

LDC Workshop on National Adaptation Programmes of Action

NAPA Case Study 1

Republic of Sudan

Summary of Key Vulnerabilities

Much of Sudan's surface area is comprised of arid lands and desert. Water resources are limited, soil fertility is low, and drought is common. These underlying conditions are exacerbated by range of human pressures, creating a situation in which Sudan is already highly vulnerable to current climatic shocks - and apart from taking adaptive measures - will become even more vulnerable in the face of future climate change.

The agricultural sector is dominated by small-scale farmers. Typically, such farmers are living in conditions of persistent poverty and rely on rain-fed and traditional practices. Rainfall, which supports the overwhelming majority of the country's agricultural activity, is erratic and varies significantly from the northern to southern ranges of the country.

The unreliable nature of rainfall, together with its concentration in short growing seasons, heightens the vulnerability of Sudan's rain-fed agricultural systems.

Numerous other development challenges are taking place simultaneously with increasing climate risks. For example, land degradation and desertification, brought on by human land-use pressures and recurrent drought, has degraded large areas of area and continues to threaten already vulnerable arable zones. Depletion of forests – primarily for household fuel use – threatens biological diversity, human communities, and reduces other valuable services forests provide. Industrial and human waste discharge impact water quality for communities that are already water-stressed.

Key Vulnerabilities

Agriculture/Food Security

- Intensification of desertification process; decline in crop production; agricultural activities moving south rendering north unsuitable for food production; increasing vulnerability of pastoralism;
- Frequent droughts resulting in loss of crops and livestock, food shortages. Challenges for poverty reduction strategies.

Water Resources

- Reduced groundwater recharge – either through decreased precipitation or increased temperature and evaporation; further decline in soil moisture (combined with human consumption patterns) creating future water crisis;
- Frequent floods resulting in loss of life, crops, livestock; insects & plant diseases, epidemic/vector diseases, decline in hydro power; damage to infrastructure & settlement areas

Public Health

- Significantly increased risk of malaria and other vector-borne diseases resulting in overburdening the healthcare system.

NAPA Projects

Order of Project Priority	Project Title	Project Sector	Sector Component(s)	Project Cost (USD)
1	Enhancing resilience to increasing rainfall variability through rangeland rehabilitation and water harvesting in the Butana area of Gedarf State.	Cross sectoral	Livestock, water harvesting and disaster management	2,800,000
2	Reducing the vulnerability of communities in drought-prone areas of southern Darfur State through improved water harvesting practices.	Cross sectoral	Vulnerability mitigation, water harvesting and reforestation	2,500,000
3	Improving sustainable agricultural practices under increasing heat stress in the River Nile State.	Food security	Agriculture	2,350,000
4	Environmental conservation and biodiversity restoration in northern Kordofan State as a coping mechanism for rangeland protection under conditions of increasing climate variability.	Terrestrial ecosystems	Terrestrial biodiversity	2,400,000
5	Adapting to strategies to adapt to drought-induced water shortages in highly vulnerable areas in Central Equatorial State.	Cross sectoral	Agroforestry, environmental and health mitigation and water management	5,000,000

NAPA Priority Project 1

Enhancing resilience to increasing rainfall variability through rangeland rehabilitation and water harvesting in the Butana area of Gedarf State

Rationale

Pastoral systems are a major contributor to the Sudan economy. In 2005 the animal wealth was responsible for 19.3% of national GDP (Ministry of Finance and National Economy, 2005). Over 80% of rural households in Sudan earn their livelihoods from a combination of pastoral and agricultural activities. However, Sudan has experienced increasing levels of rainfall variability in recent decades, which has led to diminished water availability and fodder production as current practices have been slow to adapt to changing rainfall patterns. Ensuring that fodder production systems remain viable in the face of increasing rainfall variability is of critical importance throughout Sudan.

As part of a past pilot project, a small dam was constructed in 1997 in the *Wabi Abu Garod* valley to capture and store rainfall run-off during the rainy season and make it available to meet irrigation and other needs. The successful experience of the dam thus far has been recognized by local communities as a significant contributor to building resilience against rainfall variability. Water harvesting techniques that are suitable relative to expected increased evapotranspiration from climate change would help reduce the vulnerability of communities in *Batana* area.

Baseline Situation

The proposed project will reduce vulnerability to increasing rainfall variability through rangeland rehabilitation in the *Butana* area of *Gedarif* State in northeastern Sudan. This site, home to over 30,000 people spread out in 10 major villages, has been chosen because it is traditionally known as the most important communal grazing area for all tribes in the region (as well as for a number of tribes from neighboring states), particularly during the rainy season. In the past, *Butana's* rangelands have been characterized as one of the best in northeastern Sudan by virtue of their abundance of high value fodder species and the relative absence of most pests and diseases that threaten animal health.

Climate Variability and Climate Change Problem

A consensus clearly has emerged among pastoralists in the region that climate has been changing over the past few decades and has adversely affected the productivity of *Butana's* rangelands. Rainfall became unreliable and erratic leading to more frequent low-level drought episodes, while widespread anecdotal evidence affirms that temperature levels have also been increasing. This combination has resulted in the steady deterioration of both the productivity and biological diversity of the *Butana* rangelands. In addition, given its past reputation throughout northeastern Sudan as a highly productive rangeland area, it has attracted relatively distant pastoralists struggling to cope with their own local drought conditions in other parts of Sudan. This combination of circumstances has intensified pressure on its fragile and deteriorating resource base, further exacerbating the vulnerability of its pastoralists.

Description

Goals and Objectives

The proposed project will also seek to reduce local vulnerability to increasing rainfall variability through the introduction of widespread and suitable water harvesting techniques in the *Butana* area. This area is known as a natural water catchment zone in which rainfall runoff during rainy

seasons typically drains into a number of valleys. However, water is then discharged downstream without being tapped as optimally as possible for agricultural, household, and livestock watering activities.

The main goal of the proposed project is to enhance the resilience of local communities in the *Butana* area to current and future rainfall variability through rangeland rehabilitation and the widespread introduction of water harvesting and storage techniques. Within this broad goal, there are several major objectives as follows:

- To rehabilitate Butana communal rangelands through the introduction of new fodder rotation and management schemes;
- To improve household income diversity through the introduction of new cottage industries in order to provide alternative income sources during periods of low rainfall;
- To identify optimal water harvesting, storage and spreading techniques relative to climate change and to implement these techniques to the fullest extent possible in the region;
- To reduce pressure on rangelands resources through building awareness among pastoralists and other livelihoods regarding community forestry and alternative firewood resources;
- To mitigate the potential for future conflicts over dwindling rangeland resources from rainfall variability by providing basic services for nomads and herders, including safe access and regress routes to minimize conflict between nomads and farmers in the area.

Activities

The main activities will include:

- Mapping of the vulnerable fodder production areas in the region and identifying suitable sites for water harvesting technologies;
- Organizing local people and establishing leadership committees (e.g. friends of the environment and/or development committees) to assume an active role in the implementation of project components;
- Evaluating the potential of various water harvesting and utilization techniques relative to local climatic conditions;
- Designing and constructing water harvesting systems (from stone, sand, and other local materials as necessary) to harvest rainfall run-off;
- Developing a drought early warning system through the installation of rain measurement and other meteorological measurement equipment and technologies;
- Training pastoralists and building awareness among local communities for the storage and utilization of water and communal fodder management schemes.

Relation to current policies

The current 25-year development strategy aims to conserve water resources for domestic and other users in this area through afforestation to reduce land degradation and desertification. Also, the proposed project is consistent with rural development policies and objectives.

Expected Results

The main outcomes expected from the proposed project include:

- Development of a database of Butana rangeland characteristics;
- Greater flexibility in responding to drought through the early warning system as well as improvement in household income levels/diversity;
- Improvement of water supply in the area for meeting different needs of local people;
- Development of local awareness of environmental challenges and tools/skills to meet those challenges.

Duration

The duration of the proposed project is 3 years.

Cost

A total budget of USD 2,800,000 is needed.

Breakdown of major project costs

Budget for enhancing resilience to increasing rainfall variability through rangeland rehabilitation and water harvesting in *Gedarif State*

Activity	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Total (USD)
Mapping	200 000	100 000	50 000	350 000
Fodder production schemes	50 000	200 000	250 000	500 000
Set up of cottage industries	50 000	100 000	150 000	300 000
Equipment	250 000	400 000	100 000	750 000
Evaluation of water harvesting	50 000	50 000	0	100 000
Construction	50 000	225 000	150 000	425 000
Training	50 000	50 000	50 000	150 000
Management	75 000	75 000	75 000	225 000
Total	775 000	1 200 000	825 000	2 800 000

NAPA Priority Project 2

Reducing the vulnerability of communities in drought-prone areas of southern Darfur State through improved water harvesting practices

Rationale

Southern Darfur State is located in western Sudan and is inhabited by 3.8 million people (according to the 1993 census). Agriculture, which represents the basic livelihood in the State, has always been practiced in a very traditional way under diverse conditions of climate and soil. People grow staple as well as cash crops. However, they face the threat of crop reduction and crop failure due to the variability and continuous decrease in rainfall that has been recorded in the region since 1921. The rainfall isohyets are found to be moving southward.

In the last century, Southern Darfur State was exposed to drought cycles during the years 1987, 1989, 1990, 1993, and 1996. Residents are still suffering from the negative impacts of these cycles, which have affected the entire Darfur environment. The combined effect of rainfall variability/reduction and drought has culminated in reduced surface water runoff. The rate of recharge of groundwater basins has also been significantly reduced. Dams, *hafirs* and reservoirs, which depend on surface water, were/are not receiving enough water relative to their storage capacity. Rangelands are also experiencing rapid deterioration, and the effect is reflected in the total pasture production, which is only enough to meet 53% of animal population's needs in the State. Consequently, this has led to early grazing and overgrazing of the rangelands.

Furthermore, due to drought some herders are being forced to move southwards (Tesy Tesy fly zone) where chronic conditions exist for the spread of disease. Certain tribes have lost their herds and have been forced to uproot their livelihoods - some have become subsistence farmers; others have migrated and became internally displaced persons (IDP). The scarcity of resources has led to social tension among the different tribes and in the whole region of Darfur, culminating in serious and violent conflict.

Baseline Situation

The NAPA consultation process showed that the whole state is quite adversely affected by climatic variability. However, the most vulnerable groups are those who live in Shairiah, Muhagriah, Malam, Darbat, Marshung. The communities of these vulnerable areas have suffered from the reduction of both agricultural and animal production, which was caused mainly by the variability/reduction of rainfall and scarcity of water resources. The vegetation cover of these areas has been seriously deteriorated due to the dependency of the local people on it for the supply of their basic needs (e.g. fuel wood, building materials).

Climate Variability and Climate Change Problem

With further variability/reduction in rainfall and with more frequent droughts, the situation will worsen in Darfur. The loss of production is likely to be acute and desertification is expected to cover wide areas. The poverty level will be higher, which might mean loss of lives and even more severe conflict over scarce resources.

Description

Goals and Objectives

The main goal of the proposed project is to enhance the resilience of local communities in the drought-prone areas through water harvesting measures. Within this broad goal, there are several major objectives, which are as follows:

- Secure water supply in dry areas, which will increase productivity of arable and grazing land;
- Increase yields of rain fed farming so as to minimize the risk of crop failure in drought prone area;
- Supply drinking water for animals;
- Supply domestic water for people;
- Tribal conflict avoidance.

Activities

The main activities will include the following:

- Use of water-harvesting techniques in order to increase feeding rate of ground water and to reduce soil erosion;
- Increase of production through the increase of cultivated areas;
- Rehabilitation of Gum Arabic belt through re-cultivation of Hashab trees (Acacia Senegal);
- Combat desertification by afforestation, fruit tree planting and agro forestry;
- Promotion of social forestry;
- Rehabilitation of rangeland and provision of satisfactory veterinary services;
- Poverty reduction.

Relation to current policies

The NAPA process facilitated the participation of stakeholders who represent different perspectives. Hence, the priority adaptation option reflects a consensus of stakeholders. The project is well linked to government policies and plans, being in line with the 25-year National Strategy and the Poverty Reduction Strategy Program (PRSP). It has also strong links with the Millennium Development Goals (MDGs).

Expected Results

The main outcomes expected from the proposed project include the following:

- Increased productivity of both animals and crops;
- Increased farmers' income;
- Increased vegetation cover;
- Wise increase of livestock number;
- Increase of the level of environmental awareness;
- Poverty reduction;
- Improve quality of life;
- Release tension over resources and ensure stability in the project area.

Duration

The duration of the proposed project is 3 years.

Cost

A total budget of USD 2,500,000 is needed.

Breakdown of major project costs

Budget for reducing the vulnerability of communities in drought-prone areas of southern Darfur State through improved water harvesting practices

Activity	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Total (USD)
Construction of water harvesting scheme	250 000	400 000	100 000	750 000
Recultivation of Hashab trees (small farmers)	50 000	100 000	112 500	262 500
Social forestry	50 000	100 000	137 500	287 500
Rehabilitation of rangeland	100 000	225 000	135 000	460 000
Provision of veterinary services	50 000	50 000	50 000	150 000
Fruit tree planting and agro forestry	50 000	100 000	125 000	275 000
Training	45 000	45 000	45 000	135 000
Management	60 000	60 000	60 000	180 000
Total	655 000	1 080 000	765 000	2 500 000

NAPA Priority Project 3

Improving sustainable agricultural practices under increasing heat-stress in the River Nile State

Rationale

The River Nile State is located in northern Sudan (desert, semi-desert zone), and covers an area of 124 km². The State is transversed from south to north by the river Nile and its tributaries, River Atbra and number of seasonal streams. About 950,000 citizens inhabit the state with over 80% practicing agriculture (farmers and herders) as their main livelihood. Cultivated lands are concentrated around the River Nile and Atbra (banks and delta). Flood irrigation is concentrated mainly around the River Atbra. Farmers grow staples (sorghum and fodders) as well as economic crops (watermelon and vegetables). However, recently the annual rate (flow and water amount) of River Atbra has been decreasing, and this has led to the deterioration of crop and animal production. This is also exacerbated by land constraints as it has become difficult and costly to cultivate terraced land (i.e., far from river banks), which represents about 90% of the agricultural land.

Winter represents the basic agricultural season. In general, this season is characterized by being short and warm in Sudan. However, the River Nile State has relatively cold and long winters. Therefore, some winter crops are cultivated including wheat, legumes, vegetables, fruits, and spices. Currently, and for the past decade (1994-2005), significant increases in winter temperatures have been recorded mainly at the beginning and the end of the growing season. Consequently, the growing season has been shortened. Both the high temperature and the short growing season have a very negative impact on the productivity of winter crops.

The increase of temperature reduces growth of some crops (i.e., wheat), increases weeds, encourages pests and diseases (e.g. white fly, root rottenness), and reduces growing periods for seeds (poor quality). Given that cultivated agricultural land is quite limited, production decreases due to temperature changes have led to serious food shortages.

Baseline Situation

Large groups of local people (small scale, subsistence farmers) are dependent on agricultural production to meet basic needs as well as to generate limited household income. Indeed, most farmers are quite vulnerable, The NAPA assessment of vulnerability to climate change found that the most vulnerable are those who live in the area of the lower River Atbara. People there suffer from reduction of rainfall, which affects both the flow and amount of water carried by river Atbra. However, even in good rainy years, floodwaters have been found to cause a lot of damage and loss of lives and properties.

The increase in temperature during both winter and summer seasons adversely affect animal and crop production. As the state is part of the desert zone, they also suffer from high wind speed and shifting sand dunes that negatively affect the cultivated lands and cause blockage of irrigation channels. Due to climate change (scarcity rainfall, increase in temperature, drought) and desertification on one hand and due to lack of irrigation and storage facilities on the other hand, the cultivated area has become very limited and that was found to have very negative effects on the stability of farmers who were forced to live on very meager resources or migrate to face major socio-economic and security problems. People cultivate limited areas around the riverbanks as well as terraced areas that surround the banks. While the cultivation of the former is practiced in very limited areas, the latter is very expensive to cultivate as it depends on both surface and ground water, which is subject to availability and high drilling costs. Accordingly, very few people are able to cope.

The increase in temperature has already caused reductions (sometimes failure) of winter-grown crop yields in the state. In very limited areas, improved varieties have been found to grow very well even under warmer condition. However, they were only grown on research farms.

Climate Variability and Climate Change Problem

With further increases in temperature, the shortening of the winter season, and further reduction/variability in rainfall, farmers in the region are likely not to be able to produce enough food, or they might face severe food gaps.

Description

Goals and Objectives

The main goal of the proposed project is to reduce the vulnerability of farmers caused by the increase of temperature during the winter season. Within this broad goal, there are several major objectives as follows:

- Improve agricultural system practices of the targeted farmers;
- Maximize the utilization of flood water for irrigation of more agricultural lands in order to reduce the food gap;
- Control flood water to reduce its negative impact on people and to store water for agricultural and domestic and animal uses;
- Increase agricultural production and provision of solutions for socio-economic and security problems that arise due to loss of livelihoods and displacement.

Activities

The main activities will include:

- Introduction of heat resistant plant varieties and intensification of growing season (winter, summer, autumn) in order to reduce dependency on a single season (winter) and diversification of grown crops in each season to reduce risk of mono-cropping;
- Introduction of new economic crops such as sesame, sunflower, summer legumes, fodders etc.;
- Increase the cultivated area particularly in terraced area through improvement of irrigation, digging and cleaning of irrigation channels from the accumulated sand;
- Digging of water pools (hafirs) and wells for domestic and animal uses;
- Training and improvement of abilities of farmers through establishment of demonstration farms in order to raise their awareness regarding how to act when conditions changed;
- Establishment of rocky barriers to reduce wind speed and intensification of trees planting in villages and towns and along irrigation channels.

Relation to current policies

The NAPA process facilitated the participation of stakeholders who represent different perspectives. Hence, the priority adaptation option reflects a consensus of stakeholders. The project is well linked to government policies and plans, being in line with ongoing strategies to raise agricultural productivity in the River Nile State.

Expected Results

The main outcomes expected from the proposed project include the following:

- Insurance of food security;
- Build up of resilience and adaptive capacity in order to help vulnerable communities meet the challenge of climate variability and climate change;
- Reduction of poverty;
- Reduce the negative impact desertification.

Duration

The duration of the proposed project is 3 years.

Cost

A total budget of USD 2,350,000 is needed.

Breakdown of major project costs

Budget for improving sustainable agricultural practices under increasing heat-stress in the River Nile State

Activity	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Total (USD)
Introduction of heat-resistant varieties	40 000	45 000	50 000	135 000
Introduction of new crops	50 000	60 000	70 000	180 000
Improvement of irrigation digging and cleaning channels	75 000	215 000	255 000	545 000
Digging of water pools	75 000	225 000	259 000	559 000
Establishment of rocky barriers	75 000	100 000	125 000	300 000
Control of flood water	85 000	110 000	135 000	330 000
Training	36 000	37 000	38 000	111 000
Management	63 333	63 333	63 334	190 000
Total	499 333	855 333	995 334	2 350 000

NAPA Priority Project 4

Environmental conservation and biodiversity restoration in northern Kordofan State as a coping mechanism for rangeland protection under conditions of increasing climate variability

Rationale

Northern Kordofan State is located in central Sudan in the woodland savannah (poor savannah on sand). The livelihoods (herding, farming, forestry, gum collection) practiced are considered part of the traditional rain fed sector. Over the past several decades, livelihoods have been affected by frequent drought cycles. The region also suffers from extreme fluctuations in rainfall which generally vary from 150-450 mm/year. Severe climatic conditions and land mismanagement (overgrazing, over cropping, deforestation) have caused vegetation cover in the region to become very poor and the loss of many endemic species (woody, rangeland species) that were once dominant. Furthermore, as the region is bordering the desert zone, there is a persistent threat associated with shifting sand dunes and desertification.

Baseline Situation

The NAPA consultation process revealed that the most vulnerable groups in the state are those who live in the Bara, Gabrat Alsheikh and Sawdery localities. Fluctuation of rainfall and the increase of frequency of drought have led to an increase in crop failure and soil degradation. The dry conditions also encourage the spread of wildfires, which cause substantial damage to natural vegetation; rangelands become deteriorated, overgrazed and become dominated by poor species that replace the favorable nutritive species, which retreated to the rich savannah zone. Herders in the region lost most of their livestock (left only with goats) during drought cycles and were forced to shift from animal keeping to practicing agriculture in very marginalized lands. Many people were not even able to survive and were forced to migrate to towns as well as to irrigated agricultural schemes.

Climate Variability and Climate Change Problem

With projected increased rainfall variability and drought frequency in the region, the vulnerability of people who inhabit the area is anticipated to increase as they lose productive lands, vegetation cover and eventually face desertification.

Description

Goals and Objectives

The main goal of the proposed project is the rehabilitation of vegetation cover and restoration of biological diversity to reduce the vulnerability of livestock following increased temperatures. Within this broad goal, there are several major objectives as follows:

- Awareness raising of the local people in order to ensure their participation in the rehabilitation process;
- Achievement of sustainability of livelihoods through the wise use of resources and provision of alternatives;
- Development of animal wealth sectors;
- Fixation of sand dunes and combating desertification.

Activities

The main activities will include the following:

- Preservation of forests and establishment of grazing allotments;
- Training of local people to manage their natural resources and to support the different activities of the project;
- Management of rangeland using water-harvesting techniques, reseeding of rich and favourable species;
- Establishment of nurseries;
- Sand dunes fixation through planting of shelter belts and wind breaks;
- Introduction of renewable energy sources;
- Provision of revolving fund.

Relation to current policies

The NAPA process facilitated the participation of stakeholders who represent different perspectives. Hence, the priority adaptation option reflects a consensus of stakeholders. The project is well linked to government policies and plans, being in line with ongoing strategies to increase biological diversity in Northern Kordofan State.

Expected Results

The main outcomes expected from the proposed project include the following:

- Improvement of vegetation cover;
- Involvement of local people in natural resources management;
- Rehabilitation of rangeland and enhancement of biodiversity;
- Control of sand dunes movement;
- Reduction of dependency on biomass as a source of energy;
- Provision of alternative livelihoods.

Duration

The duration of the proposed project is 3 years.

Cost

A total budget of USD 2,400,000 is needed.

Breakdown of major project costs

Budget for environmental conservation and biodiversity restoration in northern Kordofan State as a coping mechanism for rangeland protection under conditions of increasing climate variability

Activity	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Total (USD)
Establishment of grazing allotments	35 000	55 000	75 000	165 000
Reseeding of rich favorable species	55 000	60 000	85 000	200 000
Establishment of nurseries	110 000	215 000	255 000	580 000
Planting shelter belts	125 000	225 000	265 000	615 000
Introduction of renewable energy	75 000	100 000	135 000	310 000
Provision of revolving fund	100 000	35 000	35 000	170 000
Training	55 000	55 000	55 000	165 000
Management	65 000	65 000	65 000	195 000
Total	620 000	810 000	970 000	2 400 000

NAPA Priority Project 5

Strategies to adapt to drought-induced water shortages in highly vulnerable areas in Central Equatorial State

Rationale

Central Equatorial state is located in Southern Sudan, geographically located between latitude 6°N and 3.95 °N and longitude 27 °East and 29 °East. The total area of the state is about 46,300 square kilometers, with total arable land of about 31,200 square kilometers. Current population is 1,375,684 people (based on December 2006 records FAO – Juba office).

Soils are sandy clay with alluvial soil. The state is inhabited by groups of native tribes mainly Bari, Mundari, Lokoya, Lububo, Nyamgwara, Pojulu, Kakuwa, Lugware, Kaliko and Monakupi. The nomadic tribe in the state is Mvndari; their main livelihood is raising cattle, sheep and goats, with little agricultural activity practiced. The majority of the tribes in state are agro-pastoralists. They practice agriculture as a source of livelihood and also maintain small herds of cattle, sheep and goats for marriages, prestige and traditional practices.

Baseline Situation

Juba County has a permanent water source, the River Nile. In addition, there are other sources of water such as seasonal rainfall, seasonal water streams and scattered water ponds fed by rainwater. Despite the richness of Juba county regarding water supply, all these sources are associated with several obstacles and constraints. The utilization of all these water sources is not efficient due to lack of infrastructure and the fact that the people lack the technical know-how to utilize and harvest water sources.

The participatory vulnerability assessment and the NAPA consultation process revealed that the county has two seasons i.e. wet and dry seasons. But due to climate change in the area, agricultural activities (crops and livestock) are increasingly water stressed due to prolonged dry seasons and shortened rainy seasons with substantial fluctuations in the quantity and distribution of water.

The recently ended armed conflict in the Southern Sudan damaged the basic infrastructure in the state, including land and livestock. This coincided with changes in rainfall patterns, rendering local communities more vulnerable to the impacts of climate variability and change.

Therefore, there is a great need to adapt to these circumstances in order to mitigate and reduce the effect of water deficiency in dry seasons. Such action will give people greater hope for poverty alleviation among them by increasing household incomes from agriculture and livestock practices.

Climate Variability and Climate Change Problem

The state is classified as rich savanna with an average rainfall of 900-1,000 mm per year. The topography of the state is undulated with many streams ending in the Nile, the main water source in the state. Rainfall patterns typically commence in March and end in October. With climate change, rainfall is commencing in April/May and ending in September/October with low intensity, which leads to water shortages in the region.

Description

Goals and Objectives

The main goal of the proposed project is to promote sustainable livelihoods in the Southern Equatorial State. Specifically, this involves the establishment of two micro-catchments with the

capacity for holding 10,000 – 15,000 cubic liters of water. Within these broad goals, the major objectives are as follows:

- Address the problem of water shortage due to drought in areas highly vulnerable (e.g. in the areas of Liggi, Tigore and Kuda);
- Introduce agroforestry practices to increase the adaptive capacity to climate changes in west Juba areas;
- Reduce the vulnerability of local communities to increased malaria transmission from climate variability;
- Minimize the negative impact of floods in highly vulnerable areas (e.g. Jebel Lado, Mongalla and Gondokro);
- Reduce the vulnerability of rangelands to climate change in the areas of Terekeka and Tali.

Activities

The main activities will include the following:

- Physically survey the land in order to locate the side of micro-catchments, dams and bore wells;
- Arrange for the bidding of contractors;
- Enlargement of the water reservoirs behind the dams and water catchments;
- Use of filters and pipes for improvement of water supply to the villages and residential areas;
- Introduction of tariffs for cattle and other livestock watering;
- Introduction of irrigation systems for pasture improvement and grazing management;
- Develop extension training programmes for proper water management as well as plants and livestock husbandry;
- Introduction of fish species for additional nutrition of high protein and income generation;
- Raise awareness regarding water resources management;
- Improve capacity of local communities regarding water resource management and safety.

Relation to current policies

The NAPA process facilitated the participation of stakeholders who represent different perspectives. Hence, the priority adaptation option reflects a consensus of stakeholders. The project is well linked to government policies and plans, being in line with ongoing water conservation strategies in the Central Equatorial State.

Expected Results

The main outcomes expected from the proposed project include the following:

- Cease seasonal migration of the people searching for water and pastures;
- Reduce water borne diseases;
- Increase productivity and income generation of household and individuals by reducing the distances of fetching water, as well as reducing diseases;
- Increase potential and improve grazing management in the area;
- Introduction of new natural resources such as fish and fruit trees;
- Increase income generation and its diversity;
- Increase crop and milk production and its sustainability.

Duration

The duration of the proposed project is 3 years.

Cost

A total budget of USD 5,000,000 is needed.

Breakdown of major project costs

Budget for strategies to adapt to drought-induced water shortages in highly vulnerable areas in Central Equatorial State

Activity	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Total (USD)
Land surveys	100 000	135 000	75 000	310 000
Enlargement of water reservoirs	125 000	225 000	265 000	615 000
Improvement of water supply	275 000	335 000	375 000	985 000
Introduction of tariffs for cattle/livestock watering	35 000	55 000	75 000	165 000
Irrigation systems for pasture improvement/grazing management	425 000	495 000	480 000	1 400 000
Introduction of fish species for additional nutrition	300 000	350 000	200 000	850 000
Training/extension programmes/awareness raising	125 000	125 000	125 000	375 000
Management	100 000	100 000	100 000	300 000
Total	1 485 000	1 820 000	1 695 000	5 000 000