



Environmental Strategies to Increase Human Resilience to Climate Change: Lessons for Eastern and Northern Africa

A Final Report Submitted to Assessments of Impacts and
Adaptations to Climate Change (AIACC), Project No. AF 14

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Submitted by Balgis Osman Elasha
Higher Council for Environment and Natural Resources (HCENR), Sudan

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About AIACC

Assessments of Impacts and Adaptations to Climate Change (AIACC) enhances capabilities in the developing world for responding to climate change by building scientific and technical capacity, advancing scientific knowledge, and linking scientific and policy communities. These activities are supporting the work of the United Nations Framework Convention on Climate Change (UNFCCC) by adding to the knowledge and expertise that are needed for national communications of parties to the Convention.

Twenty-four regional assessments have been conducted under AIACC in Africa, Asia, Latin America and small island states of the Caribbean, Indian and Pacific Oceans. The regional assessments include investigations of climate change risks and adaptation options for agriculture, grazing lands, water resources, ecological systems, biodiversity, coastal settlements, food security, livelihoods, and human health.

The regional assessments were executed over the period 2002-2005 by multidisciplinary, multi-institutional regional teams of investigators. The teams, selected through merit review of submitted proposals, were supported by the AIACC project with funding, technical assistance, mentoring and training. The network of AIACC regional teams also assisted each other through collaborations to share methods, data, climate change scenarios and expertise. More than 340 scientists, experts and students from 150 institutions in 50 developing and 12 developed countries participated in the project.

The findings, methods and recommendations of the regional assessments are documented in the *AIACC Final Reports* series, as well as in numerous peer-reviewed and other publications. This report is one report in the series.

AIACC, a project of the Global Environment Facility (GEF), is implemented by the United Nations Environment Programme (UNEP) and managed by the Global Change SysTem for Analysis, Research and Training (START) and the Third World Academy of Sciences (TWAS). The project concept and proposal was developed in collaboration with the Intergovernmental Panel on Climate Change (IPCC), which chairs the project steering committee. The primary funding for the project is provided by a grant from the GEF. In addition, AIACC receives funding from the Canadian International Development Agency, the U.S. Agency for International Development, the U.S. Environmental Protection Agency, and the Rockefeller Foundation. The developing country institutions that executed the regional assessments provided substantial in-kind support.

For more information about the AIACC project, and to obtain electronic copies of AIACC Final Reports and other AIACC publications, please visit our website at www.aiaccproject.org.

Summary Project Information

Project Title

Environmental Strategies to increase Human Resilience to Climate Change: Lessons for North and East Africa (AF 14)

Abstract

The AF-14 project was motivated by the observation that certain community-based development activities serve to build coping and adaptive capacity in the face of climate-related shocks. In countries like Sudan, where many communities currently lack the capacity to effectively cope with drought, measures such as these can serve to build coping and adaptive capacity and can play a role in emerging climate change adaptation strategies. Indeed, such measures are essential for closing the current deficit in climate coping capacity and providing communities the basis upon which to adapt to climate change. But if, in its adaptation planning process, a country like Sudan wished to prioritize adaptation for certain communities highly vulnerable to drought impacts, it would face the challenge of determining which specific measures to foster. What works at the community scale, in what settings, under what conditions? The methods designed and adapted by the AF-14 project aimed to respond to this challenge. The project explored the hypothesis that a simple set of project impact assessment tools – in this case, structured around the sustainable livelihoods (SL) framework – can help to fill the practical and conceptual gap that exists between local vulnerability to climate impacts and national adaptation assessment and decision-making processes. The project explored this hypothesis by employing the SL framework to assess the impact of community-based development activities on community coping capacity. The project developed and adapted existing project impact assessment methods, and applied these in three communities in which efforts had been undertaken to increase the capacity of households to cope with drought. In participation with the communities, indicators of household coping capacity were developed and knowledge elicitation methods were used to explore the specific nature of this change. The results point to suites of measures that have clear beneficial impact and can be employed in Sudan for building the capacity to cope with current climate variability, and by extension, to adapt to climate change. Of equal value and broader relevance, the success of this community-based assessment process suggests that the methods used, and others like them, have clear applications within the larger vulnerability and adaptation assessment process.

Administering Institution

Higher Council for Environment & Natural Resources (HCENR), Gamaa Street, Khartoum-Sudan

Participating Stakeholder Institutions

Faculty of Forestry, University of Khartoum, Sudan; Institute of Environmental Studies, University of Khartoum, Sudan; Gezira University, Sudan; Drought and Desertification Control Unit, Ministry of Agriculture and Forestry, Sudan; Environmentalist Society, Sudan; EDGE Centre for Research and Consultancies, Sudan; State Ministry of Water Resources, Sudan; Ministry of Agriculture and Animal Resources, Sudan; Kordofan, Darfur and Red Sea States; SOS Sahel; Intermediate Technology Development Group (ITDG), Sudan; Community Development Committee and SECS, Bara, Sudan; Community Organization, Arbaat; and Farmers' Union, Darfur, Sudan.

Country of Primary Focus

Sudan

Countries of secondary focus

Countries of the Sahelian region: Chad, Niger, Mali and Burkina Faso; and Countries of Northeast Africa: Egypt, Eritrea, and Ethiopia. The study is applicable to region of Northeast Africa

Case Study Areas

Three case studies were conducted covering areas located in the West, Central and East Sudan between latitudes 10°–18°N), namely:

- 1st Case study: Community-Based Rangeland Rehabilitation in Sudan, Geraigikh, West Central Sudan/ North Kordofan State
- 2nd Case study: Khor Arba'at Rehabilitation Programme (KARP), Red Sea State, Eastern Sudan
- 3rd. Case study: Water Harvesting Technique as a Coping Mechanism to Climate Variability and Change (Drought), North Darfur State, Western Sudan.

Sectors Studied

Directly addressing: Agriculture sector (crop production, livestock, mixed crop-livestock), water resources and food security

Indirectly addressing: Forestry, ecosystems (grasslands and forests) and biodiversity

Systems Studied

Agricultural systems, pastoral systems, human Livelihoods and food security

Groups Studied

Livelihood groups - mainly subsistence farmers and herders; and demographic groups - rural poor, women and minority groups

Sources of Stress and Change

Primary sources: Climate variability and extremes – drought and low rainfall; and fluctuation in seasonal stream flow (Khor Abu Habi)

Secondary sources of stress or change

Land degradation and desertification, land use change, institutional change and policy change

Project Funding and In-kind Support

AIACC: US \$150,000 grant; HCENR-Khartoum: US \$30,000 in-kind contribution

Investigators

Principal investigators: Balgis Osman Elasha, HCENR, Gamaa Street, P.O. Box 10488, Sudan. Phone: ++249 183 786903, Fax: ++ 249 183 787617, Email: balgis@yahoo.com; Nagmeldin Goutbi, HCENR, Gamaa Street, P.O. Box 10488, Sudan. Phone: ++249 183 786903, Fax: ++ 249 183 787617, Email: goutbi@yahoo.com; Erika Spanger-Siegfried, Stockholm Environmental Institute - Boston (SEI-B), 11 Arlington Street Boston, MA 02116 USA. Phone: (617) 266-8090, Fax: (617) 266-8303, Email: esiegfried@tellus.org.

Project Advisors: Ismail ElGizouli, HCENR, Sudan, Email: gizouli@yahoo.com; Bill Dougherty, SEI-B, Email: billd@tellus.org

Case Study Researchers: Dr. Hassan A. Abdel Ati, EDGE Centre for Research and Consultancies, Phone: 481836, Email: h-abdelati@hotmail.com; Hashim Mohd El Hassan, Ministry of Agriculture, Sudan, Phone: 234768; Dr.Sumaya Zakiieldin, Institute of Environmental Studies (SEI), University of Khartoum, Sudan, Email: zakkiields@yahoo.com, Phone: 0912977277; Ahmed Hanafi Abd-Elmagid, Intermediate Technology Development Group (ITDG), Sudan, Email: ahanafi2001@yahoo.com, Phone: 0183424549; and Dr. .Elamin Sanjak Baldo, Faculty of Forestry, University of Khartoum, Sudan, Email: ssanjak2000@yahoo.com, Phone: 310104

National Taskforce members: Prof . Hussein Adam, Email: hsadam2002@yahoo.com; and Prof. Yagoub Abdalla, Email: envi@sudanmil.net.sd

Regional Taskforce member: Dr. Taye Bekele, Ethiopia, Email: tayebekele@yahoo.com

International Taskforce members: Dr.Saleemul Huq, IIED, Email: Saleemul.Huq@iied.org; and Dr. Tom Downing, SEI-Oxford, UK, Email: Tom.downing@sei.se

Executive Summary

Research problem and objectives

Despite remaining uncertainty surrounding the magnitude, pace and character of future climate change, there is an urgent need for Africa to build its capacity to cope with and adapt to climate impacts. Africa, more than any other continent, lacks adequate resilience to withstand and recover from current climate variability and extremes. As recent reports suggest, the spectre of the added stress of climate change is of profound concern.¹ For Africans exploring climate change vulnerability and considering adaptation options, the irony of the recent G-8 meeting (July,2005) – in which increased aid to Africa was agreed upon while climate change mitigation goals were not – is striking. In reality, it is absolutely urgent and fundamentally necessary that climate change mitigation goals are met otherwise the tentative basis upon which Africa struggles for sustainable human development may quickly erode – potentially beyond the reach of the G-8 development aid.

Yet, even with aggressive steps toward mitigation, some level of climate change will be unavoidable. Alongside mitigation efforts, resilience to both current and anticipated climate impacts must be built. Throughout Africa, there are activities that achieve resilience-building goals, enabling communities to cope more effectively with shocks and stress, including climate impacts. In light of two key observations – the uncertainty around climate projections and the tenuous and at worst deteriorating state of human development in Africa – there is a need to understand and build on these activities. While advancing mitigation, the global community as well as individual African states must overcome the bureaucratic distinction between adaptation to current climate impacts and future climate change and must support broad-based resilience building, uniting the development and adaptation communities in the process. In essence, adaptation cannot be effectively undertaken separate from poverty alleviation and sustainable development activities in general, just as poverty alleviation efforts will be short-lived if undertaken without consideration of climate change and improved coping needs.

The AF-14 project in the AIACC project series is motivated by these observations, and by the understanding that limited information exists for adaptation decision making at all the levels (international, regional and national) as well as for African decision-makers who might wish to pursue efforts that achieve both these goals. Poverty alleviation and adaptation are not synonymous; instead, they overlap, sometimes indistinguishably in ground-level activities. In light of this and in anticipation of growing demand for information on such activities, the objective of the AF-14 project has been to demonstrate a method for generating information on effective resilience-building activities, and to raise the profile of such activities within the climate adaptation and broader development communities.

In Sudan, where drought is a current threat and will continue to be in the foreseeable future – potentially worsening under climate change – activities to improve community and household capacity to cope with drought are of particular value.² Certain environmental management strategies (sustainable development activities) in Sudan – whether approached from a poverty alleviation or natural resource management perspective – have been quite effective in this regard. The AF-14 project explored three examples of such experiences, documenting both, the lessons they had to offer and, equally important, an approach to extracting those lessons and to better understand how to support community coping capacity.

Approach

The AF-14 project was based on the following premises:

¹ See e.g., *Africa: Up in Smoke?* the second report from the Working Group on Climate Change and Development, 2005. http://www.neweconomics.org/gen/z_sys_publicationdetail.aspx?pid=208

² While recent climate modelling (see Hoerling, Martin P., James W. Hurrell, and Jon Eischeid. "Detection and attribution of 20th century northern and southern African monsoon change." Submitted to Journal of Climate) suggests that the Sahel may become wetter on average in the future, there is significant uncertainty surrounding this and other modelling efforts; if such research proves to be accurate, drought and dry spells would almost certainly continue to be a major factor in the region.

- Increasing the capacity of the most vulnerable groups to cope with today's climate-related impacts must be a pre-eminent goal of adaptation – without this, there is inadequate basis upon which to build future coping and adaptive capacity.
- To achieve this, small-scale, community-level strategies will be needed alongside the large-scale, technical/ structural approach that may dominate adaptation planning. However, there is a need to provide decision-makers with information on these small-scale strategies.
- Methods have been developed in separate fields of practice – sustainable livelihoods, natural resource management and disaster risk management – which can meet these needs.
- Lastly, these sorts of strategies – i.e., that increase the resilience and adaptive capacity of the most vulnerable people while accomplishing added social and environmental goals (e.g., slowing desertification) – can diversify and strengthen national adaptation plans of developing countries, and development efforts in general.

It is these types of strategies that the project aimed to identify, explore and discuss, making them accessible, readily understandable and useable to the policy-making process. Case studies, including a policy analysis component, served as the primary research tool for this purpose.

Drawing from existing research platforms, the project research consists of three interlinked processes – the empirical, in which background information is gathered and organized, the analytical, in which case studies are carried out, and the participatory, in which community input, validation and guidance is sought. Within the analytical process, the project used the sustainable livelihoods framework to enable researchers to measure resilience at the local level to climate-related impacts. With this approach, the following research scope was established:

- The project undertook three separate case studies in different arid regions of Sudan. Case studies were concerned with current and recent historical experience, and focused in particular on the experience of the 1980s through to the present.
- Each case study focused on a single community or cluster of communities within an ecological/ agricultural system as its unit of research.
- Each case study explored examples where “local” knowledge (e.g., traditional, indigenous, autonomous, informal) and/ or “external” knowledge (e.g., formal, technical, directed) have been applied within a target community(ies), generally in the form of sustainable livelihoods (SL) or natural resource management (NRM) measures, to enable the community to cope with or adapt to climate-related stress.
- Case studies compared a community's resilience to climate extremes, before and after project activities.
- Case studies were conducted by commissioned researchers, through desk-based and field research over a six-month period.
- Finally, it is important to note that the project selected case studies based in part on advance knowledge that the case represents a *successful* example of community-based measures reducing community vulnerability to drought. The project accepted, based on initial scoping activities and direct community consultation, that a set of measures was basically effective, and focused instead on (1) the extent to and manner in which these measures increased local resilience to drought impacts, and (2) why? (i.e., because of what local, national, regional policies and conditions?).

Building from this framework, the case studies themselves sought to

- Generate informative background material on each community's unique context, vulnerabilities, assets, coping strategies, etc.;
- Within each community, employ methods to measure community resilience to climate-related impacts, with and without the project measures;
- Employ policy analysis techniques to explore the relationship between community resilience-building activities and micro-, meso- and macro-scale policies, institutions and processes; and
- From the above, draw lessons for increasing community climate resilience that can be applied to adaptation and related processes.

In addition to what the case studies entailed, it is important to note what they did *not* involve. Climate scenarios were not developed for the purposes of this study, as discussed in the corresponding section below. Instead, historic climate records and existing climate scenarios were considered and current climate was used as a proxy for climate change. Vulnerability assessment was not specifically undertaken, as discussed in the *impacts and vulnerability* section below. Instead, the project focused on areas of known, historic drought vulnerability, attempting to assess vulnerability as perceived by the local communities from their description of their livelihood condition before the intervention and considered promising and contextually appropriate adaptation options. Furthermore, in-depth policy and institutional analysis was not undertaken. Ideally, each case study would have included detailed analysis of policy and institutional drivers of the documented outcomes. Instead, the analysis is more cursory – and clearly an area for future follow-up research.

Scientific findings

The exploration of the three case studies revealed several broad themes. These themes echo basic principles of sustainable livelihoods and sustainable rural development more broadly. This was not unexpected, since the AF-14 case studies deliberately explored projects that had experienced success in achieving rural development goals. It is important to reiterate that households and communities articulated, through consultations and interviews, what it is that enables them to cope with climate impacts, and then expressed how those indicators changed following the establishment of project activities. Thus, while the observations generated are fairly commonplace in development circles, in this study they have been assessed specifically through the climate change lens, offering lessons for climate coping, as opposed to coping and resilience in general. In this light, valuable observations across case studies include the following:

- Strategies and measures for the sustainable management of natural resources can support broad improvements in livelihood security and household and community capacity to cope with climate impacts. Specific examples observed include both autonomous natural resource management (NRM) efforts, such as the water resource management systems developed in Darfur state, and those stimulated by NGO or other external, supportive organizations, such as the rangelands rehabilitation program put in place in Bara Province, Kordofan state.
- The capacity to finance not only coping mechanisms but livelihood diversification activities that can pre-emptively lower climate vulnerability is key. In this sense, savings in liquid or like form (e.g., livestock, food stores) are critical, as is access to micro-credit to temporarily substitute for liquid assets.
- Access to basic, low-tech materials for the development and improvement of local infrastructure is also important. The material and support to develop food storage facilities, for instance, or to maintain water harvesting systems were important to vulnerable communities. Moreover, these communities assigned great value to basic tools and inputs such as improved seeds, access to farm and earth-moving equipment.
- A widely-held understanding – that human skills are critical to coping and resilience – serves to emphasize the inter-related nature of many of the indicators of coping capacity explored through the case studies. Specifically, many of the things that enabled improved coping capacity within households and communities also required improved human capacity – from animal health care skills, to mechanical skills for the maintenance of machinery, to soil management skills, to community organizational capabilities. As the breadth and depth of human skills and capacity grows, so grows resilience and adaptive capacity.
- Finally, the case study observations serve to buttress the broadly-held view that social capital is one of the most important determinants of resilience to shocks, in this case, climate-related shocks and stress. Family and informal social networks, community groups, self-help groups, effective local decision-making bodies and institutions were each identified as important resources for building and preserving the capacity to cope with climate impacts.

While the more detailed observations outlined in the body of the report point to specific measures that can be taken, the equally important development is simply that the tools used to assess the impact and effectiveness of development projects can be successfully applied to the assessment of climate change adaptation options.

Capacity building outcomes and remaining needs

The methods used in the AF-14 project represent one approach to assessing the impact of community-based activities. Others exist and can be applied for the same purpose. More important perhaps than the specific method applied, though, is the capacity among potential users to effectively apply the methods. The teams charged with assessing climate change vulnerability within their countries and considering adaptation options (e.g., for National Communications or the NAPAs) have tended to be composed of physical, more than social scientists, and as a result are less likely to have strong inherent skills in the type of community-based assessment suggested here. Thus, if these types of methods are considered valuable to such teams, a strong need exists for building team capacity to apply them. At its conclusion, the AF-14 project is developing material for this type of training - team members aim to offer and/or support training in Sudan and North and East Africa.

Clearly, though, capacity building needs exist beyond the climate change community. If a key challenge is the integration of climate adaptation with broader sustainable development processes, then awareness and capacity among key actors in the broader arena needs to be increased. While it is beyond the purview of this project to undertake such capacity building, AF-14 will nonetheless offer material, which can be used by others to explore these issues and to build understanding of the adaptation and human development links.

National Communications, Science-Policy Linkages and Stakeholder Engagement

The AF-14 project has the potential to influence the national communications process on several levels. The project was initially motivated in part by the limitations of the First National Communications process, and was designed to produce outputs useful to subsequent analyses. Thus, an immediate and promising entry point is for the project methods and findings to feed into the design of the Sudan Second National Communications (SNC), and ultimately, into the recommendations for adaptation that emerge from the SNC. The project has already had some level of influence on the Sudan NAPA process, with, for example, the NAPA review of successful coping experiences including the AF-14 case studies and others like them. As the acceptance of and capacity for stakeholder engagement among climate change teams builds, the process outlined here can meet local community engagement needs in a deeply constructive, mutually informative way. Ideally, in the next full round of Second National Communications, a number of developing countries will take up methods such as those demonstrated here and apply them to the task of assessing adaptation options for highly vulnerable people. In addition, the AF-14 project may, ideally, help to orient Sudan's key decision-makers toward practical ways of mainstreaming climate adaptation with broader development policies – e.g., through more sustainable rangeland management policies, or through national water resource policies that actively support localized water management, etc.

Policy implications and future directions

The AF-14 project is intended, first and foremost, to build the resilience and coping capacity of communities in Sudan vulnerable to climate impacts, through improved policies and effectively targeted programmes and projects. Ideally, some of what has been captured through this project will be integrated into Sudan's emerging adaptation efforts and used as a basis for mainstreaming adaptation within development policy more generally. If the outputs – either the methods or the lessons – can be taken up and applied elsewhere, they have the potential to help improve the effectiveness of adaptation planning efforts as well as future development work. Ultimately, efforts such as this should be supported, even informally, by the UNFCCC; however, this will require addressing the currently imposed distinction between adaptations to current versus future climate. At present, only the latter is supported within the UNFCCC, though a broader definition of adaptation may be required given the ambiguous distinction between the two on the ground.

Moreover, the work laid out in this report is aimed at enhancing Sudan's contribution in regional efforts on adaptation to global climate change, in particular regional efforts in the Africa Sahelian Region and North Africa. The focus will be on community-level measures and environmental management strategies that improve the overall resilience of the physical and human environment to adverse climatic conditions.

1 Introduction

Drought has taken a heavy toll on vast areas of Sudan and on the communities subsisting on these lands. Such communities have faced periodic drought throughout their history, and have developed time-tested strategies to cope. Coping strategies can bear households and communities through periods of drought, provided critical thresholds are not exceeded. Over the past several decades, though, patterns of increasing drought and desertification have been borne out across the Sahel, including Sudan, posing greater direct challenges to household coping capacity, while undermining the very resources (natural, social, financial, etc.) that communities must draw upon in order to cope (AF14 Case Study reports 2004). Under climate change scenarios, the troubling pattern of longer and more frequent drought may intensify in Sudan, posing deep challenges for vulnerable people (FNC, 2002). Should climate change create a wetter Sudan over the long term (see e.g., Hoerling, *et al.*. Submitted to Journal of Climate), Sudan would still, inevitably continue to face drought with which is it presently unprepared to cope. Sudan must adapt to climate change and must improve its capacity to cope with current climate. But how best to do so? For a country of enormous and highly exposed rural populations and limited means.

The motivation for the AIACC AF-14 project evolved out of simple observations: that (a) adaptation to a changing climate is clearly happening, albeit often at the community scale, through localized activities catered to unique local contexts, and (b) what is needed is a robust way of exploring, validating – and thus supporting – these successful experiences within the climate change community. This observation took shape as the partner organizations, the Higher Council for Environment and Natural Resources (HCENR) in Khartoum and the Stockholm Environment Institute Boston Center (SEI-B), concluded two efforts – the Sudan First National Communications (FNC) and a terminal evaluation of a UNDP Carbon Sequestration project. At the close of the FNC, the two partner organizations were struck by the challenges inherent in identifying suitable, realistic and adequately promising adaptation options for the vulnerable agro-forestry, health and water sectors. Even more striking was the disconnect between the results of the assessment and the lives of vulnerable people on the ground. This disconnect was not the result of a flawed assessment; the Sudan team had used a widely-accepted methodological framework (IPCC, 1992) and had applied accepted methods to the tasks of climate scenario generation and sectoral impact assessment (RoS, 2003). Rather, the failure was in the broader conventional approach to vulnerability and adaptation assessment, which did not effectively support assessment at the community-scale, where urgent vulnerabilities exist and require greater understanding.

At roughly the same time, SEI-B conducted a terminal evaluation for a UNDP project, titled *Community-Based Rangelands Rehabilitation for Carbon Sequestration*. This 1994-2000 project had begun as an effort to demonstrate the carbon sequestration potential of semi-arid grasslands in the Bara Province of western Sudan, a region prone to drought and ongoing desertification. It had quickly evolved, though, into one

Box 1: A history of coping with drought

Excerpted from Sudan's Initial National Communications (RoS 2003)

Drought is one of the most important natural phenomena that Sudan faces. Of the two types of drought affecting the country, the first, widespread drought, is caused by below normal rainfall across the country; the second is localized drought that affects only some parts of the country. Recurring series of dry years have become a normal phenomena in the Sudano-Sahel region.

Between 1961 and 1998, episodes of drought have inflicted Sudan with varying severity. This period witnessed two widespread droughts during 1967-1973 and 1980-1984 - the latter being the more severe. The same period witnessed a series of localized droughts during 1987, 1989, 1990, 1991, and 1993, mainly in western Sudan (Kordofan and Darfur) and parts of central Sudan.

A key example of localized drought is that which affected western Sudan (Geneina and Nyala) in 1996. This region reported below normal rainfall while central and eastern Sudan were above normal.

The most vulnerable are the farmers in the traditional rainfed sector of western, central, and eastern Sudan, where severity of drought depends on the variability of rainfall both in amount, distribution and frequency. The most heavily affected are the northern Kordofan and Darfur states.

In Sudan, the existing cultivation of about 12 million hectare of rainfed, mechanized farming and 6.6 million hectares of traditional rainfed lands are under threat of drought. Pastoral and nomadic groups in the semi-arid areas of Sudan are also affected.

which worked closely with local communities on a suite of related community development activities. In essence, project proponents had quickly realized that in order to achieve the project's rangeland rehabilitation goals, it was essential that these goals be integrated with the communities' livelihood objectives – objectives that centered on securing livelihood options in the face of drought. By doing this in close collaboration with communities, the project succeeded in implementing sequestration activities and, according to the evaluation, in helping to satisfy community needs for expanded options for coping with drought (Dougherty *et al.* 2001). This was not a climate adaptation project, and yet the project activities appeared to be effective in building capacity to cope with drought. In this part of Sudan, where warmer conditions and worsening drought are anticipated by some climate scenarios (see e.g., RoS, 2003; FNC, 2002) building drought coping capacity is essentially synonymous with building the capacity to adapt to climate change.

While this observation was not new, the partners were struck by how poorly integrated it was, at the time, into the mainstream climate dialogue. The profile of experiences like this has risen since then but, the authors would argue, that discussion has not yet focused adequately on identifying these experiences on the ground, and learning from their characteristics.

More than this, partners were struck by the apparent lack of methods designed for assessing such experiences within the climate change community. If Sudan wished to explore experiences like this and assess them for their value for adapting to climate change, how should they proceed? These project-based experiences appeared to represent both an approach to closing the current “adaptation gap” - i.e., the deficit in capacity among vulnerable groups to cope with current climate impacts - and to building adaptive capacity for climate change. But methods were needed to examine these experiences and tease out their lessons. It was in response to both of these needs that the AF-14 project was designed.

Project proponents recognized that many successful community-scale experiences could be characterized as sustainable livelihoods or natural resource management activities. To better understand such experiences, partners sought out project impact assessment tools, used specifically for gauging the effectiveness of sustainable livelihoods and natural resource management activities by practitioners in these fields. This search led to the development of the research framework outlined in section 6.2.2, and to the use of a specific project assessment tool called the Livelihood Asset Status Tracking (LAST) system, developed by Richard Bond and Neela Mukherjee (2003). Essentially designed for eliciting community perceptions of project effectiveness, the LAST system lent itself well to the purposes of the AF-14 case studies and to basic modifications by AF-14 researchers. Ultimately, case study researchers worked with communities to generate resilience indicators, structured around the sustainable livelihoods conceptual framework, and conducted structured interviews, asking questions designed to create a detailed picture of the effect of the project on these indicators. In the process, case studies were created that describe the relative effectiveness of project activities within unique community contexts.

At the same time, researchers sought to gather information on the policies and institutions that underpin successful resilience building at the community level – lessons which could aid in the process of mainstreaming climate adaptation. For this, a policy impact analysis process was adapted, again from the area of sustainable livelihoods. This method, developed by sustainable livelihoods practitioners for identifying the livelihood outcomes of certain policies, was essentially inverted for the AF-14 project.³ Specifically, the AF-14 case studies took successful livelihood outcomes as the starting point, and sought to backcast from these to their micro-, meso- and macro-scale policy and institutional underpinnings. In carrying out this research, project partners have become more convinced of the value of methods like these to national adaptation planning and mainstreaming processes and hope to foster and support improved applications elsewhere.

Through these two research processes, a model for capturing important information on climate coping and adaptation was successfully piloted.

At this point, a word on terminology may be useful. This project uses the term “resilience” to capture both current coping capacity and the capacity to cope with and recover from potential future impacts. In this sense, the current use of resilience overlaps with the concept of adaptive capacity but does not fully capture it. Instead, adaptive capacity involves not only coping with, but becoming better-suited or adapted to potential future climate conditions. For the communities addressed in this study, increased coping capacity is not only the urgent near-term need, but may also represent the necessary basis upon which adaptive capacity to future climate change can be built. In

³ See Soussan and Springate-Baginski (2001)....

building the research framework, the partners determined that it was necessary to focus on understanding current resilience building, while acknowledging adaptive capacity as the longer-term goal. In order to do so, the project explored measures that built drought coping capacity – both autonomous community-driven sets of activities as well as externally-supported (e.g., NGO or government agency) community-based projects. For ease of discussion, both types are referred to here as “projects”. In general, the sets of activities involved in such projects constituted what are commonly known as sustainable livelihoods (SL) and/or natural resource management (NRM) activities. For ease of discussion, these are referred to here simply as project activities or measures.

2 Characterization of Current Climate and Scenarios of Future Climate Change

To ensure coverage of Sudan's rural circumstances, and adequate representation of the Sahel, as well as North and East African circumstances, three case studies were selected – areas lie mostly in the semi desert zone of Sudan extending from West to East. The people living in the 3 locations could represent other people in the wider Sahel living under similar conditions.

Historic climate records were used to outline past and current climate variability (mainly drought episodes and periods of erratic rainfall) (see Box 2). The literature had shown that, drought has been a recurrent feature in the Sahel, with early records dating back to the 1680s. The magnitude and intensity of these droughts have been on the increase over the last 100 years (see figure 1 below), and consequently in the destruction caused by it (Hulme et al. 2001). The most prominent of these droughts was that of the early 1970s during which hundreds of thousands of people and millions of animals died (Mortimore 1998). The Palmer Drought Severity Index shows that the Sahel is still experiencing drought conditions). However, two contrasting views have been referenced, regarding the impact of global warming on the rainfall over the sub-Sahara Africa: The first indicated that with global warming, it is expected that the region, might experience a deficit of precipitation amounting to 200mm (Hulme et al. 2001). This is expected to increase the vulnerability of the already vulnerable population in the region that has witnessed all the droughts that have occurred in the Sahel, with the last one as recent as 1984, which threatened the livelihood systems in the study areas.

The second (more recent study) indicated that Greenhouse-gas forced experiments, conducted as part of the Third Assessment Report, do not yield a northern African drying trend in 1950-1999, and instead generate a wet trend that emerges in the last decade of the 20th Century and accelerates during the 21st Century. The greenhouse-gas forced wet trend is a consequence of an interhemispheric Atlantic SST change, but one in which warming of the North Atlantic compared to the South Atlantic favors abundant monsoon rains over northern Africa. Where as Sub-saharan drying during 1950-1999 is argued to be a response to progressive warming of the South Atlantic relative to the North Atlantic sea surface, with the ensuing anomalous interhemispheric SST contrast favoring a more southern position of the rain bearing Atlantic ITCZ (Martin P., 2005).

However, as our project had focused on recent and current climate variability, climate scenarios haven't been used, other than for illustrative purposes – relied mainly on the ones created for Kordofan State for the Sudan First National Communications. These scenarios undertaken for 2030 and 2060 have indicated that, Kordofan State will be facing a decrease on average precipitation and increase in average temperature- This could be generalized to the three areas since the general trends (historical records of rainfall and temperature) indicated the same trends.

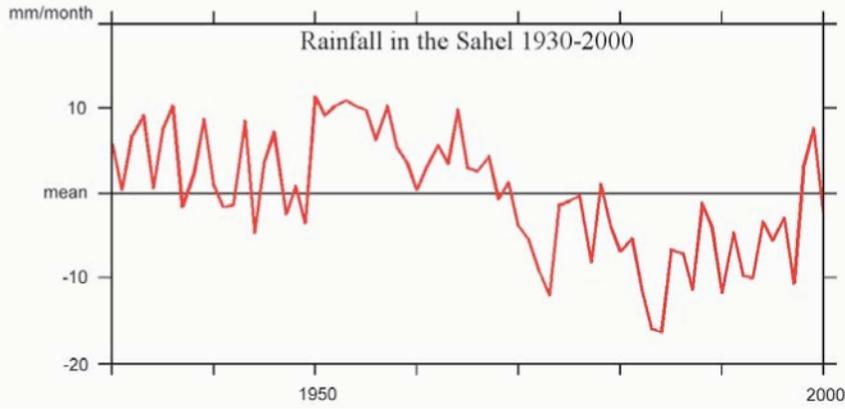
Box 2. Features Affecting Sudan's Climate

The climate of Sudan and the division of seasons are controlled by the distribution of the atmospheric pressure systems over and around Africa, including the Northern and Southern Hemisphere.

Critical factors affecting climate in the Northern Hemisphere are:

- The subtropical high pressure over the Sahara desert and the Azores. High pressure over north West Africa.
- The extension of Siberians from Central Asia to the Arabian Peninsula.
- The Oscillation of inter-tropical Convergence Zone (I.T.C.Z), which is the zone of low pressure where the trade wind from opposite hemispheres converge.

In the Southern hemisphere the most important features are the two subtropical high pressures. The South Atlantic Ocean acts as a source region of the moist air that penetrates into the Southern hemisphere.



Annual-mean anomalies in precipitation averaged at 41 stations in the Sahel, 10N-20N across Africa, over the period from 1930 to 2000 (from NOAA's Global Historical Climate Network).

Source (IRI, 2005)

Fig. 2.1: Rainfall in Sahel

3 Impacts and Vulnerability

In Sudan, many thousands of people are vulnerable to drought (HCENR,1999). This has been borne out in persistent food security crises and documented in numerous ways e.g. deterioration of rangeland, soil erosion, gullying and dust storms, moving sand dunes, and drying up of wells. Adverse socio-economic factors leading to conflicts, migration of people, environmental refugees, mal-nourishment famine and many health problems (Yagoub, 1998; Nimir, 1998). The recent drought cycle, which started in 1972, seems to be abnormal even by these highly variable standards. The meteorological data throughout the past century showed that, in the previous dry decades in the Sahel the drought periods lasted between 2-3 years, and that, such weather conditions recurred at intervals of 20-100 years. Yagoub (1998) found that traditional farmers living under such variable conditions have developed traditional coping mechanisms or strategies that enable them to tolerate single year or two of drought. But, the recent drought cycle as Ibrahim stated was more extreme. It was drier, lasted longer (5 years), cover a much larger area and it has a shorter intervals (every 10 years). This abnormal variation is absolutely beyond the capacity of the traditional adaptation strategies developed by the nomads and farmer in the region. This is why they were displaced!!

More recently, the Sudan FNC has outlined key vulnerabilities as well, albeit more in sectoral than human terms. Certain studies anticipate that climate variability and change will have overwhelming impacts on agriculture, the predominant livelihood system in the three case studies, and consequently on food security (Case study reports AF14, 2003). The lack of water, in association with high temperatures (up to 45° C at certain periods of the year), is the most limiting factors for agricultural productivity, according to such studies.

In light of the rich literature and regrettably current experience of Sudan's vulnerability to drought, the AF-14 project sought not to explore impacts and vulnerability in any depth, but to simply recap what is known and to focus instead on exploring drought coping capacity and resilience, with the aim of identifying practical, effective ways of building both current drought resilience and future adaptive capacity.

Since the AF-14 project used past and current vulnerability to climate variability as a proxy for future vulnerability under climate change, historical records and literature survey were conducted in order to see the impacts and vulnerability in a historic context. Within this framework of understanding, the project could then use community's coping and adaptive capacity in the face of current variability and extremes as a proxy for its level of coping and adaptive capacity under climate change. A growing number of sources suggest that the degree to which a sector, community, or system is adapted to today's climate extremes and variability can serve as an indicator of how resilient that system is likely to be to future climate change conditions (see e.g., Balgis *et al* 2003). The AF-14 project is based on this approach, and on the premise that numerous adaptation lessons are to be gleaned from current experience.

4 Adaptation

4.1 Scope of The Study

The AF-14 project was based on the following premises:

- a) Increasing the capacity of the most vulnerable groups to cope with today's climate-related impacts must be a pre-eminent goal of adaptation – without this, there is inadequate basis upon which to build future coping and adaptive capacity.
- b) To do this, small-scale, community-level strategies will be needed alongside the large-scale, technical/structural approach that may dominate adaptation planning. However, there is a need to provide decision-makers with information on these small-scale strategies.
- c) Methods have been developed in separate fields of practice – sustainable livelihoods, natural resource management, disaster risk management – which can meet these needs.
- d) Lastly, these sorts of strategies – i.e., that increase the adaptive capacity of the most vulnerable people while accomplishing added social and environmental goals (e.g., slowing desertification) – can diversify and strengthen national adaptation plans of developing countries.

It is these types of strategies that the project aimed to identify explore and discuss, making them accessible, readily understandable and useable to the policy-making process. Case studies, including a policy analysis component, served as the primary research tool for this purpose, and are discussed in some depth in the third section.

Building from these premises, the case studies themselves had the following objectives:

- Identify vulnerable communities (in the case of Sudan, vulnerable to drought impacts) where successful measures have been put in place and, using community consultation, confirm the success of the measure.
- Generate informative background material on each community's unique context, vulnerabilities, assets, coping strategies, etc.
- Within each community, employ methods to measure community resilience to climate-related impacts, with and without the project measures.
- Employ policy analysis techniques to explore the relationship between community resilience-building activities and micro-, meso- and macro-scale policies, institutions and processes.
- From the above, draw lessons for increasing community climate resilience that can be applied to adaptation and related processes.

At this point, a word on terminology may be useful. This project uses the term “resilience” to capture both current coping capacity and the capacity to cope with and recover from potential future impacts. In this sense, the current use of resilience overlaps with the concept of adaptive capacity but does not fully capture it. Instead, adaptive capacity involves not only coping with, but becoming better suited or adapted to potential future climate conditions. For the communities addressed in this study, increased coping capacity is not only the urgent near-term need, but may also represent the necessary basis upon which adaptive capacity to future climate change can be built. In building the research framework, the partners determined that it was necessary to focus on understanding current resilience-building, while acknowledging adaptive capacity as the longer-term goal. In order to do so, the project explored measures that built drought coping capacity – both autonomous community-driven sets of activities as well as externally-supported (e.g., NGO or government agency) community-based projects. For ease of discussion, both types are referred to here as “projects”. In general, the sets of activities involved in such projects constituted what are commonly known as sustainable livelihoods (SL) and/or natural resource management (NRM) activities. For ease of discussion, these are referred to here simply as project activities or measures.

4.2 Activities Conducted

Drawing from existing research platforms, the project research consists of three interlinked processes – the empirical, in which background information is gathered and organized, the analytical, in which case studies are carried out, and the participatory, in which community input, validation and guidance is sought.⁴ Within the analytical process, the project used the sustainable livelihoods framework to enable researchers to measure resilience at the local level to climate-related impacts. With this approach, the following research scope was established:

- a) The project undertook three separate case studies in different arid regions of Sudan. Case studies were concerned with current and recent historical experience, and focused in particular on the experience of the 1980s through to the present.⁵
- b) To ensure adequate coverage of Sudan’s rural circumstances, and adequate representation of the Sahel, as well as North and East African circumstances, each case study focused on a distinct ecosystem sub-type (such as rangelands, forested lands) or agricultural system type (such as gum arabic production, rain-fed sorghum production, animal husbandry) along the agricultural-pastoral continuum.⁶
- c) Each case study focused on a single community or cluster of communities within an ecological/agricultural system as its unit of research.
- d) Each case study explored examples where “local” knowledge (e.g., traditional, indigenous, autonomous, informal) and/or “external” knowledge (e.g., formal, technical, directed) have been applied within a target community(ies), generally in the form of SL or NRM measures, to enable the community to cope with or adapt to climate-related stress.
- e) Case studies compared a community’s vulnerability to climate extremes, pre- and post-project activities. In cases where collection of historic information is not possible, “signal” events (i.e., major historic climatic events) and role-playing were relied upon.
- f) Case studies were conducted by commissioned researchers, through desk-based and field research, over a six-month period.
- g) Finally, it is important to note that the project selected case studies based in part on advance knowledge that the case represents a successful example of SL measures reducing community vulnerability to drought. The project accepted, based on the output of an initial scoping exercise and direct community consultation (discussed below), that a set of measures is effective, and focused instead on (1) the extent to which these measures increased local resilience to drought impacts, and (2) why? (i.e., because of what local, national, regional policies and conditions?)

Each of these points is discussed in the methodology section

4.3 Case Studies

As mentioned earlier, the AF-14 project undertook three separate case studies, each involving travel, fieldwork, data collection, analysis and writing. The first, carried out in the Bara Province of western Khordofan state, explored the experience of communities with a concluded UNDP project on rangelands rehabilitation project. The second, carried out in the Khor Arba’at area of the Red Sea state, looked at a range of NGO-facilitated activities organized around community water harvesting and livelihood diversification. The third focussed on autonomous, community-driven water harvesting activities in a

⁴ See, e.g., the *Strategic Environmental Framework for the Greater Mekong Subregion* (SEI and ADB, 2002)

⁵ This wide time horizon has been chosen to capture the infamous drought of 1983-1984 (persistent regional drought) that severely impacted countries of the Sahel.

⁶ The project favored the use of agricultural systems, as these tend to be most representative of other locations at the national and regional levels. Data on agricultural systems is more readily available and tends to be more reliable. Moreover, much of the traditional knowledge developed by communities for drought-proofing is oriented around crop and food production systems.

cluster of communities in the Darfur region.⁷ Detailed information on each case study was contained in a separate case study report. However, summaries of these reports are provided below.

4.3.1 Summary of case studies

The three case studies conducted under the research component of the project represented different community settings in Eastern, West-Central and Western Sudan. It aimed at studying the livelihood strategies of rural families in agro-pastoral systems, in semi-arid areas of Sudan with the purpose of understanding how rural households cope and adapt to climate variability and what role does institutions and policies play in their livelihood systems. In the following section a brief background on each of the case studies is presented.

4.3.1.1 Khor Arba'at Rehabilitation Programme (KARP)

The study area is located in the Red Sea State, in north-eastern Sudan, about 50 KM north of Port Sudan town the State capital. Administratively, Arba'at is part of the Red Sea locality, one of the four localities, comprising the Red Sea State. The area is the catchments for Khor (*small stream*) Arba'at, after which it is named, the Khor drains a catchment area of 4750 Km² (Bashir, 1991). It then crosses the area in an east-west direction during the course of its flow from the Red Sea Hills, where it originates, to the Red Sea where it discharges. The region is generally characterized by relative isolation and harsh terrain, highly variable rainfall system with recurrent spells of drought, small area of cultivable land, and low population density and sparse distribution. The region is basically the home region of the Beja pastoralist and agro-pastoralist tribal groups. Rainfall is highly variable, but averages recorded between 1900 and 1980, range between 26 mm and 64 mm per annum. Both rainfall values and geographical distribution show a high degree of variability, which generally increases from south to north. Probability of run-off occurrence (Khor water) varies considerably between a minimum of 168-mm³ (90% probability) and a maximum of 1662 mm³ (at 10% probability) with high loss of evaporation (Musa, 1991:24-28). The hilly nature of the topography and the Basement Complex formation of the base rock made surface run-off the only source of fresh water in the Red Sea area. The rocky and compact nature of soils, the steep slope, the pattern of rainfall in the area (thunderstorms) and the poor vegetation cover. all contribute to the high rates of run-off in the Red Sea area. These lands, long known as Arba'at Zira'a, lie on the alluvial deltaic fan of Khor Arba'at, and comprise some 54,850 feddans (23,040 ha) formed on a largely silty, sandy and gravelly textured laid down where the Khor Arba'at drainage system debouches from the Red Sea littoral. Out of the total area of the Arba'at deltaic fan, the arable lands of Arba'at have recently been estimated at 23,215 feddans (9,750 ha) (R.D Law/Hunting Technical service, 1995). Of these, about 9,285 feddans (3,900 ha) can readily sustain floods irrigation agriculture. Though difficult to estimate, in the absence of any mapping of spate irrigation, but around 2,400 feddans (1000 ha) are under cultivation during the rainy seasons, A further 8000 feddans (3,380 ha) have the potential for being brought into the spate irrigation system, if more water were available. In assessing environmental strategies employed in Arbaat, the research considered both community-driven coping mechanism developed in response to drought, as well as the evaluation of livelihood strategies introduced by the SOS Sahel Project (**Khor Arba'at Rehabilitation Programme (KARP), 1993-2000**), such as diversification and introduction of income generation activities, their role in sustaining community's livelihood under adverse climatic conditions such as the fluctuations and/or deficiency of rainfall and the unsteady flow of Khor Arba'at.

Environmental strategies considered: Historically, and aware of their environments' vulnerability to drought and famine outbreaks, the Beja pastoralists over time developed and/or adopted various community-based mechanisms that assisted in preserving the system and allowed for recovery afterwards. Examples of these mechanisms identified, include the adoption of an agro-pastoral system, which was a basic form of a diversified economy that is primarily subsistent. , adoption a dispersed pattern of settlements, which maintains land carrying capacity, reduces competition and conflict and allows for population increases; Practicing geographical and temporal migration up and down the hills in pursuit of water, pasture and cultivable lands. The larger khors represented, and still do, the main winter and summer resorts for livestock and some wadi deltas developed over time into commons area, providing refuge to all groups at times of crisis. Although distance, duration and direction of migration

⁷ It is important to note that at the time of the case study research (early 2004), the cluster of communities in question had been relatively unaffected by the violence and displacement in the vast Darfur region. However, the researchers are concerned that, like many communities in Darfur, these too have subsequently been drawn into the ongoing crisis.

might have changed as a form of adaptation in response to changing conditions, the overall pattern remained largely the same in most rural areas; temporary migration for work outside home areas, primarily to Port Sudan with which the crossing point sometimes in recent years, became the only alternative for rural pastoralists; applying a strong social sanctioning system on the use of resources, especially pasture and tree protection imposed by tribal leaders (native administration) to which all pastoralists adhere; and the rebuilding of the animal stock (the reproduction of the pastoral adaptive units) after each drought cycle through the preservation of Beja traditions of *salif*¹ as the basis for managing animal and land resources; the two components of Beja agro-pastoralism. Animals, for the Beja, represent the main means of economic and social mobility, recognition and survival and through them the whole system was maintained and reproduced. (Abdel Ati, 2003: 5-6). These locally-driven coping mechanisms started to weaken due to frequent occurrences of the drought and famine conditions in the Red Sea hills, which have largely been the norm during the 20th century. That traditional pattern of natural short-term recovery was shattered after the long drought and famine of the 1980s and the system failure to re-configure (Abdel Ati, 2003). The reoccurrence of drought and famine conditions have largely made the Red Sea State heavily dependent on central government support and foreign aid organizations and made long term planning, including that of combating drought, of a low priority. In short since 80s, the Red Sea State has almost constantly been in a state of emergency and relief operations that only vary in scale, length and location from one year to the other.

In response to the Sahelian drought in the 1980s, SOS Sahel (UK) lunched the Khor Arba'at Rehabilitation Project (KARP) project, which was conceived following a regional investigation of potential development projects by SOS Sahel (UK), aiming at funding a suitable agricultural development project in the area.. Khor Arba'at delta was chosen as an area with good potential, which upon rehabilitation of the somewhat degraded agriculture farming system could provide considerable benefits to the local community. The main objectives of the project were to contribute to the rehabilitation of Khor Arba'at delta, to more fully realize the agricultural potential for the wellbeing of the tribal groups in the area in terms of improved livelihoods and sustainable management of natural resources to meet local needs; secure overall community development; and. sustainability of food security. The project planned to achieve these objectives through planning and execution of an equitable water harvesting scheme; enhance grassroots participation and come out with a package of sustainable livelihood measures that could be viewed as a replicable model of if successful.

Project contribution to adaptive capacity: The results of the assessment concluded that, water harvesting; food crop production and diversification of income had been effective activities in improving livelihood conditions in Khor Arbaat area and their overall resilience in the face of harsh climatic conditions (drought). Involvement of local people including women in the production process, sales of vegetables and value added crops have buffered many families from climate variability. Moreover, the effect of markets policies has shifted the weight of production for local consumption to production for marketing in near by towns such as Port Sudan resulting in largely decreasing the out migration, encouraging people to stick to their local land enabling them to cope with critical events during harsh period,- this is expected to contribute to their future adaptation in the long run.

Issues related to the sustainability of these locally developed coping capacities will depend on the ability of rural families to continue to develop their skills and capacity to manage their resource base and contribute to decision making process with regard to the future of the Khor Delta. Overall, according to Abdelatti (2003), the coping capacity of this community is a clear reflection of changing attitudes and human behaviour, in addition to people succeeded in the adoption of new techniques and employing more practical solutions. All are necessary pre-requisites for future adaptation. A Major concern expressed by many respondents focused on the proposed new policy intervention by the state government to heighten Khor Arba'at Dam to divert more water for urban use in Port Sudan. The farmers described the worst possible threats as the displacement of families, the spread of *Prosopis chilensis* (mesquite tree) on their fertile land and the drop in food production for them and for urban dwellers in Port Sudan. Farmers proposed as a solution for the problem that the Government should guarantee Arba'at population a regular share in Arba'at waters and/or provide for the exploitation of ground water by digging wells and installing pumps in areas where ground water is available and

¹ *Salif* is the code of social conduct and behaviour governing relations and resource utilization system among all Beja

sufficient for agricultural purposes. This report will be looking at all policy and institutional factors that directly or indirectly impacted their coping capacity and sustainability of their livelihood.

4.3.1.2 Community-based rangeland rehabilitation in Sudan in Geraigikh (Kordofan State)

The second Case study assessed environmental management strategies introduced by a project, employed and adopted by the local communities living in a group of villages located the Western part of Central Sudan in Kordofan State. Kordofan is part of the Africa Sahel region, which has undergone a general decline of rainfall since the late 1960s. Between 1961 and 1998, episodes of drought have inflicted the region with varying degree severity. This period witnessed two widespread droughts during 1967-1973 and 1980-1984 - the latter being more severe. Available records show that drought episodes have increased in both intensity and duration and have increased the vulnerability of the local populations, particularly during and after the 1986-73 and the 1984 drought (ADB et al., 2003). The drought resulted in severe impacts including: chronic poverty, socio-economic marginalization, and food insecurity, leading to a rural development crisis, which requires integrated and cross-sectoral responses (Warren and Khogali, 1991). While climate change is only one of the many factors influencing poverty in the region., many viable interventions have already been identified in response to past and current vulnerability, providing a starting point for addressing adaptation needs through addressing issues of rural development and poverty reduction. An example of a successful community experience is that of The Community-Based Rangeland Rehabilitation Project. This was implemented in Bara Province of North Kordofan State, a semi-arid land which receives a long-term rainfall of 250-300 mm annually. It consists of marginal land, which is becoming increasingly degraded under combined anthropogenic and climatic pressures, and classified as semi-arid and dominated by sandy soils with poor fertility. Most of the province consists of desert scrub vegetation on undulating sand dunes; average rain fall is quite low at roughly 250 mm per year, with frequent seasonal and inter-seasonal rainfall variability. The cumulative impact of recurring droughts, cultivation of marginal lands, fuelwood gathering and overstocking of livestock have drastically depleted the vegetation, as a result, soil erosion, desertification and dusty storms have emerged as significant environmental challenges. The local resources base has been degraded, undermining livelihoods and leaving communities more vulnerable to adverse effects of future drought. Moreover, the province was severely impacted by the 1980-1984 droughts that hit the entire Sahel, affecting family and tribal structures and their autonomous traditional practices of resource management, leading to thousands of people migrating from their villages to refugee camps around the towns and cities. In response to these devastating conditions that prevailed in the area, a UNDP/GEF project was initiated in 1992 covering 17 villages within Gireighikh Rural Council in Bara Province with a total population of 6116. The project, 'Community-Based Rangeland Rehabilitation (CBRR) for Carbon Sequestration' had two main developmental objectives. The first was to sequester carbon through the implementation of a sustainable, local-level natural resources management system that prevents degradation, rehabilitates or improves rangelands; and the second was 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 aim of the project was to implement a simple model of community-based natural resource management to prevent over-exploitation of marginal lands and rehabilitate rangelands for the purpose of carbon sequestration. It also sought to encourage biodiversity preservation and reduction of dust storms and ensure the success and sustainability of this approach by diversifying local production systems and improving socio-economic conditions. In essence, the project included both mitigation and adaptation outcomes. The package of sustainable livelihood measures undertaken by the project villages can consisted of many components, awareness and institutional building to mobilize and organize community groups for project planning and implementation.; training in a wide range of activities to build local capacity for project implementation and ensure project sustainability;\rangeland rehabilitation including land management, livestock improvement, agroforestry and sand dune fixation to prevent overexploitation and restore productivity of rangelands in addition to community development activities to address immediate needs e.g. water harvesting and management, rural energy management and diversification of local production systems and income generating opportunities , thereby reducing pressure on rangeland resources.

Contribution to adaptation: The study implemented by AIACC AF14 project on the impacts of the project's interventions on human livelihood indicated that the CBRR project succeeded in increasing the overall community's resilience. However, our focus in this report will be on the role played by policies at different levels (macro, meso and micro) and the role of institutions and legislations related to community's livelihoods.

4.3.1.3 Water harvesting technique as a coping mechanism to climate variability and change (drought) / North Darfur State

The third case study from Darfur state in Western Sudan, it represents a different type of adaptation, that is the autonomously developed adaptation (meaning the sustainable livelihood strategies, originally developed and adopted by the communities, then supported and built upon by an NGO). The study area lies in a region characterized by high climate variability leading to harsh environmental conditions. Most of the study area is deficient in water even in the wettest months of July to September. Moreover, during June, the hottest month, temperatures regularly reach over 45°C and in January, the coldest month, temperatures reach 18°C. The region is one of the most drought-affected regions of the Sudan. The drought years of 1983-85 greatly affected the demographic and socio-economic conditions of the area. Large numbers of people left their homes due to increasing poverty, famine and other environmental impacts (desertification and land degradation). This was accompanied by tribal conflicts, the growth of shanty towns and changes in the pattern of livestock raising and agricultural production. During this time, most people lost over half of their cattle (being the most vulnerable animals to droughts), as well as large numbers of sheep, goats and camels.

Environmental management strategies: Unlike the other two case studies which presented a reactive type of adaptation that had been introduced into the area by means of a project in response to specific climate stimuli, this case study represents an autonomously developed adaptation measures that were basically evolved by the local community and later on supported by a project, examples of these measures are:

- Adoption of water harvesting technique (Trus)
- Construction of terraces help the farmers to grow vegetables, including okra, eggplant and tomatoes, which can be harvested up to five months after the rainy season
- Restocking of gum trees (*Acacia Senegal*) and retention of part of the tree cover in the agricultural fields with alluvial soils for the provision of fuelwood.
- Cultivation of clay soil releasing pressure from the qoz (sandy soil), this situation favors the gum trees
- Traditional methods of food storage like *matmura* (a pit in the ground lined with chaff) and *Sweeba* (a container, made of unburned mud, mixed with straw and cow dung, kept in the family hut)
- Use of organic fertilizers (Crop and weed residues to improve the soil nutrient status).
- Use of traditional knowledge, wisdom and practices to conserve and manage the resource base and improve livelihoods.
- Social safety nets through sticking to their traditional method of mobilizing community joined labour - organizing a work party locally known as *nafir*

In 1998 a livelihood support program was launched in the area by a nonprofit organization ITDG (Intermediate Technology Development Group). The ITDG existence dated to ten years back before this program (1988), at which times their work mainly focused on humanitarian and community development initiatives, aiming at improving poor people's ability to conserve and sustain their livelihoods through: increase food production and processing; and provision of basic services. A key approach adopted by ITDG's food security programme is the building on the indigenous knowledge and the involvement of local communities in all the project activities, particularly water-harvesting techniques. The aim of which is to harvest as much of the rain water that does fall in parched North Darfur and store it for as long as possible to be used during times of scarcity for irrigation and household domestic uses. The main

intervention to provide for this was through establishing of earth dams to capture increased amounts of rainy season floodwater from streams, Other interventions employed by ITDG included the following environmental strategies:

- Provision of tractors for performing different agricultural operations;
- Construction of central grain store for communities to store the surplus production for use in times of scarcity;
- Supporting diversified income generation activities availing employment opportunities;
- Credit accessibility to the farmers;
- Training and skills building of local people to manage their resources and diversify production;
- Further women involvement in different economic activities (production of vegetables);
- Help the formation of social networks and cooperatives , organizing of farmers unions and women groups.

Contributions to building adaptive capacity: Adopting the above mentioned environmental management strategies , Darfur communities witnessed a general improvement in their livelihood , this as reflected on Increased soil fertility agricultural production and diversification of crops; availability of physical assets necessary for sustaining their livelihoods (Storage facility for surplus production to difficult times; creation of community organizations and better team work with better management skills; diversified income sources, poverty alleviation, and good quality of food and improved the general household conditions; increased community participation in decision making process and enhanced women's participation and involvement, improving agricultural production and better health condition (improved nutrition); improved communication channels between the local communities, ITDG, NGOs and CBOs.; use of home garden or *jubraka*, a backyard farm which is mostly operated by women, and used for growing of fast maturing crops and some vegetables like *okra*, *pumpkins* and *cucumbers*; shifting cultivation to minimize the risk of crop failure, on both sandy soils and clay alluvial deposits. In the sandy soils they used to grow millet, sesame and groundnut (this represent the main family cropping site, providing the greatest portion of family subsistence needs), while the clay soils were cultivated using water harvesting techniques to grow sorghum, vegetables and the cash crop tobacco in some cases.

4.4 Methodological Approach

The following major elements comprise the project's methodological approach. Specific steps involved in the case studies are outlined in section five.

4.4.1 Climate variability and extremes as a proxy for climate change

Despite tremendous progress in the science surrounding climate change scenarios, it is not currently possible to rely upon existing scenarios for Sudan (see e.g. the Sudan Initial National Communications (RoS, 2003)) or for many countries to confidently assess the impacts of climate change on vulnerable communities. In such cases, vulnerability to current climate variability can be used as a proxy for vulnerability to climate change. This approach does not equate present climate extremes with future climatic conditions; rather, a number of sources have suggested that the degree to which a sector, community, or system is adapted to today's climate extremes and variability can serve as an indicator of how vulnerable or resilient that system is likely to be to future climate change conditions (Methodology Document AF14) (Siegfried,2005). According to the IPCC WG II (Summary for Policy Makers, 2001), for example, "Experience with adaptation to climate variability and extremes can be drawn upon to develop appropriate strategies for adapting to anticipated climate change". In other words, for vulnerable communities, the most logical first step in adapting to climate change is to assess and, where necessary, increase their capacity to cope with current climate-related stressors.

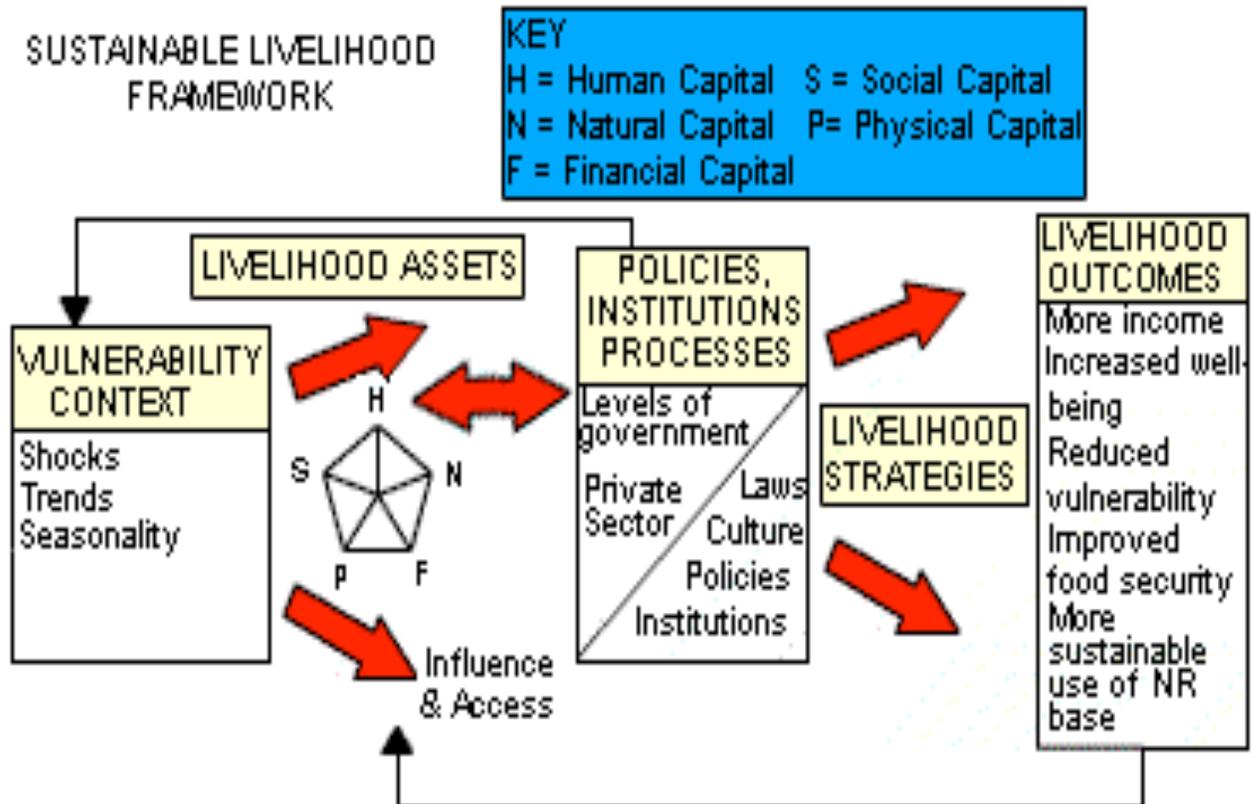
For each case study, a discrete climate-related event - past or ongoing – was identified, around which the case study were constructed. Where possible, the impact on a community of *two* separate events were assessed – one pre-project and one post-project. In cases where more recent project experiences were to be examined, a historic climate stressor could be used as a "signal" event, which the community could

project onto its current circumstances through role-playing, for the purposes of considering its current resilience to similar, hypothetical impacts.

4.4.2 Sustainable livelihoods approach, framework and assessment tools

The sustainable livelihoods approach sees poverty as vulnerability to shocks, and seeks to reduce vulnerability by building on the livelihood assets of households, increasing their access to a blend of assets and gradually building household resilience. Basically, the approach seeks to enhance existing coping and adaptive strategies in the manner most suited to the community's needs. The present project seeks to clarify the potential role of this type of approach for increasing people's resilience to climate change, thus enabling them to better adapt.

Over the past decade, the sustainable livelihoods approach has gained prominence in development work and has been used in a great number of settings. Several major development agencies (e.g., DFID, CARE, UNDP) have developed their own unique frameworks for describing and applying the approach (i.e., for presenting the primary influences on people's livelihoods, and the typical interactions between these), though each adheres to a core set of ideas. The AF-14 project was not wedded to a single framework and instead used its own variant (outlined in the case study methods section), drawing methods from those used by major development agencies (DFID, CARE and UNDP) and from a variety of past assessment experiences. Some of the benefits of using an SL framework are that it "provides a checklist of important issues and sketches out the way these link to each other; draws attention to core influences and processes; and emphasizes the multiple interactions between the various factors which affect livelihoods" (see DFID Guidance sheets). But as DFID suggests, SL frameworks should be used flexibly and adapted to suit specific contexts. The AF-14 project used the DFID model outlined below, and the notion of the five capitals (natural, physical, human, social and financial), albeit loosely, in order to capture perceptions of resilience in the data collection process. See the case study methods section for more detail.



Source: http://www.livelihoods.org/info/guidance_sheets_pdfs/section2.pdf

Fig. 4.1: DFID's Sustainable Livelihoods Framework:

As use of the SL approach has expanded, organizations have developed and applied assessment tools – impact assessment, monitoring and evaluation, etc. – in order to measure the effectiveness of projects in actually lowering people’s vulnerability. From the range of assessments undertaken, a general approach has taken shape, which draws heavily from a number of existing methods.

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. Though differences exist, most assessment strategies apply some form of an asset-based approach; most encourage examination of micro-macro linkages; most employ some degree of participatory research methods. By and large, the way that these assessment methods frame the problem and respond to the question of livelihood impact makes them highly suitable to the goals of the current project. The image above (fig 3) uses an adapted version of the UNDP approach to sustainable livelihoods to outline the way in which the project is conceptualizing the SL assessment process and its linkage to the larger process of adaptation. The UNDP approach to sustainable livelihoods may be the most compatible with the project’s overall research goals, while the DFID framework provides a useful tool for use within the case study process itself.

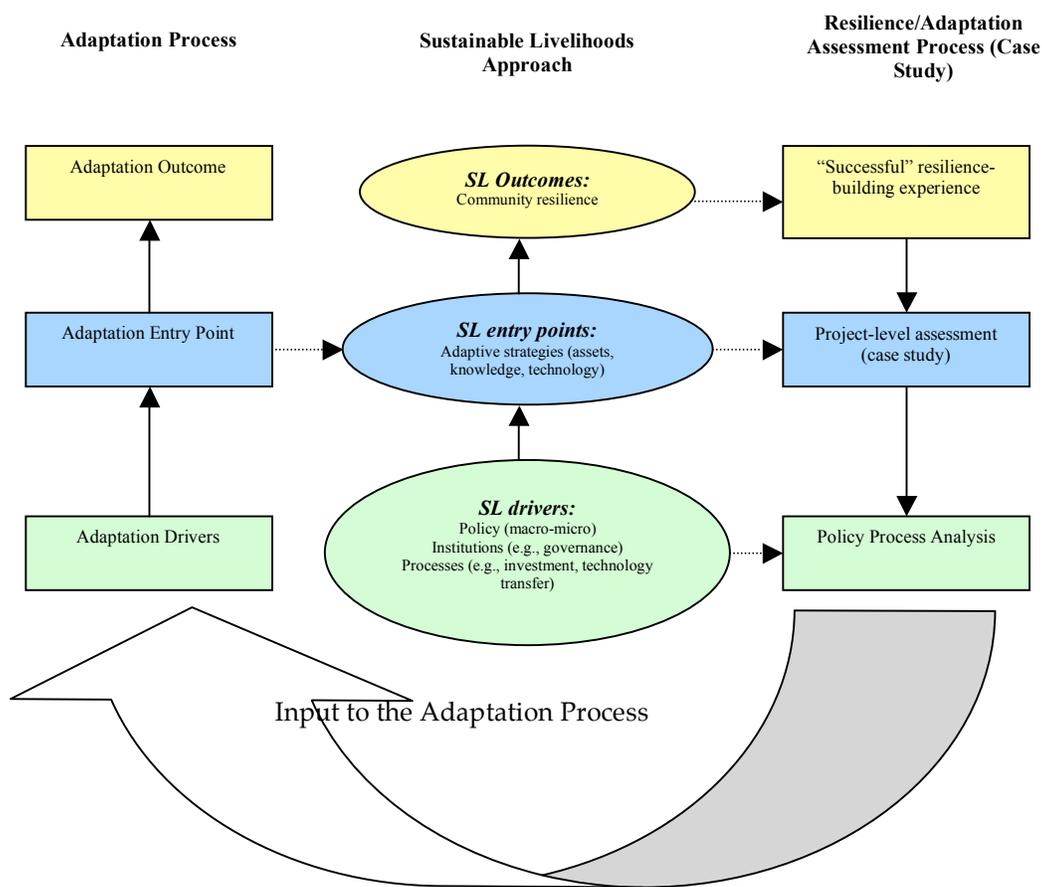


Fig. 4.2: Adapted version of the UNDP approach to sustainable livelihoods

4.4.3 Successful resilience-building experiences

The AF-14 project is motivated in part by an understanding that successful examples exist (notably, in the linked fields of sustainable livelihoods and natural resource management) of efforts to increase the

resilience of communities to climate-related shocks. Numerous reports exist, documenting project impacts and assessing success. It is therefore not the goal of the present project to establish *whether* selected project activities – e.g., SL and NRM measures – have been successful, but rather to clarify (a) the nature of that success, and (b) the enabling factors behind that success.

Success, however, is a subjective term, requiring judicious use. The AF-14 project therefore studied only those experiences that the communities themselves deemed to be successful – according to community-defined terms such as ownership, impact on asset base, sustainability, institutional linkages, etc. As discussed in the introduction, the project is thus entirely bypassing the process of vulnerability assessment in its conventional top-down approach, and instead it assessed vulnerability as perceived by local communities, in part because climate (i.e., drought and dry spell) vulnerability in large areas of Sudan is fairly homogeneous.

4.4.4 Community participation

Stakeholder participation is seen as a key component of research that seeks to directly address human needs. Though the current project is one step removed from direct community-level development activity, the reliance of the case studies on a locally-driven assessment of resilience made it essential that community participation be a mainstay of the work. The challenge to the AF-14 project arose from the limited funds and short time-span available to the case study process: there was neither budget nor time for extended direct observation and multiple community consultations. As a compromise, the project made use of a range of the most appropriate participatory tools, including participatory rural appraisal (e.g., ‘word picture’ development), household surveys, intra-household interviews, and role-playing and community-wide validation workshops.⁹

4.4.5 Resilience indicators

Borrowing from C.S. Holling and colleagues, we refer to resilience here as the capacity of a system (social and/or ecological) to tolerate disturbance without collapsing into a qualitatively different state. Resilient communities, therefore, can withstand shocks and rebuild themselves if necessary.¹⁰ With this thinking, we can see vulnerable (often poor) communities as those incapable of withstanding and recovering from climate impacts, and conversely, resilient communities as those that *are* capable of coping with and recovering. Bearing in mind the sustainable livelihoods literature, which encourages the fostering of sustainable livelihoods as a mechanism for enhancing coping and adaptive capacity, the role of sustainable livelihoods in increasing resilience to climate impacts becomes clear. But the question is how to measure this role? The AF-14 project is relying on several existing tools, developed for monitoring and assessing the impact of sustainable livelihoods on communities; with the guidance provided therein, the project has adopted a fairly simple approach to developing and using resilience indicators, as outlined in the case study methods section.

The use of indicators – to measure sustainable development, poverty reduction, ecosystem resilience, etc. – is a notoriously challenging task, tending to lean too far toward either the quantitative or qualitative extremes. However, consensus is emerging in the sustainable livelihoods field that application of an appropriately balanced blend of both types of indicators can offer up realistic and informative assessments of changes in livelihood security and community resilience.¹¹ Both types were combined for use with the Livelihood Asset Status Tracking (LAST) system, developed by Richard Bond and Neela Mukherjee (2002), outlined in the case study methods section. This tool is essentially a quality of life index, combined with the SL framework’s use of assets. In developing indicators of community resilience, the AF-14 project used community consultation, word picture construction, and local informant validation, as outlined below.

⁹ See, e.g., Bond and Mukherjee (2002); Turton (2001).

¹⁰ See The Resilience Alliance: <http://www.resalliance.org/whatisresilience.html>.

¹¹ See, e.g., Turton (2001), Marshland *et al.* (2001), Hussein (2000), Rennie and Singh (1996).

4.4.6 Policy and institutional factors

A primary goal of the AF-14 project is to draw lessons from the micro scale that are relevant to the macro scale, and vice versa. By developing this understanding, project partners hope, ultimately, to inform a process of scaling up (or scaling out) of relevant SL activities for climate change adaptation. At the macro scale, the project seeks to influence key policy processes – particularly, national adaptation planning and relevant national decision-making in e.g., poverty reduction, disaster mitigation, biodiversity conservation, water resources, forest management, etc. To do so requires an understanding of the interplay between local livelihood conditions and the “range of policies, institutions and processes which support or hinder them” (Goldman, 2000). This connection is of central interest in the sustainable livelihoods approach, however, there is no seminal guidance on how such lessons can be gleaned.

To develop this understanding, AF-14 case studies involved a distinct step of policy process analysis. This analysis was based on the approach developed by the project “Improving Policy-Livelihood Relationships in South Asia”.¹² It should be noted that while the South Asia process is designed in part to understand how policies take shape and can be influenced, our focus is more narrowly focused on understanding the ways in which existing policy supports or inhibits sustainable livelihoods activity. Ultimately we hope that this can enable supportive policies to be encouraged through the adaptation process, and inhibiting policies to be corrected. To facilitate the generation of case study lessons, particularly for the policy process, case studies used a nested assessment approach, where researchers focused analysis first on the household, next on the community and next, through the policy analysis process, on the micro-region, the sub-national context, and finally, the national or regional context.

4.4.7 Validation

Given the subjective nature – and even sensitivity – of the data to be collected (e.g., measures of household income, assets and self-sufficiency), a validation or quality-check was required at three levels. First, the community at large was used as a sounding board for the general themes emerging from the data. At the community level, informal triangulations was used to cross-check and confirm patterns and findings. Second, the local informant provided a critical review of data. Third, projects partners conducted an examination of the data, seeking to identify and distinguish misleading information from that which it considers valid. Questions from this review were referred back to the case study researcher for clarification and validation.

4.4.8 Case study methods

In this section, the case study research process is outlined, and specific methods are discussed in some detail. Case study research was divided into four main stages: background/preparation, fieldwork, policy analysis, and synthesis. Background and preparation was intended primarily to identify community-based activities for case study. For current purposes, only the fieldwork and policy analysis pieces will be explored in depth. Within fieldwork, a more in-depth discussion is provided of the purpose of each of the site visits, the design of the indicator development, interview and data collection processes. Discussion of the policy analysis process outlines the back-casting method that was selected in order to link beneficial community outcomes with their micro-, meso- and macro-scale policy origins.

Case studies explored examples of community-level projects through which local resilience to drought impacts was targeted. Such projects generally used a particular type of activity as an entry point, such as collaborative management, soil conservation, or water harvesting, but tended to involve suites of measures on the ground, or ‘strategies’. It was agreed that the measures or strategies explored through case studies should represent those that have been applied in Sudan and could be applied in other countries.¹³ It was also agreed that case studies should explore experiences that are considered successful

¹² See <http://www.geog.leeds.ac.uk/projects/prp/>

¹³ As this is considered the key criteria that distinguish one case from another, the project select the same target system more than once, since different measures were applied in the different settings within.

by e.g., government or civil society groups, and are confirmed as successful by the communities themselves.¹⁴

Commissioned experts conducted the research and writing with the supervision, coordination support and close collaboration of the project partners. Case study reports were intended to be prepared in such a way that their results could be compared and synthesized into a set of project findings. To achieve this, a carefully designed research protocol was prepared for each of the case study research teams to follow, the major elements of which are outlined here. In the end, each case study naturally required adaptations of the project's data collection methods, in order to suit the unique community context. This is appropriate: the goal in developing and using the methods is to identify the richness of a community's experience and avoid reductionism, while at the same time, gathering comparable information.

Selected systems were those in which a resilience-building approach has been previously applied e.g., sustainable livelihoods measures had been used in the system by individuals or organizations seeking to increase system resilience and/or productivity. To select such systems, project partners surveyed regions of the country for sustainable livelihood, natural resource management and related experiences that are considered successful by communities, NGOs, government agencies, etc. In the case of Sudan, this consistently involved those sets of measures that have effectively responded to community drought-proofing needs. The case study researchers then carried out field research to build understanding of the *nature* of this success, and to determine how the SL strategy was implemented, what helped it succeed, what challenges it faced, etc?

4.4.8.1 Background and preparation

In brief, background and preparation involved:

- The development of *case study selection criteria* – Selected case studies would involve representative climate-related events (i.e., drought), representative livelihood systems (rainfed smallholder production or rangelands-based animal husbandry), coping and resilience-building activities and, moreover, *successful* experiences, as noted above.
- *climate data collection* – Local project coordinators compiled background information on recent (last 20 years) extreme climatic events, including geographic extent, intensity, duration, etc., from e.g., WMO and FAO datasets in order to ensure consistency of past (see shaded text below) climate events with projected climate trends.

1. Drought In Sudano-Sahelian Countries: The word Sahel in Arabic means a plain, a coast or a boarder. Used geographically, the term refers to a band of territory approximately 200-400 km wide, centered on latitude 15° N, lying just south of the Sahara and stretching acrossmost of the width of Africa. The Sahel covers well over 2 million km² and constitutes significant portions of Senegal, Gambia Mauritania, Mali, Burkina Faso, Niger, Chad, and the Sudan. By some definitions, the Sahel covers a wider latitudinal belt that extends roughly between 10 ° and 20 ° N into parts of the Ivory Coast, Ghana, Benin, Togo Nigeria, Cameroon& Ethiopia. The mean annual temperature ranges from 15 to 30 ° C, while rainfall varies from about 100 mm in the north to about 1000 mm in the south. The rainy season, lasting 3 to 5 months, alternates with an extended, unrelieved dry season. The periodic occurrence of drought is an inherent feature of this harsh climate and successive years of drought may be followed by years with torrential rains. In the history of the Sahel there were dry periods in the 1660s, 1740s, 1750s, 1820s, 1830s, and 1910s [Nicholson 1989]. Walsh *et al.* suggested that dry periods might have been more typical than wet periods [Walsh et al. 1988]. In the **Sudano-Sahel**, there have been two distinct droughts since 1960. The first drought was in 1970. It was sharper and deeper in the western Sahel than in Sudan. The second drought, whose climax was in 1984, was more severe than elsewhere. Since 1984 there has seen a steady recovery in rainfalls in Mali, Chad and southern Sudan. In the late 1980s there appeared to have been a slackening off of recovery in some areas. Some pessimistic commentators suggested that the Sudano-Sahel is enduring the start of a secular decline in rainfall [Lamb 1982; Motha 1980]. In the Horn of Africa and East Africa, rainfall patterns are very much

¹⁴ “Success” was confirmed through site visits and assessment of community ownership of the project activities in question, as discussed below.

individual to the region. In Ethiopia, the trend has fluctuated much more closely around the mean than in Sudan and the Sahel. There was a moderate drought in the late 1970s and a slow decline in the 1980s. A sharper drought in 1984 might have appeared had the records for only the northern part of the country been analysed. Djibouti has experienced regular fluctuations in rainfall with no recent droughts. Somalia, Kenya and Tanzania experienced an abrupt drought in the early 1970s. Somalia and Tanzania were favoured by a return to fair rains in the late 1970s and early 1980s, but once again are experiencing a decline. Kenya felt another drought in the early 1980s, but has returned to good rains since. Uganda encountered a long, moderate drought in the late 1960s and early 1970s, a short period of good rains in the mid-1970s, and a period of decline since then. The widespread existence of the 1969-73 and 1984 droughts in the Sahel and Sudan is not doubted, as seen in almost all of the sources [Hare 1987; Charbonnel and Hubert 1989; Rochette 1989 & Nicholson 1989].

2. Climate Information for Sudan

2.1 Historical Background on Climate Data

Continuous and regular instrumental measurements of climate have been available for Sudan since the turn of the twentieth century, albeit of limited spatial coverage over the first two decades. Being a generally semi-arid country, rainfall has inevitably been the climatic resource most intensively measured and documented in Sudan. The longest continuous record of monthly rainfall commenced in 1893 at Suakin on the Red Sea Coast, with the second site being established outside Khartoum Hospital in July, 1899. This latter event followed Kitchner's repossession of Khartoum. Meteorological stations were designated throughout Sudan during the subsequent 20 years as the British Administration was established. Temperature, evaporation, wind, solar radiation, and atmospheric dust concentration are also essential components of the total climate resource. Regular daily temperature measurements were instigated along with rainfall at the turn of the century. Pan evaporation measurements commenced shortly afterwards at a small number of sites mainly to enable effective water management of the Nile waters and subsequent irrigation schemes (Keeling, 1909). Accurate and continuous measurements of solar radiation were established later and daily radiation series exist only from the 1960s (Khogali, 1983).

2.2 Sources of Climatic Data

For the Sudano-Sahelian countries, AGRHYMET in Niamey, founded in 1974 as a "centre of excellence", is a major regional source. One of AGRHYMET's agro-meteorological functions is deriving the NDVI (Normalized Difference Vegetation Index, a measure of the activity of vegetation) from satellite data (NOAA AVHRR).

The integrated results, in ten-day periods, are issued in map form, to give an indication of the advance of the rainy season. A different method uses temperature information derived from meteorological satellite (Meteosat) data, and combines it with ground-station data to produce a second kind of indication of the progress of the rains. The IGADD area is served by the eastern African regional drought monitoring centre in Nairobi (DMC_N).

All of the 22 countries in Africa have national meteorological (or equivalent) services, many issuing rapid and frequent bulletins. Examples are the National Meteorological Service in Ethiopia, the Meteorological Service in Niger (serving the *Comité National du Système d'Alerte Précoce*, CN/SAP), and the Sudan Early-Warning System (in the Relief and Rehabilitation Commission in Khartoum). These use much the same kind of data and have much the same output as the regional centres. The *Centre de Suivi Ecologique (CSE)* in Senegal provides data for ecological monitoring and environmental information systems. Several more international services use the same kind of data and some also issue frequent bulletins. FEWS (Famine Early-Warning System) is a system operating in the United States that issues frequent bulletins about Africa. ARTEMIS is a system within the Food and Agriculture Organization (FAO, Rome) which hopes to soon develop a service transmitting its results by satellite to African countries. UNEP/GRID Nairobi also uses these kinds of data. Other international organizations are not as free with their results, but are also researching drought on national scales (ICRISAT and ACMAD - the African Early Warning System, both, along with AGRHYMET, located in Niamey; ILCA in Addis Abeba). IGADD also has a programme for an early warning system. Some donor countries (for example at the NRI in Britain, at IEMVT in France and the University of Lund in Sweden)

also have early-warning capability, which they use to support regional and national facilities in the Sudano- Sahelian countries. Seasonal forecasting: This forecast is based on statistical relationships between wet season rainfall in the Sahel and the worldwide pattern of sea surface temperatures (SSTs) in the pre-wet season months (Folland et al ,1986; Owen and Ward,1989) .

2.3 Use of Forecast Systems Information:

Among the purposes of these systems is the: Provision to regional and national authorities, international agencies, donors, relief agencies, and charities of predictions stating where and when food crises are likely to arise. ,For this purpose, rainfall predictions and observations are combined with a range of other data to forecast crops and livestock performance. These include: Statistical surveys of production and yield of specific crops.,Market surveys and surveys of crop, animal diseases and pests, among others. Rainfall prediction in the Sudano-Sahelian region is being used for early-warning famine systems.;The accumulated data year-to-year also provide a record of desiccation, positive or negative. ;The international and national authorities need early-warning drought data, which may also be useful at the level of the land-user [Konaté and Traoré 1987].Many of the systems were in place for the 1984 catastrophe in Ethiopia and the Sudan, yet little help was organized for these areas until it was far too late [Eldredge and Rydjeski 1988; Dawit Wolde Giorgis 1989]. The same happened in the Sudanese famine of 1990 [Davies *et al.*].

3. Sudan's Changing Climate

An examination of Sudan's ecological zones indicates that the majority of its land is quite vulnerable to changes in temperature and precipitation . Of its diverse ecological zones more than half the country can be classified as desert or semi-desert, with another quarter, arid savannah. Changes in temperature and rainfall are likely to lead to desertification in some regions, while in the South, the spread of vector-borne diseases is likely. The country's inherent vulnerability may best be captured by the fact that food security in Sudan is mainly determined by rainfall, particularly in rural areas, where 70% of the total population lives. Changes in temperature and precipitation could cause shifts in the precarious distribution of these ecological zones, in the productive capacity of rainfed agriculture, and thus, in the security of the nation's food supply (NC-2001)

3.1 Rainfall Sensitivity to Climate Change

Sensitivity of Sudan rainfall to global warming is not yet known since the regional detail of precipitation changes resulting from the temperature increase are still poorly modelled by GCMs (Schlesinger and Mitchell,1987).

The table below shows the range of scenarios for future rainfall change in Sudan over the next 40 years. Scenarios depend on the cause of recent droughts and the sensitivity of rainfall to global warming.

Cause of recent rainfall depletion	Drier Sahel	Rainfall change by 2030 AD due to GHG effect – no change Sahel	Wetter Sahel
Natural cyclicity	Stronger+ -	+ -	Weaker + -
Natural climatic change	-	0	+
Regional anthropogenic climatic change *	- -	-	0
Global anthropogenic climatic change	-	N/a	N/a

Notes: Much drier - - ,Drier - ,No change 0 ,Wetter + ,Alternative wet/dry phases + - ,* Assumes no reversal of land degradation ,(1980s taken as base rainfall level) In this table four main causes of the recent rainfall depletion are suggested:

- an irregular cyclical pattern which would naturally see a return to wetter conditions
- a climatic discontinuity due to some (unknown) natural cause, in which a new stable drier regime is now the norm
- a climatic change resulting from regional changes in land surface characteristics, namely land degradation and deforestation
- a climatic change which has been induced by global scale modification of atmospheric composition through the emissions of carbon dioxide and other GHG.

The net outcome from the table is a range of scenarios heavily weighted towards either maintenance of the reduced rainfall yields of recent decades or else a further decline. Only one of the ten scenarios leads to regenerated rainfall. In view of this output and until our understanding of current drought mechanisms and modelling of the effects of global warming improves, it would seem prudent for Sudan to assume a continuation of the current depleted rainfall resource into the twenty-first century (Mike Hulme, 1989).

3.2 Observed Rainfall Trends: The changing nature of rainfall supply in Sudan during the twentieth century is examined using historical, annual, monthly and daily data recorded since 1900. Rainfall depletion has been most severe in semi-arid central Sudan. Between 1921-50 and 1956-85 annual rainfall has declined by 15 percent, the length of the wet season has contracted by three weeks, and rainfall zones have migrated southwards by 50-100km. Such migration represents approximately 25% of the fluctuation in rainfall resources that are estimated to have occurred during the last 20,000 years. This depletion has been due to a reduction in the frequency of rain events rather than to a reduced rainfall yield per rain event (Mike Hume, 1989. *The Changing Rainfall Resources of Sudan*).

It is clear that the rainfall of Sudan has altered more noticeably in recent decades compared to the decades of the early to mid century. The declining yield of annual rainfall is strongest in semi-arid central region and in southern Sudan. The decline is less evident along the Red Sea coast and in the northern region which experienced a short wet episode in the late 1970s (Mike Hulme, 1989).

Generally the rainfall distribution has an ascent from the north to the south. The level ranges from approximately zero ml. in the extreme north of the country, arising to 500 ml. in central Sudan, to more than 1500 ml. in the extreme southwest.

In the last 30 years, the rainfall had showed a very high variability north of latitude 14 degrees and lower variability to the south. Comparing annual rainfall with the normal (1960-1990), it was observed that the period 1961-1967 was characterized by above normal rainfall followed by a period of below normal to normal. The rainfall during the 1980s was unique, in the sense that during this period the annual rainfall was below normal with a period of extreme dry conditions (1983-84), while in 1988 a very high rainfall was recorded in most of the country causing heavy floods and extreme devastation.

The highest amount of rainfall reached 200.5 ml. recorded in Khartoum in August 1988. Rainfall performance improved during the 1990s with normal to above normal records except in some parts of western and eastern Sudan. There is no regular cycles performance regarding year-to-year rainfall.

3.3 Observed Temperature Trends

The Sudan is one of the tropical countries with mean annual temperatures varying between 26° and 32 ° except for the elevated points such as the high land of Imatong Mountain in the extreme southern parts of the country where temperature is 18.1°C , and Jebel Mara in the west (22.6 ° C). The hottest areas based on mean annual temperatures of 32 °C lie within the northern parts of central Sudan (Triangle Atbara – Kassala – Khartoum) decreasing in all directions outside this triangle, particularly towards the north west.

The hottest and coldest months vary according to latitude. The hottest month in the extreme south of Sudan is March, and at latitude 10 ° N is April, at 14 ° N is May, and at 20 ° N is August. The coldest month in extreme southern Sudan is August, at 10 ° N is July, and at 12 ° N is January. The highest temperature on record was 49.1 ° C measured at Dongola – Northern Sudan in June 1978, and the lowest was –1 °C measured at Zalingei (Jebel Marra) in December 1961 and January 1962 .

- *case study scoping* – Local project coordinators investigated a number of sources for information on resilience-building strategies that have been applied in the recent past in response to drought vulnerability and/or impacts associated with one of the above climatic events.
- *case study selection* – Having met the basic criteria, such as : Case studies that involve past or ongoing climate-related events that are representative of projected future climate change, as outlined most recently in the IPCC TAR, as well as the Sudan First National Communications (e.g., prolonged drought).¹⁵
- Case studies that involve climate-related events that are representative of experiences of neighbouring countries, such as Egypt, Chad, Eritrea, Ethiopia, Kenya and Somalia.
- Case studies that explore specific examples of environmental management applications (e.g., collaborative management, soil conservation, water harvesting) that have been applied in Sudan, and could be applied in other countries. - These measures should either be ones which have been autonomously developed by the community in response to drought or have been introduced by means of organization and finally adopted by the communities and their local level institutions
- that case study should represent a successful community -level experience in the face of an extreme climatic signal, specifically drought 2- demonstrated records that confirm its success and the ability of vulnerable community groups to cope with further adverse conditions i.e the success should be confirmed by the community themselves in addition to evaluation report by government institutions and other organizations working in the field
- Based on these criteria three priority case studies were then chosen through a simple screening and selection process, involving the input of task force members. Initial site visits were conducted by the case study researchers, to each of the selected sites, in order to ascertain the community’s perception of the effectiveness of the measures. Effectiveness or “success” was determined based on community feedback regarding changes in vulnerability, and on an assessment of the level of community ownership of the measures/project. Cases that were considered successful were then expanded into full case studies.
- *Generic indicator development:* In order to ascertain the “success” of community-based projects and justify case study selection, the project developed and applied indicators of community “resilience”. These indicators were used to explore the way in which projects lower a community’s vulnerability to climate-related shocks. To generate these indicators, the project relied on several existing tools, developed for monitoring and assessing the impact of sustainable livelihoods projects on communities. With the guidance provided therein, the project adopted a simple approach to developing and using resilience indicators. In developing indicators of community resilience, the project used community consultation, word picture construction, and local informant validation, as outlined below.

4.4.8.2 Outline of farm/household questionnaire

It aimed at identifying the information required for comparing the condition of community's livelihood pre and posts the project intervention (tabulated below Table (1))

¹⁵ According to both the IPCC Working Group II (2001) *Third Assessment Report* and the IPCC (1998) *Report on Regional Impacts of Climate Change*, adaptation efforts should be informed by the degree to which a system is resilient to *today’s* climate-related variability and extremes.

Natural Resources
- Rangeland productivity
- Rangeland carrying capacity
- Plant species composition
- Water sources, quality and use
- Access to Natural resources by marginal community groups (women, minority tribes, poor)
Physical Resources
- 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...
- Mud-walled houses to replace wooden huts
- Availability of spare parts
Financial resources
- 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
Human (household) resources
- Ownership of assets
- Skilled labors
- Housing type
- Access of marginal groups to education, training and extension services
Farm outputs
- 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
Access to services
- Extension
- Health
- Education
- Training
- Veterinary services
Social indicators
- Organizational set-up (local village committees)

- Role of village committees in the decision making process.
- Membership to organizations
- Sharing of responsibility
Government policies in relation to:
- Taxes and market prices
- Market prices
- Incentives
- Land tenure
Perceived Risks
- Changing government policies
- Out-migration by skilled people
- Encroachment by other tribes and pressures on rangelands by intruding nomads

Source (Balgis et al, 2003).

Table 4.1: Outline of farm/household questionnaire to determine the condition of community's livelihood pre and post the project intervention

4.4.9 Fieldwork

Case study fieldwork was conducted through two site visits over a 6 month period, lasting between 2 days (in the case of some initial site visits) and 7 days (in the case of the second site visit) each. Major goals of the fieldwork were to:

- gain community trust, commitment and participation in the case study
- confirm success of the community-based project
- finalize resilience indicators
- finalize and carry out data collection strategy
- fill data gaps and validate findings
- initiate policy process analysis

The fieldwork process that case study researchers (CSRs) followed is outlined below.

4.4.9.1 Initial site visit

The purpose of the initial site visit is four-fold: (1) to garner community trust, interest in, and support of the project and the approach, (2) to confirm the success of the SL activities from the community's perspective (and thus, justify the case study), (3) to scope and schedule subsequent fieldwork (including participatory framework), and (4) to identify and contract a local informant. Special attention was given to creating plans for community participation that are sensitive to relevant social barriers (gender, class, ethnicity, etc.). The second activity required a carefully considered approach; the following was undertaken:

- CSRs carried out the initial site visit prepared to share and discuss (a) a particular climate extreme(s), to which the community has been exposed, in order to establish the project context and objectives, (b) a set of generic, expert derived qualitative indicators (discussed below) that can help to describe aspects of people's livelihoods that can be impacted by climate events, and (c) a process, including selection criteria, through which the community can consider and revise these indicators to better describe their context.

- For its part, the community was asked to (a) develop criteria for indicator selection, based on a brainstorming exercise, (b) refine and expand the set of indicators based on these criteria, and (c) informally assess the impact of the project activities on those indicators. (At this stage, the indicators were intended to be qualitative, to allow for rapid revision and appraisal on the part of the community.) Examples of criteria which served as the basis for resilience indicators relevant to a local setting are outlined in the table below (based on Bond and Mukherjee, 2002).

Cells contain locally relevant criteria reflecting the productivity, equity and sustainability dimensions of each of the five capital assets	The five capital assets				
	Natural	Physical	Financial	Human	Social
Productivity	Soil fertility	Irrigation infrastructure	Income	Employment	Education and training
Equity	Access to crop land	Access to irrigation system	Access to credit	Individual/household rights	Access to decision-making
Sustainability	Land management	Water management	Savings and investment	Health	Local institutions

Table 4.2: Constructing local indicators from locally-driven criteria

- These critical steps are intended to determine whether the community views the project activities as successful in increasing their livelihood security, and thus their resilience to climate impacts. It is important that the community clearly, if informally, (a) assesses itself as better prepared to cope with and recover from climate impacts, following the project activities, and (b) attributes causality of resilience to the activities. The connection need not be absolute, but the researcher must be convinced that the project has played the most significant role in recent improvements in community resilience.

CSRs prepared short reports for project partners and task force members, following the initial site visit, which outlined their findings and conclusions about the appropriateness of the particular community experience for continued case study research. The table below (Table 3) provides an example of the criteria developed through community consultation in the Bara Province case study.

Cells containing locally relevant criteria	The five types of 'capital'				
	Natural	Financial	Physical	Human	Social
Productivity	1 - Area of productive range-lands, 2 - Carrying capacity of rangelands (# heads/ha), 3 - Forage production of	1 - Amount of credit granted to individuals, 2 - Household income, its sources and sustainability	1 - Number of established grain mills 2 - Capacity of established grain stores 3 - Number of functioning water pumps	1 - Number of trained CAHW 2 - Capacity of veterinary services 3 - State of social services	1 - Status of organized irrigated gardens 2 - Status of people organisation and communal work

	range lands				3 - Area of women's irrigated gardens
Equity	Access of Kawahla to grazing allotments	1 – Poor people's access to credit 2 – Women's access to credit, 3 - Kawahla people's access to credit	1 - Access of Kawahla people to village grain stores 2 - Percentage of women who participated in grain stores activities, 3 – Participation of poor people in grain storage	1 - Access of marginal groups to different social services 2 – Participation of women in irrigated gardens 3 – Access of marginal groups to training and extension services	1 - Participation of women, Kawahla and poor people in local decision-making process
Sustainability	1 – Privately held grazing allotments 2 - Sustainable grazing systems 3 - Range land quality 4 - Desirable grazing species	1 - Availability of information 2 - Local institutional management 3- Support by finance and credit systems to local income-generating activities, 4 – Credit repayment by local people	1 - Effective water well management system 2 - Maintenance for water pumps 3 - Availability of spare parts	1 – Use of improved technology (e.g., stoves, mud-walled houses) 2 – Use of livelihood alternatives 3 - Availability of drugs	1 – Use of improved technology (e.g., mud-walled public buildings) 2 - Government support of local institutions 4 - Relation between local people committees and local government institutions
External Risks	1 - Annual trespass incidences 2 - Recorded size of trespassing herds.	1 - government use of pharmacy as a pool resource 2 - Government charges to the pharmacy 3 - Changing government policies	1 - Government claim on grain stores 2 - Attraction of tribes from other areas	1 - out migration of skilled people	1 - Capability of committees to perform their tasks (mandate)

Table 4.3: Example of criteria developed through community consultation in the Bara Province case study

As can be seen from this table, one of the challenges of the case study research was to identify criteria and generate indicators that could effectively measure change due to the project activities. In some instances, CSRs working with the communities, generated indicators that clearly captured aspects of the project

itself – such as the use of improved technology, introduced by the project – and run the risk of biasing the results. However, when treated independently and not integrated with other data, such indicators provided useful information on the uptake and sustainability of project activities.

4.4.9.2 Second site visit

The case study researchers had flexibility in the data collection process, since both the indicators and collection methods were to be adapted to suit each case study context. However, case study researchers were expected to (a) collect datasets of a certain minimum size for an agreed set of resilience indicators, (b) document data collection, (c) perform basic data analysis, (d) summarize findings and (e) document any limitations and biases in carrying out the protocol. Beyond these parameters, the project approach to defining resilience indicators and collecting data is as follows:

- Building on the initial site visit, in which communities were asked to select and revise generic qualitative indicators and use these to assess project success, the second site visit focused on finalizing and using indicators to describe household circumstances, pre- and post-project activities, in order to define the net impact of the activities on their resilience to climate extremes.
- Indicators: During the initial site visit, or at the start of the second site visit, full sets of qualitative and quantitative indicators were identified and selected, based on the established criteria. Examples of both types of indicators are provided in the adjacent box. The indicators developed were reviewed by the community and by the local informant under the direction of the case study researcher and adapted as needed to accurately reflect local circumstances and experience.
- Word pictures: At the outset of the second site visit, communities were encouraged to assemble ‘word pictures’. ‘Word pictures’ are essentially descriptions of household circumstances which contain both quantitative and qualitative indicators. The main tool of the Livelihood Asset Status Tracking system, developed by Bond and Mukherjee, word pictures are essentially quality of life indices, constructed around the SL framework concepts of assets. Embedded in people’s descriptions of household circumstances are both quantitative indicators (such as cash income, crop productivity, livestock populations, year-round wells, local grain reserves, employment rates, and savings) and qualitative indicators (such as access to forest produce, rangelands, and fertile soil, or access to credit, seeds, and markets). Word pictures can be developed to capture worst-case circumstances with regard to sets of indicators, best case circumstances, and any range in between. A hypothetical example (from Bond and Mukherjee, 2002) of worst case and best case word pictures assembled by a household during the survey process is outlined in the box below.
- By consulting with communities and individuals and using the ‘word picture’ process, CSRs were able to draw out sets of indicators for each of the five capitals – natural, physical, financial, human and social. For each capital, indicators outlined a best-case snapshot of household

Box 3: Sample indicators of natural capital (quant. and qual.)

Indicator
Land ownership/access (# ha)
Food stores (# seasons)
Fertility of land (soil quality)
Location of land (degree of slope)
Subsistence and cash crops (amounts of each; ratio)
Fodder production (amount)
Surplus seeds (ability to trade)
Access to irrigation water (type and degree of access)
Livestock holdings (# heads)
Supplemental agricultural income (type; amount)
Household food production (dairy? fruit?)
Access to forest produce (type and degree of access)

circumstances; another outlined a worst-case snapshot; roughly three indicators were developed to describe household circumstances in between.

Pre-Project Activity	Post-Project Activity
Little or no land; one or two month's food available from own land; quality of land is poor, having red soil with low fertility; land is located on a slope in such a position that rain water washes away the seed sown and the top soil and hence reduces its fertility; use of traditional seeds; some have given away land as collateral; no source of irrigation; no land for growing fodder for livestock; owns one or two livestock; no milk produced; low access to forest produce;	More of black fertile soil; more land; grows one's own fodder on one's own land; fertile land with more moisture retention power; more produce from land; grows and sells cash crops; grows vegetables; grows high yielding variety seeds; lends seeds to others; irrigation facilities available round the year; land is near the forest; access to forest produce; some have government permit to grow opium; has many fruit trees; availability of home grown food throughout the year; many livestock, high returns from livestock;

Adapted from Bond and Mukherjee (2002)

Table 4.4: Hypothetical word picture of household's access to natural resources (natural capital)

- These indicators were assembled into assessment sheets for use in household interviews and group consultations. In the assessment sheets, both qualitative and quantitative indicators were organized along a simple scale (0 – 100) to enable “scoring” of responses. An example of one assessment sheet is provided below; this one containing indicators aimed at capturing household access to/ ownership of natural capital. To note:
 - one sheet was developed for each of the five capital assets (natural resources, physical capital, financial etc).
 - each sheet consisted of the criteria in the left hand column and the indicator range spread across the remaining columns. (The table below shows only one criterion.)
 - the criteria and indicator serve as the basis of interview questions, as outlined in the sample questions below; in reality, these should be adapted to suit a free-flowing conversational interview style.
 - the interviewees’ responses should correspond (roughly) to the four or five stages in the indicator range; the CSRs used judgement and additional questions to clarify an appropriate “score” for each response.
 - for each question, the interviewee was asked to give one response to indicate their circumstances/experience *prior* to the project, and one response to indicate their circumstances/experience *after* to the project.
 - in the top row is a scoring bar, which can be used to help record the interviewees responses to each question.
- Tables such as this (one for each ‘capital’) were used so that households could essentially assess their own resilience to climate impacts. To do so, households assembled their own word pictures (one for each capital) by communicating responses to the interviewer and informant, drawing from the gradient of indicators agreed upon by the community.
- One of the requirements of this exercise is that all community members agree on a ‘signal’ event – a climatic event that had significant negative impacts and is firmly captured in community memory. Household assessments of their circumstances during the signal event were compared to (a) circumstances during a more recent event, or (b) where no recent event exists, circumstances during a hypothetical event.

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)
	Sample Interview Questions:					
	a) 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? b) Associated response score: c) 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:					
	(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
	Sample Interview Questions:					
	a) Tell me about the carrying capacity of rangelands prior to the project . How many animal units could the average hectare support, per year? b) Associated response score: c) 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:					

Table 4.5: Sample assessment sheet

- In the case of (a), the impact of the project activities will actually have been tested by a climate event. In these cases, the measures will have taken effect prior to the onset of a recent climate event, and the community were able to assess the *change* in their ability to cope with the climate event, and thus assess the impact of the measures on their level of resilience. In these cases, individuals and households were asked, through surveys and interviews, to develop one word picture that best describes household circumstances during the signal event, and one that best describes circumstances during the recent event.
- In cases where the SL measures have just recently been implemented, there may be no recent climate event to use for comparison. Instead, individuals, households and the community were led through role-playing exercises. In these exercises, people were asked to project the historic ('signal') event onto the current context and to develop a word picture that best describes the household circumstances they would expect to experience if the event were to occur today.
- Based on the scores generated through the interviews, word pictures could be created of circumstances prior to and after the project activities. Each set of pictures would have an associated score, which would be used in the analysis process. In reality, the AF-14 project CSRs did not recreate word pictures with associated scores at this stage, and chose instead to explore the disaggregated sets of indicators.
- The patterns that emerged from the consultation and interview process were then put back before the community for reactions and validation.

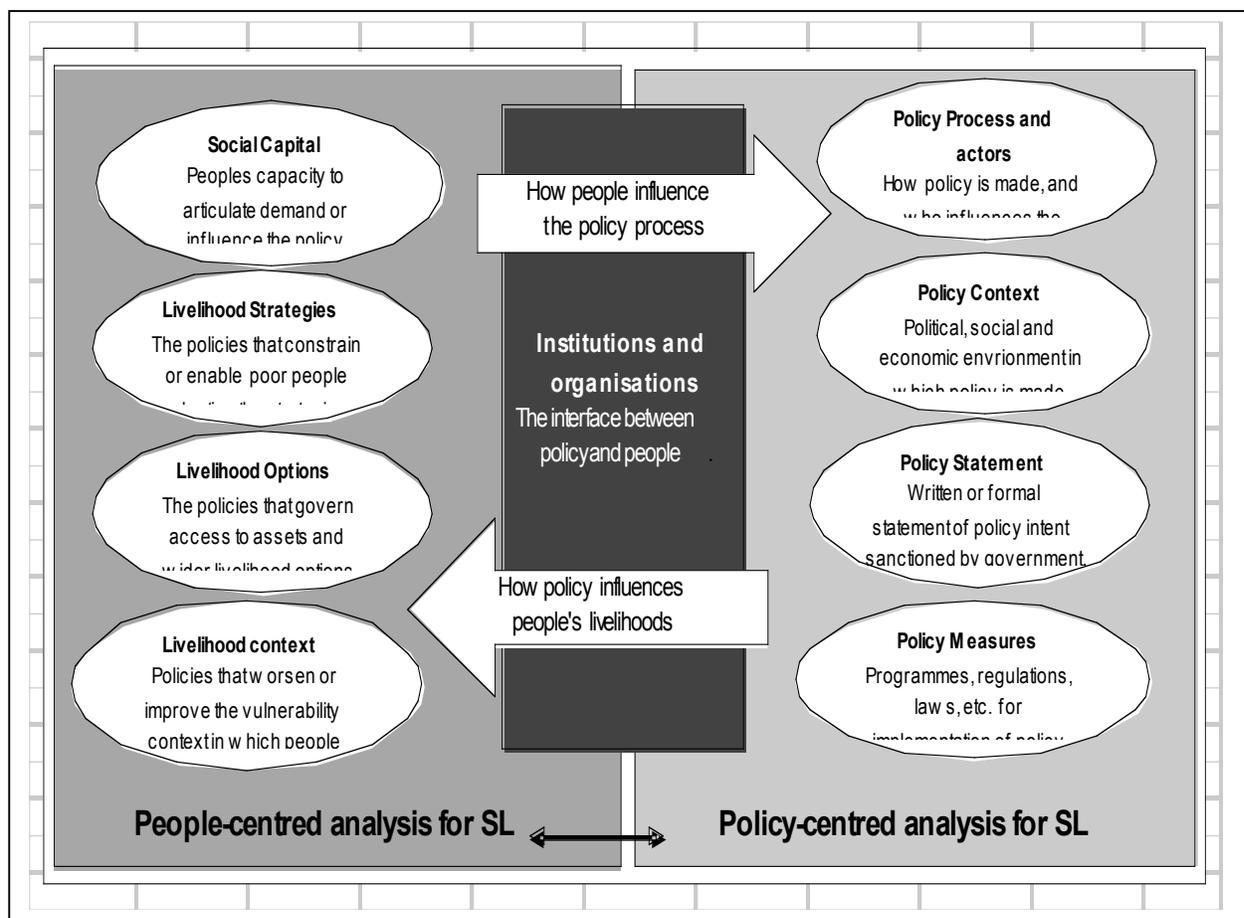
Though not a component of the livelihood assessment itself, the policy process analysis began during the second site visit. During community consultations, household surveys and targeted interviews, CSRs collected information to help determine what policies, institutions and processes (e.g., land tenure policy, local governance arrangements, market access) have enabled the project activities – and which have inhibited.

Based on the resulting scores, CSRs conducted preliminary data analysis. CSRs prepared a short report for project partners and task force members, following the second site visit, which outlined the experience, initial findings and validation needs.

4.4.9.3 Third site visit (or extended second visit)

Findings generated through data collection and analysis requires validation by the community as a whole, prior to finalization of the case study. Ideally, this would be conducted through a third site visit. In the case of the AF-14 project, though, CSRs were only able to conduct two site visits under time and budget constraints and were thus required to accomplish much of the validation at the end of the second visit. Through simple dialogue, preliminary findings regarding the role of SL/NRM measures in building local resilience to climate impacts were reviewed, discussed and as appropriate, adjusted. This represented a key opportunity to discuss causality and to explore caveats and biases of the inquiry. Often, participatory methods such as role playing can help to facilitate the validation process, though in this case such techniques were not used. The third visit can also provide an opportunity for CSRs to follow up on specific questions or concerns posed by the project team and task force regarding the preliminary findings. Lastly, the third site visit can provide an additional opportunity for CSRs to conduct interviews and consultations with key local stakeholders to gather additional perspectives for inclusion in the policy process analysis (see below). At the close of the final visit, CSR's turned their focus to the task of finalizing data analysis and summarizing the findings.

4.4.10 Policy and institutional analysis



Adapted from Pasteur (2001)

Fig. 4.3: The components of Policy Analysis for Sustainable Livelihoods

Analysis of the policy process began during the fieldwork stage and continued following conclusion of the fieldwork. The purpose of this analysis was to essentially back-cast from successful resilience-building outcomes, to try to determine what factors – primarily policy and institutional factors – enabled that success. Pastuer (2001) diagram highlighted the components of two types of policy analysis for SL: 1) the policy-centred analysis and the 2) people-centred analysis. The AIACC Sudan project employed the people-centred, in order to recommend policies and measures that can support existing and future adaptation activity. However, the analysis relied upon the approach developed by Oliver Springate-Baginski and John Soussan in their working paper *Livelihood-Policy Relationships in South Asia: A Methodology for Policy Process Analysis* (see <http://www.geog.leeds.ac.uk/projects/prp/pdfdocs/polmethod.pdf>). (Springate-Baginski and Soussan (2001) So The policy analysis phase of the research involved of a modified version of the steps presented in the "Livelihood - Policy Relationships in South Asia" Working Paper Series,¹⁶ as outlined here. In "A Methodology for Policy Process Analysis outlined a series of six policy analysis steps. Drawing heavily upon these, but reversing their order, the AF-14 project pursued the following:

- *Determining outcomes and impacts for livelihoods:* this step is essentially the livelihood assessment process undertaken through the fieldwork described above. With an assessment of impacts on local livelihoods, researchers can assemble a series of policy and institutional linkages through the subsequent steps.
- *Identifying key policy and institutional issues and defining their relationship to the community-based project:* this step involves identification of policies and institutions (at the macro, meso and micro-scales) that are seen as important to the development, implementation and success of the project and carefully exploring the relationship. At the macro-scale, land tenure reform, for instance, may play a critical role in certain projects, just as lack of reform may have challenged project implementation. At the micro or meso-scale, a sound framework for participation in local governance may pave the way for robust project participation and lasting project ownership. This step relies largely on interviews with key stakeholders (from government, civil society, etc.), household surveys, and community consultation.
- *Exploring the policy development process:* once key enabling factors have been identified, the challenge is to explore how and why these came to be. In the present step, researchers would examine how the policies and institutions of interest were developed, seeking insights into the process such as key actors and common strategies. This step involves primarily interviews with key stakeholders and desk-based research.
- *Establishing a picture of the policy, institutional and process contexts:* this step is intended to clarify why enabling factors came to be. This series of nested pictures would describe first the micro, focused on the village or village council scale, next the meso, focused on the district or sub-national scale, and finally the macro, focused on the national or regional scale. By developing these pictures of the project context, researchers can better understand the sort of groundwork that needs to be in place in order for certain resilience-building activities to take root. For the micro and meso-scales, this step involves interviews with key stakeholders, community consultation, and desk-based research. For the meso and macro scales, it relies on interviews with key stakeholders and desk-based research.
- *Creating a history of key policy milestones:* lastly, it is instructive to anchor the analysis emerging from the above steps to a policy and institutional heritage. By piecing together the preceding information, it can become apparent that certain instances of landmark legislation, reform, etc. play a direct role in enabling resilience-building activity today. It may be valuable for climate change adaptation activity to build off of or link to these policies and processes. This step relies on interviews with key stakeholders and desk-based research.

4.5 Results 1: Assessment of Sustainable Livelihood Capitals

The types of adaptations highlighted in this report are activities that represent changes in some attributes of one or more livelihood capitals, directly related to reducing vulnerability to climatic variability and change. Accordingly, adaptation options are grouped into: (1) Financial, (2) Physical, (3) Natural, (4)

¹⁶ <http://www.geog.leeds.ac.uk/projects/prp/downdocs.htm>

Social and (5) Human capitals, which are often interdependent. To find out how the measures for increasing resilience to current climate have worked across the five livelihood capitals, assessment was made covering four dimensions: productivity, sustainability, equity as well as risks and uncertainty encountered, i.e. what barriers did the implementation of these measures actually face or expect to face?.

By looking at the elements of sustainability, productivity, equity and risks, the assessment is aimed at identifying whether these adaptations have effectively reduced vulnerability to current climatic variability and whether it is going to effectively reduce potential future impacts of climate change. What are expected threats; as well as identifying what gaps exist among these measures?

4.5.1 Productivity dimension

Different indicators have been developed for each case study to assess the productivity dimension across the livelihood capitals (case specific). In the Bara case study, indicators used for assessing productivity in the natural capital considered issues related to; total rehabilitated land area and carrying capacity and forage production. In Arbaat and Darfur, it considered issues like; improvement of land productivity for supporting diversified crops, increased crop productivity and the amount of water conserved. In the first case of Bara, results indicated an overall improvement in the three indicators by 58%, 46% and 48% respectively, when compared to their situation before the intervention (Figure 1). The improvement of rangeland had also led to a significant increase in animal numbers, particularly sheep. The rehabilitation of the rangeland increased the forage production, which increased the carrying capacity. However, the improvement of the latter was relatively less than the others (46%), presumably because of the negative relationship between carrying capacity and animal numbers even under improved land productivity.

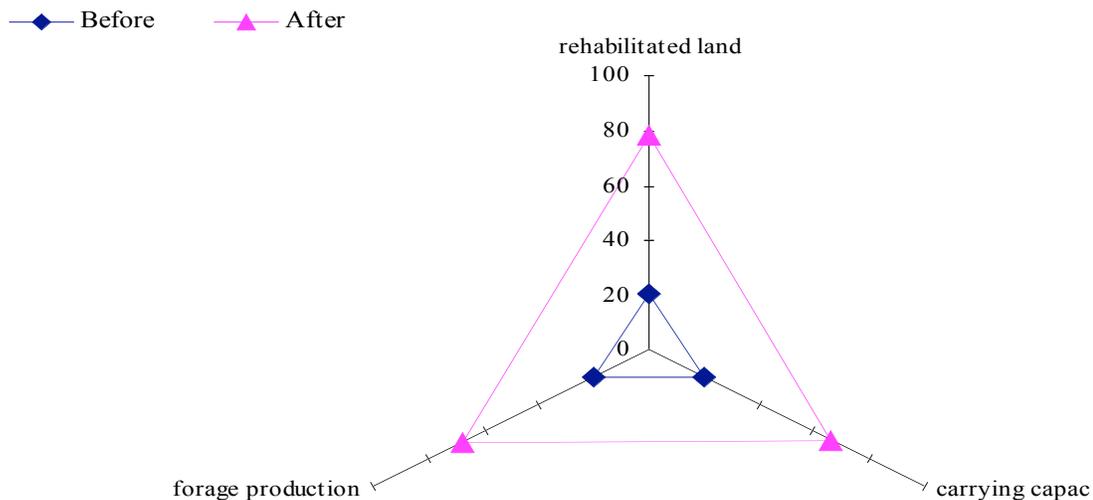


Fig. 4.4: Assessment of productivity of natural capital before and after intervention of range land rehabilitation project, using rehabilitation of range land, carrying capacity and forage production as indicators.

In the second case of Arbaat improvement in land productivity by 12%, and crop productivity by about 19 %, (Fig 5) the improvements in both water quality and quantity could be attributed to the intervention in the form of the introduction of new ideas regarding water harvesting and management by community members.

The Darfur case study showed that the productivity per unit land increased by more than 50% (production of 12 sacs of grains from the same unit of land which used to produce a maximum of 6 sacs before the introduction of water harvesting technique).

Productivity in the financial capital addressed similar issues across the three case studies, which are mainly the number of income generating activities, created employment opportunities and the efficiency of the credit systems introduced. All showed positive results with regard to the three indicators. However, in the Darfur case study, the amount and stability of credits depends to a large extent on the sufficiency of agricultural production, which means that if production is poor, then less credit will be granted. In Bara more credits will be granted to men and rich women, assuming that they will be able to repay. While in Arbaat, the Agricultural Bank provided seeds on credit and small loans for interested farmers, 36% of the people benefited from it; in spite of this, the study revealed that only slightly more than 12% of the sample think that, credit availability has directly contributed to the success of the project. The majority (40.4%), attributed the success of the project to the provision of basic community needs (education, health and training activities), i.e. meeting the local needs and demands.

The below figure (6) from the Bara Case Study shows the assessment of productivity of financial capital before and after intervention of the Rangeland Rehabilitation Project, using amount of credit and income (sources, stability, sufficiency) as indicators.

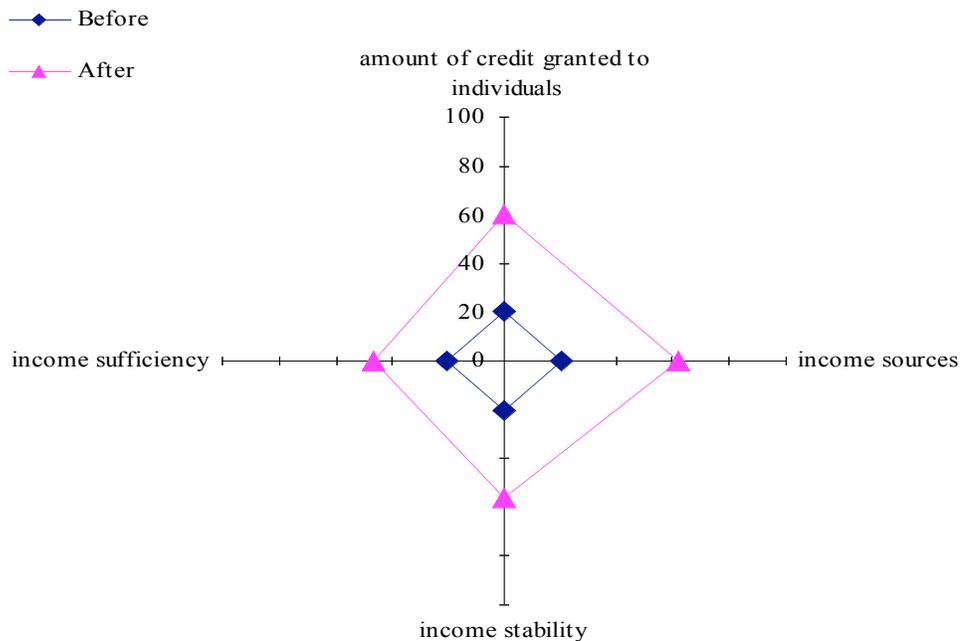


Fig. 4.5: Assessment of productivity of financial capital before and after intervention of the Rangeland Rehabilitation Project, based on availability of information, effectiveness of credit repayment, suitability of local institutions, and support of credit systems and government policy to income-generating activities.

4.5.2 Equity dimension

The assessment of equity, focused more or less on the situation and accessibility of minority groups and women to resources, as well as their contribution to the decision making process. Analysis showed that generally the equity situation was much improved compared to the pre-intervention period, in all the areas studied, although there are differences on the level of improvement. For example Bara witnessed a positive improvement in the access of women and minorities to the different social services because the project administration was keen on involving them in the various project activities; and consequently, created the enabling condition for their involvement (training and extension for minorities and women

development programs). The results showed that women's participation in productive activities like the Women Irrigated Gardens (WIG) was excellent (88% of total respondents). It also showed that the training and extension opportunities opened to marginalized groups have significantly improved (97 % of total respondents). Equity issues were a real challenge in the Arbaat area, where people traditionally, oppose and restrict women's participation in different out-door activities. However, the area witnessed a giant jump under the project; with regard to women's participation in community development activities, participation in public life, accessibility to resources, and involvement in the production process (they currently constitute 63% of total number of farmers). Another indicator is their participation in meetings (pointed out by over 76% of respondents as being reasonably high, compared to fewer than 7% prior to the project). Moreover, according to the respondents, women's involvement in community committees has doubled to more than four times its level prior to the project. On benefiting from services such as education, results reflected that adult literacy attendance was particularly high among women, (70% of respondents indicated that they attended regular classes compared to only 2.4% attendants before the project). Moreover, women and men equally enjoy good access to credit, child schooling opportunities and to a slightly lesser degree in activities that require moderate cash payment, such as possessing sprayers, improved seeds and pesticides. However, inequality in access is clearer in relation to the vegetable market, which is governed primarily by size and quality of produce, which in turn depends on the land size and type of inputs applied. This situation provided a relative advantage for rich farmers with large land areas compared to the less privileged ones.

The Darfur case study provided a different example on equity issues, where few variations were observed with regard to the role of women in the agricultural operation, water harvesting and cultivation on sandy soil (qoz). The majority of respondents indicated that the level of women's participation in these activities can be considered generally as good, however, a clear division of work was in place, and this is not very clear in the other case studies. Some tasks could be only assigned to women while others are assigned for men, particularly among members of Fruit and Vegetable Farmers Union. While fruit gardens are grown and managed only by men, vegetable plots are the responsibility of women in addition to crop farming and harvest. In spite of this disproportionate workload assigned to women, men are still the ones who make all decisions regarding land ownership and farm planning. Elasha O. (1996) concluded that although the women in Darfur constitute more than 85% of the total labour force working in forest sector, they receive minimal wages. An FAO report (1989) reflected that rural women in Sudan have been called "invisible laborers," as their work is often not counted in formal labor statistics.

4.5.3 Sustainability dimension

Taking into consideration that climate change could modify the historical patterns of both climate variability and extreme events in an unpredictable manner, communities may need to not only sustain their current flexibility and resilience, but increase their abilities to absorb and respond to differential types and a wider range of impacts, if they are to maintain their coping capacities and ability to adapt to potential changes. In this context, resilience is not just returning to a fixed level of vulnerability, but reducing vulnerability and enhancing the capacity to minimize risks so that vulnerability to future climatic events is reduced. To be sustainable, adaptation efforts must anticipate potential socioeconomic and environmental changes and pursue options that build resilience to the stresses resulting from these changes. In the three case studies, a different set of indicators was considered for each of the livelihood capitals. However, all the indicators used for assessing sustainability in the Bara case study showed poor conditions before the project intervention. The situation changed after the intervention, and the information became more readily available (80%). One important factor contributing to the sustainability of the adaptation measures in Bara is the continuation of the local institutional setup created by the project, evaluated by 78%, as being very effective, presumably because of the efficient community development committees, as well as the effort of an NGO (branch of Sudanese Environmental Conservation Society, SECS). Key to the sustainability is the availability and timely dissemination of information on rainfall, new production inputs, and prices. This is in addition to the effectiveness of credit repayment, which was found to be excellent (88%), under the revolving fund which continued to work very well as a system. Moreover, a supportive government policy was applied with regard to developing and encouraging the adoption of income-generating activities.

A list of sustainability elements presented by the Arbaat case study emphasized that the acquired skills and knowledge represent the main sustainable benefits to the community. Elements for sustainability that have been introduced right from the start of the project include:

- Government involvement and commitment to the provision of financial and technical contribution;
- Establishment of community development organizations and building their capacities;
- Continuously conducted awareness campaigns and training programs for different community groups, particularly women;
- Community participation in planning and contribution to the cost of inputs (the cost sharing of inputs: KARP 40%, Government 40% and beneficiaries 20%);
- Positive reaction of the project, to basic community needs (initiating and/or strengthening of the community services (e.g. health and education));
- Use of appropriate techniques and technology in different farm level practices;
- The serious consideration and positive responses by the project to recommendations and experts' advice put forward upon the evaluations of different project activities. For example the women's component was not part of the original planned activities; but following the first evaluation it was proposed, and now women farmers constitute 63% of total project components.

In the case of Darfur, a key sustainability element is the fact that the basic environmental management measure around which all the other measures have been built, is the autonomously developed water harvesting technique. This is very important as it is a clear indication that this is an adapted, tested viable measure, which evolved with time and has so far provided a safeguard to local communities against harsh climatic conditions. In addition, the case study of Darfur highlights the prominent role played by community leaders, in ensuring sustainability of important indigenous knowledge, cultural values and wisdom and their transfer between generations. Moreover, under the traditional system of local administration the responsibilities of the traditional leaders used to include: land allocation; protection of common natural resources; organization of management of natural resources; security and organization of foreign tribes passing or residing in the area; defining and delineating nomadic routes; and settlement of tribal disputes. However, the changing in government policies and institutions led to the replacement of traditional administration with different government structures, which is among the major factors contributing to the current conflicts in Darfur Region.

4.5.4 Perceived risks

Arbaat case study: The main risk perceived in the Arbaat case study, is the government plan to heighten the Khor Arba'at dam and the add new diversions to increase its storage capacity and increasing supply to Port Sudan. This is expected to reduce the cultivated area in Arba'at al Zira'a (farming areas) and may pose a real threat in the long term with population increase. The solution proposed by the local committee to the State authorities, as alternatives, includes (1) digging wells to irrigate the home gardens, (2) guaranteeing an agreed amount of water from the Khor to Arba'at and (3) providing compensation to the area in the form of social and economic services. Digging of wells will also contribute to reducing the risk of frequent low seasonal rainfall. Given the present level of technology, knowledge and economic conditions in the area, the predictability of a good runoff of the Khor or abundant water volume coming from the highland is extremely difficult, and hence, there is always a risk of the occurrence of water shortages or floods. Another risk is the increase in the population and water demand for Port Sudan, which is very likely to occur given the current trends of migration from rural areas to big cities and towns. This requires developing a rational and economically effective water management system within the urban areas, in order to guarantee sustainable water supply, without causing greater deficiency problems elsewhere.

4.5.5 Conflicts over natural resources

Bara case study: The improved range land condition and the available water within the area have attracted more people with their livestock. This might be the main external risk, which could trigger problems in the future. Moreover, there are some worries with regards to brain drain as the analysis showed that 20-30% of trained people (mainly CAHW) used to migrate during the dry season to work in towns or in irrigated schemes. This migration was found to be temporary as the workers return to their

areas during the rainy season. Nevertheless, if the percent of the migrating people increased significantly, that might constitute a risk, particularly if it is combined with a shortage in training opportunities.

Darfur: The current conflicts in Darfur present a real risk to the sustainability of different adaptation measures. This is a clear example of the effect of war on the human livelihood and sustainable development interventions. The hard work of many people could easily be lost and resources that could have generated income for years could be destroyed. Historically, conflicts in Darfur are over scarcity of natural resources. During the terrible droughts of the 1980s, nomads faced with dried-out natural pastures started to take their herds into the farms of the resident agriculturalists. They allowed their herds to graze the farmers' crops and the farmers, suffering just as much from the drought, defended their land and their crops. Animal herders and farmers clashed, sometimes different groups of herders also fought each other for water or pastureland. Fighting between different groups has led to tribal quarrels and local skirmishes have escalated in to larger tribal conflicts. The result we see now is a violent conflict that holds the concern and attention of the world.

Summary tables of characteristics of measures based on their applicability across the three case studies

Measure	Benefits	Actors	Resources	Capacities	Uncertainties
Water harvesting and management	Improved environmental conditions	Subsistence farmers	- Resource base	Basic farming skills	- Shortage of financial resources
Introduction of new crop species (palm in Arbaat, fodder in Bara & vegetable in Darfur)	- Household food security - Improved water supply (quantity and quality)	Women Government and project officials (guidance & supervision) CBOs ¹	- Source for funding Capital money	- Basic management skills - Training & Extension knowledge	- Changing government policies
Increased vegetation cover (hortic trees, and Acacia trees)					
Home gardens					
Maintenance of irrigation system	Provision of physical assets necessary for sustaining their livelihoods	Development Committees (supervision) Community workers CBOs	Financial resources Local building material Spare parts Machines for digging	Training skills Technical know how related to operation & maintenance	Shortage in financial resources
Grain stores (2)					
- Fertilizers (organic and non-organic)					
Income generation activities	Income generation, poverty alleviation and improved livelihood conditions	- Community-based organizations (committees, unions, women etc) - Rural extension officers - CBOs	Creditable seed money Extension facility	Organizational skills (committees, unions, women etc) Rural extension skills	Government policies Limited finance
Diversification of livelihood systems					
Access to credit and increased production					
- Build on traditional knowledge	Improved human capacities and management skills	Community-based organizations (CBOs) Rural extension officers and school teachers	Training and extension material Clinics and health services Schools and literacy classes	Teaching and training skills Rural Extension capacity	Migration of skilled people Conflicts and civil war
- Capacity building (training, extension, education, health)	Improved health conditions				
Empowering women					
Organizational setup	Community organization	Community based organizations (farmers, women, leaders) Teachers and Extension officers	Communication means (networking) A source for providing and updating the climate information - Extension material	Community leadership capacity Extension and teaching skills	Social & tribal conflicts Migration of skilled workers
Increased participation of communities in the decision making process	Enhanced community participation in the decision making process				
Further women participation in public life	Improved ability of women to participate in public life.				
Information exchange & networking					

¹ CBOs = Village development Committee in Bara, Community organization in Arbaat and Farmers Union, cooperative societies in Darfur

Table 4.6: Characteristics of measures across the 3 CSs

4.6 Conclusions

Adaptation Measures addressing local livelihoods

- The project attempted to evaluate adaptation measures applied across the three case studies and their individual and combined impacts on the five livelihood capitals. The results indicated that essentially there are similarities in characteristics and impacts of those measures addressing same livelihood capitals in the three localities, e.g. those common measures addressing the natural capital were found to focus mainly on issues related to Water harvesting and management, Introduction of new crops or species (palm in Arbaat, fodder in Bara & vegetables in Darfur), improvement of vegetation and green cover (horticultural and Acacia trees as home gardens and shelterbelts). However, the main players or people responsible for implementing those measures were mostly found to be the persistent farmers who really need to adapt and consequently they accepted the change- although under normal conditions people tends to resist the change- but when it came to being a matter of survival, then were left with out a choice – they were forced to accept and adopt new ideas. Other main players were the government officials, NGOs members, whose roles complemented the farmers' roles, i.e. supervision, extension and guidance,. Women in the three areas played an influential role in making the required change specially in areas where women used to traditionally confine themselves to household activities, and remain isolated from any sort of income generating activities or involvement in public life., like the case in Arbaat (Eastern Sudan) where traditionally Beija women were denied outdoor activities or practicing any productive roles outside their family domain. Surprisingly, they happened to play a major role in the success of the KARP project activities, completely transformed into very active community members. According to (Abdelati, 2003), Beija women are the ones who have developed and were managing home gardens,. Moreover, they helped in implementing different forms of income generating activities, have largely contributed to food security, and increased cash incomes of their households.
- Moreover, common measures addressing physical capitals included: the installment and management of farming machinery (specially related to irrigation systems), establishment of big grain stores for storing surplus grains, use of improved seeds and application of fertilizers (organic and non-organic) . Other measures identified in Bara include: Energy conservation techniques (improved stoves) and the use of mud-walled houses to replace wooden huts and conserve the tree cover in a addition to the regular maintenance of all the assets e.g. water pumps, and the provision of spare parts. This required special skills that were provided by means of training and capacity building to selected individuals from the local community (the need for developing human capital). Key players in implementing measures addressing the physical capital were the community workers plus community organizations and committees (supervision). Since most of the work needs some skills and more funds that can not be availed individually – here the presence of committees and other social structures became vital for the continuity of these measures. However, some key uncertainties highlighted by respondents, was the shortage in financial resources and the volatile government policies, e.g. In Bara area, the government decided to take possession of some important physical assets (Veterinary pharmacy) after the termination of the project.
- In the case of financial capital, common measures were: income generation by means of practicing various in door and outdoor activities (such as cottage industries) and through the diversification of livelihood systems, in addition to having access to credit and revolving funds. Women play major role in the development of this capital, as they represent the engines that have long been cut off from the production line, being deprived from playing a real role in the household economy. . Other players include the extension agents who deliver the messages and make the people aware of financial opportunities, building their capacities and train them in order to acquire the required skills for managing their financial returns. Major resources needed to run these measures include the availability of creditable seed money and extension facilities.
- For the human capital, most important elements across the different three sites are: the success in making use of and building on existing traditional knowledge for the purpose of improving community's livelihood. Similarly, important is the creation of skilled labours among the household members through training and building capacity. Special emphasis was given to the

training of women, equipping them with knowledge and skills to play an active role in public life as well as in their households. Moreover, the availability and accessibility to basic services open to local people (Extension, health, education and veterinary) had also been identified as essential factors. Implementation of measures leading to the development of the human capital was the responsibility of different actors mainly community-based organizations (CBOs), community elders, extension officers and school teachers. Improving in this capital was perceived by most respondents in Arbaat case studies to have a great impact in terms of improving the overall household living conditions. Major risks identified were the out-migration of skilled people, tribal conflicts and civil war.

- With regard to social capital, common characteristics highlighted include the building of community's capacity to organize themselves and form organisational structures, and empower communities to improve their participation in the decision making process. Moreover measures targeting women included training, building skills and further their participation in public life. Another important measure identified is the information exchange & networking. Agents for change who contributed to this capital are the community based organizations (Farmers Unions, Women Group, Community Leaders), teachers and extension officers. Traditional systems of group work have also been considered such as the Nafir which is the grouping of people in response to an emergency call, usually made by the local leaders to perform an urgent task in a cooperative manner, e.g. rescuing the agricultural crop from the invasion by locusts or to perform a group harvest of individual farms etc.

4.7 Results 2: Assessment of Policies and Institutions

4.7.1 Summary

Beside the assessment of impacts of SL measures on local community livelihoods, the researchers assembled a series of policy and institutional linkages through the

- a) Identification of d key policy and institutional issues and defining their relationship to the sustainable livelihoods project: this step involved identification of policies and institutions (at the macro, meso and micro-scales) that are seen as important to the development, implementation and success of the SL project and carefully exploring the relationship.
- b) Exploring the policy development process: once key enabling factors have been identified, the challenge is to explore how and why these came to be. So, researchers examined how the policies and institutions of interest were developed, seeking insights into the process such as key actors and common strategies.
- c) Establishing a picture of the policy, institutional and process contexts: this step is intended to clarify why enabling factors came to be. This series of nested pictures described first the micro, focused on the village or village council scale, next the meso, focused on the district or sub-national scale, and finally the macro, focused on the national or regional scale. This will lead to better understand the sort of groundwork that needs to be in place in order for certain SL activities to take root.
- d) Creating a history of key policy milestones: lastly, there is a need to attach the analysis emerging from the above steps to a policy and institutional heritage.

Key challenge to this report is to compare between the outcome of the three case studies, in spite of the fact that the research framework and an agreed set of common basic data were basically considered in order to ensure thematic comparability between sites.

Analysis of the policy process began during the fieldwork stage and continued following conclusion of the fieldwork. The purpose of the analysis was to essentially back-cast from successful sustainable livelihoods outcomes, to try to determine what factors – primarily policy and institutional factors – enabled that success. By piecing together the preceding information, it become apparent that certain instances of landmark legislation, reform, etc. play a direct role in enabling SL activity today as well as in developing future adaptation. Moreover, institutions are common element in any policy process, their analysis is needed to complement the policy analysis, ranging from the local institutions, to the micro

institutions at the state level to macro level institutions which provide the institutional context in which livelihoods are managed, and succeed or fail. (Pasteur 2001) indicated that Policy does not happen in isolation. It is not formulated and implemented solely by policy makers in government offices. A range of institutions, such as markets or the legal system, and organizations such as NGOs or bureaucracies, mediate a messy relationship between policy and people's livelihoods. This is the interface where policy and people meet. The information generated through the research was then assembled into this policy process analysis report.

Main policies institutions and stakeholders relevant to the assessment included; local CBOs, NGO's, international NGO's, range of government institutions and research institution, NGOs and Community Based Organizations (CBOs) in addition to individuals from the Private sector, Scientific Research communities, Education and donors. Of course not all and each of these stakeholders groups have been assessed in each case study. Moreover, government institutions identified and assessed differ from one case study to another with the Ministry of Agriculture being common across the three case studies. The assessment was extended to cover the National Institutions responsible for natural resources. Although natural resources as occur in nature are closely related and interdependent, this close relationship and interdependence are not reflected in the counterpart relationship of the various institutions concerned with their use and management. As they are criticized as lacking coordination subjected to frequent changes through the creation of new administrations and ministries and frequent changes in affiliation of institutions. This situation of instability reflects lack of vision and ad hoc decision. The project reports shed light on some of these institutions and their assigned roles in relation to natural resources management.

At the meso level, the project assessed policies and institutions that positively contributed or hindered the process of building community's capacity to adapt to climate variability and change, including policies related to land tenure, conservation of natural resources, and state levels institutions responsible of implementing these policies. Generally more information could be provided on Micro-level policies and institutions, since most of the respondents have a clear perception regarding the role of local level policies and institutions and their respective impacts on their livelihood.

However, policy studies conducted under the AIACC project reflected that of meso and micro level policies and institutions are closely linked to each other in most cases and sometimes, we can not separate their roles e.g. in land ownership, although issues related to land tenure is always being regarded as a central government concern, but certain control is maintained at the meso and local levels.

Assessment at the local level covered the community based organizations- local NGOs, unions and committees- the Role of Traditional Leaders in Natural Resources Management was emphasized since traditional leaders have recognizable influence on the central government, where leaders can use their tribal weight in the election of governors. Moreover, through the traditional leaders it is possible to establish ethnic balance in regional governments. The traditional administration played a major role in natural resources management for very long periods in different parts of Sudan, particularly in remote areas. They kept the different ecosystems working in harmony, and consequently they were kept intact and firm. Problems between herders and farmers were always under control and routes of migrating tribes were well known by others, settled tribes. Traditional leaders respect and consider each other, and their communities respect them also. Local leaders such as El-Omdah and El-Sheikh led and supported certain good activities and values, e.g., El-Nafeer (working in groups in cooperative way). Most of their activities were extremely connected with natural resources management (NRM). They directed people towards rotational grazing, i.e. grazing a particular area while resting another for the re-growth of the different pasture species.

The responsibilities of the traditional leaders include: land allocation and settlement of conflicts; protection of common natural resources; organization of usage of natural resources; keeping order of security and organization of foreign tribes exist in their areas; definition and delineation of nomadic routes; and settlement of tribal disputes. This was illustrated in Darfur case study, where traditional leaders have largely contributed to the success, and sustainability of water harvesting technique, they maintain control over the tribal land,, protection of common natural resources; organization of usage of natural resources; security and organization of foreign tribes existing in their areas; clear definition and delineation of nomadic routes; and settlement of tribal disputes, fast adoption of new techniques within the tribal territory. Moreover, this situation of social welfare contributed to the widespread of water harvesting techniques among the different community households in Darfur and improved their production in terms of quality and quantity Similar to this in Northern Kordofan (Bara project), where,

El-Omdah and El-sheikh gave a lot of support to the project, in terms of their commitment to all of the activities, which meant the commitment of the whole community. Guided by them, the project management succeeded in convincing the Rural Council to enforce a local decree whereby the area of agricultural land for crop production within the Rural Council would be reduced by a factor 25% of its total. The area to be deducted from the crop land would be added to the fallow land that is either conserved as range land or forest.

Moreover, the project assessed the role of financial policies at the state level, where it was found that flexible credit policies have played a major role in improving the financial capital in the three case study areas. In Bara, it was agreed that the bank would pay credit to the Credit Committees of the project villages at a more lenient rate, to encourage them help the villagers to utilize the credit for income-generating activities.

An important financial policy intervention in Arbaat is the formulation of a cost sharing arrangement between SOS Sahel organization and the Arbaat community, where by the SOS provide production inputs e.g. rent them a loader, improved seeds and means of transport etc. The farmer starts by repaying in a flexible manner e.g. paying 25% of the market value of the cost of inputs then gradually complete the full cost. This agreement facilitated lots of things for the Arbaat community like, accessibility to big cities markets to supply of vegetables and fruits to Port Sudan.

Similar impacts were obtained in Darfur, from employing a different credit system called the Shyl system. The people used it in order to overcome some of the constraints they encountered when they apply for credits. The Shyl system, played a major role in resolving constraints, associated with issues of accessibility to credit, where 48 % of the respondents, indicated that it has not been always easy to get access to credits from the Agricultural Bank due to the complicated procedures set by the bank, e.g. the necessity of availing a collateral "ownership of a fixed assets by the farmers" in order to make them alleageable for obtaining credit.

4.7.2 Challenges to policies and institutions research

In an attempt to find answer to what contribution can we expect policy analysis to make for the livelihoods, a paper was developed, based on the assumption that understanding policies and institutions and their impacts on livelihoods is fundamental to understanding the enabling factors for improving community's adaptation, as well as disabling factors undermining their capacities or leading to mal-adaptation.. This is challenging, because, based on this assessment community needs and interests could be defined, as well as priority options for sustainable livelihoods i.e. its outcome could be considered as the basis for future policy decisions.

Issues related to methodologies for policy analysis have been raised by researchers as challenges, as many questions regarding methodological lessons and practical issues were raised during the project research, they were similar to those raised by (Brock 2001): related to "what is the best way to represent complexity? How can the multiple views of different actor groups be incorporated into such a representation?, how can such a learning process be effectively managed within the boundaries of available resources? On the other hand, there were more abstract considerations: what, and who, is this research for? How could this process of research best be transformed into something which usefully serves the needs of the vulnerable groups, or supports environmentally sustainable practices?." . Other challenge identified was related to cross-scale policy analysis that is how to attribute change at one scale to policies/institutions at another, especially when considering impacts of macro scale policy on the community at the local level – who sometimes might not even be aware of it.

Moreover, it was found difficult to determine changes that could solely be attributed to policy and isolate it from other factors, using only information gathered by means of community's interviews and questionnaire. Since in their responses to questions about changes in their livelihoods before-and-after' the interventions, households couldn't indicate one or two specific factors, but rather they talk about the impact of a whole package of interventions adopted, policies issued and institutions established , that jointly affected their different livelihood capitals.

Taking these limitations into consideration, the researchers decided that for the purpose of achieving the project objectives, they should make use of different means in order to generate information e.g. gathering policy relevant data from available secondary sources and asking focused questions on the

impact of these policies, legislation, practices and make comparisons with historical base-line studies. Another way is by seeking the support of community elites and elders to provide information on milestones policies and institutions and its direct and indirect links to different SL outcomes (which are impacted both by policies as well as by other factors).

4.7.3 Main policies institutions and stakeholders relevant to the assessment

The stakeholders' list includes local CBOs, NGO's, international NGO's, government departments and research institution. The assessment covered different relevant stakeholders, this include broadly a range of government institutions, NGOs and Community Based Organizations (CBOs) in addition to individuals from the Private sector, Scientific Research communities, Education and donors. Of course not all and each of these stakeholders groups have been assessed in each case study. Moreover, government institutions identified and assessed differ from one case study to another with the Ministry of Agriculture being common across the three case studies. Fig 4 represents the policy influences map highlighting the different policy levels and their links to sustainable livelihood.

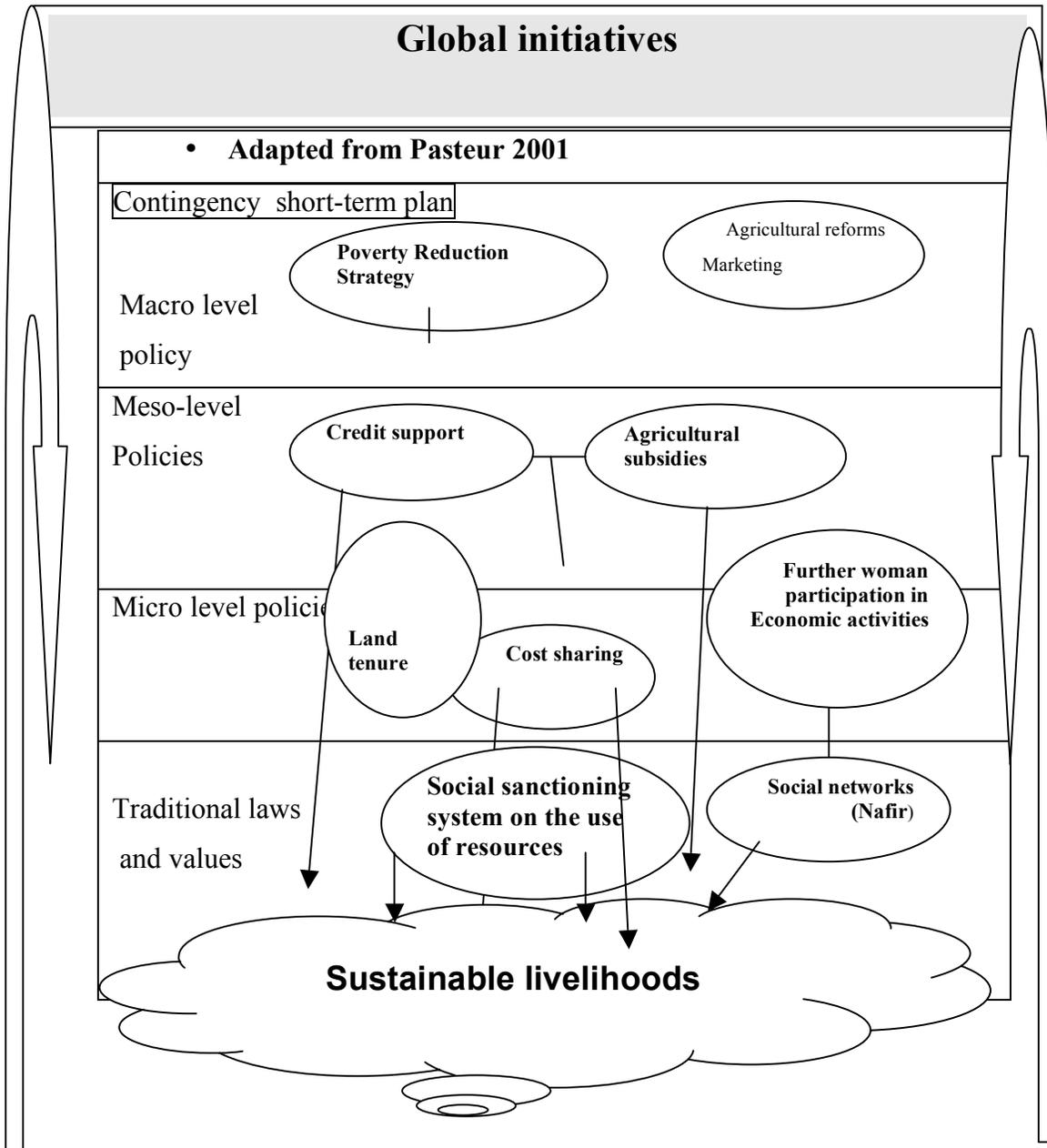


Fig. 4.6: Policy influences map

4.7.4 Policies and institutions across the different scales (macro, meso and micro)

Macro-level: included the :a) the Post Colonial Agricultural policies where the focus was on exporting cotton and the development activities were mainly concentrated in certain parts of Sudan . This approach had also influenced the post-independence policies and focused them more on irrigated and mechanized rainfed agriculture . Traditional agriculture including livestock raising has been neglected. Moreover, expansion of mechanized rainfed agriculture negatively impacted the forest and rangeland which contributed to the desertification problem in . This policies was followed by the natural resources conservation policies e.g the six-year Development Plan (1977-1983) in which the conservation of the natural resources was considered as one of the means for achieving this plan (Tolentino, 1994). Up to 1980 the legal and institutional context of the development was not leading to any significant results. The sectoral scope, lack of comprehensiveness and the absence of effective coordination have had very serious bearing on the environment and the natural resources. The 1990s witnessed among other development in legislation related to the environment, the establishment of the Higher Council for Environment and Natural Resources (1992) as coordinating unit in the fields of environment and natural resources. In 1992, Sudan adopted the federal system, to devolve responsibilities and to re-divide power and revenues among Sudanese people. Twenty-six States were established and assumed responsible for local administration. The 4th Constitutional Decree laid down the responsibility for the environment and natural resources under the new federal system. With regard to land tenure policies which according to the local communities could greatly influence their ability to stand against harsh climatic condition (AF14 Case study reports). The first written law that specifically dealt with this issue was "The Land Settlement and Registration Act", issued in 1925 It provides for rights and interests over land such as cultivation, pasture, wood-cutting, occupation, passage, water resources etc... In 1970 this position was affected by the issuance of the Unregistered Land Act that gave the government the ownership over any wasteland, forest or unregistered land. This land tenure system greatly influenced the exploitation of the natural resources. Although government had the formal ownership of the unregistered land, it was not able to exercise effective control over land allocation and utilization. According to Tolentino (1994), there is no legislation that specifically deals with land use Other important set of policies identified are the post 1984 policies and plans (post the famous Sahelial drought of 1983-84) Inspite of the fact that most of the plans implemented at that time are short term aid and relief plans (ready foods) , but some aimed at supporting the production of subsistent food . The community in Arbaat area blame their vulnerability on the relief-dependency created by the government and international organization on the relief approach that dominated their programs during the 1984 drought episode and thereafter . According to them (Arbaat CS report, 2003) , the distribution of Relief food and aid to communities in Red Sea State in response to recurrent drought has been the only contingency short-term plans for mitigating the impacts of drought . This have always led to short term improvement of living conditions , but at the same time contributed to the creation of relief dependent communities not capable of future adaptation. The same situation has been highlighted in Bara case study ,where community Development Committees established by the CBRR Project decided to sell the releif food to people at a nominal price instead of distributing it for free , and to make use of the generated revenue by employing it in revolving funds or any other income generating activities for the benefits of the communities. According to (DFID,2004) Climate variability drives huge allocations of mergency resources and affects everything from health and infrastructure planning to public finances and budget support debates.DFID contributed £43 million in relief to Africa alone in 2002. A 'relief culture' – in which local and national authorities rely on humanitarian agencies to address humanitarian crises – must be avoided. The alternative is a 'risk reduction' or risk management culture, providing co-ordinated social protection, preventative measures and carefully targeted relief, and promoting increased resilience through access to markets and income generating opportunities.

However, After the drought of the 1984 the Central Government declared a policy of supporting rural areas producing subsistent food, mainly grains (stable food such as millet and sorghum). The support included the provision of inputs and subsidies, tax exemptions, new technology or improved production methods and technical assistance. Although this policy have targeted poor rural farmers ,encouraging them to produce more food and consequently improve their livelihood , some areas such as Arbaat didn't benefit from it , the reason being that Arbaat area is viewed as an area for production of cash crops (vegetables and fruit), while the policy only support areas producing subsistent food , although at

the end Arbaat people use the cash generated from selling the vegetables and fruits to buy subsistent food. However, this situation proved not to be completely negative as one advantage attributed to it was the high community's spirit of solidarity and cooperation and the emergence of creative local initiatives in the utilization of available resources, as if to compensate for being left alone to handle its own problems. No responses were obtained from Darfur and or Bara regarding the impacts of this policy on community livelihood, indicating that, the impacted people sometimes may not be aware of most of the macro level policies, in spite their direct or indirect impacts on them. This highlights the need for identifying means and methods for transferring the information to people at the grass-roots level, in order that they could persuade their representatives in councils and states to address

Other policies assessed include the Economic Salvation Program (1989) to boost agricultural production (e.g decontrolling markets, liberalizing prices, opening new markets for livestock, removing subsidies on inputs, and the shift from cheap public financing to commercial lending) The impact of these policies seems to have yielded contrasting results. The price decontrol led to the improvement of rural-to-urban terms of trade by increasing the price of many cash crops. On the other hand, the lifting of subsidies on agricultural inputs and the costly commercial financing led to an increase in the cost of production and a decline in productivity. The opening of new markets for livestock created more demands and encouraged the herders to go on for the sheep-fattening intervention; this presented a good chance for farmers practicing sheep raising and fattening. The impact of this policy was captured in Bara case study, sheep fattening flourished, providing farmers with stable source of income. As a result of this policy, prices of inputs increased, consequently the contribution of the modern irrigated sector to GDP decreased from an annual average of 17% in the 1980s to 12% in the 1990s. The traditional and rain-fed plant and animal production sector, which is less dependent on imported inputs, responded positively to the reform policies. Its contribution to the GDP has risen from 18% in 1980 to 33% in the 1990s with the highest contribution from livestock. However the productivity of the whole sector is still very much lower than the international standards. Other factors contributing to the unsatisfactory performance of this sector include poor infrastructure, delayed maintenance, lack of adequate investment and slow and unsystematic growth of exports. The reform policies have lessened the bias against agriculture but there still a lot to be done to improve agricultural productivity and export competitiveness if this leading sector is to realize its potential and lift many people out of poverty.

4.7.5 Key national institutions

Sudan is predominantly an agricultural and pastoral country, endowed with diverse ecological zones and a variety of natural resources upon which the people of Sudan depend. Despite the fact that, the different components of natural resources as occur in nature are closely related and interdependent, this close relationship and interdependence are not reflected in the counterpart relationship of the various institutions concerned with their use and management. Instead these institutions have different affiliations, interests and mandates. Coordination is almost lacking and cooperation is limited even among the departments and units of the same ministry. Moreover, government institutions are subjected to frequent changes through the creation of new administrations and ministries and frequent changes in affiliation of institutions. This situation of instability reflects lack of vision and *ad hoc* decision. The paper will shed light on some of these institutions and their assigned roles in relation to natural resources management:

Forests National Corporation (FNC): has the following functions: lay down the general policies for forests; propose law, to implement the approved policies; follow-up the implementation of the forests general policies; technically supervise all forests, at the country's level; disseminate awareness with respect to forests and trees; conduct researches and lay down the necessary plans; increase the reserved forest areas and intensify tree plantation; encourage the establishment of forests through provision of necessary inputs; develop the production of gum, especially Gum Arabic; and coordination with related sectors.

Range and Pasture Administration (RPA): the main activities include; proper distribution of water resources to allow balanced utilization of grazing resources and production of fodder crops under irrigation. The main responsibility of RPA is the protection and management of pasture and animal feed.

Ministry of Animal Wealth: the main duties are: formulation of Policies related to development of animal resources; planning and organization of scientific researches; organization of extension, veterinary services and animal health programs; development and maintenance of range lands; development of

fisheries and aquatic lives sector; supervision of animal and meat marketing programs; management of national level programs on Veterinary services and quarantines; training and capacity building of human resources; supervision of imports, exports and local manufacturing of inputs, machinery's, vaccination and inoculation necessary for the sector; supervision of animal slaughter houses and exports specifications; coordination with relevant institutions for increasing production; and development of regional and international cooperation in the field of animal resources management.

Wildlife Conservation General Administration (WCGA): is responsible of the following: sustainable management and utilization of wildlife resources in the country; origination of hunting (issuing licenses and setting by limits); cropping of wildlife, trade in wildlife parts and live animals; establishment of zoological gardens for wildlife public education; control of wildlife damaging problems; management of marine national parks and protected areas; and WCGA is the focal point for CITES (Convention on International Trade in Threatened and endangered Species (includes botanical or animal sp.).

Higher Council for Environment & Natural Resources (HCENR): In recognition of the importance of environmental protection for the sustainable development of Sudan, as well as for the fulfilment of the various United Nations global environmental commitments, the government in 1992 established the Higher Council for Environment and Natural Resources (HCENR) as the central government organ coordinating efforts for sustainable development, use of natural resources and environmental protection

4.7.6 Meso (State) and micro levels policies and institutions

At the meso level, we are going to assess policies and institutions that positively contributed or hindered the process of building community's capacity to adapt to climate variability and change, including policies related to land tenure, conservation of natural resources, and state levels institutions responsible of implementing these policies. More information is provided on Micro-level policies and institutions, since most of the respondents have a clear perception regarding the role of local level policies and institutions and their respective impacts on their livelihood.

However , the study reflected that of meso and micro level policies and institutions are closely linked to each other in most cases and sometimes , we can not separate their roles e.g. in land ownership , although issues related to land tenure is always being regarded as a central government concern, but certain control is maintained at the meso and local levels.

Land tenure system:

The Sudan government holds *de jure* titles of unregistered land but cultivars enjoy *de facto* customary usufructary rights. Customary land tenure is the most dominant in the rural areas of Sudan, whereby land is owned and disposed of in accordance with customary regulations. Specific rules vary according to ethnic groups and regions. This tenure system also exists on its own as communal land ownership. The principal categories of customary tenure are: communal/tribal tenure where ownership of land occupied by the community or tribe is vested in the paramount tribal leader as owner, who holds it in trust for the entire group, and clan/family tenure where land is vested in the head of the group as owner or trustee for the entire group. Customary tenure does not recognize individual ownership of land. It only recognizes the rights of the individual to possess and use land subject to superintendence by his family, clan or community. However, in Sudan different types of customary land holding could take one of the following land tenure like freehold Tenure (in which ownership is also in perpetuity and a certificate of title is issued), leasehold tenure (in which land is held based on agreement between leaser and lessee), rent and sharecropping.

4.7.7 Micro level policies and institutions

4.7.7.1 Role of traditional leaders in land tenure

The village domain is the scale of organization where the sheikh in a committee of wise men supervises land allocation. Land and the different run-off farming techniques are open to all. However, the traditional leader is the cornerstone in the allocation of lands. This could be identified in Bara case study, where the tribal communal land and the individual land, are being assigned by the "Sheikh" or head of the village. The system widely used in Darfur is the communal/tribal ownership, which has also been



controlled by the State government in cooperation with the traditional Leaders .This system enhanced the overall community condition through good control of land resources exerted by traditional leaders. Inspite of all positive impacts attributed to communal land tenure system, but still some negative impacts started to show up upon the scarcity of resources particularly in times of crisis where resources are scarce due to declining rainfall, which usually lead to conflicts between farme s and nomads, aggravated by the

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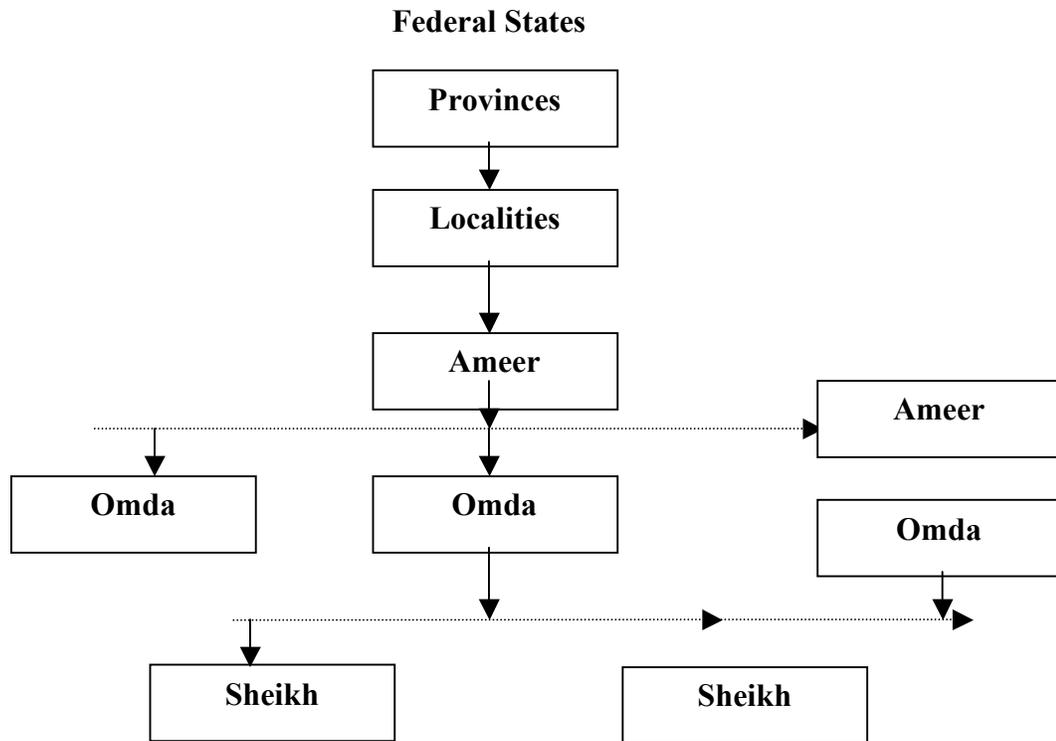


Fig. 4.7: Illustrate native administration structure - local institutions in Kordofan State Adapted from CBNRM (2001).

The Commissioner of Bara Province, who was transferred to another place shortly after the project started, was serious about protecting trees from being cut by the community. He was working very closely with the Forests National Corporation officials at the state level to enforce legal measures against people who cut the trees illegally. He was serious in enforcing the law against them and therefore, during the four years when he was based at Bara, the density of tree cover within the area improved significantly. Arbaat area has a village Sheikh as a traditional tribal leader beside the community elders. Many examples of his influence were cited in the case study like the local regulations and rules calling for conservation of natural resources and application of a strong social sanctioning system on the use of resources. This took the form of laws issued by the tribal leaders or native administration calling for pasture conservation and tree protection – with a penalty for any violation to this law. This had a positive impact on their immediate environment resulting in the adherence of pastoralists to the regulation; improved productivity of natural resources; and Improved general environmental conditions.

4.7.8 International and national NGOs and CBOs working at the Meso and Micro levels

The three case study areas, which are the focus of this assessment, witnessed the arrival of many international organizations and NGOs in response to international call for help after the 1980s drought which severely impacted the Africa Sahel, It witnessed as well, the emergence of national NGOs and CBOs, Among these organizations are: Care International in Bara, ITMD in Darfur & SOS in Arbaat.. All of them came with a main agenda of helping the drought-struck communities to recover from the drought and mitigate its impacts. These organizations together with other local NGOs like SECS played a key role on raising people's awareness to current and emerging environmental changes and building their capacities to deal with future changes. Specifically highlighted impacts are: awareness generated among different stakeholders group, through conducting of extension activities, promoting issues related to conservation of environment and natural resources, adoption of the mud-wall building and improved energy conservation devices such as the improved firewood and charcoal stoves in Bara

Sudanese Environmental Conservation Society (SECS): A branch of (SECS) in Gereigikh played major role in the success of the project activities. It added a lot to the process of building and spreading environmental awareness. The Executive Committee of SECS gave good support to the project; they managed to assemble the community and attracted its attention to the value of different project activities. During the time of the project, the Credit Committees, helped by the project management, managed to get credit from Bara branch of the Savings and Social Development Bank to the project beneficiaries. It was agreed that the bank would pay credit to the Credit Committees of the project villages at a more lenient rate, to encourage them help the villagers to utilize the credit for income-generating activities. The idea was to help the beneficiaries reduce their agricultural activities, which was the sole livelihood for them. The poorest sector benefited a lot from that new bank policy. After the completion of the project, the SECS played a major role in the sustainability of that credit as it acted as guarantee body for the Revolving Fund Committee. SECS also adopted the mud-wall building activity. The role of the SECS branch was highly appreciated not only by the community of the CBRR project but also by other developmental bodies that work in the region. IFAD for example stated their interest in establishing similar branches in areas where they implement their project. They affirmed that such an NGO with executive members from the community could play a major role in the transfer of new ideas and improve communication with the community.

Intermediate Technology Development Group (ITDG) Although the activity of water harvesting in Northern Darfur is a locally driven innovation, ITDG adopted the innovation for sake of provision of necessary assistance and to develop the activity at a large scale. The organization managed to construct dams and to train the local farmers the techniques of construction of the crescent shape terraces. While in North Kordofan Corporation of American Relief Everywhere (CARE international) contributed to the conservation of the environment in the area.

Care International Organization: CARE had significant influence in the project area as well as in many other parts of the country, particularly in arid and semi-arid areas. They are specialists in the field of water construction, digging wells and aquifers. After the completion of their activities they normally give its monetary advantage to the community while very small shares are given to the government.

Social informal organization: traditional forms of collective works are deeply rooted in the Sudanese culture, particularly in work related to agricultural activities. In Northern Darfur men and women participate in all agricultural tasks, although some gender division of labor exists according to the type of the duty. Members of the household do most of the field activities. In seasons of good production farmers cope with labor shortages traditionally through *nafir* (reciprocal exchange of labor). The host of a communal work party is expected to respond to his his guests' labors by working in their *nafir*. The second source of labor to cope with labor shortage is help from relatives and/or neighbors. This type of help differs from the *nafir* in that this is mainly formed by the poor farmers' who are not able to offer the meals and beverages for the *nafir*. Generally participation in public or private *nafir* is socially obligatory and culturally acknowledged. Now *nafir* has become a culturally recognized institution.

Community Development Committees: In North Kordofan, the informal social organization is represented in the villages committees (Water, Women, Natural Resources, Credit, Drought, Monitoring and Evaluation, and Coordination and Executive) which were established by the CBRR project and they played a major role in the success of the project. During the period of the project they received the support they needed to perform efficient work.

Farmers Unions: the Federal Government Act 2003 has set the general framework of organization of farmers and pastoralist according to the law of organization of farmers and pastoralist. According to this acts farmers are organized into unions. The objectives of organization of farmers and pastoralists in different unions are: raising the standard of the members economically and socially; solving the problems of development in the fields of agriculture and animal production; participation of stakeholders in the planning process of agricultural and animal policies; creation of local institutions capable of developing agriculture activities; ensure food security; and creation of capable leaders among farmers and pastoralists. The selection of the union members is based on election through voting. In Northern Darfur State there are five farmers' kind unions which are made from the basic farmers union, namely. Mechanize farmers, traditional farmers, vegetable and fruits producers and tobacco producers. The state Farmers Union has direct links with the Minster of Finance and National Economy, The State Governor "Wali" and the State Minster of Agriculture.

In Darfur the presence of unions (farmers, herders etc.) played key role on supporting and empowering local people , as these unions possess an official status and consequently their members have the authority to negotiate with the policy makers on behalf of the people. In many situations they can establish a political stand against certain decisions that conflict with their interests.

The absence of active unions in Bara- although was compensated to a large extent- by the presence and active role of the Community Development committees, but its impact could still be felt in situations when there is a need for lobbying against specific government policies or decisions that contradict with their interests, this could possibly result in the community missing some opportunities that could have otherwise, positively contributed to their well being had they been effectively used. Moreover, after the completion of the project the committees lost most of their moving assets (cars, trucks, a generator, computer, audio-visual equipment, etc.). Due to the absent of any legislation that would entitle village committees to register as developmental projects or commercial organizations. These assets were transferred to the Ministry of Agriculture of the government/ North Kordofan State as that was part of the project agreement. They don't have organizing rules or general assembly, similar to those led by cooperative societies and supported by developmental projects such as International Fund for Agricultural Development (IFAD). Such bodies could legalize the developmental work and solve problems which may rise upon the completion of a developmental project, particularly those related to the ownership of assets and sustainability of the project activities.

However, the presence of NGOs like the Sudanese Environment Conservation Society (SECS), greatly supplemented the role of the committees in improving the organizational setup, and defending community's rights and interests.

4.7.9 Private sector

Generally the role of the private sector has not been highlighted in the case studies- the communities assessed were mostly subsistent farmers in rural areas of Sudan. Where there is no direct intervention by the private sector. However, it has been mentioned in Darfur case study that, private sector started to invest in the area after been attracted by the success of the water harvesting measure, and subsequent improvement in land productivity. They manage to possess good land along the seasonal streams; the investors are mainly government officials and rich people from the capital city of North Darfur (ElFashir). These groups are not originally farmers but they possessed their lands by making agreement with traditional leaders and sometimes through purchase. They do not practice cultivation, but they consider the land they possess as a treasure or a mine they have to utilize seasonally by renting their lands at high rates to the farmers after a clear-cut agreement between the two sides. However, they happened to large areas of good lands, which otherwise, could have been used as rangeland or rented to poor landless farmers, this situation poses a risk threatening the sustainability of the livelihood.

4.7.10 Traditional systems based on religious and cultural values

These are deeply rooted traditions and values that have been developed and adopted by the community members since long times in the history. In many circumstances these values represent the unwritten rules and policies by which all community members or specific tribal groups became abide. They could deal with different issues related to social, natural, financial or human capitals. They are maintained and conserved by the traditional leaders who inherit them from their ancestors and pass them on from one generation to another. In our assessment we found some common values shared across the three case studies, and others which are unique to each area. In Darfur for example, people believed that, according to the *Islamic shara*¹⁷, they should share three things: water, range land and fire. Based on this, they allow poor people in the tribe and moving nomads, accessibility to water and pasture. This situation however, could not be sustained under extreme climatic variability; - particularly drought- when resources become very scarce and the law of survival dominate all other social and cultural values. The current situation in Darfur is an ideal illustration, where by drought triggered a tribal competition over the same natural resources that , one time used to be shared among farmers and nomads, leading to a critical social conflicts and political crisis. Another social system in Darfur as well as in many parts of Sudan, is the

¹⁷ Islamic laws

formation of Nafeers¹⁸ during the harvest time or upon crisis e.g. when there is a big fire a Naffir will be called upon by the traditional leader to assist in putting out fires and opening up of fire-lines to prevent the wildfire from spreading to other areas. This system proved to have been effective as a safety net against sudden or expected incidences, as well as contributing to the conservation of the natural resource base.

In Arbaat , a social system known as Salif system which is customary law controlled by the tribal leaders on the Arbaat community trespassing tribes – it defines clear cut social rights and responsibilities and decides necessary mechanisms for conflict prevention and/ or resolution . Settled farmers as well as migrating tribes were subject to punishment according to local legislation if they committed any offenses. However, people view these legislations as being sacred and consequently avoid breaking them. These regulations together with local ordinances issued by the community leaders provided a solid social safe guard against human violation to the natural resources. E.g. according to the local laws, it is prohibited to cut a trees , they can only collect and use the dead wood , and if anyone did, he/she could be subject to prosecution and could be fined, imprisoned or forced to perform hard labor. This is also applied in Bara case study with a permission, to use only one tree species, the Marakh, which is quite adapted to pruning, and commonly used the branches for fencing and building. Many positive impacts attributed to the setting and application of these social systems has been identified by respondents. A general consensus was reached in Bara and Arbaat on issues related to their role in conservation and management of the local natural resources, and subsequent improvement of the vegetation cover in their respective areas, especially when compared to the surrounding villages. Moreover, people mentioned the harmonization between different livelihood components, natural, human and social and its role on tribal conflicts resolutions

4.8 Policies Influencing Livelihood Capitals

Financial policies: Flexible credit policies played a major role in improving the financial capital in the three case study areas. In Bara, it was agreed that the bank would pay credit to the Credit Committees of the project villages at a more lenient rate, to encourage them help the villagers to utilize the credit for income-generating activities. This was initiated by Social Development Bank and the Village Credit Committees, support is also given by the Sudanese Environment Conservation Society (SECS) Bara Branch. This step has largely contributed to: accessibility of good percentage of the rural people in the revolving funds activities; Involvement of good number of the community in different income generating activities; and the sustainability of the crediting system even after the termination of projects. Major benefits identified included reduced dependence on the agricultural activities and improved livelihood conditions.

An important financial policy intervention in Arbaat is the formulation of a Cost sharing arrangement between SOS Sahel organization and the Arbaat community, where by the SOS provide production inputs e.g. rent them a loader, improved seeds and means of transport etc. the farmer starts by repaying in a flexible manner e.g. paying 25% of the market value of the cost of inputs then gradually complete the full cost. This agreement facilitated lots of things for the Arbaat community like, accessibility to big cities markets to supply of vegetables and fruits to Port Sudan and to ,provision of improved seeds and agricultural inputs, opening the way for new alternative income sources e.g. Handicrafts production, as well as other indoor activities targeting women, fodder marketing and trading activities. The net results are: the diversification of production (new crops, new breeds and market access etc.), improved economic conditions, improved purchasing power, stability in production in terms of quality and quantity, Farmers became engaged in the market economy.

Similar impacts were obtained in Darfur, from employing a different credit system called *the Shyl system*. The people used it in order to overcome some of the constraints they encountered when they apply for credits. The Shyl system, played a major role in resolving constraints, associated with issues of accessibility to credit, where 48 % of the respondents, indicated that it has not been always easy to get access to credits from the Agricultural Bank due to the complicated procedures set by the bank, e.g. the necessity of availing a collateral "ownership of a fixed assets by the farmers" in order to make them

¹⁸ Nafir is the grouping of people in response to an emergency call, usually made by the local leaders to perform an urgent task in a cooperative manner, e.g. rescuing the agricultural crop from the invasion by locusts or to perform a group harvest of individual farms etc...

allegeable for obtaining credit. The Shyal system provide the required guarantees for those who doesn't possess collateral assets. Sometimes it uses the harvested crop as collateral, in which case the system used to provide the main source for credit for those practicing shifting cultivation. However, the different farmers unions (organized body) in the study area were able to establish sound relationship with the Agricultural Bank, this further helped credit accessibility to the farmers based on trust and social relations. Moreover, the ITDG played significant role the development and promotion of this social and financial initiative.

In certain circumstances, very minor measure could have a profound impact on the community livelihood e.g. is the positive impacts obtained in Darfur from a deal that was agreed upon by the traditional merchants and community members assigning village markets to operate on certain days of the week (once or twice a week), and to be organized in such a way that people can attend several markets in one week, thus increasing their buying and selling options. This granted them accessibility to more than one village markets per day and gave them the chance to exchange goods and services in a free competitive way. Most of the respondents indicated that, this have much improved their economic condition and provided them with a diversity of food stuff, sometimes they just trade or exchange grains for vegetables or vice versa. Moreover, the village market provides the opportunity for people coming from different villages to meet and share experiences and gossips (that is a kind of socialization activity).

4.9 Policy Associated Risks

Arbaat Case study: The main policy related risk perceived, is the proposal by the state government of the Red Sea, supported by the centre to put in place a strategic goal of supplying water to big cities in Sudan e.g PortSudan, ElObied) utilizing available resources. This led to the decision of heightening of the Khor Arba'at dam¹⁹ and the new diversions added to increase its storage capacity and increasing supply to Port Sudan. This is expected to reduce the cultivated area in Arba'at al Zira'a (farming areas) and may pose a real threat in the long term with population increase. The solution proposed by the local committee to the State authorities, as alternatives, includes (1) digging wells to irrigate the home gardens, (2) guaranteeing an agreed amount of water from the Khor to Arba'at and (3) providing compensation to the area in the form of social and economic services. Digging of wells will also contribute to reducing the risk of frequent low seasonal rainfall. Given the present level of technology, knowledge and economic conditions in the area, the predictability of a good runoff of the Khor or abundant water volume coming from the highland is extremely difficult, and hence, there is always a risk of the occurrence of water shortages or floods. Another risk is the increase in the population and water demand for Port Sudan, which is very likely to occur given the current trends of migration from rural areas to big cities and towns. This requires developing a rational and economically effective water management system within the urban areas, in order to guarantee sustainable water supply, without causing greater deficiency problems elsewhere.

Darfur conflict: Conflicting policies represented in Darfur crisis. The conflict over natural resources are expected to get worse under future climate change with extreme variabilities - particularly severe drought extreme - when resources become very scarce and the law of survival dominate all other social and cultural values. The current situation in Darfur is an ideal illustration, where by drought triggered a tribal competition over the same natural resources that, one time used to be shared among farmers and nomads, leading to a critical social conflicts and political crisis.

4.10 Major Policy-Relevant Conclusions

- Policy analysis conducted in the context of SL framework can contribute to drawing attention to the possible ways in which policy impacts on different aspects of people's livelihoods: their livelihood assets; the vulnerability context within which they operate; and their capacity to choose effective livelihood strategies
- Contingency short-term plans for mitigating the impacts of drought, have always led to short term improvement of living conditions, but at the same time contributed to the creation of relief dependent communities not capable of future adaptation (Arbaat CS).

¹⁹ This has been completed now.

- Understanding the policy context and its impacts on livelihood assets available to people as well as the institutional set up will help to identify constraints and priority areas for interventions
- Policy on paper does not necessarily mean there is policy in practice, especially the macro level policies, since they may not impact on livelihoods in the way it was intended. Analysis of policy documents only helps in understanding policy content 'on paper', it is important to assess, processes and measures in order to understand the impacts.
- Community level policies and institutions play major role on the success of sustainable livelihood environmental management strategies employed.
- In policy analysis it is important to understand contextual factors that shape the policy, related to the social, political and economic environment, moreover, looking at changes in the policy context over time can add valuable insights to the policy evolution and development.
- To ensure proper implementation of policies, work should focus on enhancing knowledge of rights and duties of community members. The study indicated that, regulations and policies which are based on real knowledge by communities and sense of responsibility lead to positive results and grant sustainability, similarly regulations or laws that involve changing human behaviour and attitudes towards the environment and natural resources.
- The same Policy could yield contrasting results ,for different sectors or different activities in the same sector, e.g. removing subsidies on inputs, from agriculture produced positive impact on traditional rain fed sector (using minimum inputs), and negative impacts on mechanized irrigated agriculture (using intensive inputs).
- the need for identifying means and methods for transferring the information to people at the grass-roots level, in order that they could persuade their representatives in councils and states to address higher governmental levels, so as to support, alter or end certain macro-policies, based on their interests
- Traditions, community values and, religious affiliations can play major role on the success of policy intervention, care should be taken to build upon these and avoid policies that contradict with them.
- Community Leaders are key players in the policy process , they possess a wealth of indigenous knowledge regarding the wise use and conservation of natural resources, moreover, customary rules and orders issued by them , are considered sacred by their local community , that should always be respected and followed development policies and adaptation plans should build on this knowledge in order to ensure success , longevity and buy in...
- Policies impacting community's livelihood could come from different levels Macro, meso or micro, it is sometimes difficult to differentiate between these levels in the policy analysis. Moreover, an analysis of policy for sustainable livelihoods (SL) requires an understanding of the livelihood priorities of the poor, the policy sectors that are relevant to them, and whether or not appropriate policies exist in those sectors. According to (Pasteur, 2001) the policy priorities of poor people will be realized more effectively if they have the capacity to articulate their demands and influence the policy process. Finally, policy is made and is implemented at a variety of 'levels': international and regional, national and sub-national (state, provincial or local). The linkages and paths of influence between these levels are also significant for understanding policy

5 Capacity Building Outcomes and Remaining Needs

The AIACC AF-14 project aims to respond to the most pressing climate-related vulnerabilities in Sudan by exploring successful community resilience-building measures and transferring lessons-learned to adaptation decision-makers and policy processes. Ultimately, the project aims to assist in building the coping and adaptive capacity of vulnerable communities by enabling the adaptation process in Sudan to respond more directly to community needs. A key challenge in this is to overcome the significant communication and awareness gap that exists between the micro-scale, or ground-level, at which key observations are made, and the various macro-scale processes within which decisions are made – a challenge to which the present proposal responds. Critical requirements in the success of the AF-14 undertaking are first to identify key communities to work with, and second, to know which actors in the local, regional, national and international decision-making frameworks needs to be included in the dialogue. The first requirement is thoroughly addressed under the existing project workplan. However, as the very nature and composition of the adaptation decision-making framework is still evolving, particularly in light of the emerging NAPA process, the second requirement is more complex and, as yet, not fully addressed within the scope of the AF-14 workplan. A stakeholder engagement proposal was funded by START aiming at responding to this deficit, by creating robust mechanisms for stakeholder involvement in the project, and by forging valuable links between the project and key stakeholder consultation processes, including the NAPA process.

The Overall Objectives of this work is to inform, guide and enhance planning and decision-making in Sudan to better respond to the needs of vulnerable communities.

Specifically to present proposal aims to build upon the outreach and capacity building component of project AF-14 in order to heighten the project’s ability to:

- Identify key planning and decision-making stakeholders from a range of arenas (local to national, and from policy-making, research, programme management, advocacy, etc.),
- Create targeted tools for stakeholder learning and dialogue,
- Work directly with key stakeholders at several points in the project,
- Where possible, integrate activities with relevant, ongoing stakeholder consultation processes, and
- Ensure increased awareness and decision-making capacity among a range of key actors which aim at exploring adaptation measures for drought and climate change impacts. Addressing the interests of various stakeholders groups at different levels including local communities, CBOs, NGOs, research & scientific communities, government organizations at local, national & regional levels, disaster and natural resource management communities, IPCC and climate change communities in addition to funding and donors organizations.

6 National Communications, Science-Policy Linkages and Stakeholder Engagement:

6.1 Link of AIACC-AF14 with the Sudan First National Communication (FNC)

- First, the AF-14 team within HCENR consists of the same individuals engaged in the preparation of Sudan's First National Communications, As such, the project could closely interact with upcoming activities under the UNFCCC.
- The V&A assessment conducted as part of the FNC didn't include the potential adaptation measures that can potentially reduce the impacts to current and future changes. This information is essential for effective communication of actions necessary to reduce potential impacts, to the public and decision-makers in order to enable the integration of adaptation aspects in the planning process. Hence the results generated by AIACC-AF14 project will contribute to the national implementation strategy of the Sudan's 1st National Communication to the UNFCCC, as well as the provision of practical lessons for adaptation that can contribute to the Sudan's National Adaptation Action plan (NAPA).
- Under our current workplan, outreach activities will involve outreach to climate change teams in neighbouring countries, as well as at the international level. The project will seek additional funds to more closely integrate the project process and outputs with the Sudan NAPA process.

6.2 Link of AIACC-AF14 with the Sudan National Adaptation Plan of Action (NAPA)

The emphasis of NAPA on current climate variability and immediate needs is consistent with the approach of the AF14 project. In the project we examined existing practices of communities to find and document proven measures that are yielding benefits today. The lessons that we derive from communities' experiences with SL and NRM measures will be made available for use in Sudan's NAPA. The Sudan NAPA process is employing a consultative process to develop criteria and evaluation tools to identify adaptations that respond to urgent national needs and to prioritize adaptations. If AIACC AF14 Project will have a second phase we will aim at applying the same criteria and evaluation tools that emerge from the consultative NAPA process to evaluate SL and NRM measures. This will facilitate the integration of results and recommendations from the AF14 project with the NAPA process in Sudan.

The findings from the 3 case studies in drought prone areas in Sudan indicated that sustainable livelihood analysis can generate insights of community livelihoods through the assessment of a range of capital assets (natural, physical, social, human and financial) which are combined in the pursuit of different livelihood strategies (e.g. conservation, diversification, intensification etc.). These were assessed at a variety of scales such as household, individual, and committees. Moreover, policies and institutional processes have been identified and analyzed to allow for the identification of barriers and opportunities to sustainable livelihood. These and other related findings can be taken into consideration when conducting the other different NAPA activities, namely; establishing institutional structure for the preparation of NAPA, synthesizing available information on impacts and adaptation to climate change, and developing indicators and criteria for prioritizing the adaptation activities.

7 Outputs of the Project

The Project output included the following:

a) A series of three case study reports:

- Khor Arba'at Rehabilitation Programme (KARP)
- Community-Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity Project (CBRRP)
- Water Harvesting Technique as a Coping Mechanism to Climate Variability and Change (Drought) - North Darfur State

b) A series of three project synthesis reports:

- Making adaptation work for the vulnerable: An approach for assessing community-based measures.
- Coping with current and future drought: Lessons on community-based measures for climate adaptation
- Analysis of Policies and Institutions related to Sustainable livelihood: Paving the Way for Adaptation

c) Peer-reviewed publication of one or more synthesis documents

d) Other outputs:

- Working Paper No. 17: Sustainable livelihood approach for assessing community resilience to climate change: case studies from Sudan. B. Osman, N.G. Elhassan, H. Ahmed, and S. Zakieldin. August 2005. (AIACC Project No. AF14)
- Working Paper No. 18: Methodological framework: an internal scoping report of the project Strategies for Increasing Human Resilience in Sudan, Lessons for Climate Change Adaptation in North and East Africa. E. Spanger-Siegfried, B. Dougherty, N. G. El Hassan, and B. Osman. August 2005. (AIACC Project No. AF14)

e) A series of two training modules:

- Sustainable Livelihood approach for assessing community's resilience to climate variability and change / A case study from Sudan
- Bottom-up versus top-down approaches for vulnerability & Adaptation Assessment

f) National workshop:

- A Final project workshop was scheduled to take place in 10Sept. 2005-targetting researchers, policymakers, NGOs, planners working in the different natural resources related sectors in addition to representatives from the private sectors.

g) A dedicated web page: Started

h) National and regional network of actors engaged in one or more aspects of this work:

- Involvement in the IPCC activities – WGII -AR4
- Membership of the Steering Committee of AIACC Data, Methods, and Synthesis Activity (DMS) The goal of the AIACC DMS is to facilitate access to extensive data, software and bibliographic resources related to climate impacts, adaptation, and vulnerability across multiple sectors both for the AIACC project participants and for researchers working in the field of climate change impacts and vulnerability. A further goal is the synthesis of information on the sectors, systems, and groups studied, methods utilized, and key results of the AIACC projects

i) Increased technical, managerial and analytical capacity of local project researchers and participants

8 Policy Implications and Future Directions

8.1 Policy Implications

The AF-14 project primarily focused on shedding light on the resilience and coping capacity of the local communities in Sudan who are vulnerable to climate impacts, the improvement of the existing policies that had positively contributed to the success of the community in coping to climate hazards and the identification and recommendations of effectively targeted programmes and projects. Ideally, some of what has been captured through this project will be integrated into Sudan's emerging adaptation efforts and used as a basis for mainstreaming adaptation with development policy more generally. If the outputs – either the methods or the lessons – can be taken up and applied elsewhere, they have the potential to help improve the effectiveness of adaptation planning efforts as well as future development work. Ultimately, efforts such as this should be supported, even informally, by the UNFCCC; however, this will require addressing the currently imposed distinction between adaptations to current versus future climate. At present, only the latter is supported within the UNFCCC, though a broader definition of adaptation may be required given the ambiguous distinction between the two on the ground. The results generated from this project indicated that, through this research, the project succeeded in bringing to light those environmental management measures that can provide a 'triple dividend' - decreased climate-related disaster vulnerability, reduced demand for international humanitarian assistance in disaster response and recovery, and achievement of national and global sustainable development objectives.²⁰ More specifically the project contributed to:

- Strengthen the capacity of actors (decision-makers, researchers, community-based groups, intergovernmental agencies, etc.) in Sudan and surrounding countries to respond to climate change vulnerability with affordable adaptation options;
- Provide decision-makers with the most current information on environmental management strategies that can meaningfully increase the resilience of the most vulnerable groups;
- inform national adaptation strategies (both National Communications and National Adaptation Programmes of Action) under the UNFCCC,
- Enhance and expand national regional, and international collaboration between institutions and agencies (e.g., HCENR) in the areas of environmental management, disaster mitigation and climate change adaptation; and ultimately
- Direct future efforts aiming at reducing human vulnerability to both current climate extremes and climate change.

The Analysis of the policies and institutions which had begun during the fieldwork stage and continued following conclusion of the fieldwork. The purpose of the analysis was to essentially back-cast from successful sustainable livelihoods outcomes, to try to determine what factors – primarily policy and institutional factors – enabled that success. By piecing together the preceding information, it became apparent that certain instances of landmark legislation, reform, etc. play a direct role in enabling SL activity today as well as in developing future adaptation. Moreover, institutions are a common element in any policy process, their analysis is needed to complement the policy analysis, ranging from the local institutions, to the micro institutions at the state level to macro level institutions which provide the institutional context in which livelihoods are managed, and succeed or fail. (Pasteur 2001) indicated that Policy does not happen in isolation. It is not formulated and implemented solely by policy makers in government offices. A range of *institutions*, such as markets or the legal system, and *organisations* such as NGOs or bureaucracies, mediate a messy relationship between policy and people's livelihoods. This is the interface where policy and people meet. The information generated through the research was then assembled into this policy process analysis report and it could be developed into a policy analysis

²⁰ Though the inclusion of carbon "sinks" in the Clean Development Mechanism has yet to be fully negotiated, the possibility exists of a fourth dividend from adaptation through improved environmental management – that of carbon emissions credits.

document, to serve as valuable guidance to adaptation planning and to the longer-term adaptation mainstreaming process.

Moreover, the work laid out in this report is aiming at enhancing Sudan's contribution in regional efforts on adaptation to global climate change, in particular regional efforts in the Africa Sahelian Region and North Africa. The focus will be on community-level measures and environmental management strategies that improve the overall resilience of the physical and human environment to adverse climatic conditions.

8.2 Future Direction

Depending on the availability of funds, the project intend to build on its current achievements and expand the work in the future with regard the following activities:

Outreach for Project Identification: There should be outreach to Sudanese sectors through local institutions, NGOs, and to project proponents that have been previously identified through other UNDP-funded programs, as well as a preliminary set of projects with climate change adaptation potential to be included into Sudan's National Adaptation Plan of Action (NAPA).

In addition to creating project brochures a number of project proposals could be developed ready to be submitted to national and international funding organizations.

Dissemination of Lessons Learned from the Project: In addition to preparing and disseminating reports on its activities, the project team should identify opportunities to make presentations and share the lessons learned from the project case studies activities with other East and North African countries, financing institutions and the private sector. Project pipeline and news on project progress would be put on the web site.

Development of the training material and implementing a strategic training program: It will be important to plan a targeted training that can best serve to equip Sudan to attract investments in climate change adaptation. A training strategy should be carried out keeping the following issues in mind: What are the target audiences where training can help advance a national consensus for climate change adaptation in Sudan?

What kind of information and technical training is required to enhance and support the capability of Sudan to implement viable, cost effective and win-win adaptation measures? Training courses, workshops and seminars should be designed through extensive collaboration with counterparts in government, research institutions and NGOs.

Strengthen National Consensus for Climate Change adaptation Action: Outreach and training will support the institution building and project preparation activities of the Initiative. Moreover, outreach activity should provide access to national and international climate change information and conduct a series of roundtables, business dialogues and meetings to help foster a better understanding of climate change vulnerability and adaptation, stimulate public discussion on key issues, and catalyze project development efforts in Sudan. Information dissemination on national policies, strategies and international cooperation should also be supported through continuous maintenance of the Internet web site as well as through traditional channels such as journals, press and other media.

Maintain the AIACC Web Page: The web Page, which has been created and designed as part of HCENR web site, should continue and be dedicated to providing information on Sudanese and international vulnerability and adaptation activities. The web page should link to other national, regional and international climate change, -related web sites. .

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For copies of final reports from the AIACC project and other information about the project,
please contact:

AIACC Project Office
The International START Secretariat
2000 Florida Avenue, NW, Suite 200
Washington, DC 20009 USA
Tel. +1 202 462 2213
Fax. +1 202 457 5859
Email: aiacc@agu.org

Or visit the AIACC website at:
www.aiaccproject.org

