run by NRC delegates who on departure took records with them.

- Budgets and documentation from old programmes are hard to source but are crucial for successful cost benefit analysis. In addition budgets are often not broken down per intervention. For example most budget architecture places all staff costs under an HR heading and does not split these costs across different types of interventions or specific geographical locations related

to a programme. This makes it difficult to retro-actively estimate staff time and hence costs spent per intervention.

In conclusion, CBA may be a more useful tool to use in order to better design future programmes since cost efficiencies of different interventions can be determined. When "ex post" or retro-active CBA is planned it will be necessary to ensure that appropriate baselines and tracking systems are set up prior to programme implementation in order to facilitate access to the necessary disaggregated data.

7.0 Conclusion

Impact and Cost Benefit Analysis

Both the NRC and DRC supported SRCS programmes in Red Sea State have had substantial impacts on the targeted Beja communities. Impacts are being realized in socio-economic, health and education terms. The women centers and education support, while proving difficult to provide a cost benefit analysis for, appear to have the potential to have "generational" and societal impact. This is demonstrated by increased girls attending school and an increase in those attending university. Equally women attending the women centers are gaining new skills and knowledge including literacy, health and nutrition awareness which is being translated into their practices. These interventions have started to influence the Beja traditions and societal norms, for the better, and will continue to do so in the future.

In addition, the food security/livelihood interventions have increased access to food and income through the improved utilization of existing water sources. The improved utilization of water sources was achieved through local solutions and where possible low/appropriate technology solutions. Cost benefit analysis generated a ratio of greater than 1:1 for interventions such as communal gardening, terracing and earth embankments suggesting that these interventions were cost efficient.

Water and health interventions have reportedly decreased the incidence of diarrhoea[18]. Water interventions have also supported livestock health by ensuring that livestock have access to sufficient water which in turn ensures that milk production is maintained. While these impacts were reported by beneficiaries a CBA undertaken of the hafir built in Delai resulted in a benefit to cost ratio greater than 1:1 suggesting that it is unclear whether the intervention was economically efficient.

Interventions in support of the Hospital in Derudeib have improved the treatment of Tuberculosis, maternal and child health, as well as reducing pregnancy complications and maternal deaths. A key factor in reducing pregnancy complications and maternal deaths has been the outreach provided through the training and equipping of mid-wives to work at community level.

Key to the realization of the impacts described was the integrated, multi-sectoral programme approach adopted by the SRCS and the long term commitment of the donors and SRCS. Key areas for concern remain the sustainability of the programmes and the substitution of the Government of Sudan role.

The SRCS reported that they were able to maintain programming from 1998 to 2005 based on an estimated 45,000 USD budget provided by the DRC following the end of funding from DANIDA. This coupled with the fact that many of the interventions are low tech and low cost in nature suggests that sustainability can be achieved. However some interventions visited will continue to require SRCS input for the foreseeable future. For example the communal farm visited had damaged solar panels that required replacing. These are high cost items and require SRCS funding. In addition, the SRCS reported that it had withdrawn support from some intervention sites and that the outputs continue to function indicating that sustainability had been reached, however the study team did not visit any of these sites.

[18] Reduction in diarrhoea could not be verified using clinic or hospital information, but is based on information collected from community members.

Perhaps of greatest concern is the level of "substitution" of Government services/responsibility occurring in the programme. This is not a new issue for the programme[19] but does require noting as it is likely to have a considerable impact on the ultimate success of the programmes. The SRCS has involved the Government authorities locally and at state level in the programme; for example, using agriculture extension workers to train community members. However, this engagement has invariably seen the SRCS funding interventions, including Government inputs, such as the travel and incentives of extension workers. While this is necessary to realize the achieved impacts it does raise concerns with regards to the SRCS substituting for Government of Sudan responsibilities and to a large extent being the safety-net for vulnerable communities in Red Sea State. Continued advocacy with the GoS is necessary to promote engagement by the Government in a balanced partnership.

Many lessons were learned and documented by the study team with regards to undertaking Cost Benefit Analysis. These are best summarized by stating that perhaps the most effective use of CBA is prior to programming in order to determine the most efficient means of intervening. If future "ex post" CBA studies are to be undertaken these should be planned in advance of programming so that appropriate baselines and information can be tracked and made available after programme implementation.

Resilience and community safety Indicators

The final task assigned to the study team was the development of community based indicators of resilience and safety. The study team developed, through community consultation, a number of indicators that could be used to monitor community resilience. These indicators were then placed in broader categories of indicators that could be used at a global level to monitor overall progress in strengthening community resilience. The broad categories identified were:

- favourable market access
- lack of productive asset loss
- lack of distress migration
- social capital

The study team would recommend the testing of these broad indicators for applicability in different contexts in order to ensure that they can be used at a global level to monitor progress.

[19] Please see Evaluation of the Sinkat Community Development Project and Port Sudan Organizational Development Programme, 2004 and Mid-Term review Derudeb and Haiya Integrated Rural Food Secuirty Programme, Red Sea State, 2006

References

-UN Human Development Report 2009

-UNICEFs' State of the Worlds Children, 2008.

-Addressing chronic livelihood vulnerability in Red Sea State, HPN, 2006, M.Babiker and Sara Pantuliano

-Sudanese Red Crescent Society, Five year Food Security Strategy (2009-2014)

-Draft Oxfam America Guidelines for cost benefit Analysis.

-Evaluation of the Sinkat Community Development Project and Port Sudan Organizational Development Programme, 2004

-Mid-Term review Derudeb and Haiya Integrated Rural Food Security Programme, Red Sea State, 2006

-Case study of the Philippines National Red Cross Community based Disaster Risk Management Programming, Part 1 and 2, 2009

-World Bank, Literacy and Primary Education, Kowsar P. Chowdhury

-Measuring Cost benefits of community disaster risk reduction in Ilam, Nepal, 2008

-Derudeb and Haya integrated Rural Food Security Programme Impact Assessment March 2007

-Danish Red Cross EC Food Sec-Derudeb and Haiya Food Security Programme, 2005-2007

-IFRC, Draft Summary Global Alliance Disaster Risk Reduction Performance Framework

-UNDP and GoS, Red Sea State Situation Analysis, April 2009

Annex 1. Terms of Reference: Impact and cost-benefit analysis of the Sudanese Red Crescent Society's Greater Sinkat Community Development Projects

Aim of the study

The objectives of the study are:

1. To identify both qualitatively and quantitatively the key aspects and outputs of the Sudanese Red Crescent Society's Greater Sinkat Community Development Projects (Sinkat, Haya and Derudeb) that have contributed towards increased and sustainable community safety and resilience.
2. To undertake a quantitative cost-benefit analysis of the programs.
3. This study will contribute to a broader Federation-wide effort to improve disaster risk reduction performance measurement and impact analysis[20]. This includes identification and definition of measurable and objective indicators of community safety and resilience as well as development of DRR impact assessment and CBA methodologies applicable by National Societies. Within this framework a similar impact and cost-benefit analyses will be performed in the Philippines in September-October 2009. This current Red Sea State study must progress from the Philippines study, refining and testing developed methodologies and lessons-learned.

Background

The Sinkat Community Development and Derudeb and Haya Integrated Rural Food Security Projects of the Sudanese Red Crescent Society (SRCS) have and continue to aim at re-establishing the means of subsistence for Beja nomads to prepare them and the environment to cope with future climatic extremes. The projects were initiated in 1986 and 1990 in response to food insecurity for the nomads living in the Greater Sinkat Province (Sinkat, Haya and Derudeb) of Red Sea State of the Sudan, and are currently being carried out based on agreements between the SRCS and the Norwegian Red Cross (NRC) and Danish Red Cross (DRC). The projects have undergone various cycles and evaluations, as described below.

Sinkat Community Development Project

- Phase One (1986-1990) was concerned with rehabilitation of wells and small-scale agricultural activities.
- Phase Two (1990-1996) concentrated on earth embankments and families started growing communal vegetable gardens.
- Phase Three (1996-????) began a series of activities directed at local income generation.
- Phase Four (2009-2011, proposed) focusing on increasing community safety and resilience.

A 2004 evaluation[21] found significant progress towards achievement of the expected results, providing an integrated approach to the priority needs of the people including lack of food and water, low incomes and high prices, and lack of education. This has led to a growing sense of self-reliance amongst farmers, pastoralists and women. The project has continued, taking into account recommendations from this evaluation, and has plans focusing on increasing community resilience and preparedness until at least 2011.

Derudeb and Haya Integrated Rural Food Security Project:

- Phase One (1990-1992) included a socio-economic survey and launching of urban-based activities mainly in the area of environmental health, rehabilitation and the construction of wells.
- Phase Two (1993-1998) diversified and expansed the project over a broader geographical area, with activities including the rehabilitation and construction of wells, haffirs, earth dams and water

[20] The objective of this global initiative is "to globally map and quantify, on an on-going basis, International Federation DRR programmes and activities, including monitoring of performance, impacts and resultant increases in community safety and resilience."

[21] SRCS & NRC (2004). Final Report: Evaluation of The Sinkat Community Development Project and Port Sudan Orgnizational Development Program in Red Sea State of Sudan, 1997-2003.

storage tanks. Seeds and agricultural tools were distributed, and curative and preventive health supported.

- Phase Three (2005-2007) aimed to reduce the loss of human and animal lives and revive traditional livelihoods. Main activities revolved around addressing availability, accessibility and utilization of water, land and foodstuffs. This included rehabilitation/construction of water points, livestock development, agricultural production, work/employment creation and capacity building implemented by the SRCS in partnership with the communities and relevant government authorities.
- Phase Four's (2008- 2011) main aim is to achieve timely and sustainable reduction in the food insecurity of vulnerable groups in situations of transition and state fragility, and thus enable crisis recovery and to take advantage of development opportunities. Activities include increasing access to water and arable land access through irrigation and water harvesting as well as increased diversification of crop and livestock production. Capacity building in rural communities and skills and income generation development in Women's Centres is also being implemented.

A mid-term evaluation was carried out by the DRC Disaster Preparedness Advisor in 2006 for Derudeb and Haya Integrated Rural Food Security Project concluded:
"… the implementation of the programme is proceeding as planned. Almost all of the planned inputs and activities were provided and undertaken within the prescribed timeframe, and in some cases even beyond schedule, or with a larger number of 'products' than planned. There is no major risk that the programme should not produce the planned outcomes in time.

Recognizing that sustainable development must inherently mainstream disaster risk reduction (DRR), especially in the context of slow-onset food insecurity, the over 20-year Sinkat Community Development and Derudeb and Haya Integrated Rural Food Security Projects provide excellent cases to investigate and learn from the impacts, costs, benefits, and economic efficiency of community-based DRR and climate change adaptation.

Expected Outcomes
The study has three separate but related outcomes:

1. To qualitatively and quantitatively identify the key aspects and outputs of the program that have contributed towards sustainable increases in community safety and resilience including enhanced awareness, capacity, preparedness and mitigation. Factors to consider include:
   - the linkages to external partners including government, civil society, PNS and the community itself;
   - issues related to active community and partner participation;
   - the importance of community governance including community organization and leadership influences;
   - the relationship between SRCS and target communities;
   - the outcomes which have encouraged the sustainability of community awareness and increased capacity to deal with the risks they face;
   - action and systems followed as well as the availability of appropriate resources within communities who have been involved in the program and have experienced a natural disaster post program completion;
   - behavioral change that has resulted in communities during the Program;
   - preparedness and mitigation projects.
2. To identify and define a maximum of 10 driving indicators for community safety and resilience. The Federation aims to develop a global set of indicators for community safety and resilience so to be able to measure disaster risk reduction progress globally, regionally, nationally and at the community level in a standardized way. The Philippines study will produce a first draft of these indicators (maximum 10), and in this Red Sea study this list will be refined to ensure applicability in different settings and contexts. The indicators should:
   - be based on participatory input from both communities and SRCS staff;

- each indicator must be measurable either through directly quantifiable numbers or a scale (for instance 1-5) where each scale level is clearly defined/measurable through a standard description (such that different people assessing the same community would achieve the same results, therefore making it as objective as possible).
- the results will inform Federation-wide discussion and agreement on a globally applicable measurement of community safety and resilience.

3. To undertake a cost-benefit analysis of the risk reduction initiatives implemented under the program including:
   - assessment of the above-developed indicators of community safety and resilience before, during and after the project (before and during may not be realistically possible);
   - summary analysis of the contributions (financial, human, technical, in-kind, political, etc.) of participating communities, local government and external donors related to sustainability of outputs and systems developed;
   - cost-benefit analysis (CBA) of individual activities as well as the full program, covering the full duration of implementation and if appropriate future years of program impact. The following guidance should be employed:
     - based on Philippines study outcomes and developed methodologies;
     - inclusion of quantifiable as well as non-quantifiable benefits and resultant guidance on how both can/should contribute to CBA and resultant decision-making processes;
     - all analytic assumptions must be transparently documented and major assumptions must be informed through participatory processes;
     - probabilistic disaster assumptions (frequencies of events) are primarily to be treated in a simplified manner understandable to SRCS staff and communities (if more thorough data is available, it should be incorporated in a concurrent CBA for sensitivity analysis);
     - quantified benefits should be based on comparisons of disaster impacts under "with" and "without" Sinkat Community Development Project scenarios;
     - savings in annual SRCS disaster response operations should be considered a benefit (potentially the primary benefit);
     - unquantifiable benefits should be listed to inform the limitations of the CBA;
     - negative Porgram impacts should be considered and where possible quantified as negative benefits (not costs);
     - sensitivity analysis to test the impact of assumptions (benefits, discount rate, etc.) and robustness of results should be performed, including potential disaster frequency/magnitude changes due to climate change.
   - comparative impact analysis of structural verses non-structural components of program implementation;
   - comparative impact analysis reflecting the duration of program implementation verses funding levels, taking into consideration the speed necessary for concept absorption and behavioral change in at-risk communities (can an optimal duration be identified?);

Geographical location

It is proposed that the study team will visit the following communities in Red Sea State, Sudan:

- Sinkat
- Derudeb
- Haya

Target audience

The target audiences for the case study and knowledge exchange are the International Federation's member National Societies and Secretariat personnel, as well as other organisations (international organisations, NGOs, donors, etc.) involved in disaster risk reduction, and the broader public. It is therefore planned to make the results public.

Activities
The study team should perform the following tasks:

- Collate and review existing information on the Sinkat Community Development and Derudeb and Haya Integrated Rural Food Security Projects, including written reports, videos, photos and other forms of multi-media documentation produced to date;
- Consult through interviews, simulation and participatory process, with a representative cross-section of the current and past SRCS headquarters and Red Sea State Branch personnel (staff and volunteers) involved in the implementation of the Project local authority personnel involved in project implementation, other stakeholders and beneficiaries.
- Analysis as per the expected outcomes.
- Review of study experience, lessons-learned.

Expected deliverables
The specific output of the study will consist of a written document. In addition the study team should draw upon and incorporate other relevant multi-media forms of communication to convey the findings of the study. Creativity and imagination are encouraged to develop documentation that is as appealing and meaningful as possible for the range of audiences described above.

The document should be no more than 15,000 words, including photos with the following outline:

o *Executive summary*	provides an overview of the study touching on the processes taken and conclusions.
o *Background*	describes the situation of the country/area where the program/project is taking place and methodology used.
o *The project*	comprises all the details needed so that one can easily understand what it is about; describes why the program/project has been undertaken, its evolution, how the beneficiaries and other program partners have been selected, where the programme has been implemented.
o *Project Outcomes*	describe the planned and unplanned outcomes and impact of the project including related to describe what is going well, what are current or past problems experiences, what has been (or is being) learned by doing this program/project, the corrective actions that have been taken to date, what could/should have been done differently and what has contributed to the sustainability of community awareness and capacity.
o *CBA*	provides an overview of the resource requirements for implementing the project and the outcomes of the CBA.
o *Lessons-learned*	important lessons-learned and experiences that will contribute to the development of a standardized DRR impact assessment and CBA methodology useable by National Societies and contributing to Federation-wide measuring and reporting.
o *Conclusions*	describes the key findings of the project, how and under which circumstances should these be replicated within Sudan and other countries across the Horn of Africa and globally, and what influence it will have on the long run on the beneficiaries and/or communities.

The first draft of the case study will be reviewed by representatives of the Sudanese Red Crescent Society, the Norwegian Red Cross and the International Federation. Feedback from these reviews will be incorporated into the case study before finalisation.

Consultant
The consultant will require expertise in the following:

- a theoretical understanding of disaster risk reduction and food security/livelihood issues;
- practical experience in developing community resilience, community-based programming, program design and implementation, and community participatory processes;

- be able to identify key issues that support sustainability of DRR and food security/livelihood programming;
- capacity to undertake a cost-benefit analysis;
- knowledge of African food security issues.

Timeframe

The study will be undertaken during the months of November and December 2009 and should be finalized no later than end of December 2009. The consultancy period will be for a maximum of 35 working days. A draft outline is provided below.

Dates	No of Days	Activity
1 Nov.	5	Preparatory research and preparation: - desk top preparation - review of lessons-learned and methodologies from Philippines study - confirmation of process and methodology to be used - prelimany interviews (email/phone)
	1	International consultant travel to Khartoum
	20	In country - briefing at SRCS HQ, Khartoum - travel to Port Sudan, Red Sea State - briefing at SRCS Red Sea State Branch - field visit to Red Sea State - debriefing at SRCS Red Sea State Branch
	1	International consultant travel return from Khartoum
	5	Quantitative analysis and drafting study
	1	Review and feedback on Study draft - distribution and compilation of feedback - face to face / teleconference briefing on feedback
	2	Follow-up and finalisation - face to face / teleconference briefing on feedback - Incorporation of feedback and finalisation of study
31 Dec.		Final study submitted

Annex 2. List of People Interviewed

Mohammmed Taha SRCS Director RSS Branch

Hashim Abbaker	SRCS Project Manager and Director of Emergency Relief, RSS
Onour Abu Ali	SRCS Sub-Branch Office, Sinkat
Mahmoud Hamid Adam	SRCS Sub-Branch Office, Derudeib
Torild Naess	NRC Representative, Khartoum
Dietrich Fischer	IFRC, Head of Delegation, Khartoum
Ibrahim Ohaj	Pastoral group elder, Delai, Derudeib
Ali Abu Asha	Key Informant, Lashob
Abu Bakar	Elder Key Informant, Al Manar
Ali Ahmed	Leader, group, Al Garada
El Amin Ohaji	Hospital Director, Derudeib
Mariam Mohammed Moussa	Womens Centre, Derudeib
Asha Al Sadq	Womens Centre, Derudeib
Fatma Abdallah	Womens Centre, Derudeib
Abdallah Mohammed	Group, Leader, Hamisiet
Ibrahim Ahmed	Key Informant, Solqibab
Fatma	Supervisor, Womens Centre, Sanganai
Adam Ali Nourit	Leader, group, Tomsha
Al Tayeb Mohammed Hussein	Leader, group, Halgeet
Haleema Ahmed Ibrahim	Womens Centre Supervisor, Ciet, Sinkat
Babiker Hussein Sash	Min. of Education, Sinkat
Tahir Amin Mahmoud	Min. of Education, Sinkat
Mohammed Talib Mohammed Ahmed	Min. of Education, Sinkat
Mohammed Badawee	Min. of Education, Haya
Hameed Batar	Min. of Health, Haya
Seyedna Moustafa	Community Leader, Legislative council, Haya
Seyedna Ismail	Min. of Education, West Haya
Onour Mohammed	Min. of Water (Haya Locality)
Abu Nafisa Hamed	Min. of Agriculture/Livestock, Haya
Malka Ahmed	Womens Union

Annex 3. Cost Benefit Analysis tables for Interventions

Table 1: Benefits associated with the construction of terraces

Benefit Category	Magnitude of Impact "Without"	Magnitude of Impact "With"	Values	Assumptions	Detailed Calculation of Benefit
Cultivated land				Programme costs are based on annual costs. Due to budget structure these costs reflect an assumed equal distribution of staff time and office consumables across 8 project sites	N/A Land is not sold in the region and therefore has no market value.
Amount of Sorghum Produced	No sorghum production. Households destitute, relying on daily wage labour.	3680 households able to produce Sorghum	Value of Sorghum Sorghum 4 shawaal x90kg (90kg=125SDG) Shawaal=90 kg bag	The target population of the intervention was a displaced population on the outskirts of Duredeib. Therefore without the intervention they were destitute.	Without: 4shawaalx125SDG=500SDGx3680= 1,840,000SDG **Losses=1,840,000SDG** With: **Losses=0** **Benefit= 1,840,000SDG**
Amount of Vegetables Produced	No vegetable production. Households destitute, relying on daily wage labour.	3680 households able to produce vegetables and sell produce and save money as well as meet social obligations.	Value of Vegetable Sales Okra= 3SDG/ratul 2.25 ratul=1kg(price per kg 3SDGx 2.25=6.75SD) Production was 50 kg for every 2 days for a period of 7 months. Water melon 1-2 SDG/piece, produced 2000-3000 pieces Cucumber 1SDG/bunch (1 bunch is 2-3 kg) Production is 250 kg Melon1SDG/piece Production 400 pieces	In this case the benefit is accrued as a result of additional production capacity i.e. without intervention this population had no production capacity however following intervention production was realized.	Without: Water Melon 1.5SDx2000x3680=11,040,000SDG Melon 1SDx400x3680=1,472,000SDG Okra 105 daysx50kgx6.75SDx3680 =130.410,000SDG Cucumber 83.33x1SDx3680=306,666SDG **Losses=143,228,666** With: Losses=0 **Benefit=143,228,666** **Total Benefit Accrued=143,228,666+1,840,000= 145,068,666SDG**

Table 2.Costs associated with the construction of terraces

Description of Cost	Cost (SDG)
Cost of Construction	92 terraces x 310SDG=28,520
Farm Work	210 days x 3SDG x 3680=2,318,400
Programme Support Costs	32,330 per year
Total	**2,379,250**

Terraces are constructed from soil and require regular maintenance due to the nature of the construction. A key informant reported spending a total of five days on maintenance and that this would happen over the cultivation period of 7 months of every year. This means that the maintenance cost can be calculated as 5 daysx3SDGx3680=55,200SDG.
It is assumed that the terraces should be viable and bring benefits for the community for the next 10 years. A discount rate of 10% is assumed. The following Worksheet was generated from the draft Oxfam America CBA guidelines and workbook to generate the cost benefit ratio.

COST BENEFIT ANALYSIS								
This worksheet corresponds with Step 7 of the Toolkit								
Data should only be entered into the yellow cells below, no data should be entered into the gray cells								
If the project lifetime is less than 20 years, do not enter any data beyond the number of years required (do not delete rows)								
Inputs				**Results**				
Project Lifetime (yı	**10**			**NPV**	**########**			
Discount Rate	**10%**			**Benefit/Cost Rati**	**61.61**			
Year	**Costs**	**Benefits**	**Net Benefits**	**Present Value Costs**	**Present Value Benefits**	**Present Value Net Benefits**		
0	**2,379,250**	**145,068,666**	**142,689,416**	**2,379,250**	**145,068,666**	**142,689,416**		
1	**2,350,730**	**145,068,666**	**142,717,936**	**2,137,027**	**131,880,605**	**129,743,578**		
2	**2,350,730**	**145,068,666**	**142,717,936**	**1,942,752**	**119,891,460**	**117,948,707**		
3	**2,350,730**	**145,068,666**	**142,717,936**	**1,766,138**	**108,992,236**	**107,226,098**		
4	**2,350,730**	**145,068,666**	**142,717,936**	**1,605,580**	**99,083,851**	**97,478,271**		
5	**2,350,730**	**145,068,666**	**142,717,936**	**1,459,618**	**90,076,228**	**88,616,610**		
6	**2,350,730**	**145,068,666**	**142,717,936**	**1,326,926**	**81,887,480**	**80,560,554**		
7	**2,350,730**	**145,068,666**	**142,717,936**	**1,206,296**	**74,443,164**	**73,236,867**		
8	**2,350,730**	**145,068,666**	**142,717,936**	**1,096,633**	**67,675,603**	**66,578,970**		
9	**2,350,730**	**145,068,666**	**142,717,936**	**996,939**	**61,523,276**	**60,526,337**		
10	**2,350,730**	**145,068,666**	**142,717,936**	**906,308**	**55,930,251**	**55,023,943**		
11								
12								
13								
14								
15								
16								
17								
18								
19								
TOTAL	**25886550**	**########**	**########**	**16,823,468**	**########**	**########**		

Table 3: Benefits associated with construction of earth dams(embankments)

Benefit Category	**Magnitude of Impact "Without"**	**Magnitude of Impact "With"**	**Values**	**Assumptions**	**Detailed Calculation of Benefit**
Cultivated land	Land is not sellable and therefore has no value	Land is not sellable and therefore has no value.	Number of Households benefiting in the area=300 (conservative figure as this is a poor rainfall year) can be 1000 Value of cultivatable land/Feddan=0 (land is not sellable, it is sub-tribe land) Daily wage= 3 SDG	In this case sorghum production capacity existed prior to the intervention, but increased after the intervention.	Land is not sellable and therefore has no value.
Amount of Sorghum Produced	2-2.5 shawaal (90kg bag) Social obligation to share(it is not possible to estimate the quantity as varies)	4-5 shawaal (90kg) Social obligation to share (it is not possible to estimate the quantity as varies)	Value of Sorghum/kg=1.39 SDG	Note that the assumption made to do the calculation is based on the immediate economic value of Sorghum. It does not factor in the social elements which in some senses s an obligation on those that have to provide to those that don't. Assumption used was that average rainfall produced the stated quantities of Sorghum	**Benefit** *Drought Year:* Without: 4x90x300=108,000kg Total value of Sorghum losses= 150,120 SDG With: 1.5 x 90x300=40,500 kg Total value of sorghum losses=56,295 SDG **Total Benefit=93,825 SDG** *Normal Year:* Without: 4x90x1000=360,000kg Total value of sorghum losses= 500,400 SD With: 2.5 x 90x300=67,500 kg Total value of sorghum= 93,825 SD **Total Benefit=406,575 SD**
Amount of Vegetables Produced		Attempts to grow water melon and Okra have failed	Value of Vegetable Sales/Feddan=0		**Total Benefit=0**

Table 4.Costs associated with the construction of Embankments

Description of Cost	Cost (SDG)
Cost of Construction	26,250
Cost of training community members	8680
Provision of seeds	200
Cost of Farm work	90daysx3SDGx300hh=81,000
Programme Support Costs	32,330
Total	**67,460**

Embankments require regular maintenance due to the nature of the construction i.e. the fact that they are constructed from soil. A key informant reported spending 10-15 days of maintenance and that this would happen over the cultivation. This means that the maintenance cost can be calculated as 10-15daysx300x3=13,500 SD. 15 days of maintenance was used as the more conservative measure of required maintenance. It is assumed that the terraces should be viable and bring benefits to the community for a period of 10 years. A discount rate of 10% is assumed. The following Worksheet was generated from the draft Oxfam America CBA guidelines and workbook to generate the cost benefit ratio.

COST BENEFIT ANALYSIS								
This worksheet corresponds with Step 7 of the Toolkit								
Data should only be entered into the yellow cells below, no data should be entered into the gray cells								
If the project lifetime is less than 20 years, do not enter any data beyond the number of years required (do not delete rows)								
Inputs				**Results**				
Project Lifetime (yr	**10**			**NPV**	**1,166,193**			
Discount Rate	**10%**			**Benefit/Cost Ratio**	**2.38**			
Year	**Costs**	**Benefits**	**Net Benefits**	**Present Value Costs**	**Present Value Benefits**	**Present Value Net Benefits**		
0	**148,460**	**281,475**	**133,015**	**148,460**	**281,475**	**133,015**		
1	**113,330**	**281,475**	**168,145**	**103,027**	**255,886**	**152,859**		
2	**113,330**	**281,475**	**168,145**	**93,661**	**232,624**	**138,963**		
3	**113,330**	**281,475**	**168,145**	**85,147**	**211,476**	**126,330**		
4	**113,330**	**281,475**	**168,145**	**77,406**	**192,251**	**114,845**		
5	**113,330**	**281,475**	**168,145**	**70,369**	**174,774**	**104,405**		
6	**113,330**	**281,475**	**168,145**	**63,972**	**158,885**	**94,913**		
7	**113,330**	**281,475**	**168,145**	**58,156**	**144,441**	**86,285**		
8	**113,330**	**281,475**	**168,145**	**52,869**	**131,310**	**78,441**		
9	**113,330**	**281,475**	**168,145**	**48,063**	**119,373**	**71,310**		
10	**113,330**	**281,475**	**168,145**	**43,694**	**108,521**	**64,827**		
11								
12								
13								
14								
15								
16								
17								
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19								
TOTAL	**1281760**	**3,096,225**	**1,814,465**	**844,824**	**2,011,017**	**1,166,193**		

Table 5:Benefits associated with communal (vegetable) farms

Benefit Category	Magnitude of Impact "Without"	Magnitude of Impact "With"	Values	Assumptions	Detailed Calculation of Benefit
Amount of fruit and vegetables produced			Population is 280HH	Assumption that government subsidy totalled half the cost of solar panel, i.e. 9,277 SDG. In this case the benefit is accrued as a result of additional production capacity i.e. without intervention this population had no production capacity however following intervention production was realized.	Without: Tomatoes=2000kgx1.5SDx280=840,000SD Eggplant=30bagsx50kgx20SDx280=8,400,000SD Pepper=10bunchesx2kgx5SDx280=28,000SD Carrots=20kgx0.25SDx280=1400 Okra=50bagsx50kgx50SDx280=35,000,000 Green Leaf veg.=100bagsx50kgx45SDx280=63,000,000 Parsley=25bagsx50kgx15SDx280=5,250,000 Limes=50x50kgx50SDx280=35,000,000 Water Melon=50 (90kgbags)x15SDx280=210,000 Melon=50 (90kgbags)x15SDx280=210,000 Losses=840,000+8,400,000+28,000+1400+35,000,000+63,000,000 +5,250,000+35,000,000+210,000+210,000 =147,939,400 With: Losses=0 **Total Benefit accrued=147,939,400-0=147,939,400**

Table 6.Costs associated with the establishment of Communal Farms

Description of Cost	Cost (SDG)
Cost of Establishment and Maintenance (SRCS)	94,149
Cost of training community members	23,250
Cost of Farming	30hh x 3 SDG x 365=32,850
Programme Support Costs	32,330
Total	**182,579**

Communal gardens require regular care and maintenance in order to yield good harvests. Focus group discussions with farmers suggested that 19 days were spent on maintenance by farmers in every month. This means that the maintenance cost can be calculated as 30hhx19daysx3SDx12months=20,520SDG. It is assumed that the communal gardens should be viable and bring benefits to the community for the next 10 years. A discount rate of 10% is assumed.

This worksheet corresponds with Step 7 of the Toolkit								
Data should only be entered into the yellow cells below, no data should be entered into the gray cells								
If the project lifetime is less than 20 years, do not enter any data beyond the number of years required (do not delete rows)								
Inputs				Results				
Project Lifetime (yı	10			NPV	########			
Discount Rate	10%			Benefit/Cost Ratı	1812.72			
Year	Costs	Benefits	Net Benefits	Present Value Costs	Present Value Benefits	Present Value Net Benefits		
0	182,579	147,939,400	147,756,821	182,579	147,939,400	147,756,821		
1	65,180	147,939,400	147,874,220	59,255	134,490,364	134,431,109		
2	65,180	147,939,400	147,874,220	53,868	122,263,967	122,210,099		
3	65,180	147,939,400	147,874,220	48,971	111,149,061	111,100,090		
4	65,180	147,939,400	147,874,220	44,519	101,044,601	101,000,082		
5	65,180	147,939,400	147,874,220	40,472	91,858,728	91,818,256		
6	65,180	147,939,400	147,874,220	36,792	83,507,935	83,471,142		
7	65,180	147,939,400	147,874,220	33,448	75,916,304	75,882,856		
8	65,180	147,939,400	147,874,220	30,407	69,014,822	68,984,415		
9	65,180	147,939,400	147,874,220	27,643	62,740,747	62,713,105		
10	65,180	147,939,400	147,874,220	25,130	57,037,043	57,011,913		
11								
12								
13								
14								
15								
16								
17								
18								
19								
TOTAL	834379	########	########	583,082	########	########		

Table 7: Benefits associated with construction of hafir-Delai, Derudeib

Benefit Category	Magnitude of Impact "Without"	Magnitude of Impact "With"	Values	Assumptions	Detailed Calculation of Benefit
Time without adequate water during seasonal migration of Sahel nomads			Wage Rate/hour=3 SD/day Quantity of days water supply is affected (prior to Hafir 50 days with minimal water, now 20-30 days with sufficient water) Number of families affected=1200 hh, Construction cost=9,300 Maintenance cost=60daysx15peoplex3SD=2700SD		Without: Losses=1200x30x3=108,000SD With: Losses=1200x50x3=180,000SD **Benefit=180,000-108,000=72,000SDG**
Number of Livestock Lost: **Cattle** **Sheep** **Goats** **Camels** **Donkeys**			Value of Livestock by Type: Camels= 1500 SD Cattle=800-1000 SD (m); 600 SD (nm) Sheep=150 SD (m); 80 (nm) Goats= 80 SD (m); 30 (nm) Donkeys= 200-250 SD (Draft)	1.Livestock loss estimate was based on SRCS staff estimates. 2. Community indicated that deaths occurred prior to the Hafir and that current deaths are much less. 3. Best estimates suggest that there were anywhere between 3-4% livestock losses prior to the Hafir and current livestock losses stand at 1%. 4. An average pastoralist has 5-15 goats (camel are not considered for loss as they are more likely to withstand long periods without water.	Without: 1% of 10 goats=0.1 goats, Losses=0.1x 80SDx1200=9,600 SDG With: 3% of 10 goats =0.3 goats Losses=0.3 x 80SDx1200=28,800SDG **Benefit=28,800-9,600=19,200SDG**

Benefit Category	Magnitude of Impact "Without"	Magnitude of Impact "With"	Values	Assumptions	Detailed Calculation of Benefit
Number of cases of Diarrhoea			Cost of treatment: (Dr. fee, Travel, carer travel)=Dr. Fee=0 SD; travel for 2-3 people 140 SD; cost of medicine 1.5-15 SD Sickness used to be 1 x per year/hh, currently none. Lost work = 3-4 days	Now there is a clinic in/close to Delai	Without: Losses=0 SDG With: Losses=140SD+1.5SD+(3x3x2)=159.5SDG **Benefit=159.5-0=159.5SD** **Total Benefit=159.5+19,200+72,000=91,360SDG**

Table 8.Costs associated with the establishment of Communal Farms

Description of Cost	Cost (SDG)
Cost of construction	9300
Programme Support Costs	32,330
Total	**41660**

The Hafir requires little maintenance however activities such as de-silting are likely to take up most of the costs incurred for maintenance. Increasing sand catchment is also expected to take place in the future in order to reduce the efforts required for de-silting. The maintenance costs are estimated at 60daysx15peoplex3SD=2700 SDG. It is assumed that the Hafir should be viable and bring benefits to the community for the next 15 years. A discount rate of 10% is assumed. The following Worksheet was generated from the draft Oxfam America CBA guidelines and workbook to generate the cost benefit ratio.

COST BENEFIT ANALYSIS								
This worksheet corresponds with Step 7 of the Toolkit								
Data should only be entered into the yellow cells below, no data should be entered into the gray cells								
If the project lifetime is less than 20 years, do not enter any data beyond the number of years required (do not delete rows)								
Inputs				Results				
Project Lifetime (yı	15			NPV	484,556			
Discount Rate	10%			Benefit/Cost Ratio	2.73			
Year	Costs	Benefits	Net Benefits	Present Value Costs	Present Value Benefits	Present Value Net Benefits		
0	41,660	91,360	49,700	41,660	91,360	49,700		
1	32,330	91,360	59,030	29,391	83,055	53,664		
2	32,330	91,360	59,030	26,719	75,504	48,785		
3	32,330	91,360	59,030	24,290	68,640	44,350		
4	32,330	91,360	59,030	22,082	62,400	40,318		
5	32,330	91,360	59,030	20,074	56,727	36,653		
6	32,330	91,360	59,030	18,249	51,570	33,321		
7	32,330	91,360	59,030	16,590	46,882	30,292		
8	32,330	91,360	59,030	15,082	42,620	27,538		
9	32,330	91,360	59,030	13,711	38,746	25,034		
10	32,330	91,360	59,030	12,465	35,223	22,759		
11	32,330	91,360	59,030	11,331	32,021	20,690		
12	32,330	91,360	59,030	10,301	29,110	18,809		
13	32,330	91,360	59,030	9,365	26,464	17,099		
14	32,330	91,360	59,030	8,513	24,058	15,544		
15								
16								
17								
18								
19								
TOTAL	494280	1,370,400	876,120	279,825	764,381	484,556		