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resilience to climate change: case studies from Sudan**

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Sustainable livelihood approach for assessing community resilience to climate change: case studies from Sudan¹

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Abstract

Exposure to climate variability and extremes, most particularly drought, poses substantial risks to people living in the Sudano-Sahel region. In several rural communities of Sudan, community based sustainable livelihood (SL) and environmental management (EM) measures have been implemented to build resilience to the stresses of drought and other climate variations and extremes. It is hypothesized that these measures also build resilience and adaptive capacity that lessen the vulnerability of rural communities of the region to future climate change. A research method based upon a sustainable livelihood conceptual framework is being developed and applied in case studies in Sudan to evaluate the performance of sustainable livelihood and environmental management measures for building resilience to today's climate-related shocks and for their potential for reducing community vulnerability to future climate change.

The initial design of the sustainable livelihood framework and research method are described in this paper. As research on the case studies progressed, the framework and method were modified in response to the specific contexts of the selected cases. The revised framework and method will be described in papers on the case studies that are in preparation.

Sustainable livelihood assessment is intended to generate an understanding of the role and impact of a project on enhancing and securing local people's livelihoods. As such, it relies on a range of data collection methods, a combination of qualitative and quantitative indicators and, to varying degrees, application of a sustainable livelihoods model or framework. The research used the sustainable livelihood model of UK Department of Foreign and International Development (DFID), and the notion of the five capitals (natural, physical, human, social and financial), albeit loosely, in order to frame the inquiry and capture perceptions of coping/adaptive capacity in the data collection process. Primary results obtained so far indicate that the framework can be a useful tool in understanding the impact of sustainable livelihood measures in increasing communities' resilience to climatic stresses - mainly drought - from local people's point of views.

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1. Introduction

It is clear that climate change will, in many parts of the world, adversely affect socio-economic sectors, which include water resources, agriculture, forestry, fisheries and human settlements, ecological systems and human health. Developing countries are the most vulnerable. (IPCC 2000a).

Sudan encompasses an area of about 250.6 million hectares, the majority of which is arid lands and desert. Throughout much of the country, water resources are limited, soil fertility is low, and drought is common. Compounded by a range of human pressures, these underlying conditions create a state of vulnerability in Sudan to climate impacts, and a troubling picture of vulnerability to anticipated climate change.

Drought is one of the most important climate phenomena that the country faces, as a recurring series of dry years has become a normal occurrence in the Sudano-Sahel region. The drought is threatening the existing cultivation of about 12 million hectares of rainfed, mechanized farming and 6.6 million hectares of traditional rainfed lands; pastoral and nomadic groups in the semi-arid areas of Sudan are also affected.

Climate scenario analyses conducted as part of the preparation of Sudan's First National Communications indicated that average temperatures are expected to rise significantly relative to baseline expectations. By 2060, projected warming ranges from 1.5°C to 3.1°C during August to between 1.1°C to 2.1°C during January.³ Projections of rainfall under climate change conditions also show sharp deviations from baseline expectations. Results from some of the models show average rainfall decreases of about 6 mm/month during the rainy season. The most vulnerable groups would be traditional rainfed farmers and pastoralists, groups least resilient to climate-related shocks. While in certain respects, the country is quite exposed to the potential impacts of climate change, it is simultaneously poised to undertake proactive steps that can preempt certain negative impacts, mitigate others, and enable the country to adapt to a changing climate. In response to these challenges, Sudan has been actively seeking to promote domestic sustainable development policies, by engaging in international environmental processes, facilitating strategic research, employing preventive measures and monitoring mechanisms, enabling ground-level sustainable livelihood development work, and strengthening its human and institutional capacity.

1.1 Background on Sustainable livelihood

Conceptually, "livelihoods" connote the means, activities, entitlements and assets by which people make a living. Assets, in this particular context, are defined as not only natural/biological (i.e., land, water, common-property resources, flora, fauna), but also social (i.e., community, family, social networks,

³ The range reflects the outputs of global circulation models applied to the central part of the Sudan.

participation, empowerment, human (i.e., knowledge, creation by skills) and physical (i.e., roads, markets, clinics, schools, bridges).

The Brundtland Commission in 1987 introduced SL in terms of resource ownership and access to basic needs and livelihood security, especially in rural areas.

The International Institute for Sustainable Development (IISD) defines sustainable livelihoods as being “concerned with people's capacities to generate and maintain their means of living, enhance their well-being, and that of future generations”

The definition used by the UK's Department of Foreign and International Development (DFID) incorporates these sentiments.

'A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base' (Chambers, and Conway, 1992).

1.2 Livelihood assessment

Livelihood assessment is a way of looking at how an individual, a household, or a community behaves under specific frame conditions. One of the ways to understand livelihood systems is to analyze the coping and adaptive strategies pursued by individuals and communities as a response to external shocks and stresses such as drought, civil strife and policy failures. There is, however, an important distinction between *coping* and *adaptive* strategies. Coping strategies are often a *short-term* response to a specific shock, such as drought. Actions could include switching to cultivation of drought-resistant crops or reliance on external food aid. Adaptive strategies, on the other hand, entail a long-term change in *behavior patterns* as a result of a shock or stress.

2. Sustainable livelihood and adaptation to climate change

Adaptation is the ability to respond and adjust to actual or potential impacts of changing climate conditions in ways that moderates harm or takes advantage of positive opportunities. It reflects positive actions to change the frequency and/or intensity of impacts, as opposed to coping strategies that are responses to impacts once they occur. The adaptation can be anticipatory, where systems adjust before the initial impacts take place, or it can be reactive, where change is introduced in response to the onset of impacts that will re-occur and reflect a structural change of state of the system: in climate terms, where new temperature and rainfall patterns emerge.

Adaptations vary not only with respect to their climatic stimuli but also with respect to other non-climate conditions, sometimes called intervening conditions,

which serve to influence the sensitivity of systems and the nature of their adjustments.

The goal of the research component of the Sudan AIACC Project “Environmental Strategies for Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East African” is to establish that certain sustainable livelihood and environmental management measures are and should be considered to be climate change adaptation options that can be included in the planning of future adaptation strategies.

In order for the project to make this claim, the research component has the following main objectives:

- To show ways in which certain sustainable livelihood and environmental measures increase the community resilience to today’s climate-related shocks such as drought.
- To show how such measures can be effectively implemented and supported for last impact.

Case studies are the primary research elements of the project. Selection is based, in part, on advance knowledge that the case presents a successful example of sustainable livelihood environmental management measure (SL/EM) increasing community resilience to climate shocks (mainly drought), and hence can operate as adaptation to climate change and maintains that:

- Climate variability and extremes can be used as a proxy for climate change since, as argued in the Third Assessment Report of the IPCC (2001), that experience with adaptation to climate variability and extremes can be drawn upon to develop appropriate strategies for adapting to anticipated climate change.
- Each case study will explore examples where local knowledge (e.g. traditional, indigenous autonomous and informal) and/ or external knowledge (formal, technical, directed) has been applied within a target community in the form of SL/EM strategy to enable the community to cope with or adapt to climate –related stress.
- The project will accept, based on the output of an initial scoping exercise and direct community consultation, that a set of measures has been effective and will focus instead on:
- The extent to which these measures increased coping and adaptive capacity and why; i.e., because of what local, national, regional policies and conditions.

The primary tool employed in this assessment is the sustainable livelihood impact assessment methods for assessing project impacts on target communities. To ensure coverage of Sudan’s rural circumstances and adequate representation of the Sahel (Africa Sahelian Region) as well as North and West Africa, case studies are intended to focus on distinct ecosystem sub-types (such as rangelands, forested lands (gum arabic belt) or agricultural System (rainfed sorghum along the agro-pastoral

continuum). Each case study focuses on a single community or group of communities within an ecological agricultural system as its unit of research and will compare a community vulnerability to climate extremes pre- and post-SL intervention.

3. Sustainable Livelihood (SL) assessment method

In relation to AIACC AF-14 Project, sustainable livelihood assessment is used to measure the impact of an intervention on a community's coping/adaptive capacity along the following parameters:

- it is intended to generate an understanding of the role and impact of the SL measure or intervention on enhancing and securing local people's livelihoods. As such it relies on a range of data collection methods, a combination of quantitative and qualitative indicators, and, to a varying degree, application of a sustainable livelihoods model or framework.
- Use of the DFID SL model and notion of the five capitals (natural, physical, human, social and financial (Box 1) in order to frame the enquiry and capture perception of coping/adaptive capacity in the data collection process.
- Within the SL framework the project employed the Livelihood Assets Tracking (LAST) system to measure changes in coping and adaptive capacity. Quantitative and qualitative indicators will be combined for use with LAST system.
- Consultation with communities was used to develop indicators of community resilience and construct word pictures. The role of SL intervention will be further examined in community forums, household surveys and targeted interviews. The word pictures will be used by households to assess their own coping and adaptive capacity to a climate-related impact. Stratified sampling methods were used to ensure representation of a range of individuals and household circumstances.

Box (1) ***Sustainable livelihood capitals or assets:***

Assets are considered to be stocks of different types of capital that can be used directly or indirectly to generate livelihoods. They can give rise to a flow of output, possibly becoming depleted as a consequence, or may be accumulated as a surplus to be invested in future productive activities.

Based on the five types of capital identified by the sustainable livelihood framework, five assets are identified:

Natural capital: consists of land, water and biological resources such as trees, pasture, and biodiversity. The productivity of these resources may be degraded or improved by human management.

Financial capital: Consists of stocks of money or other savings in liquid form. In this sense it does not include financial assets only but should also include easily disposable assets such as livestock, which in other senses may be considered as natural capital. It includes income levels, variability over time, and distribution within society of financial savings, access to credit, and debt levels.

Physical capital: Is that created by economic production. It includes infrastructure such as roads, irrigation works, electricity, reticulated equipment and housing.

Human capital: is constituted by the quantity and quality of labour available. At household level, therefore, it is determined by household size, but also by education, skills, and health of household members.

Social capital: Any assets such as rights or claims that are derived from membership of a group. This includes the ability to call on friends or kin for help in times of need, support from trade or professional associations (e.g framers' associations) and political claims on chiefs or politicians to provide assistance.

From Carney, 1998

4. Measuring adaptive capacity

A community's coping and adaptive capacities in the face of climatic variability and extremes is used as proxy for its level of coping and adaptive capacity for future climate change. Use of LAST system approach will be employed in indicators development – word pictures (quality of life indices) are the main tool of the LAST system for gathering and reorganizing data. Word pictures are description of household circumstances developed in a participatory manner with the community in question. A one-word picture will outline a “best case;” another will outline a “worse case” snapshot. Several word pictures will be developed to describe household circumstances in between. Embedded in these word pictures are quantitative and qualitative indicators; e.g., access to forest produce or rangeland.

Indicators selected for assessing communities' resilience should reflect the following:

- Communities' ability to cope with and recover from shocks and stresses;
- Economic efficiency and income stability,

- Ecological integrity, ensuring that livelihood activities do not irreversibly degrade natural resources within a given ecosystem; and
- Social equity, which suggests that promotion of livelihood opportunities for one group should not foreclose options for other groups, either now or in the future.

In other words, SL reflects the capability of people to make a sustainable living and improve their quality of life without jeopardizing the livelihood options of others, either now or in the future.

5. Selection of case studies

Selected case studies necessarily satisfy the following criteria:

- Involving past or on-going climate-related events that are representative of projected future climate change; e.g., prolonged drought.
- Involve climate-related events that are representative of experiences of neighboring Sahelian countries.
- Explore specific examples of community-level SL/EM strategies that have been applied in other countries.
- Explore specific examples of community-level SL/EM applications that are considered successful by government and/or civil society groups and are confirmed as successful by the communities themselves.
- Involve clear research objectives, available data, and feasible fieldwork strategies.

Having met the basic criteria, case studies are then chosen through a basic selection process involving a series of screenings for feasibility, issue coverage, and overall contribution to major project goals.

Once cases have been selected, they are commissioned to locally-based professionals, selected for their relevant expertise, to conduct the research.

A preliminary case study protocol includes the following:

- (a) Workplan;
- (b) Initial Scoping Report;
- (c) Recruitment of Local Informant;
- (d) Initial Site Reconnaissance;
- (e) Design of the Field Research Tool;
- (f) Implementation of the Research Tool;
- (g) Synthesis;
- (h) Follow-up visits (if necessary).

5.1 Initial scoping

In order to enable the selection of the case study process, the project team gathered the following background information in advance:

- *Climatic events:* compiled information on recent (within the last 20 years) extreme climatic events, including geographic extent, intensity, duration, etc., from, e.g., WMO and FAO datasets.

- *SL/EM Strategies*: a number of sources for information on SL/EM strategies that have been recently applied in response to drought vulnerability and/or impacts associated with one of the above climatic events.

The information collected included:

- a) The category of practice (e.g., agriculture, water resources, etc.),
- b) The type of action (e.g., autonomous or directed),
- c) The specific strategy (e.g., soil conservation, rangelands management, watershed restoration)
- d) The specific action (e.g., intercropping, windbreak construction, water harvesting),
- e) The implementing group (e.g., government agencies, NGOs, community groups, individual farmers, etc.),
- f) The intended beneficiaries (e.g., communities, nomadic groups, individual farmers),
- g) The location and duration of use.

Sources of this information included community groups, local, regional and international NGOs, government agencies, university departments, bilateral and multilateral development agencies, etc.

5.2 Pilot case study

To demonstrate the use of sustainable livelihood framework for measuring the adaptive capacity of local communities to climate change impacts, the framework was applied to assess a pilot project, Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity. The pilot project was implemented in Gireighikh, Bara Province of North Kordofan State with a grant from the United National Development Program, Global Environment Facility. This community is a mix of agropastoralists and transhumants who are frequently exposed to and extremely vulnerable to drought. The main development objectives of the community project were twofold: a) to sequester carbon through the implementation of a sustainable, local-level natural resources management system that prevents degradation, rehabilitates or improves rangelands; and b) to reduce the risks of production failure in a drought-prone area by providing alternatives for sustainable production, increasing number of livelihood alternatives so that out-migration will decrease and population will stabilize”.

The package of sustainable livelihood measures undertaken by the project villages included institution building, training, rangeland rehabilitation (e.g. replanting, stabilization of sand dunes, creation of windbreaks, and livestock restocking and management practices), and community development measures such as water harvesting and management, rural energy management, revolving credit program, and drought contingency planning.

A project evaluation conducted by an independent team of experts concluded that the community project is highly successful in meeting its development objectives

and the Near East Foundation is seeking to expand the project to more communities. The evaluation showed the following results:

- Community institutional structure created
 - o Land-use master plans;
 - o Oversight and mobilization structures
- Rangeland rehabilitation measures implemented
 - o 5 km of sand dunes re-vegetated
 - o 195 km of windbreaks sheltering 130 farms
 - o Approximately 700 ha improved
 - o Livestock restocking
- Community development
 - o 2 revolving funds
 - o 5 pastoral women's groups focused on livestock value-adding activities
 - o 5 new irrigated gardens and wells
 - o A grain storage and seed credit program
- Effectively combined participatory planning, capacity building and access to credit
- Diversified production system and established drought contingency measures
- High impact – several major objectives exceeded original targets of the project due to perceived benefits
- Positive leakage- additional villages implementing project strategies
- Overall there was an enhanced capacity of the community to withstand drought.

(See scoping summary annex 1)

5.3. Development of indicators

Our interest in the community project is to examine its performance for building resilience in the community to climate stresses and shocks. This required the development of community resilience indicators. Our first step was to assemble lists of generic⁴ quantitative and qualitative indicators around the five capital assets in the sustainable livelihoods framework – i.e., those that are relevant to rural, drought-prone settings in Sudan. The team also strives for indicators that represent balance between productivity, equity and sustainability. In this way, a core set of ten to fifteen generic quantitative, 'expert-derived' indicators was developed by the project team and task force, as well as a core set of qualitative indicators.

These indicators were revised and refined for each case study by the researchers and communities in question, in order to better reflect their specific circumstances i.e. to review the initial set of indicators in a community forum and to guide the community members through a process of reflection and revision, resulting in a set

⁴ Represent a set of sustainability indicators that is developed as expert-derived ones are revised/adapted by local communities.

of locally-derived indicators. The preliminary list of generic indicators included measures of:

- Land degradation (slowed or reversed);
- Condition of the vegetation cover (stabilized or improved);
- Soil and/or crop productivity (stabilized or increased);
- Water supply (stabilized or increased);
- Average income levels (stabilized or increased);
- Food stores (stabilized or increased);
- Migration (slowed, stabilized, or reversed);

Two site visits to communities that participated in the pilot project were made. In the initial site visit, communities were consulted to consider the preliminary *qualitative* indicators and to develop their own sets of indicators that are relevant to and representative of their realities and concerns. Objectives of the first visit included garnering community trust and cooperation, introducing the study to the different stakeholders (government, NGOs, community members), confirming that communities shared the view of the independent evaluators' that the pilot project was successful, identifying parameters of success, understanding why communities consider the project successful, and deriving a preliminary list of locally-determined indicators. Local informants were nominated by the communities and second site visits were scheduled.

Building on the initial site visit, a second site visit focused on finalizing and using indicators to describe household circumstances, pre- and post-SL intervention, in order to define the net impact of the SL activity on their resilience to climate extremes. Data was collected for the agreed set of resilience indicators and the data collection was documented, basic data analysis was conducted, and findings summarized.

6. Outline of farm/household questionnaire

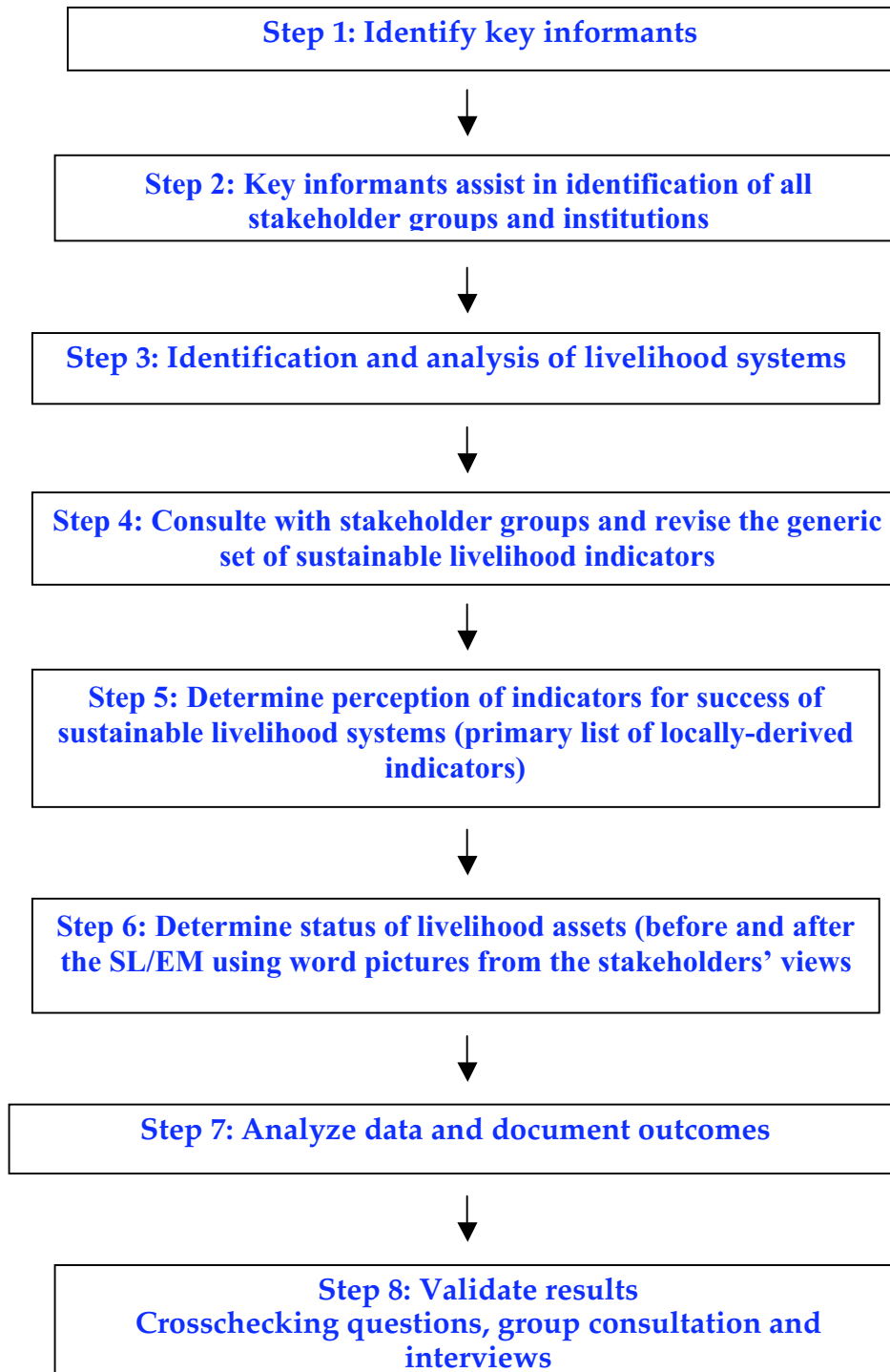
A questionnaire was developed and administered to collect data on pre- and post-project intervention status of indicators noted in the table below.

<u>Natural Resources</u>
- Rangeland productivity
- Rangeland carrying capacity
- Plant species composition
- Water sources, quality and use
- Access to Natural resources by marginal community groups (women, minority tribes, the poor)
<u>Natural resources management</u>
- Management of water wells
- Maintenance of water pumps
- Grain stores (capacity and accessibility)
- Grain mills (capacity and accessibility)
- Energy conservation techniques (improved stoves)

- Effectiveness of management systems applied to pasture, water, livestock etc...
- Availability of spare parts
<u>Financial resources</u>
- Income generating activities
- Income levels and stability
- Revolving funds / amount of credit granted to individuals
- Savings
- Accessibility of vulnerable groups to credit (women, poor and Kawahla)
<u>Human (household) resources</u>
- Ownership of assets
- Skilled labors
- Housing type
- Access of marginal groups to education, training and extension services
<u>Farm outputs</u>
- Average production per unit area of rangeland
- No. of animals per unit area of rangeland
- Yield from main crops
- Production of vegetables and fruits from women gardens
<u>Access to services</u>
- Extension
- Health
- Education
- Training
- Veterinary services
- <u>Social indicators</u>
- Organizational set-up (local village committees)
- Role of village committees in the decision making process.
- Membership to organizations
- Sharing of responsibility
<u>Policies</u>
- Government polices in relation to:
- Taxes
- Market prices
- Incentives
- Land tenure
<u>Risks</u>
- Changing government policies
- Out-migration by skilled people
- Encroachment by other tribes into the project area
- Pressures on rangelands by intruding nomads

7. Steps for the assessment of sustainable livelihood

The steps conducted for assessing the sustainable livelihood can be summarized as follows:



8. Development of criteria and indicators around the capital assets:

Around each capital asset a set of criteria and indicators are developed as tabulated below:

Capital assets	Dimension	Criteria	Indicators
Natural capital	Productivity	1.Rangeland productivity 2.Carrying capacity 3.Forage production	Area of improved / rehabilitated rangeland -Animal units per average ha -Average ton of dry matter /ha per year -
	Equity	Access of marginal groups to grazing allotments	% of Kawahla tribes with access to grazing allotments
	Sustainability	-Rangeland management -Sustainability of rangeland -Rangeland quality	-Effectiveness of management practices -% of agric. land been transferred into rangeland, Abundance of desirable plant species
	Risks	-Pressures on rangeland	Frequency of nomads from other areas encroachment into the project RL.
Financial Capital	Productivity	1Availability of funds -Household income	-Amount of funding granted to each household -Household income level, sources (degree of diversification) stability and sufficiency
	Equity	Access of marginal groups to cash credits	-% of poor people receiving credits Ability of women to obtain credits Kawahla tribes with access to credits

	Sustainability	-Stability of income generating activities (economic activities)	- Availability of information on rainfall forecast or early warning to enable communities to respond to extreme climatic conditions in a timely fashion -Support from local institutions (management committees) to support local income-generating activities. -Support from finance and credit systems to local income-generating activities -Effectiveness (timeliness) of credit repayment by local people -Supporting government policies to income-generating activities
	Risks	- Instability of government policies Government regarding local income generation activities (claims to locally funded infrastructure)	No. of times when vet. Pharmacy or its equipment were used by the government as a pool resources -Taxes charged by government on vet. Pharmacy (income taxes)
Human capital	Productivity	- Training facilities -Capacity of Vet. Services -State of social services	-Number of trained CAHW -No. of animals treated by skilled CAHW -No. of vaccination campaigns conducted each year -Chances for local communities in getting education, health, and extension. -

	Equity	-Accessibility and affordability to social services -Accessibility to women garden	-% of marginal groups (Kawahla tribes, poor and women) who have access to social services % of women who have access and benefit from the women garden
	Sustainability	-Level of environmental awareness (conservation measures) -Availability of affordable human and animal medicines	-Rate of adoption of improved charcoal by households -% of farmers who shifted to less NR dependence alternative income generating activities -% of households using mud walled houses instead of wooden houses. % of household who can afford to get animal and human medicines and drugs .
	Risks	-Out-migration of skills	Rate of out migration of skilled people per village.

Physical Capital	Productivity	-Grain storage capacities -Irrigation facilities	-Quantity of grains stored in good harvest season -No and capacities of grain mills (kg of flour produced / day) -No. of running water pumps -
	Equity	Access of marginal groups to grain stores	-% of Kawahla tribes with access to grain stores % of women with access to and ability to participate in grain store activities -% of poor who participate in grain store activities

	Sustainability	- Effectiveness of management system to water facilities - Training of workers (capacity building)	- % of wells under proper management systems No. of trained workers for doing the routine maintenance of water facilities Availability of affordable spare parts
	Risks	- Government claims on community grain stores	How frequent?
Social capital	Productivity	- Areas of women gardens - Contribution of women gardens in satisfying community needs for the vegetables, fruits and other agric crops - Role of local committees on the organization and promotion of community works.	- % of expansion or decrease in areas of women garden Garden products as % of total village supply of fruits and vegetables - % of people who participate in community development
	Equity	Participation in the decision-making process, and access of marginal groups to same	- Representation by each group in the decision-making process.
	Sustainability	- Expansion in the use of mud to public buildings - Expansion in the use of improved charcoal stoves - Provision by government of institutional support to local community institutions	- % of public building with mud walled (mosques, schools and restaurants) - Dissemination rate of improved charcoal stoves - No. of coordinated activities between government and local committees
	Risks	- Capability of committees to continue performing their tasks	

9. Preparation of a livelihood assets status framework matrix:

The purpose of this matrix is to provide a simple, quick, and easily-understood assessment of the status of access, endowment, and/or utilization capitals based on local understanding and perceptions of stakeholders in the system. The framework is then used to assist in the interpretation of local criteria and indicators of success of the system and compare between different times (pre- and post- project intervention). The framework is based on the five capitals of the sustainable livelihoods framework (Box 1) and describes the best and worst

status of the five capitals as defined in locally understood terms and perceptions. This is an adaptation of the method of “quality of Life Assessment” (Bond & Hulme, 1992). For each capital a different range of word pictures, scenarios, or indicators are determined by the relevant stakeholders to represent the best and worst scenarios in their views.

The communities are expected to describe the worst case and the best case as well as other stages in between, this can include anything from two to five situations or pictures. A sample of this assessment matrix is shown below:

BARA CASE STUDY ASSESSMENT SHEET: Natural Capital

Notes on using this assessment sheet:

There is one sheet for each of the five capital assets (natural resources, physical capital, financial, etc). Each sheet consists of the criteria in the left hand column and the indicator range spread across the remaining columns the criteria and indicator serve as the basis of each interview question, as outlined in the sample questions below. The interviewees responses should correspond (roughly) to the four or five stages in the indicator range. For each question, the interviewee should give one response to indicate their circumstances/ experience PRIOR to the project, and one response to indicate their circumstances/ experience AFTER the project. In the top row is a scoring bar, which can be used to help record the interviewees' responses to each question.

Assessment sheet for natural resources						
		Worst case	2	3	4	Best case
Criteria	Indicator	0 5 10 15 20	20-40	40-60	60-80	80 85 90 95 100
Productivity: Rangelands productivity	(1) Area of improved/rehabilitated rangelands	Area degraded, worsening	Low level of rehabilitation (0 to 30ha)	Moderate rehabilitation (30 to 60ha)	Good rehabilitation (60 to 90 ha)	Excellent rehabilitation (>90 ha)
<p>Sample Interview Questions: Tell me about the status of rangelands productivity prior to the project. Were they degraded or had there been any rehabilitation, and if so, how much? Associated response score: Tell me about the status of rangelands productivity following the project. Were they degraded or had there been any rehabilitation, and if so, how much? Associated response score:</p>						
	(2) Carrying capacity	<5 AU/ha/year	5 to 10 AU/ha/year	10 to 15 AU/ha/year	15 to 20 AU/ha/year	>20 AU/ha/year
<p>Sample Interview Questions: Tell me about the carrying capacity of rangelands prior to the project. How many animal units could the average hectare support, per year? Associated response score: Tell me about the carrying capacity of rangelands following the project. How many animal units could the average hectare support, per year? Associated response score:</p>						
	(3) Forage production	Poor production (0 to 5 tons DM/ha)		Moderate production (5 to 10 tons DM/ha)		High production 10 to 15 tons DM/ha)
<p>Sample Interview Questions: Tell me about forage production prior to the project. How many tons of dry matter would you estimate the average hectare produced each year? Associated response score: Tell me about forage production following the project. How many tons of dry matter would you estimate the average hectare produced each year? Associated response score:</p>						

Equity: Marginal group (Kawahla) access to grazing allotments	(1) Access of Kawahla stocks to village grazing allotments	No access	0 to 20%	20 to 40%	40 to 60%	60 to 80%
Sample Interview Questions: Tell me about the access of Kawahla people to grazing allotments prior to the project. What percentage of Kawahla stocks were grazed on village grazing allotments? Associated response score: Tell me about the access of Kawahla people to grazing allotments following the project. What percentage of Kawahla stocks were grazed on village grazing allotments? Associated response score:						
Sustainability: Rangelands management	(1) Transition from privately held marginal agricultural land to privately held grazing land	No transition (private land = 100 % agricultural land)	Low transition (ratio = 90 % agricultural, 10 % grazing land)	Moderate transition (ratio = 80 % agricultural, 20 % grazing land)	Good transition. (Ratio = 70 % agricultural, 30 % grazing land)	Excellent transition (ratio = less than 60 % agricultural, more than 40 % grazing land)
Sample Interview Questions: Tell me about per cent of grazing land compared to agricultural land prior to the project. What percentage of land was left as grazing land Associated response score: Tell me about percent of grazing land compared to agricultural land following the project. What percentage of land was left as grazing land Associated response score:						
(2) Application of sustainable grazing systems		Not applied at all	Applied on 25 % of the grazing land	Applied on 50 % of the grazing land	Applied on 75 % of the grazing land	Applied on the whole grazing land
Sample Interview Questions: Tell me about application of the sustainable grazing systems prior to the project. What part of the land was the grazing systems applied on it? Associated response score: Tell me about application of the sustainable grazing systems following the project. What part of the land was the grazing systems applied on it? Associated response score:						
(3) Application of sustainable stocking rates (given rangeland conditions)		Unsustainable rate applied; land degradation		Stable rate applied; no land degradation		Sustainable rate applied; some areas of land regenerating
Sample Interview Questions: Tell me about the stocking rate used prior to the project. Given the condition of grazing land at the time, were sustainable stocks of animals grazed? Associated response score: Tell me about the stocking rate used following the project. Given the condition of grazing land at the time, were sustainable numbers of animals grazed? Associated response score:						
External Risks: External (e.g.,	(1) Annual trespass incidences recorded at native court	More than 20	15 to 20	10 to 15	5 to 10	Less than 5

(e.g., nomadic) pressures on improved rangelands	Sample Interview Questions: Tell me about the number of annual trespass incidences prior to the project. How many times per year did people from outside the project area brought their animals to utilize the grazing resources within the project area? Associated response score: Tell me about the number of annual trespass incidences following the project. How many times per year did people from outside the project area brought their animals to utilize the grazing resources within the project area? Associated response score:					
	(2) Recorded size of trespassing herds	More than 80 AU per ha	60 to 80 AU per ha	40 to 60 AU per ha	20 to 40 AU per ha	<20 AU per ha
	Sample Interview Questions: Tell me about the recorded size of the trespassing herds prior to the project. How many heads of different animal species (AU) recorded as trespassing per hectare? Associated response score: Tell me about the recorded size of the trespassing herds following the project. How many heads of different animal species (AU) recorded as trespassing per hectare? Associated response score:					

These assessment sheets were further detailed into questionnaire forms to facilitate the data collection, as shown below

Example (1)

(1) Natural Capital

(a) Productivity

(Rangeland productivity):

Q1: Tell me about area of improved/ rehabilitated rangelands, were they degraded or had there been any rehabilitation, and if so, how much?

Prior the Project	0 5 10 15 20 Worst case	20-40	40-60	60-80	80 85 90 100 Best case
	Area degraded, worsening	Low level of rehabilitation (0 to 30ha)	Moderate rehabilitation (30 to 60ha)	Good rehabilitation (60 to 90 ha)	Excellent rehabilitation (>90 ha)
Following the project	Area degraded, worsening	Low level of rehabilitation (0 to 30ha)	Moderate rehabilitation (30 to 60ha)	Good rehabilitation (60 to 90 ha)	Excellent rehabilitation (>90 ha)

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Q2: Tell me about carrying capacity, how many animal units could the average hectare support, per year?

Prior the Project	<5 AU/ha/year	5 to 10 AU/ha/year	10 to 15 AU/ha/year	15 to 20 AU/ha/year	>20 AU/ha/year
Following the project	<5 AU/ha/year	5 to 10 AU/ha/year	10 to 15 AU/ha/year	15 to 20 AU/ha/year	>20 AU/ha/year

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IISD Community Adaptation and Sustainable Livelihoods (CASL) Programme:
<http://www.iisd.org/casl/default.htm>

CASL Drought Mitigation Project:
<http://www.iisd.org/casl/projects/drought.htm>

Institute for Development Studies: <http://www.ids.ac.uk/ids/>

DFID/IDS Livelihoods Connect: <http://www.livelihoods.org/>

Annex (1)

Pilot Case Study: Scoping Report: Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity

Location: Gireigikh rural council of Bara Province of North Kordofan State.

Coordinator: Community of Gireigikh Rural Council, the Range and Pasture Administration office of North Kordofan State, and the Federal Range and Pasture Administration.

Time Frame: 1996-2000

Status: Completed.

Source: United Nations Development Program Global Environment Facility

1. **Project focus:** “The project’s main development objective was twofold: a) to sequester carbon through the implementation of a sustainable, local-level natural resources management system that prevents degradation, rehabilitates or improves rangelands; and b) to reduce the risks of production failure in a drought-prone area by providing alternatives for sustainable production, so that out-migration will decrease and population will stabilize” (*Summary Report*).
2. **Local context:**
 - a. **Climatic:** Semi-arid and desert scrub areas.
 - b. **Geographic:** Western Sudan.
 - c. **Socio-economic:** A mix of agropastoralists and transhumant. Extremely vulnerable to drought.
 - d. **Key ongoing pressures:** Degraded rangelands, and atmospheric dust in the region.
 - e. **Current Vulnerabilities:** Most vulnerable to global warming effects. Degraded soil and failing livestock and crop production.
 - f. **Intended beneficiaries:** 30% of villages in Gireigikh rural council, but also, because this project is a model for all semi-arid areas, long-term beneficiaries will be all highly vulnerable semi-arid areas.
3. **Project response:**
 - a. **Agriculture:** Small scale irrigated vegetable gardens, pest management.
 - b. **Water Supply:** Construction and Management of water wells.
 - c. **Watershed Management:** Water management sub-committee created in every village.
 - d. **Forestry/Rangelands:** Wind-break planting, sand dune stabilization, tree and shrub planting
4. **Project approach:**

- a. **Institution building:** Implementation Committees and Coordination Committees created in village communities.
 - b. **Capacity-building/training:** 45 training events to enhance community development and improve natural resource management. Topics included soup production, macaroni production, range management, and pest management. These activities encouraged representation by women.
 - c. **Participation:** Voluntary participation from community, especially women.
5. **Reported achievements:**
- 700 hectares of improved rangeland with proper management. 600 of these hectares were voluntarily improved by members of the community.
 - Several neighboring villages implemented project strategies due to the positive response in project villages.
 - 5 kilometres of sand dunes re-vegetated.
 - 130 farms provided with windbreaks.