REPUBLIC OF SOUTH SUDAN

MINISTRY OF AGRICULTURE FOOD SECURITY

CLIMATE RESILIENT AGRI-FOOD SYSTEM TRANSFORMATION (CRAFT) PROJECT: AWEIL RICE SCHEME IN NORTHERN Bahr El Ghazal STATE, SOUTH SUDAN

INTEGRATED PEST MANAGEMENT PLAN

JUNE 2024

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ACRONYMS

ABC	Aggregation Business Centre
ADF	African Development Fund
AfDB	Africa Development B
AMVAT	Agricultural Markets, Value Addition and Trade Development Project
ASDP	Agricultural Sector Development Program
BPA	Business Producer Association
CAMP	Comprehensive Agricultural Development Master Plan
CSA	Climate Smart Agriculture
CSP	Country Strategy Paper
DP	Development Partners
ESMF	Environment and Social Management Framework
ESMP	Environment and Social Management Plan
FAO	Food and Agriculture Organization of the UN
FPA	Fiduciary Principles Agreement
GAP	Good Agricultural Practices
GoSS	Government of South Sudan
IDP	Internally Displaced Person
IFAD	International Fund for Agricultural Development
JICA	Japan International Cooperation Agency
MAFS	Ministry of Agriculture and Food Security
MTI	Ministry of Trade and Industry
MTR	Mid-term Review
NAC	National Advisory Committee
NARS	National Agricultural Research Systems
NDS	National Development Strategy
NTB	Non-Tariff Barriers
NTC	National Technical Committee
PMP	Pest Management Plan
RBLF	Results Based Log frame
RMC	Regional Member Countries
SDGs	UN Sustainable Development Goals
SEG	Seed Enterprise Group
SSAPU	South Sudan Agricultural Producers Union
SSNBS	South Sudan National Bureau of Standards
SSP	South Sudan Pound
TAAT	Technologies for African Agricultural Transformation
TPIA	Third Party Implementation Agency
TSF-I	Transitional State Facility Pillar 1
USD	United States Dollars
WFP	World Food Program

EXECUTIVE SUMMARY

1. Overview of the project: Aweil **R**ice **S**cheme (ARS) is a sub-project within the **C**limate **R**esilient **A**gri-**F**ood Systems **T**ransformation **(CRAFT)** Project earmarked for implementation by the Government of South Sudan (GoSS) in five states in South Sudan. The scheme is a national farming project located in the Northern Bahr El Ghazal State. The scheme was established during British rule in the mid-1940s, to-date it is the biggest rice production scheme in the country, stretching about 11, 000 fedans (approximately 4600 Ha). The need for the Rice Value Chain Transformation Program is very crucial in ensuring food sufficiency, and economic empowerment of farmers and the national economy as well as rehabilitation and expansion of the scheme's channels, mechanization, and capacity improvements of farmers are being conceived to promote national sufficiency and enhancing the country's potential in rice production. The project development objective is to increase agricultural production and productivity, create jobs, and build resilience for the people of South Sudan. Specific objectives include: (i) scaling up climate-adaptive technologies and rice production systems; (ii) developing women and youth-led businesses in rice value chains, (iii) promoting digital agricultural and climate advisory solutions, and (iv) building technical and entrepreneurship skills for addressing some of the root causes of fragility.

The ARS prioritizes and targets increased rice production with enabling factors: food value chains; resilience through community-based approaches innovative and sustainable agricultural production through the formation of Farmers' Organizations; investing in transport infrastructure, improving storage infrastructure, and enhancing market systems. The project is being prepared for financing by the African Development Bank (AfDB), and will be implemented by the Ministry of Agriculture and Food Security (MAFS) of the Government of South Sudan. It is envisaged that MAFS will work in collaboration with agricultural organizations based in South Sudan such as the Food and Agriculture Organization of the United Nations (FAO) to implement the project.

The project activities will entail Climate-Adaptive Production particularly scaling up climate-smart production systems focusing on the development/rehabilitation of the Aweil Rice Scheme, Scaling up climate-smart production systems. The production of improved climate-adapted seed – introducing Early Generation Seed (EGS) in collaboration with TAAT through establishing seed multiplication and demonstration sites supplied with quality declared seeds (QDS) and other inputs; Training of Trainer (ToT) of 20 extension staff; training of 3,000 seed farmers and 30 organized Seed Enterprise Groups (SEG) of 10 farmers each, producing a total of 163 tons of improved seeds for own use and distribution as a SEG business line. Promotion of good agriculture practices through 240 farmer field and business schools (FFBS), and target 3,200 women who are also rice farmers, in gardening techniques. The project will develop 2,000 ha for irrigation, promote water use efficient technologies as well as malaria-preventative infrastructure design while also providing mosquito nets[1] - all benefitting 8,000 ARS farmers. It will also invest in soil and water conservation of 1,000 ha of degraded lands that will benefit 1,000 persons upstream of the Lol River watershed. ARS Project will be implemented in **Northern Bahr el Ghazal State,** focusing on one agricultural value chain (rice production) in the scheme. The production will address national Food security and improve the farmer's income.

Projects Baseline Environment

Aweil Rice Scheme is located in Northern Bar el Ghazal state Aweil County in northwestern part of South Sudan, near the international border with the Republic of Sudan and the Abyei Region. This location lies approximately 800 kilometers by road, northwest of Juba, the capital and largest city in the country. The coordinates of Aweil are: 8° 46' 02.00"N, 27° 23' 59.00"E (Latitude: 8.7671; Longitude: 27.3998).Aweil town is the capital city of *Northern Bahr el Ghazal*. The town's infrastructure is relatively developed. The topography is flat and is prone to flooding, although the city itself lies on higher ground that the surrounding plains. The city lies close to the confluence of the *Lol River* with the *Pongo River*. The average elevation of the city of Aweil is about 425 meters (1,394 ft) above sea level.

In South Sudan, rice is ranked amongst the first four major staple cereals and is produced in two types of production systems, that is, uplands and lowlands or paddy rice production. However, the total rice area,

[1] Sustainability is expected to be ensured as the awareness on the health benefits accrued from the use of the nets will be disseminated, combined with increased household income (due to irrigation) to purchase nets.

productivity and production remain low due to lack of commercial rice farming practices coupled with the existing small scale rice farming activity in the country. Although the demand for rice cereals is potentially high in the domestic markets, the rice supplied into South Sudan were majorly through imports from the regional and international countries (Mamuru *et al* .2024).

Rationale of the Pest Management Plan (PMP)

Most pesticide studies associate the use of chemical pesticides with a myriad of diseases exposed through the skin, or the eyes or through inhalation or ingestion, with key risks being death, cancer, birth defects and damage to the nervous system, etc. Pesticide usage is also associated with significant negative environmental impacts; including; soil, water, and air pollution. The AfDB safeguard policy on Pest Management has been triggered and as a result, MAFS South Sudan is required to prepare PMP as a standalone document. This PMP has been developed in direct response to the risk of pests and diseases and to guide the operation of the project to achieve compliance with applicable national regulations and AfDB Operational Safeguard (OS) 4 - Pollution Prevention and Control, Hazardous Materials and Resource Efficiency. As well as OS 5- Labour Conditions, Health and Safety

Pest Management Plan Objectives

The objective of the Pest Management Plan is to:

(i) Promote the use of environmentally friendly practices (hygienic, cultural, biological or natural control mechanisms and the judicious use of chemicals) in pest control;
(ii) Effectively monitor pesticide use and pest issues amongst participating farmers;
(iii) Provide for implementation of an IPM action plan if serious pest management issues are encountered.
(iv) Assess the capacity of the country's regulatory framework and institutions to promote and support safe, effective, socially and environmentally sound pest management and to provide for appropriate institutional capacity support recommendations;
(v) Ensure compliance with the national policy and strategy;
(vi) Ensure compliance with AfDB; OS 4 - Pollution Prevention and Control, Hazardous Materials and Resource Efficiency. And OS 5 - Labour Conditions, Health and Safety

The PMP is to address the concerns of relevant stakeholders with regard to pests and pesticides. It stresses the need to monitor and mitigate negative environmental and social impacts of the Program including the use of pesticides and promote ecosystem management with the human health risk being the underlying principle from seed usage, through planting and growth stage as well as post-harvest issues including safe crops for consumption. It emphasizes the need for an integrated approach to the management of pests in line with the country's policy on Integrated Pest Management (IPM) as well as AfDB's requirements on pest management and makes provision for adequate measures to enable the project implementation unit sustain the adoption of IPMP techniques.

Stakeholder Engagement and Outcomes especially potential project beneficiaries and actors were engaged to obtain the full support of key actors during project implementation to promote the effective implementation of the PMP. Key among them included; i) Government institutions directly or indirectly involved project; ii) ARS farmers and workers; iii) Agricultural practitioners at National and state offices; and iv) UN agencies working South Sudan (FAOSS).

During the stakeholder engagement, several issues were identified and prioritized by stakeholders to improve pest and pesticide management. At the institutional, legislative, and regulatory levels, issues were identified among others a) the Porosity of national borders which allows for the influx of banned chemicals into the country b) insufficient regulation; c) lack of database on diseases in crop production; d) Need for capacity building; e) Lack of awareness f) Inadequate human resources, g) Equipment logistics and financial resources for the field monitoring of IPM approaches.

Monitoring is also a major concern for stakeholders with issues such as a lack of personnel and equipment in assessing the impacts of pesticides and insufficient control over the use of pesticides identified. Inaccessibility of approved pesticides near farmers, lack of efficient treatment and waste disposal systems at the farms, and insufficient extension of alternative methods to pesticides and integrated pest management

were also identified as concerns by farmers. Farmers also raised concerns on issues regarding lack of regular training for farmers on pesticide use and management of empty containers, inadequate information on the

Current approaches to pest management in the project area

A wide range of tropical and semi-tropical crops are grown in South Sudan in a variety of cropping systems. The bulk of agriculture remains traditional land holdings are small, crop production is labor intensive, and little or no external inputs are used. Pest management practice under this condition is built-in process in the overall crop production system rather than a separate, well-defined activity (ICIPE 2005). Small parcels of land are cleared of vegetation by hand and a range of crops sown. After several seasons, during which the soil becomes exhausted and weeds become a problem, new areas are opened up. The cropping systems of the project area is based on a wide range of domesticated rice species but pests and diseases also thrive as a wide range of insects and mites attack the rice crop and reduce potential yields (Abate et al, 2000, ICIPE; 2005).

The most common methods applied by smallholder farmers to control crop pest and disease in the project area of command include; physical control- hand picking of pests, uprooting infested crops, using fire to remove pests on crop residues, and frequent weeding etc., However, there is a need to enhance their application to ensure that they are used in a systematic and coordinated manner. Climate change-induced invasive pests remain a major bottleneck to agricultural productivity and food security in the project area. There is a serious need to strengthen the plant health system in the entire country, this has the potential to contribute to reducing crop losses caused by pests. A situational analysis conducted to assess the current state and effectiveness of plant health functions in South Sudan, by Makale *et al* (2024) indicated low access to plant health services, including advisory and extension, training, and information. There is a high dependence on NGOs and UN agencies to provide plant health services, indicating a gap in government-led initiatives. Socioeconomic variables also had varying effects on crop management practices, suggesting inequitable access to plant health services and resources depending on income levels.

Current issues in the use and management of synthetic chemical pesticides in the project site

The farmers employed both modern and traditional methods in control pests and diseases such as pesticides through spraying and the use of local ash sprayed on the rice regularly to avoid crop infection. According to the farmers, ash was found to be effective although it requires a lot of labour during its application process in the rice fields. One of the major challenges to rice production was the issue of pests and diseases which the farmers would need to be trained on the effective use of chemicals and their environmental impacts. There is a need for coordination on the handling of agro-chemicals used to control pests and diseases.

The common weeds include Striga, Bidens pilosa (Spanish needle), Datura stramonium (Thorn apple), Galisonga parviflora (Gallant soldier), Guizotia scarbra (Sunflecks), Tagetes minuta (Mexican marigold). Crops are also subject to attack and spoliation during storage. Storage facilities typically comprise above-ground brick granaries and woven bamboo baskets). Aboveground storage is especially susceptible to attack by rats and weevils. The most prevalent vertebrate pests include the Red-billed Quelea (Quelea quelea) birds. These are more common in the project areas and are the most problematic pests while growing rice and other cereals. Rodents' pests including ground squirrels (Xerus erythropus) and cane rat (Thryonomys swinderianus) are more common in all the project sites

2. Policy, Legal and Regulatory Framework for Pest Management

The major policy and regulatory frameworks, relevant to the performance and success of ARS project as they relate to agriculture, land, water, environmental protection, rice production value chain, pests and other ancillary activities include:

(i) The National Environment Policy, 2015-2025

(ii) National Water Policy, June 2007
(iii) The Agriculture Sector Policy Framework, 2015-2025
(iv) The Health Policy 2016-2025

National Bills and Acts

(i) The Environment Protection and Management Bill, 2013
(ii) The Water Bill, 2013
(iii) The Pesticide Control Bill for South Sudan (Proposed as of 2021)
(iv) Plants and Fertilizer Act, 2010 (Act 803)
(i) The Public Health (Water and Sanitation) Acts, 2008

International Conventions

(i) Convention on Biological Diversity (1992)
(ii) AfDB Integrated Safeguard System (OS 4 – Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency and OS 5- labour and working conditions)
(iii) International Plant Protection Convention of FAO (1952)
(iv) FAO Guidelines on Good Practice for Aerial Application of Pesticides (2001)
(v) FAO International Code of Conduct on the Distribution and Use of Pesticides
(vi) FAO Guidelines on Good Practice for Ground Application of Pesticides (2001)
(vii) FAO Directive on Safety and Environmental Precautions (2003)
(viii) FAO Guidelines on Locust Campaign Organization and Execution (2003)
(ix) FAO Guidelines on Desert Locust Control (2003)
(x) FAO Guidelines on Management of Empty Containers (2008)
(xi) WHO Guidelines for personal protection when handling and applying pesticides-International Code of Conduct on Pesticide Management

Currently, there is no regulatory framework for the importation and use of pesticides in South Sudan. A draft pesticide policy has been prepared and is yet to be enacted. There is no separate policy on IPM in South Sudan or any developed IPM implementation strategy. Similarly, there is no formal policy on organic agriculture or the development, quality control, and marketing of organic produce. South Sudan is not yet a signatory to the Stockholm Convention on Persistent Organic Pollutants (POPs), as well as the Rotterdam convention and therefore, has not domesticated the law.

Institutional Framework

MAFS plays a major role in the import and distribution of pesticides in the country and provides training to staff working in plant protection departments around the country. In turn, the staff members of the plant protection departments are involved in training of field extension workers and farmers. However, due to lack of facilities, trained personnel and funds, inspection tasks such as checking on package, labeling, test for quality and residue in plant parts, animals and soils are not taking place as expected.

Local distribution of pesticides is carried out by the State MAEF at the counties. There is no official private sector distribution of pesticides, but minimal informal activity. Pest management advice is mainly delivered through the extension system run by MAFS.

The South Sudanese government has collaborated with international and national partners to create a national plant protection organization (NPPO) and prepare a framework for phytosanitary ARS. This is to enhance the nation's regulatory framework through the creation and enforcement of legislation. Aimed at expanding the nation's market access as well as protect the environment, livestock, and public health. IGADs; the Centre for Pastoral Areas and Livestock Development (ICPALD) approved the National Sanitary and Phytosanitary (SPS) Strategy for South Sudan. The strategy seeks to enhance the nation's sanitary and phytosanitary (SPS) measures' current state, obstacles, and future directions. SPS technical specialists from around the nation reviewed the plan, which is in line with the IGAD regional SPS policy. It is anticipated that the Line ministries will incorporate the plan into federally and donor-funded initiatives.

Existing and Anticipated Pest and Disease / Management Practices

The farmers in the Project area of interest employed both modern and traditional methods to control pests and diseases. According to a recent study (Mamuru *et al,* 2024), examples of methods currently applied in Aweil include:

- Spraying pesticides (nature of chemical not known) and
- Use of local ash sprayed on the rice regularly to avoid crop infection.

According to the above study, majority of farmers felt that the use of ash, was effective although it is considered labor intensive.

It is also demonstrated that pests and diseases is one of the major challenges to rice production. Therefore farmers would need to be trained on the effective use of chemicals and their environmental impacts. As well as a need for coordinating the safe handling of agrochemicals and access to credit for agrochemical trade. Generally, the use of highly persistent toxic chemicals must be avoided and prohibited during the PMP implementation in ARS. Natural pest control methods should be adopted to effectively reduce or eliminate pest or disease infestation without harming humans, crops, and other organisms.

Pest Problems and Control Practices

Some of the common pests envisaged in the ARS targeted areas include rodents and migratory and outbreak of pests such as locusts, borers, caterpillars, nematode, aphid, and mealy bug. IPM strategies are recommended and used by some farmers as long as it is possible because no one control practice can provide acceptable control of the target pest. Rodents, particularly the field rats (Rattus rattus), the small house mice (*Rattus norwegians*) and the multimammate or shamba rat, (*Mastomys natalensis*) are key pests of food crops.

IPM Strategy for Pest Control

The Relevant agency (FAO, together with the Plant Protection Department), in the MAFS generates and publishes a list of approved and registered chemical pesticides for use by farmers. Additionally, there is a list of banned pesticides. This list is updated periodically. These pesticides are tested to improve the quality of the pesticides used i.e., the reduction of the toxicity and the increase of the efficacy. Integrated pest management is the adopted strategy for the fight against pests in South Sudan and Aweil in particular, the use of integrated combat is not widespread. There is likely hood that the use of pesticides will increase despite the high cost of the products relative to the financial capacity of the majority of farmers. Research Institutions in South Sudan have had some good results regarding the efficient use of botanical or organic products. MAFS through the support of international development partners including FAOSS and the United States Agency for International Development (USAID), has developed separate booklets and manuals to serve as extension guides on integrated pest management practices for food production.

The national IPM approaches developed for rice are largely based upon 15 principles, practices and what happens in each case. Preventive Methods are usually applied for pests such as locusts whereby regulatory bodies collaborate with international partners during the indicated periods of the year in order to follow the evolution of the situation of the populations (i.e. FAOSS Emergency Locust Response Project**).** Surveillance of other agricultural pests is the responsibility of farmers. However, plant protection services also identify pests to determine areas at risk of infestation that compromise food security. The use of drones for pest management is also a method FAOSS and the MAFS should be looking forward to using to make pest control/management easier and faster. The curative fight methods require that locust invasions are managed at the national or even sub-regional level. Farmers encountering pest problems usually rely on competency of MAFS extension services to receive control advice that they will apply in the field.

Alternatives to Pesticides

Over the years, efforts have been made particularly by the research institutions to develop alternative products to the use of agro-chemical products especially containing POPs (Persistent Organic Pollutants) with the aim of reducing the use of pesticides in agriculture and the areas of use of these pesticides. These alternatives include cultural control, physical control, genetic control, integrated pest management, biological control, the use of bio-pesticides, the use of pesticides of the organophosphorus family, carbamates, pyrethroids, etc. During the consultative processes for the development of this PMP, farmers demonstrated knowledge and understanding of alternative products to pesticides. They indicated

practices such as the use of neem grains, as bio-pesticides; chilli powder for the preservation of rice grains, and others (powders of tree bark, neem leaves) as alternatives to pesticides application. Farmers are also aware of cultural techniques such as cultural association, crop rotation, transplanting, organic manure, etc. Nonetheless, they indicated their preference for chemical pesticides due to their efficacy, and accessibility to treat large areas as compared to the alternative approaches.

Controlling Pesticides used in Crop Protection

To ensure the efficient use of the pesticides for the fight against rice crop pests/diseases, the maximum residue limits (MRL) have been defined by European markets/EU standards. Where undefined, the Food Code / Codex Alimentarius" (a collection of international standards, guidelines and codes of practice to protect the health of consumers and ensure fair practices in the food trade) is considered. South Sudan is required to comply with sanitary and phytosanitary measures (SPS) and especially the pesticides residue values available in farm products that should not exceed the acceptable maximum residue limit, otherwise produce from South Sudan will be banned. Every imported pesticide product is expected to be subjected to approval.

Potential Impacts and Challenges Associated with Agrochemical Use in ARS Interventions

The use of various agrochemicals especially pesticides is a common feature of rice production activities and is expected to intensify during the implementation of the ARS project interventions. The PMP assesses the potential risks/impacts associated with the procurement, transport, storage, use/handling, and disposal of pesticides. The PMP also discusses in detail the major risks and impacts likely to be associated with the use of pesticides under interventions envisaged as part of the ARS. These include the following: The impacts and challenges identified include:

• Lack of IPM sustenance measures even though national pest control strategy is IPM;
• Likely pollution of water resources and aquatic life from pesticide usage;
• Public health concerns from water-borne and water-related diseases can trigger the use of pesticides in controlling their vectors;
• Mycotoxin poisoning from poor rice drying;
• Poisoning from improper use of pesticides by farmers
• Impact from improper disposal of pesticide containers;
• Production losses from threats from other crop pests and diseases;
• Abuses associated with pesticide supply and sales; and
• General health and safety of farmers and environmental hazards.

Project to meet PMP Requirements

ARS project team will adopt the following specific strategies to achieve an effective pest and pesticide management process:

- Formation of a project environmental safe guide Unit
- PMP Communication and Orientation Workshop
- Education and Awareness Creation
- Participatory Pests Inventory and Monitoring Measures
- Stakeholder Consultation and Involvement
- Prevention of new Pest Infestations
- Management of established Pests
- IPM Capacity Building
- Institutional Arrangements and Training Responsibilities
- Participatory Monitoring and Evaluation
- Sustainability Issues
- Management Reviews
- Institutional arrangements for the implementation and monitoring of the PMP

PMP Implementation Budget

The estimated budget for the implementation of the PMP during a 5 year period is US$ 42,000. Details are provided in the table below

Component/Sub-component	**Total US$**

Capacity Building	
Orientation workshops	3,000.00
ToT and Farmer group training (monitoring, prevention and control, technologies, safe use of pesticides)	3,000.00
Support/Advisory services	
Registration and training of all interested pesticide distributors/resellers under the Project	3,000.00
IPM problem diagnosis	3,000.00
Pest/ vector surveillance	3,000.00
Development of brochures on targeted Pesticides for use (Field guides/ IPM materials)	3,000.00
Public awareness/ sensitization campaigns	3,000.00
Emergency response support	6,000.00
Training on application methods and the use of certified sprayers or applicators to reduce the exposure	3,000.00
Environmental management	3,000.00
Pesticide monitoring in and around project areas	3,000.00
Reviews and reporting	3,000.00
Monitoring and surveillance	3,000.00
TOTALS	**42,000.00**

Conclusion Pesticide poisoning and pollution are two major negative effects of pesticides usage in agriculture. Policies and Laws governing pesticide use are inadequate and deficient in South Sudan and may not regulate the use of pesticides and protect workers and consumers. Context-specific policies and regulations are needed. In general, the overall potential negative environmental and social impacts that were anticipated as a result of project activities would develop as a result of the use of agrochemicals that may have negative effects on the people during the application and the biodiversity in general. In that line, therefore, the envisaged potential negative impacts concerning project activities could be addressed through the application of mitigation measures recommended in the Action plan. Overall, the study has determined that the implementation of the rice project will have some positive and negative impacts, but in the long term, the positive ones will outweigh the negative impacts. In addition, the Project's positive impacts will include improvement of rice production, job creation and income of people in the communities will be improved contributing to poverty reduction.

Recommendations (i) There is a need to strengthen the national policies, laws, and regulations on pesticides for the safe handling and use of pesticides. (ii) Wide-scale capacity-building efforts. An awareness program should be included to obtain optimized pesticide use (iii) Integrated pesticide resistance management should be included in farm practices in the Project area (iv) Proper pest monitoring, protective clothing, and application of pesticide at the right time at the right dose, and the right quantity should be integral parts of pesticide usage.

CHAPTER 1. INTRODUCTION

1.1 Project Overview

Climate Resilient Agri-Food Systems Transformation (CRAFT) Subproject; **the Aweil Rice Scheme (ARS)** is a proposed government initiative arising out of the 'High-Level Summit on Feed Africa: Food Sovereignty and Resilience' In Dakar, Senegal. The ARS Project aims to increase production and productivity and to improve food and nutrition security by transforming agriculture and livestock sectors in South Sudan. ARS prioritizes and targets **Rice** with enabling factors: food value chains; resilience through community-based approaches innovative and sustainable agricultural production through the formation of Farmers' Organizations; investing in transport infrastructure, improving storage infrastructure, and enhancing market systems. The Project is being prepared for financing by the African Development Bank (AfDB), and will be implemented by the Ministry of Agriculture and Food Security (MAFS) of the Government of South Sudan. It is envisaged that MAFS will work in collaboration with agricultural organizations based in South Sudan such as the Food and Agriculture Organization of the United Nations (FAO).

The African Development Bank's Feed Africa Strategy (2016-2025) aims to "**Transform African agriculture into a competitive and inclusive agribusiness sector that creates wealth, improves lives, and secures the environment**". Following the Dakar 2 Feed Africa Summit, the AfDB renewed its commitment to accelerate and scale up interventions for increased agricultural production and productivity, post-harvest value addition, and investments in soft and hard infrastructure for market access and inclusivity, to turn the continent into a continent that is able to feed itself, and a net exporter of agricultural commodities. South Sudan's Country Food and Agriculture Delivery Compact Programme focuses on increasing food production and productivity of four strategic value chains: rice, sorghum, sesame, and fisheries. By financing the ARS project, the Bank is delivering on its commitments to mobilize financing for the implementation of the Country's Food and Agriculture Delivery Compact presented at the Dakar 2 Summit. A key priority of the Country Compact is to empower the people of South Sudan to participate in agriculture and food systems by addressing the challenges that limit their participation, thereby enabling communities to obtain decent jobs, sustainable livelihoods, and food and nutrition security through engagement in agriculture and agribusiness.

The expected project beneficiaries include 661,483 people. These will include producers, processors, rural entrepreneurs, and government staff at local and national levels, staff and faculty at the identified training institutions, private sector actors – including traders, agro-dealers, among other. Youth and women will be a priority target group. Inclusion quotas for youth and women will be applied across project activities. This will be monitored ensuring the youth inclusion levels and levels of female participation. The project will target, 50% women to benefit across project activities, of which 30% will be young women between the ages 18-35 years. The remaining beneficiaries 50% will be men, of which 30% will be young men between the ages18-35 years.

The Project is aligned to the sustainable development goals (SDGs): SDG1 (no poverty), SDG2 (zero hunger), SDG 4 (education, technical and vocation skills for decent jobs), SDG 5 (gender equality), and SDG 8 (productive employment), and SDG 13 (climate action). It is also aligned with the African Union's (AU) Agenda 2063 for a Prosperous Africa, based on Inclusive Growth and Sustainable Development. The project also aligned with the Bank's Interim-Country Strategy Paper (I-CSP, 2022-24) that aims to provide an enabling environment for a diversified and resilient socio-economic development and reducing fragility. The I-CSP's single priority objective is ***Agriculture value chains development for economic diversification and resilience***

and thus is expected to boost production and productivity to ensure food and nutrition security; diversified the economy, creating jobs and contributing to cross-cutting issues such as addressing climate resilience, green growth, gender inclusion and fragility

The initiative is anticipated to build on Bank-supported activities implemented by FAO: Building Resilience of Food and Nutrition Security in the Horn of Africa (BREFONS) South Sudan, and the related Africa Disaster Risk Financing Programme (ADRiFi); Strengthening Emergency Preparedness and Response to Food Crisis (SEPAREF); South Sudan Emergency Food Production Programme (SSEFPP); and Agriculture, Markets and Value Addition (AMVAT). The project builds on the Netherland's-supported Fisher Community Resilience Enhancement Project; and will optimize synergies with World Bank's (WB) Resilient Agricultural Livelihoods Project), IFAD Rural Livelihood Project (SSRLP), IFAD Rural Enterprises for Agricultural Development, and World Food Programme (WFP) home-grown school feeding to be launched in 2024. Project interventions will address these challenges directly through implementation of activities under 3 project components: 1) Developing climate adaptive and resilient production systems; 2) Strengthening value chain development, women and youth entrepreneurship and private sector development, and 3) Digitalization and skills for jobs and entrepreneurship.

The project activities: entail Climate-Adaptive Production particularly scaling up climate-smart production systems focusing on the development/rehabilitation of the Aweil Rice Scheme, Scaling up climate-smart production systems. The production of improved climate-adapted seed – introducing Early Generation Seed (EGS) in collaboration with TAAT through establishing seed multiplication and demonstration sites supplied with quality declared seeds (QDS) and other inputs; Training of Trainer (ToT) of 20 extension staff; training of 3,000 seed farmers and 30 organized Seed Enterprise Groups (SEG) of 10 farmers each, producing a total of 163 tons of improved seeds for own use and distribution as a SEG business line. Promotion of good agriculture practices through 240 farmer field and business schools (FFBS), and target 3,200 women who are also rice farmers, in gardening techniques. The project will develop 2,000 ha for irrigation, promote water use efficient technologies as well as malaria-preventative infrastructure design while also providing mosquito nets[2] - all benefitting 8,000 ARS farmers. It will also invest in soil and water conservation of 1,000 ha of degraded lands that will benefit 1,000 persons upstream of the Lol River watershed.

However; according to the Environmental and Social Impact Assessment report for ARS sub project, in the area of influence, agriculture is practiced with minimum to none application of agrochemicals. Few farmers use pesticides, though Government Officers through specific projects such as Locusts eradication occasionally apply pesticides for the control of migratory and outbreak pests such as locusts and armyworm. Herbicide use is becoming more common, though still amongst a small minority of the target populations. The project may encourage increased usage of pesticides as an option for pest control in the project areas.

This IPMP briefly summarizes current knowledge of the incidence of crop pests in the cropping and marketing systems of the ARS Project area where crop production is to be enhanced. The IPM Plan reviews relevant national policies and regulatory systems, and recent experience in the application of Integrated Pest Management techniques. These are followed by an outline of the budget for integrated pest management to be applied in ARS project Activities. The key pest problems likely to be encountered in the targeted Aweil Rice scheme crop production systems are indicated in a Table under specific crop value chain type.

[2] Sustainability is expected to be ensured as the awareness on the health benefits accrued from the use of the nets will be disseminated, combined with increased household income (due to irrigation) to purchase nets.

1.2 The Approach

The Integrated Pest Management Plan (IPMP) is designed to minimize potential adverse impacts on human and environmental health of pesticides through the promotion of Integrated Pest Management as well as training and supervision for the safe use and disposal of pesticides.

The Bank's Operational Safeguards objectives (SO4 and SO5) require the borrowers to manage pests that affect either agriculture or public health, therefore the Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. Therefore the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. Thereafter the project proponents (MAFS-SS) should incorporate in the project components a work plan to strengthen the country's capacity. Therefore the IPMP;

1. highlights the anticipated pests and pest management problems in the areas targeted by the project,
2. Review national policies and regulations for dealing with these pests,
3. Review the country's pest management practices including its experiences with IPM and
4. Outlines a work plan and budget for applying IPM to improve the effectiveness safety of pest management under the proposed project and
5. Defines a monitoring and evaluation plan for the implementation of the IPMP.

1.3 Methodology

The IPMP study methodology involved;

(a) Literature reviews (ARS Project Documents; Agricultural Sector Development Program (ASDP) Integrated Pest Management Plans; AfDB Safeguard Policies on Pest Management, among other relevant literature)
(b) Consultations with relevant government departments, (both national regional and local government officials)
(c) Consultations with the targeted farming communities.

An inventory of common pest problems in the project sites, and the practices commonly used by farmers to control these pests was undertaken, discussed and compared with adoption data available in the literature.

CHAPTER 2. POLICY, LEGAL, AND INSTITUTIONAL FRAMEWORK

2.1 Policy and Regulatory Framework

The control of pests and the use of fertilizers are critical to increased agricultural production. A number of sectoral policies will impact on the performance of the project. Key policies include; agriculture, land, water, environmental protection, and pest/pesticide policies.

There is no stand-alone policy or implementation strategy on IPM or organic agriculture in South Sudan. The Country is also not yet a signatory to the **Stockholm Convention** on Persistent Organic Pollutants (POPs) as well as the **Rotterdam Convention**; which promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals to protect human health and the environment from potential harm and contribute to the environmentally sound use of these chemicals therefore, is not party to and has not domesticated the laws of either of the two conventions.

The government of South Sudan (GoSS) applicable policies and laws that pertain to the ARS project activities include the following:

2.1.1 The National Environment Policy, 2015-2025

The National Environment Policy (NEP) 2015-2025 calls for a comprehensive ESIA to be conducted before project execution, the focus is on the potential negative impacts, the mitigation measures, management, and remediation. The objectives of the environmental policy seek to: (a) development activities require an Environmental and Social Impact Assessment (ESIA) and must obtain an Environmental Certificate before implementation; (b) approved development activities should conduct regular environmental audits; and (c) the Ministry of Environment and Forestry must review the issuance of all permits, licenses and compliance certificates.

2.1.2 The Agriculture Sector Policy Framework, 2015-2025

The Food and Agriculture Policy Framework (FAPF) of the Ministry of Agriculture and Food Security (MAFS) emphasizes the need to transform agriculture from a traditional/subsistence system and achieve food security through science-based, market-oriented, competitive, and profitable agriculture without compromising the sustainability of the natural resources for generations to come. Its strategic objectives include: Priority policies that quickly boost agricultural production, Make agricultural inputs, including credit facilities, affordable to farmers Develop and provide research and extension services and market linkages, Develop and strengthen institutional and human resource capacity Protect, regenerate, and conserve natural resources; formulate policy incentives for rational and sustainable management, and use.

2.1.3 The Health Policy 2016-2025

The National Health Policy 2016-2025 aims to ensure improved health services by defining new paradigms for health service delivery, health financing, strategic information, leadership and governance, human resources for health, and access to essential medicines. Policy objectives include strengthen: (i) organisation and infrastructure for effective and equitable delivery of the basic package of health and nutrition services; (ii) leadership and management of the health system and increase health system resources; (iii) partnerships for healthcare delivery and system development.

Guiding principles are: (i) health and health services as a human right; (ii) primary health care approach; (iii) decentralisation; (iv) partnerships; (v) international conventions and guidance; (vi) gender mainstreaming;

(vii) community participation; (viii) efficiency and effectiveness; (ix) respect for values and cultures. ARS project activities must aligned with the policy need to protect human health and the environment as well as preventing any adverse impact due to phytosanitary products, including pesticides and other agrochemicals.

2.1.4 The Public Health (Water and Sanitation) ***Act.*** **(2008):** Focus on the legislative framework on water and sanitation as an approach to addressing some of the health challenges. The Act regulates all activities related to pesticide registration, importation, storage, transportation, use, formulation, and any other related activities in the country through the National Pesticides Council (NPC) surveillance and monitoring of health and determinants of health the Act underpins all three aspects of Health: Protection Health Social Care and Quality Health Improvement.

2.1.5 The Labour Act (Act No. 64 of 2017)

2.1.6 The Pesticide Control Bill for South Sudan (Proposed as of 2021) currently there is no regulatory framework for the importation and use of pesticides in South Sudan. A draft pesticides policy has been prepared and is yet to be enacted**.**

2.2 International Policies

2.2.1 The International Plant Protection Convention (IPPC), 1951

The IPPC is an intergovernmental treaty overseen by FAO that aims to protect the world's plant resources from the spread and introduction of pests and promoting safe trade. The Convention introduced International Standards for Phytosanitary Measures (ISPMs) as its main tool to achieve its goals, making it the sole global standard setting organization for plant health. The first ISPM was adopted in 1993 and there were 44 adopted ISPMs, 29 Diagnostic Protocols and 39 Phytosanitary Treatments as of March 2021. These international standards: include; Protect sustainable agriculture and enhance global food security, and Protect the environment, forests and biodiversity

2.2.2 Convention on Biological Diversity (1992) The Convention on Biological Diversity adopts a broad approach to conservation. It requires Parties to the Convention to adopt national strategies, plans and programs for the conservation of biological diversity, and to integrate the conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programs and policies. The proposed programme is expected to conserve biodiversity, especially the rare and endangered species in the project area and its environs.

2.2.3 Ramsar Convention on Wetlands on Wetlands of International Importance ARS project activities involve production of rice under paddy conditions raising seedlings and planting materials raises fears of systematic use of pesticides by beneficiaries for crop protection. The project is therefore challenged by this convention and will have to ensure the rational use of wetlands (maintenance of their ecological characteristics).

2.2.4 Bamako Convention on the Prohibition of the Import into Africa of Hazardous Wastes and on the Control of Transboundary Movements and the Management of Hazardous Wastes Produced in Africa, adopted in Bamako on 31 January 1991

2.2.5 ***African Development Bank Group - Updated Integrated Safeguards System (2023) E&S Operational Safeguard 3.*** Resources Efficiency and Pollution Prevention and Management

OS3 recognizes that economic activities often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. The objectives of OS3 are as follows: To promote the sustainable use of resources, including energy,

water and raw materials, To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, To avoid or minimize project-related emissions of short and long-lived climate pollutants, To avoid or minimize generation of hazardous and non-hazardous waste, To minimize and manage the risks and impacts associated with pesticide use. The applicability of this OS is established during the environmental and social assessment described in OS1.

2.2.6 International Code of Conduct on the Distribution and Use of Pesticides – (Revised Version – 2003).The International Code of Conduct on the Distribution and Use of Pesticides was one of the first voluntary Codes of Conduct in support of increased food security, while at the same time protecting human health and the environment. It's the worldwide guidance document on pesticide management for all public and private entities engaged in, or associated with, the distribution and use of pesticides. The code is designed to provide standards of conduct and to serve as a point of reference about sound pesticide management practices, in particular for government authorities and the pesticide industry. The revised version of the International Code of Conduct on the Distribution and Use of Pesticides by Council Resolution 1/123 includes the life-cycle concept of pesticide management and an expanded definition of IPM as well as strengthens the monitoring of the Code and explicitly invites governments, the pesticide industry, NGOs and other interested parties to provide regular feedback on its implementation. The Code demonstrates that pesticide management should be considered a part of chemical management, as well as of sustainable agricultural development. This means that collaboration, cooperation and information exchange between various government and nongovernment entities, in particular those involved in agriculture, public health, environment, commerce, and trade, have become increasingly important.

2.2.7 International plant Protection Convention of FAO (1952)

The IPPC is an international treaty to secure action to prevent the spread and introduction of pests of plants and plant products, and to promote appropriate measures for their control. It is governed by the Commission on Phytosanitary Measures (CPM) which adopts International Standards for Phytosanitary Measures (ISPMs).

2.2.8 World Food Security and the Plan of Action of November 1996

This declaration seeks to secure effective prevention and progressive control of plant and animal pests and diseases, including especially those which are of trans-boundary nature, such as rinderpest, cattle tick, foot-and-mouth disease and desert locust, where outbreaks can cause major food shortages, destabilize markets and trigger trade measures; and promote concurrently, regional collaboration in plant pests and animal disease control and the widespread development and use of integrated pest management practices.

2.3 Institutional Framework

MAFS plays a major role in the import and distribution of pesticides in the country, and provides training to staff working in plant protection departments around the country. In turn, the staff members of the plant protection departments are involved in training of field extension workers and farmers. However, due to lack of facilities, trained personnel and funds, inspection tasks such as checking on package, labelling, test for quality and residue in plant parts, animals and soils are not taking place as expected.

Local distribution of pesticides is carried out by the State MAEF at the counties. There is no official private sector distribution of pesticides, but minimal informal activity. Pest management advice is mainly delivered through the extension system run by MAFS.

The South Sudanese government has collaborated with international and national partners to create a national plant protection organization (NPPO) and prepare a framework for phytosanitary ARS. This is to enhance the

nation's regulatory framework through the creation and enforcement of legislation. Aimed at expanding the nation's market access as well as protect the environment, livestock, and public health. IGADs; the Centre for Pastoral Areas and Livestock Development (ICPALD) approved the National Sanitary and Phytosanitary (SPS) Strategy for South Sudan. The strategy seeks to enhance the nation's sanitary and phytosanitary (SPS) measures' current state, obstacles, and future directions. SPS technical specialists from around the nation reviewed the plan, which is in line with the IGAD regional SPS policy. It is anticipated that the Line ministries will incorporate the plan into federally and donor-funded initiatives.

CHAPTER 3. DESCRIPTION OF BASELINE ENVIRONMENT

3.1 Introduction

The proposed ARS Project will focus on implementing activities on an integrated approach to improve value chains through increased productivity of targeted crops and forging sustainable market linkages. ARS Project will be implemented in Northern Bahr el Ghazal, focusing one crop (rice production) in the state.

3.2 Project Location

Aweil Rice Scheme is located in Northern Bar el Ghazal state Aweil County in northwestern part of South Sudan, near the International border with the Republic of Sudan and the Abyei Region. This location lies approximately 800 kilometers by road, northwest of Juba, the capital and largest city in the country. The coordinates of Aweil are: 8° 46' 02.00"N, 27° 23' 59.00"E (Latitude: 8.7671; Longitude: 27.3998).Aweil town is the capital city of Northern Bahr el Ghazal. The town's infrastructure is relatively developed. The topography is flat and is prone to flooding, although the city itself lies on higher ground that the surrounding plains. The city lies close to the confluence of the Lol River with the Pongo River. The average elevation of the city of Aweil is about 425 meters (1,394 ft) above sea level.

0-1 Table 1: ***ARS Project implementation sites***

State	County	Location/ Payams	Priority Value chain
Northern Bahr el Ghazal	Aweil; East, Central West, South	AWS	Rice

3.4 Physical Environment

3.4.1 Topography and Hydrology of the project site

The flat topography is prone to flooding and lack of drainage significantly affects crop production in the project area, inundation during the wet season can suffocate plant root zone & during the dry season the plant die from shortage of moisture.[3] The proposed command area has flat plain topography with an insignificant slope gradient to drain out water from rainfall or Lol river spill flood. Several portions of the command areas are found to be inundated and flooded during the wet season. An analysis of satellite imagery datasets shows that the Bahr el Ghazal swamps spatial size varies, over six years between 2014 and 2019. This is in response to seasonal and internal changes in inflows. The findings showed that the areas flooded from each tributary were actually quite separate, and not a continuous swamp. The evaporation flux from the Bahr el Ghazal wetland has been estimated using thermal infrared remote sensing data and a parameterization of the surface energy balance (SEBAL model). It is concluded that the actual spatially averaged evaporation from the wetland over 3 years of different hydro meteorological characteristics varies between 1460 and 1935 mm/yr. This is substantially less than open-water evaporation (Mohamed, et al 2006). The elevation rises slightly towards Odhum village and along the railway and highway road to Khartoum town. The flat topography and lack of drainage affected existing crop production & rural settlement in the project area, inundation during the wet season plants may experience water logging & during the dry season, the plant is likely to have moisture stress. Therefore, the project should envisage a sufficient & effective drainage system (sub-surface drainage) to avoid excess flooding in the project area. Papyrus and grasslands dominate the flooded areas. Minimum wetland area

[3] Moukaddem, Karimeh (2011). *"South Sudan's tropical forests fast disappearing"*. Sudan.net.

is noticed in May and June at the end of the dry season and the maximum is noticed in November and December at the end of the wet season. The mean annual wetland area in Bahr el Ghazal during the study period was 7158 km2 (Mansour, 2022)

3.4.2. Geology & Soils

The major soils found in the project area are black vertisol which occupies most of the command area; others are alluvial deposits and brownish soil observed along the existing dyke and structures. Over the years spills from the Lol River and flooding brought silt that dispersed in the project field, also resulting in clogging of structures. The regional geological setup of the Lol River basin consists of a thick Sedimentary non-marine clastic Sequence of Jurassic-Cretaceous and Tertiary age. It includes thick lacustrine shales and claystones, and floodplain, lacustrine, fluvial and alluvial sandstones as noted in the geological study findings. The study further recommends sandstone layer which is laid under the black soil layer as suitable construction material for the dyke embankment

3.4.3. Climate

South Sudan's climate is primarily tropical, however, the far northern and south-eastern parts have a warm semi-arid climate. Rainfall occurs in a single rainy season from March to November and peaks from May to September. Altitudes in Southern Sudan range from 600 to 3000 meters above sea level. Southern Sudan has a sub-humid climate. The lowland areas including Bahr el Ghazal (project area) receive between 700 and 1,300 mm of rainfall annually. However, there is evidence that rainfall is decreasing, and this is likely a result of climate change (USAID, 2007). There is no meteorological station operational in the proposed project area.

Temperatures in Southern Sudan are typically above 25°C and can rise above 35°C, particularly during the dry season, which lasts from January to April of each year. For pastoralists, the hot, dry conditions trigger seasonal human and livestock migration to more permanent water sources (the toic), which serve as dry season grazing pasture, and for some ethnic groups, as well as fishing grounds along the river riverine. At the onset of the main rains (April to June), people and cattle return to upland wet areas.

Among the impacts of climate change are: (i) loss of agricultural production potential increasing famines and general food insecurity; (ii) negative impacts on rain-fed agriculture; (iii) loss in pastureland productivity and reduced access to water resources for livestock; (iv) increase in disease and pest occurrence for humans and livestock as well as crops; (v) reduction in production potential due to habitat degradation could result into human conflicts (inter-community conflicts over resources); and, (vi) destruction of infrastructure through intermittent flooding.

3.4.4. Water resources

Lol River is the main surface water source in the project area. Seasonal fluctuation in the river system is considerably high and the river is flowing in full potential during the wet season that lasts for four months from June/July to Sept/October. The base flow for the rest of the months is considerably low and the flow observed during the dry period that lasts from Jan/Feb to May/June is so meager.

Other water resources in and around the project area include streams with intermittent flow, swamps, seasonal flood plains, artificial ponds, and groundwater sources. Groundwater is the major source of water supply to the people, and the groundwater table of the shallow well is about 4m during the wet season the water level rises and can come up to the ground. There is no water quality analysis lab and hence no baseline water quality data is available, no monitoring is conducted to check whether groundwater points and supply are polluted or not. Spills from the Lol River and flooding of the proposed and potential farms were mentioned to be the major problems that affected crop production and resulted in other adverse socio-economic impacts. The previous EIA study & observation in Feb 2011 indicated that about 50 % of the project command (430ha) and the

surrounding area became under flood during the wet season and the height of the inundation reached up to 1.5m.

3.4.5. Flora and Fauna

The main vegetation types in the project area include grassland, shrubland and scattered trees, and riverine vegetation. The grassland, inundated area in the command area and elsewhere in the flood plain, as well as the Lol River and riverine forest & woodland provide important habitats for wildlife. Aquatic flora include shrubs and tall grasses as seen in the figure below

The proposed command and surrounding area provide suitable habitat for various fauna species. Some of the fauna include Baboons, Antelope, Hippos, leopards, Cheetah, Aardvark, Zebra, Bushbuck, as well as Common warthog, Giraffe and Oryx, and various bird species. There is no nationally protected area in the proposed command land. Protected areas in the project's surrounding area (USAID 2007) The project development is expected to have no impact on these important wildlife habitats as they are located upstream of the proposed AoI.

3.4.6. Land use & land cover

The present soil & land survey (2013) indicated that the main land cover of the project area is natural vegetation (85.9%) which consists dominantly of grassland and some shrubs. Livestock grazing is the main land use utilization of the natural vegetation (grass & shrub). Crop cultivation constitutes about 14.1% of the total project command area which is based on rain-fed crop production. Such vegetation cover has significant importance in the regulation of Lol River flow and prevention of sedimentation affecting the project irrigation infrastructure.

Present land use in the proposed rice crop production is highly constrained with flooding and lack of drainage, grass growth inundation and livestock grazing observed during the site visit: but the land is expansive and grazing usually practiced following the end of the wet season and recession of flooding which occurs after crop harvesting. Majority of the project command area is dominated with flood plain (land extremely unsuitable for settlement). The area is under swampy conditions. There are also grass species used for roofing dwellings as well as for selling especially by women but this livelihood is significantly **not** under threat as the area is expansive and the cropping area is insignificant. Figure below shows the Aweil rice scheme area of influence.

3.5 Socio-Economic Environment

3.5.1. Administration Population and Settlement Pattern

The project is located in Northern Bahr el Ghazal State (NBGS) and fall under four zones of the state. The total population residing in this zone is 147, 574 people (Table 4.5).

0-2 Table 2: ***Administrative and population in the project area***

Zone	Name of the Rice Farm	Population		Total
		Male	Female	
Aweil town	Aweil town	20785	25388	46173
Aweil West	Lolkou	15000	15733	30733
Aweil West	Mariem	17755	18580	36335
Aweil West	Karkou	17000	17333	34333
				147574

Source: Ministry of Physical Infrastructure NBGS, Directorate of Water & Sanitation

The population of the Aweil city fluctuates. During the dry season, the population is lower as the plain-dwellers return to the plains to tend to their gardens and harvest their crops. When the rains come and the plains flood, they return to the city, to escape the raging waters.

3.5.2 Economic Activities & use of the Natural Resource

Economic activities in the project area and in South Sudan at large were greatly affected and people suffered food shortages, lack of basic services and lack of infrastructure and overall insecurity during the three decades of the civil war. The peace agreement in 2005 is the turnkey to change the situation, followed by the January 2011 referendum that led to the establishment of an independent South Sudan Government. Owing to the flood plain agro-climatic zone, majority of the people rely more on livestock production. Crop production (principally rice) is an important economic activity in the high potential Aweil rice farming area. However, it should be supported with flood protection & irrigation structures for supplementary irrigation to ensure crop production. Aweil town is the most densely populated town and capital of the Northern Bahr El Ghazal State (NBES) and has more developed service and infrastructure and has various economic activities. There are also settlement centers around the farm like in Lolkou, Mariem and Karkou. Economic activities in these settlement centers include trade, shop-keeping, hotels, etc. The tall grasses found in the flood plains and wetland are used for hut roofing, and also for making local materials sold to improve households and family income. There exists no commercial fish production despite the potential for fishery. The extensive swamp and diversity of bird species can provide opportunity for tourism, especially an attractive destination for bird watchers.

CHAPTER 4 COMMON PESTS AND PESTICIDES IN PROJECT AREA (with respect to crops to be planted)

4.1 Major Pests and Diseases

Agricultural production in South Sudan remains largely traditional with low yields. In the cereal subsector, for example, it is widely acknowledged that the vast majority of farmers do not use high-yielding seeds nor do they use any synthetic fertilizer or herbicide. Farmers in most AWS project areas practice slash-and-burn agriculture on relatively small plots (an average of two feddans per household). Cereals, especially sorghum, are grown as a staple, with additional crops being small amounts of vegetables, some of which are sold for cash and domestic consumption. Other crops include cassava, groundnuts, sesame, maize, finger millet, cowpeas, beans, and pigeon peas, vegetables (onions, okra, tomatoes, cabbage, eggplant, cucumber and pumpkins). Rice production was expanded under the Aweil Rice Scheme which collapsed during the war. At the present time minimal rice production is continuing by farmers who adopted rice production outside the scheme. Vegetables are grown on relatively small pieces of land, not exceeding ¼ feddan per household. Crop pests and vectors cause economic losses. Although no systematic loss assessments have been undertaken.[4]

The key broad categories of pests and vectors include insects, weeds, storage pests, plant and vertebrate pests including rats and birds. Common insect pests in the project areas include the elegant grasshopper (Zonocerus sp.) that attacks cassava, boll worm and cutworms that attack vegetables, stalk borers that attack sorghum and aphids that normally attack vegetables. Common plant diseases include Rust (fungus) that attacks sorghum and the Grain molds which attacks rice. All crops are affected by weeds, numerous other weeds affect crops, springing up every year depending on crop type, farming system, rainfall, flood intensity, antecedent crops and cultivations, etc. Farmers' perceptions are that weed infestation and diversity is rapidly increasing. In fact, some farmers abandon previously cultivated areas and open up new areas in a new planting season partially because of the high weed infestation in the previously cultivated areas. The common weeds include Striga, Bidens pilosa (Spanish needle), Datura stramonium (Thorn apple), Galisonga parviflora (Gallant soldier), Guizotia scarbra (Sunflecks), Tagetes minuta (Mexican marigold). Crops are also subject to attack and spoliation during storage. Storage facilities typically comprise above-ground brick granaries and woven bamboo baskets). Aboveground storage is especially susceptible to attack by rats and weevils. The most prevalent vertebrate pests include the Red-billed Quelea (Quelea quelea) birds. These are more common in the project areas and are the most problematic pests while growing rice and other cereals. Rodents' pests including ground squirrels (Xerus erythropus) and cane rat (Thryonomys swinderianus) are more common in all the project sites

4.2 Pests and Disease Control

The farmers employed both modern and traditional methods in control pests and diseases such as pesticides through spraying and the use of local ash sprayed on the rice regularly to avoid crop infection. According to the farmers, ash was found to be effective although it requires a lot of labour during its application process in the rice fields. One of the major challenges to rice production was the issue of pests and diseases which the farmers would need to be trained on the effective use of chemicals and their environmental impacts. There is a need for coordination on the handling of agro-chemicals used to control pests and diseases. Furthermore, the need for the public sector to facilitate access to credit facilities for agrochemical trade and other inputs is required.

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[4] *https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/SouthSudan Infrastructure Action Plan Program.pdf,*

4.2.1 Rice

Insect, pest and disease management is vital in attaining sustainable rice production. Crop agronomic practices show an intense effect on the population of stem borer. The main management measure which is commonly used by farmers against these diseases and insect pests is mainly synthetic pesticides and other cultural practices as detailed below is the 5 most common yield threating pest and diseases for rice crop;

0-1 **Table 3** ***Five yield-threatening pests and diseases of rice***

***Nilaparvata lugens* (brown planthopper)**		Brown planthoppers are probably the most serious insect pest of rice in Asia, causing severe damage and reduced crop yields. These small, flying insects suck sap from rice plants, causing them to wilt and eventually die. The feeding damage is commonly referred to as 'hopper burn'. Hopperburn begins in patches and rapidly spreads as planthoppers move from plant to plant. Using resistant rice varieties and removing weeds from filed bunds can help manage the problem.
***Leptocorisa oratorius* (slender rice bug)**		Slender leaf bugs are notorious for damaging rice grains directly. Adult and nymph rice bugs have piercing-sucking mouth parts that they use to cut the grain hulls and feed on the developing kernels. Their feeding activity can result in partially filled or empty grains. As a result, slender rice bugs are responsible for significant yield losses. Slender rice bugs can survive on weeds and grasses around paddy fields, which causes significant problems for control strategies. Cultural control options include the cultivation of bunds around paddy fields and the periodic burning of grass grown on the bunds and fallow fields.
***Rhizoctonia solani* (rice sheath blight)**		Rice sheath blight is a fungal disease that attacks rice plants, causing dark lesions on the sheaths and leaves. These lesions can expand rapidly, girdling the plant and leading to wilting and death. The fungus survives in the soil and floats on the standing water of the rice field. It spreads quickly in high humidity conditions and can devastate entire paddy fields. Recommended preventative measures include clean cultivation to eliminate the disease-causing fungus and crop rotation.
***Scirpophaga incertulas* (yellow stem borer)**		Yellow Stem Borers are a severe pest of rice, particularly in Asia. In regions where it occurs, it is found in almost every rice field, in each rice season. Yellow stem borers are the larvae of a moth species that bore into rice stems, disrupting nutrient flow and weakening the plant's structure. Infested plants exhibit 'dead hearts,' where the central shoot dies, leading to stunted growth and reduced yields. This pest is particularly challenging to control due to its hidden feeding behaviour. *Scirpophaga incertulas* has a large complex of natural enemies; however, these mainly occur at low levels. Conservation of these natural enemies is essential to maximize natural biological control.

***Pomacea canaliculata* (invasive apple snail)**		Invasive apple snails are a significant threat to rice crops. These invasive aquatic snails feed on young rice seedlings. The first symptom of damage is a reduced plant stand where snails have severed the plant stalk below the water level. They have a voracious appetite – a large adult snail can consume a blade of rice in 3-5 min. The life cycle of the invasive apple snail and its ability to grow and reproduce quickly make it a particular menace for rice farmers.
Xanthomonas oryzaepv. oryzae (Xoo)		Bacterial blight is caused by Xanthomonas oryzaepv. oryzae (Xoo) and affects the rice plant at the seedling stage where infected leaves turn grayish green and roll up. As the disease progresses, leaves turn yellow to straw-colored and wilt, leading whole seedlings to dry up and die

Source PlantwisePlus Knowledge Bank The gateway to practical plant health information https://plantwiseplusknowledgebank.org/.

The most prevalent vertebrate pests include the Red-billed Quelea (*Quelea quelea*) birds. These are the potential most problematic pests while growing rice and other cereals in the project area.

The potential chemicals that are likely to be used in a heightened production system may include; Lambda-cyhalothrin, Malathion, and zeta-cypermethrin, they are all broad-spectrum pesticides used on rice. Zeta-cypermethrin is better known as Mustang, while lambda-cyhalothrin is sold as warrior. (NRRI, 2024)

Other General Pest Problems and Their Management in the Project Area

Common pests in the project areas include: rodents and migratory and outbreak pests such as rodents, locusts, borers, caterpillar, nematode, aphid, mealy bug among others. IPM strategies are recommended and used by some farmers as much as it is possible because there is no one control practice that can provide acceptable control of the target pests.

Rodents

Rodents, particularly the field rats (*rattus rattus*), the small house mice (*rattus norwegicus*) and multi-*mammate shamba* rat, (*Mastomys natalensis*) are key pests of food crops. The most affected crops are OFSP, soybeans, pawpaw and cabbage. The damage caused by rodents starts at early booting and continues through the mature stage as well as the storage stage.Farmers are strongly advised to do the following to reduce potential damage to crops and the environment:

• Weeding for clean bunds and fields regular surveillance. The earlier the presence of rodents is observed, the cheaper and simpler any subsequent action will be and losses will remain negligible

• Store Sanitation. It is much easier to notice the presence of rodents if the store is clean and tidy

• Proofing i.e. making the store rat-proof in order to discourage rodents from entering

• Trapping. Place the traps in strategic positions

• Use recommended rodenticide. However, bait poisons should be used only if rats are present. In stores orbuildings, use single-dose anticoagulant poisons, preferably as ready-made baits.

• Encourage team approach for effectiveness. The larger the area managed or controlled with poison, the more effective the impact

• Predation Keep cats in stores and homesteads.

Migratory and outbreak pests

The key migratory and outbreak pests of economic significance in South Sudan are armyworm (*Spodoptera exempta*) and the red locusts with an exception of the elegant grasshopper; the management of migratory pests is majorly coordinated by the Ministry of Agriculture and Food Security (MAFS).

Locust

Locusts live and breed in numerous grassland plains/savannah zones. During periods with favorable weather, locusts multiply rapidly and form large swarms that can cause huge damage to plants in a very short period of time.

4.3 IPM Strategy for Pest Control

The integrated pest management is the adopted strategy for the fight against pests in the County. However, the use of the integrated combat is not widespread despite the efforts undertaken. The use of pesticides is increasing in spite of the high cost of the products relative to the financial capacity of majority of farmers.

0-2 **Table 4***: IPM Approaches for grains, pulses and vegetable*

Principles	**Cereals/grains**	**Pulses/legume**	**Vegetables**
Principle 1	Obtain good seeds	Obtain good seeds	Obtain good seeds and other planting materials
Principle 2	Select fertile soils and suitable planting sites	Select fertile soils	Select well-drained fertile soils for the nursery and the farm
Principle 3	Plan crop rotation	Plan crop rotation	Adopt good nursery practices
Principle 4	Adopt appropriate planting distances and planting patterns	Adopt appropriate planting distances and planting patterns	Practice rotation with appropriate crops
Principle 5	Plant crops at appropriate times	Plant crops at appropriate times so that their growth coincides with low pest and disease incidence	Adopt appropriate planting distances
Principle 6	Weed early and regularly	Weed early and carefully	Plant crops at the appropriate time
Principle 7	Adopt good soil management practices	Adopt good soil management practices	Weed early and carefully
Principle 8	Adopt suitable water management practices	Adopt suitable water management practices	Adopt good soil management practices
Principle 9	Visit fields regularly	Visit fields regularly	Adopt suitable water management practices

Sources: Integrated Pest Management Extension Guide 4/Integrated Pest Management

4.4 Key Pests and Recommended Management Practices

4.4.1 Major Natural Enemies and Enhancing Natural Enemy Populations

One important aspect of the IPM approach is the role of natural enemies. Natural enemies are the predators and parasites, parasitoids and beneficial micro-organisms that attack crop pests and disease organisms. Predators are hunters that usually feed on a range of insects or other animals, while parasitoids

are often very specific to a certain pest in which they develop. The table below shows the major natural enemies and the pests they feed upon.

0-3 **Table 5** ***Major natural enemies and the pests they feed upon***

Natural Enemy Groups	**Examples**	**What they feed upon**
Predators	Predatory mites	Pest mites and thrips
	Spiders	A wide range of insects, such as flies, aphids, caterpillars, butterflies, moths, plant hoppers
	Mantis	A wide range of insects, such as flies, aphids, moths, caterpillars
	Assassin bugs	Other bugs, aphids, leafhoppers, maggots, caterpillars
	Predatory ants	Insect eggs, caterpillars, grubs, maggots, termites
	Ladybirds (larva and adult)	Aphids, scale insects, mealy bugs, white flies, mites
	Lacewings (Larvae only)	Aphids and other soft-bodied insects, as well as insect eggs and mites
	Ground beetles (larva and adult)	Caterpillars, grubs, bugs, beetles, maggots
	Hover fly (larvae only)	Aphids, thrips and other soft-bodied insects
	Robber fly	Caterpillars and small insects
Parasites	Parasitic wasps	Caterpillars, aphids, scale insects, maggots, mealy bugs, white flies, insect eggs, beetles
	Parasitic flies	Caterpillars

Source: Integrated Pest Management Extension Guide 1. Principles of Integrated Pest Management:

Populations of natural enemies can be increased in the field so that they help to control crop pests. Simple techniques for doing this are based on creating a conducive environment for their development and on providing attractive substances to concentrate them on infested crops including;

a. Minimize the use of chemical pesticides, as these will kill the natural enemies and thus reduce their populations; if it is absolutely necessary to spray crops with pesticides, use selective rather than broad- spectrum pesticides;
b. Mulch crops with dried leaves and other plant materials; mulch provides protected, cool and moist sites suitable for the breeding and resting of natural enemies such as predatory ants, spiders, centipedes and ground beetles;
c. Predatory ants are attached to sugar/water solutions; prepare and spray on the leaves of the infested crop; this solution will attract ants onto the crop plants where they will prey on thus eliminate the pests;
d. Leave strips of flowering weeds around the crop field to serve as a refuge for natural enemies.

4.4.2 Recommended IPM Practices for Rice Crop Pests/Diseases

0-4 **Table 6***: Major Rice pest problems and recommended management practices*

Pests	Name	Recommended management practices
Insect	Stem borers (Three families; Noctuidae, Diopsidae, & Pyralidae)	● Clipping the seedlings tip before transplantation is done to eradicate the egg masses. ● Postponing of sowing and transplanting time is considered a good practice in escaping moth's ● first-generation and it can also decrease the density as well as damage of stem borers ● Biological control of stem borers mostly comes from native parasites, predators, and entomo-pathogens. Over 100 species of these parasitoids have been recognized. ● Chemical control repeated foliar applications. Granular insecticides, particularly diazinon and gamma BHC, are most effective than foliar sprays,
Insect	Armyworms and cutworms	● Agronomic Methods: Seedbeds should be made away from grasses and weeds areas to avoid cutworms and armyworms ● Use of resistant rice varieties ● Biological Methods: Cutworms have several natural enemies. ● Timely apply recommended insecticide or botanical extract.
Insect	Ants	● Agronomic Methods: Ants usually attack at seeds after sowing so in order to reduce loss, an increased rate of seeds is used. ● Chemical Methods: Seed coating with powdered insecticides helps to control ants in rice fields.
Insect	Rice gall midge Orseolia oryzae (Wood-Mason)	● Agronomic Methods: The use of suitable amounts of nitrogen fertilizer in split doses on different growth stages. ● Biological Methods: Numerous predators and parasites attack at gall midges. ● Selection of tolerant varieties ● Timely harvest ● De-husking and shelling ● Proper drying ● Sorting and cleaning of the produce ● Cleaning & repair of the storage facilities ● Use rodent guards in areas with rat problems ● Use improved granaries ● Use appropriate natural grain protectants where applicable with recommended dosage. ● Keep the grain in air tight containers/bags and store safely. ● Carry out regular inspection of the store and produce. ● Timely detection of any damage to the grain and/or storage structure is essential to minimise potential loss or damage. ● Promote biological control of LGB using *Teretriosoma nigrescens* (Tn) to minimize infestation.
	Rice water weevil (Lissorhoptrus oryzophilus)	● Agronomic Methods: Early planting of rice can skip the time of pest attack and reduce the yield loss. ● Chemical Methods: Granular insecticides are applied at the appropriate time. ● Biological Methods: The fungus, Beauveria bassiana, attack on rice water weevil.

Diseases	Seedling Blight	● Agronomic practices, such as sowing of early maturing varieties ● Treating seed with seed-protectant fungicides (e.g. mefenoxam, metalaxyl, thiram, and mancozeb) ●
Diseases	Water Mold; fungal (Achlya sp. and Pythium sp.) disease.	● Draining and flushing the seeding prevents water mold. ● Seed treatment with fungicides ● Removal of infected plants
Diseases	Rice blast (causative agent is Pyricularia oryzae)	● burning and destroying the diseased plant debris and stubble, ● Avoid over nitrogen fertilization as this increases the plant's receptiveness to the disease. ● Early planting, ● Use of healthy seed, ● dusting the seed with the seed dressing organic mercurial fungicides, ● spray the crop with organo-mercurial, cultivation of resistant varieties, ● avoid excessive application of irrigation water and utilize good water ● Management to ensure that plants do not experience water stress. Crop rotation ● Deep plough of the crop residues ● Plant recommended resistant varieties e.g. H6302, UH6010, TMV-2, H614. ● Removal of infected plants
Weeds	Various	● Hand pulling and hoe weeding ● Intercropping ● Improvement of soil fertility ● Tillage ● Proper land preparation ● Timely weeding (after planting) ● Apply recommended herbicides

4.4.5 Management of post-Harvest pest for rice grain

The most important post-harvest pest of rice grains include; the storage weevil and the and storage. Losses due to damage caused by these pests can be minimized through the Following IPM strategies:

• Dry seeds properly immediately after harvest and before storage to prevent attack by storage pests and diseases.

• Divide seeds into batches for short term (less than 3 months) and long-term storage,

• Clean the store properly before storing pulses there; use containers that are airtight and clean, and do not allow humidity to build up.

• Use rodent guards in areas with rat/rodent problems

4.4.6 Pesticide applications –cereals, pulses and vegetables - In line with IPM approaches

1. A decision to use chemical pesticides should be taken only as the very last resort and should also be based on conclusions reached from an agro-ecosystem analyses (AESA).
2. All pesticides should be approved and recommended.
3. If it is absolutely necessary to spray, use selective rather than broad- spectrum pesticides.
4. All pesticides should be applied using appropriate (knapsack) sprayers.

5. All the insecticides for storage pests of cereals/grain are in dust or liquid form and therefore used as supplied without mixing with anything else.
6. The list of pesticides may change as new products are recommended and/or some of the chemicals are withdrawn. Therefore always consult the retailer/stock list.

4.5 Controlling Pesticides used in Crop Protection:

- Every pesticide produced in is subjected to registration and approval however presently South Sudan does not operate a functional registration and approval system
- To ensure the efficient use of the pesticides for the fight against crop pests/diseases, the maximum residues limits (MRL) have been defined by European markets/EU standards, if not it is the codex alimentarus that is considered. South Sudan is required to comply with sanitary and phytosanitary measures (SPS) and the pesticides residue values available in farm products that should not exceed the acceptable MRLs, otherwise produce from South Sudan will be banned. There are no restrictions on MRL for crop products sold locally.

4.6 General health problems and environmental hazards associated with pesticides

There are acute and chronic health effects and these effects may manifest as local or systemic effects. They include skin irritations, such as itching, rashes, blisters, burns, wounds, irritation of throat leading to cough or difficulty in breathing with or without wheezing or choking, chest pain, burning mouth and throat with pain on swallowing, runny nose, sore throat, head ache, dizziness, and sudden collapse with or without unconsciousness.

0-5 **Table 7** ***Pesticide problems relating to health, environment and crops***

Hazards to health	**Hazards to Environment**	**Hazards to crops**
Acute poisoning: 3 million poisonings including 20,000 unintentional deaths occur annually (WHO). Symptoms of acute poisoning include severe headaches, nausea, depression vomiting, diarrhea, eye irritation, severe fatigue and skin rashes. Chronic ill-health problems can affect women and men, exposed to pesticides, whether because of their occupation or because they live near areas of use. Problems may include neurological disorders, cancers, infertility, birth defects & other reproductive disorders.	Contamination of drinking water and ground water. Water contamination kills aquatic organism & Contamination Soil Wildlife and domestic animals may be affected by spray drift or drinking contaminated water. Exposure may also cause infertility and behavioral disruption. Persistence in the environment and accumulation in the food chain leads to diverse environmental impacts. Loss of biodiversity in natural and agricultural environments	Pesticides resistance: 520 species of insects and mites, 150 plant diseases; and 113 weeds are resistant to pesticides (FAO). Resistance can create "treadmill syndrome", as farmers use increasing inputs to little effect, while elimination of beneficial insects causes secondary pest outbreaks. High cost of pesticides lead deceased incomes for farmers: Newer products tend to be safer, but are more expensive. Farming communities lose knowledge of good Agronomic practices & become dependent on expensive external inputs.

CHAPTER 5 POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND MITIGATION MEASURES OF THE USE OF PESTICIDES PRODUCTS

The use of various agrochemicals especially pesticides is more likely during the implementation stage under this project. Currently pesticides are often applied without Personal Protective Equipment (PPE) resulting in significant health risks. The country and the project location have a challenge with the regulatory and supervisory services during usage. Many sellers and users do not meet the profiles required by the profession. The situation is such that empty pesticide packaging, are used to store transport and even serve food and beverage products (including water, milk, cooking oil, salt. etc.)

5.1. Critical steps in pesticide management

Uncontrolled use of pesticides has negative impacts on the human and the environment. The impacts of toxic products on human and environment are related to their concentration in the target organs. The foreseeable risks are related to the following steps:

1. the storage of products;
2. handling and transport;
3. the dosage during the treatments (contamination of the applicators) that could be exposed to the effects of the pesticides when the standards of use are not respected,
4. The consumption of the products harvested immediately after their treatment if the populations are not sufficiently informed and associated with the preventive control.

The table below summarizes the environmental and social risks of pesticide management.

0-1 **Table 8***: Summary of the environmental and social risks of pesticide management methods*

Step	**Determinants**	**Risks**		
		Public Health	**Environment**	**Individual**
Transport	Lack of training	Discovery of pesticides in inhabited places	Accidental spill, ground water pollution by leaching	-Inhalation of product: steam, dust,-risk of skin contact
Storage	- Lack of means to realize the ware house -training deficit on pesticide management	Accidental contaminati on -Gene, nuisance of the nearby populations	Soil contamination	Contact with the skin by reversal caused by the exiguity of the places
Handling / manipulation	Training and awareness deficit	Contamination of water sources by washing containers	Soil contamination by accidental or intentional spill, groundwater pollution	Inhalation of steam, dermal contact by splashing during preparation
Elimination of Packaging/ containers	Training and awareness deficit	Ingestion of products through the reuse of containers	Dermal contact	Dermal contact
Washing containers	Training and awareness deficit	Dermal contact, wells contamination	-Intoxication of fishies and -pollution of wells and ponds, groundwater,	Dermal contact

			-Selection of resistance at the larval stage	

Quantities of unregistered or obsolete pesticides pose major risks to the health of humans, animals and the environment of the project area. The conditions of transport and storage of this toxic waste are often very precarious. This is a source of diseases of all kinds (cancer, rashes, and etc.) for humans. Moreover, with regard to the use of pesticides, its health consequences are often cases of death or intoxication. Indeed, over the years, there have been several cases of intoxication, including fatal for humans, livestock or the fish population that are not declared for lack of a good monitoring and documentation.

5.2. Populations at risk

Many people are exposed to the risks of pesticide management. This situation concerns both carriers and unauthorized resellers as well as manipulators (applicators) of these products. However, it should be noted that those involved in treatment operations are considered to be the most exposed link, although it is important to note that all other segments of the population may be at risk. Risks occur during:

- The application of pesticides for foot applicators and manipulators of the apparatus;
- Transport: contamination of containers, containers, bursting or spilling of drums;
- Monitoring during treatment or prospecting operations.

5.3. Negative impacts on the environment

The use of pesticides has several disadvantages and side effects, including environmental pollution and the risk of intoxication that justify the need to abandon the method and the use of other methods natural protection methods. Negative impacts on fauna, flora, soil, air, and water are:

(i) risk of mortality on non-target species that fulfill important ecological functions: bees and other pollinators, natural enemies of certain pests (parasites, predators, pathogens);
(ii) pollution during space treatments of parks and nature reserves, fishing and farming areas with contamination of fauna and flora;
(iii) water pollution either directly or through runoff;
(iv) Appearance of resistance in insect populations.

0-2 **Table 9***: Negative impacts of uncontrolled use of pesticides on the environment*

Receiving environment	Nature of the impact
Soil	• Falling fertility • Acidification • Alkalization • Salinization
Surface water and wetlands	• Loss of quality (contamination) • PH change
Well water or drilling Groundwater	• Contamination • PH change
Air	• Air contamination, • Olfactory nuisances

Biodiversity	• Chemoresistance of pests • Intoxication of wildlife • Poisoning and mortality • Reduction of number and/or biomasses • Disappearance of species or groups of species • Breaking off of ecological balance • Biodiversity erosion • Loss of natural habitats or useful species

5.4. Negative health impacts

Plant protection products intended to prevent and control pests and diseases in agricultural production have started to be harmful to humans and their environment. Thus, it should be noted that some plant protection product storage depots are:

- installed in inappropriate geographical areas (in the middle of agglomerations);
- constructed without respect for conventional standards (without holding tank, without sump and a firebreak);
- Poorly ventilated and poorly lit.

In addition, the personal protection measures and the recommended doses are not respected. Plant protection products cause burns, human poisoning (nausea, vomiting, dizziness, coma, death) and animal poisoning in rural areas, especially in vegetable growing areas, pollute water and air, destroy wildlife and dangerously modify the functioning of the ecosystem.

0-3 **Table 10** ***: Negative impacts of uncontrolled use of pesticides on health***

Receiving environment	Nature of the impact
Human health	• **Acute poisoning** - headache, dizziness, nausea, chest pain, vomiting, - rashes, muscle aches, excessive sweating, cramps, - diarrhea and breathing difficulties, staining and falling nails, poisoning, death • **Chronic poisoning:** - Lowering of cholinesterase levels, - Effects on the nervous system (neurotoxins), - Effects on the liver, - Effects on the stomach, - Decrease of the immune system, - Disruption of hormonal balance (brain, thyroid, parathyroid, kidney, adrenal, testes, and ovaries), - Risk of abortion (embryotoxins), - Mortality at birth (fetotoxins), - Sterility in humans (spermatotoxins)

5.5. Synthesis of minimization of the negative impacts of Pesticides

The use of pesticides by users could lead to environmental and social impacts or risks. Pesticides can cause the decline of soil fertility, cause its acidification and strengthen its content of heavy metals with various consequences, especially for the food chain. Their intrusion or discharge into groundwater or surface water

contributes to the increase of heavy metals, nitrates that may cause eutrophication phenomena and / or inconvenience or even destroy the fauna and flora.

Pesticides could also contribute significantly to the decline of the wildlife population, especially birds whose eggs do not reach hatching because of weak shell texture. In humans and livestock, the impacts can be mortality shock effects or be more insidious with the long-term accumulation that can cause, including mutagenic effects, loss of fertility, bronchopulmonary problems, etc. The following table outlines some measures that can mitigate these negative impacts of pesticides.

5.6 Impact of pesticides on aquatic fauna

Pollution from agrochemicals may also affect aquatic organisms in water bodies. The organisms may host vectors, pathogens and viruses. These can be transmitted to human beings by contact or through consumption of those aquatic organisms

5.7 Improper pesticide use and disposal of pesticide containers

This is caused by poor knowledge, inadequate equipment and storage. Pesticide containers have been found to be reused at homes. Improper washing or cleaning could lead to harmful consequences where containers are reused as food or drink containers. The population groups at risk include women, children, elderly and rural farmers who are mostly illiterate and principal users of empty containers without proper treatment. An increase in pesticide containers in the project area is expected during the implementation stage. Therefore a collecting system and disposal is required to minimize reuse of containers for domestic activities.

5.8 Abuses in pesticide supply and sales

The abuses associated with the supply and sale of pesticides are likely to occur under the Project and these abuses include:

1. Use of banned and or unregistered pesticides
2. Decanting of pesticides into improper containers without appropriate labels and use information at the retail level and farm gate points
3. Supply and sale by unauthorized persons /persons without license and permits
4. Supply and sale of adulterated and or expired pesticides

5.9. Synthesis of minimization of the negative impacts of Pesticides

The use of pesticides by users could lead to environmental and social impacts or risks. Pesticides can cause the decline of soil fertility, cause its acidification and strengthen its content of heavy metals with various consequences, especially for the food chain. Their intrusion or discharge into groundwater or surface water contributes to the increase of heavy metals, nitrates that may cause eutrophication phenomena and / or inconvenience or even destroy the fauna and flora.

Pesticides could also contribute significantly to the decline of the wildlife population, especially birds whose eggs do not reach hatching because of weak shell texture. In humans and livestock, the impacts can be mortality shock effects or be more insidious with the long-term accumulation that can cause, including mutagenic effects, loss of fertility, bronchopulmonary problems, etc. The following table outlines some measures that can mitigate these negative impacts of pesticides.

0-4 **Table 11*: Measures to Mitigate the Negative Impact of Pesticides***

Environment	Nature of impact	Mitigation measures
Soil	Falling fertility	• Popularize the use of manure or compost; • Use mineral fertilizer rationally; • Apply appropriate farming techniques and recommended by MAFS • Fight against erosion.
	Acidification	• Minimize and respect the dosages of nitrogen fertilizer use

		• Apply appropriate cultivation techniques
	Pollution by phosphates, heavy metals (Pb ++, ZN ++, Mn ++)	• Strengthen the pesticide control system; • Provide obsolete and outdated pesticide disposal devices; • Use pesticides efficiently; • Popularize and encourage integrated pest management
Surface and underground water	Pollution by nitrates, heavy metals	• Minimize the use of nitrogen fertilizers; • Establish empty container storage facilities and r their removal by the manufacturers.
Biodiversity	Chimoresistance of pest	• Practice the Agro ecosystem Analysis (AESA) before making decisions on the choice of pest management method; • Identify pests and pesticides that are specific to them; • Rational application of pesticides; • Diversification of pesticides used.
	Intoxication of aquatic and terrestrial fauna	• Educate users about the risks of intoxication; • Sensitize livestock farmers on watering at safe water points.
	Terrestrial biodiversity loss	• Apply integrated pest management methods (biological control, genetics, use of attractants, repellents,
Health	Intoxication Poisoning, Death, Cholinesterase	• Respect the storage and storage conditions of pesticides; • To sensitize the populations on the risks of food poisoning: • Strictly apply rational measures of use; • Use personal protective equipment.

CHAPTER 6 INTEGRATED PEST AND PESTICIDE MANAGEMENT ACTION PLAN

The pest and pesticide management action plan as part of the implementation of ARS project activities will make it possible to regulate the use of pesticides more effectively and specially to recommend a set of measures to limit the negative impacts. Its main purpose is to protect the biophysical and human environment through the promotion of the use of integrated pest management methods, capacity building of farmers, destruction of obsolete stocks, and environmental impact assessment of Agricultural development projects likely to use a considerable quantity of pesticides, the management of empty containers and the provision to farmers of protection and spraying equipment.

6.1. Priority issues identified in the project area

The following issues and constraints have been identified and prioritized as a result of stakeholder consultations to improve pest and pesticide management:

6.1.1. On the plan of Institutional, legislative and regulatory

- Insufficient regulation;
- Porosity of national borders;
- Lack of awareness
- Absence of database on rice pest and diseases;
- Insufficient human resources, equipment (efficient laboratories) and financial resources for the field monitoring of IPM approaches.
- Need for capacity building.

6.1.2. On the plan of capacities of the actors and the awareness of the populations

- Insufficient farmers training on pesticide use and management of empty packaging;
- Insufficient information of the populations on the dangers related to the use of pesticides;
- Illiteracy of the populations.

6.1.3. On the plan of technical management of pests

- Insufficient extension of alternative methods to pesticides and integrated pest management;
- Lack of efficient treatment and waste disposal systems;
- Unavailability of approved pesticides near farmers.

6.1.4. At the level of control and monitoring

- Insufficient control over the use of products (personnel and equipment);
- Insufficient control and monitoring of negative impacts related to pesticides (pollution, intoxication, etc.).

6.2. Plan for Integrated Pest Management

For the most part, the action plan is structured around the axes as indicated by the following logical framework:

0-1 **Table 12***: Logical framework of the pest management action plan*

Objectives	Activities to be implemented in response to identified problems	Indicators	Sources of verification
1: Strengthen the institutional framework for pest and pesticide management	Strengthen the capacity of action (financial and material resources) of the Ministry of Agriculture and Food Security and its representations in the **Northern Bahr el Ghazal state**	Number (Nb) of vehicles purchased or repaired available to divisions and operational units	Minutes of meetings
	Organize a regional workshop to share the Pest Management Action Plan	Number of workshops organized Number of participants	workshop organization report
	Ensure the development of effective pesticide regulations	Initiate the development of pesticide Regulations	Workshops report
	Promote an incentive policy to recover pesticide packaging and require production / distribution companies to recover packaging	Number of empty packages recovered	Activity Report
2:Strengthen technical and organizational measures for the management of pests and pesticides	Support research institutions and universities to develop technologies and alternatives to pesticides, seeds and planting material resistant to diseases and pests	Types and number of rice and seed varieties	Activity Report
	Popularize techniques of alternatives to pesticides and methods of integrated pest management	Number of extension sessions	Minutes
	Disclose periodically / regularly the list of registered pesticides	Number of publications	Disclosure
	Make available to farmers the results / technologies resulting from research (Local radio, brochure, etc.)	Number of diffusions carried out Number of brochures	Project activity report
	Proceed with collection, storage and final disposal of obsolete and outdated chemicals products	Number of pesticides seized	Minutes of confiscation
	Proceed to recycle some empty packaging	Quantity of empty recycled packaging	Minutes of the operation
	Prepare Information-Education-Communication (IEC) booklets so that Populations (farmers) are informed and sensitized on IPM approaches and the responsible use of pesticides.	Number of training booklets produced	Activity Report
	Subsidize farmers in the acquisition of personal protective equipment	Number of farmers with Personal Protective Equipment (PPE)	Reports
	Develop database with appropriate formats in collaboration with the MAFS	Database	Database Report

Objectives	Activities to be implemented in response to identified problems	Indicators
3 : Capacity building of actors involved in integrated pest management	Conduct IEC to farmers and populations on IPM approaches and the judicious use and management of pesticides, hazards and good hygiene practices in the use of agricultural inputs	Number of IEC Nu of participants
	Strengthen the exchange of information on pesticide management with other stakeholders involved in pesticides.	Number of meeting
	Train regional health officers on the management of poisoning cases due to pesticides (toxicology) and set up a database to monitor cases of intoxication.	Number of health w Existing database
	Actively involve civil society, including outreach committee in information / education / communication in popularizing approaches to integrated pest management	Number of commu involved in IEC on pesticide m
4 : Provide control, monitoring and evaluation of pest and pesticide management	Perform periodic checks and analyzes	Number of check carried out
	Provide supervision and final evaluation of the PMP	Number of m evaluation mission
	Provide post-clearance import control before customs clearance	Number of checks

6.3. Participatory Monitoring and Evaluation Plan

The monitoring will verify, in the field, the accuracy of the assessment of certain impacts and the effectiveness of certain mitigation measures provided for in the PMP, and for which there is still uncertainty in the analysis of data to verify whether the implementation of the activities is proceeding as planned and to make immediate adjustments, if necessary. It is therefore a short-term evaluation activity to enable real-time action. The frequency of monitoring will depend on the type of information needed, however it will be ongoing throughout the implementation of the action plan.

Overall monitoring will be provided by the project's Implementation unit. It will be organized through periodic visits to the field. A comprehensive monitoring plan will be developed and made available to other actors involved in the implementation and who are challenged; each as far as it is concerned, in monitoring.

6.3.1. Activities to monitor

To measure the effectiveness of the Pest Management Plan (PMP) on the level of reduction of the diseases and intoxications of the people concerned, particularly the safety in the treatment environment (in the field), the recommended actions should be the subject of monitoring / evaluation. Thus, all activities concerning the purchase and use of pesticides requiring quantitative or qualitative information on the environmental and social impacts and benefits of ARS project activities should also be monitored by the Environmental Unit.

6.3.2. Reference situation

The reference situation on the management of pesticides and agrochemicals products will have to be established as part of the overall study of the reference situation of the project. This situation should establish the basic level of indicators to be observed throughout the Project with regard to the progress made in the management of pesticides and other zoo-sanitary products, for a better and lasting protection of the different components of the biophysical environment and human (human, fauna, flora, and ecosystems).

6.3.3. Monitoring indicators

Indicators to be followed during the implementation of the project by the actors involved includes;

6.3.3.1. Strategic indicators to be monitored by the Environmental and Social Unit (ESC) of the project.

The strategic indicators to be followed by the ESC are:

1) Designation of Regional Environmental and Social Respondents at the level of the structures involved in the implementation of the project;
2) Regional workshops organized to share and disseminate the PMP before or just at the beginning of project implementation;
3) Number of actors trained / sensitized on good management practices for pesticides and their packaging;

4) Number of people subject to intoxication;

5) Number of complaints received.

6.3.3.2. Indicators to be followed by the project implementation structures

The indicators below are proposed to be followed by the project implementation structures:

0-2 **Table 13*: Indicators to be followed***

Designation	Indicators
Health and Environment	- Degree of toxicity of the pesticide products used; - Level of knowledge of good management practices (pesticides, empty packaging, etc.); -Level of impact on aquatic organisms and fauna; - Level of contamination of water resources.
Conditions of storage management of pesticides and empty packaging	- % of available and adequate storage facilities; - Level of risks associated with transportation and storage; - Level of control of spraying and impregnation processes; - Number of disposal equipment, functional packaging, quantity of packaging eliminated
Productivity	-Impact of the adoption of IPM on production performance of farmers

6.3.3.3. Indicators to be followed by other state institutions

During the implementation phase of the activities of the PMP, the monitoring will focus on the main environmental components (water, soil, vegetation and fauna, living environment, health, etc.) and will be provided by the State structures in charge of the project management of these components: Ministry of Environment and Forestry, Ministry of Health; National Laboratories etc.).

6.3.4. Responsibilities for monitoring of the PMP

The PCU will be responsible for implementing of the PMP. The overall coordination of the monitoring of the PMP will be under the supervision of the Environmental and Social Safeguard Specialist (ESSS) of the PCU, in collaboration with the relevant national institutions.

6.3.5. Evaluation of the plan

Two evaluations will be carried out during the implementation of the PMP. This is an internal mid-term evaluation and external evaluation during the month following the end of implementation in order to maintain the objectives of the action plan. The mid-term evaluation will be carried out by a Consultant (international or local). The purpose will be to determine the correct evolution of the management plan, the mid-term results. The financial partners, the project beneficiaries and the other partners involved will participate fully in this evaluation. The external evaluation will measure the effectiveness of the project and its performance and identify lessons learned. This evaluation will be integrated into the evaluation of the ARS project Social safe Guides.

6.3.6. Summary of the monitoring plan

The plan below summarizes the monitoring elements, monitoring indicators, periodicity and monitoring responsibilities.

0-3* Table 14*: summary of the monitoring plan

Component	Elements of monitoring	Indicators and elements to collect	Periodicity	Responsible of monitoring
Water	State of pollution/contamination of surface water and underground resources (wells)	Physicochemical and bacteriological parameters of bodies of water (rate of presence of organochlorines, pesticide residues, etc.)	Twice a year (Start and end of campaigns)	- PIU - Specialized laboratories
Soils	State of pollution of the sites Pesticide storage	Typology and quantity of discharges (solid and liquid)	Once a year	-PIU - Specialized laboratories
Vegetation and fauna	Evolution of fauna and microfauna; the state of the flora of animal and plant biodiversity	Presence of toxic residues in plants and crops Levels of destruction of non-targets (animals, aquatic fauna and vegetation)	Once a year	- PIU - MEF
Human Environment	Hygiene and health Pollution and nuisances Protection during operations	Types and quality of pesticides used Number of accidents / intoxication Waste management (pesticide residues and empty packaging)	Once a year	PIU Health laboratory

6.4. Training of actors involved in the pest integrated management

In order to ensure the effective integration of the project environmental concerns, a capacity building program (training and awareness raising) will be implemented for all stakeholders, which will have to focus on the following areas:

1) Make operational the strategy of Integrated Pest Management;
2) Protect the health and safety of people and plant protectionist.
3) The training should be targeted

As a general rule, the best trainers are found in the staff of the Ministries of Health, Environment and Agriculture. The training will mainly concern the pesticide management staff (extension agents), to enable them to acquire the necessary knowledge on the content and methods of prevention, to be able to evaluate their work environment in order to improve it by reducing the risk factors. It will also enable them, adopt precautionary measures likely to reduce the risk of intoxication, promote the use of protective equipment and to correctly apply the procedures to be followed in the event of accidents or intoxication.

The training modules will cover: (i) Integrated Pest Management (IPM) methods and approaches; (ii) risks related to the handling of pesticides, ecological methods of management (collection, disposal, storage, transportation, treatment); (iii) the appropriate behavior and good agro-environmental practices, (iv) the maintenance of treatment facilities and equipment, protective measures and measures to be taken in case of intoxication, etc. Particular emphasis will be placed on the requirements of secure storage, to avoid mixing with other common household products, but also on the reuse of empty packaging.

6.5. Awareness campaigns on pesticide management

In the field of agriculture, the most imminent dangers come from the unregulated use of pesticides usually used for plant protection. However, these products are inappropriately used in the production of cereals and for market gardening, hence the need for awareness oncorrect use of pesticides and chemical fertilizers. Also, the awareness campaign should first address the users of chemicals, including beneficiaries and traders on the risks of using certain chemicals hazardous to human health. This awareness should aim at seeking and popularizing modern methods of protection and conservation and even traditional methods of highly efficient granaries as well as biological and natural methods of controlling pests.

For the public, media broadcasts should be regularly organized. The risk of poisoning by chemicals is a serious public health problem. On the one hand, it is necessary to distinguish between: (i) health problems resulting from eating, that is to say, from the consumption of food products (especially vegetables or cereals) contaminated by dangerous chemicals ; (ii) health problems due to the consumption of damaged products (due to expiry date) that have been chemically decomposed or contain chemical sweeteners; (iii) health problems due to the use of outdated plant protection products whose chemical components are corrupted or disintegrated due to non-compliance with the rules of conservation, storage or normal duration; (iv) health problems due to overdose.

In total, according to farmers, information and awareness on environmental and health risks are very poorly organized due to insufficient human and financial resources. One-off actions by public services and the desire to regulate through legal texts remain marginal. It is necessary to develop long-term strategies and effective approaches to inform and sensitize all stakeholders (window vendors, wholesalers, agricultural users, rural populations, etc.), by moving towards the following areas of intervention:

1) develop and distribute video documents and posters / leaflets / posters on the various risks and good practices in the use of pesticides;
2) sensitize actors through radio and television debate programs;
3) provide support to actors operating in the various sectors concerned to raise the awareness of their
4) members of the occupational risks related to chemicals (pesticides) in their respective fields;
5) support consumer associations to raise awareness among the general public;

6) strengthen the training of rural supervisors and extend their action through rural radios.

Information and awareness programs, especially for the general public and decision-makers in particular, are essential to reduce the risk of disease and poisoning by pesticides, and ultimately, to induce a real change in behavior. These programs will have to be multifaceted and rely on several supports. Public media can play a relatively important role in raising awareness among the public and users. NGOs and associations / groups of agricultural producers, but also community structures and health services, should also be involved in raising awareness.

6.6. Coordination and monitoring of integrated pest management

The implementation of the pest and pesticide management strategy is a concern for many stakeholders and requires the participation of a wide range of national organizations. Development activities, such as agricultural projects, can lead to the creation of suitable habitats (habitats) for vectors and ultimately to the increased incidence of vector-borne diseases. In addition, the safe and appropriate use of insecticides, including quality control and resistance management, requires intersectoral collaboration. Several actors are involved individually or in partnership in the implementation of planned actions. The management of pests and pesticides requires a frank and close collaboration between the Project, the health services, the population, the MAFS and MEF, the local communities, the private sector involved in the import and distribution of pesticides and producer organizations. It will be necessary to establish communication and close collaboration among the various actors to ensure the necessary support for the proper implementation of policies and strategies.

6.7. Reporting and review arrangement

Annual report on the progress of pest and pesticide management at the project sites will be prepared by the Program Coordinating Unit of WAATP. The reports will indicate the pest cases identified and treated using IPM approaches, location of pests, level of success of treatment, the amount and type of herbicide/pesticide used, level of corporation from farmers and other relevant information (e.g. training programmes organized, farmer field schools held, etc.).

Concerning the management reviews, the PCU will undertake annual pest and pesticide control and management reviews to confirm the implementation of the various control measures or programmes or actions outlined in the PMP. Recommendations from the reviews will help the PCU to refocus and plan effectively towards achieving planned targets.

6.8. Institutional arrangements for the implementation and monitoring of the PMP

The implementation of the PMP requires an institutional arrangement as The PMP will be implemented under the coordination of the project environmental unit;

CHAPTER 7 IMPLEMENTATION ARRANGEMENTS

7.1 **Implementation Budget**

The estimated budget for the implementation of the PMP during a 5 year period is US$ 42,000. Details are provided in the table below

0-4 **Table 15** ***Table estimated Implementation Budget***

Component/Sub-component	**Total US$**
Capacity Building	
Orientation workshops	**3,000.00**
ToT and Farmer group training (monitoring, prevention and control, technologies, safe use of pesticides)	**3,000.00**
Support/Advisory services	
Registration and training of all interested pesticide distributors/resellers under the Project	3,000.00
IPM problem diagnosis	3,000.00
Pest/ vector surveillance	3,000.00
Development of brochures on targeted Pesticides for use (Field guides/ IPM materials)	3,000.00
Public awareness/ sensitization campaigns	3,000.00
Emergency response support	6,000.00
Training on application methods and the use of certified sprayers or applicators to reduce the exposure	3,000.00
Environmental management	3,000.00
Pesticide monitoring in and around project areas	3,000.00
Reviews and reporting	3,000.00
Monitoring and surveillance	**3,000.00**
TOTALS	42,000.00

CHAPTER 8. STAKEHOLDER CONSULTATIONS

8.1 Stakeholder Engagement and Outcomes

Stakeholders especially project beneficiaries and actors were engaged to obtain the full support of key actors during project implementation (See appendixes 1, 2, 3 and 4) to promote the effective implementation of the PMP. Key among them included;

- Government institutions directly or indirectly involved in pest or vector management;
- ARS farmers and workers;
- Agricultural practitioners at National and state offices;
- Non-Governmental Organizations;
- Agrochemicals industry;
- Agricultural practitioners
- Bilateral and multilateral development partners.

During the stakeholder engagement, several issues were identified and prioritized by stakeholders to improve pest and pesticide management. At the institutional, legislative and regulatory level, issues such were identified among others

a. Porosity of national borders which allow for the influx of banned chemicals into the country
b. Non- compliance with the regulations;
c. insufficient regulation;
d. lack of database on diseases in crop production;
e. Need for capacity building;
f. Lack of awareness
g. Inadequate human resources,
h. Equipment logistics and financial resources for the field monitoring of IPM approaches.

Monitoring is also a major concern for stakeholders with issues such as lack of personnel and equipment in assessing the impacts of pesticides and insufficient control over the use of pesticides identified. Inaccessibility of approved pesticides near farmers, lack of efficient treatment and waste disposal systems at the farms and insufficient extension of alternative methods to pesticides and integrated pest management were also identified as concern by farmers. Farmers also raised concerns on issues regarding lack of regular training for farmers on pesticide use and management of empty containers, inadequate information on the

8.2 Grievance Redress Mechanism

AfDB- supported projects require that the propoent facilitate mechanisms that address concerns and grievances that arise in connection with a project activities. One of the key objectives of The AfDB's Operational Safeguard Policies: includes Stakeholder Engagement and Information Disclosure. These provides project-affected parties with accessible and inclusive means to raise issues and grievances and allow the project proponent to respond and manage such "grievances" FAO integrates such concern within its Accountability to Affected Populations (AAP) Policy.

As such, the grievance redress mechanism (GRM) developed for the ARS project (in the accompanying ESIA) will facilitate responses to concerns and grievances of the project-affected parties related to the environmental and social performance of the project arising from PMP implementation.

The AfDB's 5 Operational Safeguard Policies as outlined and summarized in in the table below informed the development of this report. The AfDB Safeguards Policies include: (1) Environmental Assessment (OS1); (2) Involuntary Resettlement including Land Acquisition, Population Displacement and Compensation (OS2)**;** (3) Biodiversity and Ecosystem Services (OS3); (4) Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource efficiency (OS4); and, (5) Labour Conditions, Health and Safety (OS5).

CHAPTER 9. CONCLUSION AND RECOMMENDATIONS

9.1 Conclusion

Pesticide is an indispensable part of modern rice production system. Over the years, new research from private and public organizations has been geared towards developing new molecules or new formulations that are easy to use, economical, and environmentally safe. Pesticide poisoning and pollution are two major negative effects of pesticides. Policies and Laws governing pesticide use are inadequate and deficient in South Sudan and may not regulate the use of pesticides and protect workers and consumers. Context-specific policies and regulations are needed. In general, the overall potential negative environmental and social impacts that were anticipated as a result of project activities would develop as a result of the use of agrochemicals that may have negative effects on the people during the application and the biodiversity in general. In that line, therefore, the envisaged potential negative impacts concerning project activities could be addressed through the application of mitigation measures recommended in the Action plan. Overall, the study has determined that the implementation of the rice project will have some positive and negative impacts, but in the long term, the positive ones will outweigh the negative impacts. In addition, the Project's positive impacts will include improvement of rice production, job creation and income of people in the communities will be improved contributing to poverty reduction. Especially, the people do not think that the projects will have adverse impacts on the ecosystem and their socio-economic conditions. The negative impacts will be mostly short-term in nature, localized, and small-scale, and can be mitigated through the Action Plan to strike a balance between development and environmental protection. Implementation of the rice projects is not expected to have adverse negative impacts on terrestrial ecosystems.

9.2 Recommendations

(i) There is a need to strengthen the national policies, laws, and regulations on pesticides for the safe handling and use of pesticides.
(ii) Wide-scale capacity-building efforts. An awareness program should be included to obtain optimized pesticide use
(iii) Integrated pesticide resistance management should be included in farm practices in the Project area
(iv) Proper pest monitoring, protective clothing, and application of pesticide at the right time at the right dose, and the right quantity should be integral parts of pesticide usage.

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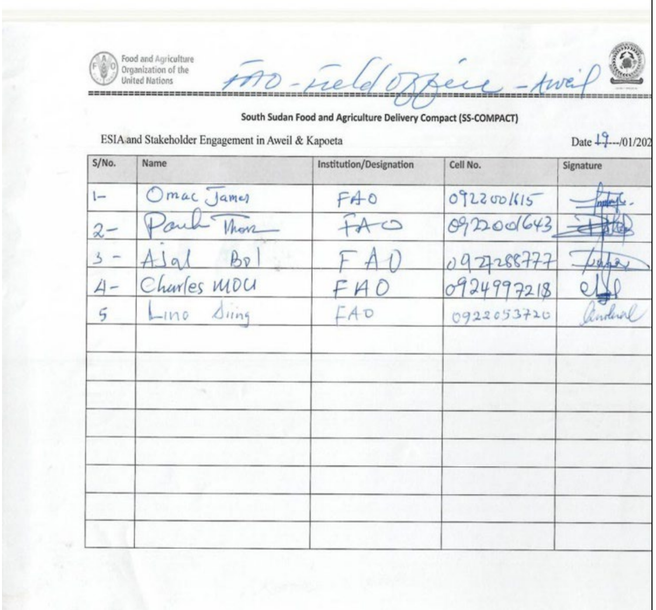
Appendixes

Appendix 1 List of Attendance and respective photos for stakeholder engagements

Stakeholders attendance in Torit.pd

List of Attendance and respective photos for stakeholder engagements



Food and Agriculture Organization of the United Nations

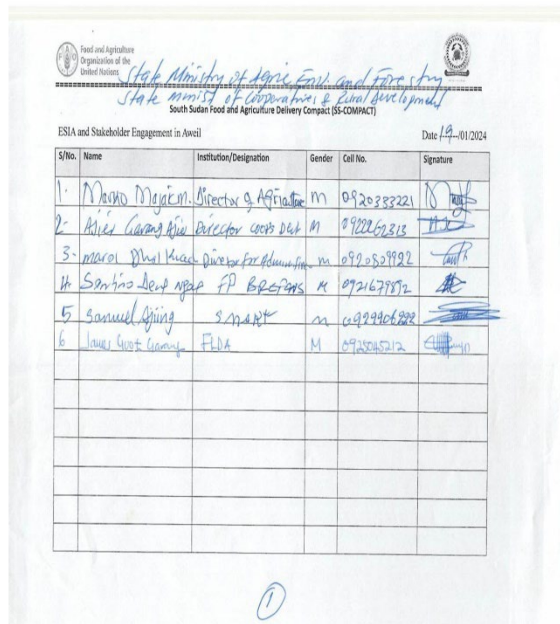
FAO - field office - Aweil

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil & Kapoeta

Date 19---/01/202

S/No.	Name	Institution/Designation	Cell No.	Signature
1-	Omac James	FAO	0922001615	[signature]
2-	Paul Thon	FAO	0922001643	[signature]
3 -	Ajal Bol	FAO	0927288777	[signature]
4-	Charles MOU	FAO	0924997218	[signature]
5	Lino Diing	FAO	0922053720	[signature]



Food and Agriculture Organization of the United Nations

State Ministry of Agric, Env. and Forestry
State minist of Cooperatives & Rural development

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil

Date 19--/01/2024

S/No.	Name	Institution/Designation	Gender	Cell No.	Signature
1.	Marko Majakm.	Director of Agriculture	m	0920333221	[signature]
2.	Ajier Garang Ajier	Director coops Dept	M	0922262313	[signature]
3.	Marol Dhal Kuac	Director for Admin fin	m	0920809922	[signature]
4.	Santino Deng Ngap	FP BRE-FARS	M	0921679892	[signature]
5	Samuel Ajiing	SMART	m	0929906222	[signature]
6	James Guot Garang	FLDA	M	0925045212	[signature]

(1)

FAO Field Office Staff

State Ministries Technical Communities

Food and Agriculture Organization of the United Nations

FGD - Basin "9"

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil

Date 20/01/2024

S/No.	Name	Institution/Designation	Gender	Cell No.	Signature
1.	Aduong Beng	Housewoman	F		
2.	Abuk Aguer	Housewoman	F		
3	Deng Madwok Alen	Farmer	M	09	
4.	Nuoi Maton Wel	Farmer	M	09	
5.	Ahw Wien Guot	Farmer	F	09	
6.	Nyamt Agany Wol	Farmer			
7	Abuk Malong Tong	Farmer			
8	Nyamt Madwok Garang	" "			
9	Dut Wel Aleu	" "		0924817017	
10	Majok Thuo Aruop	" "			
11	Aleu Madwok Aleu	" "			
12	Yol Akoon Athian	" "			
13	Apiok Akol Mondep	" "		0924206623	

(1)

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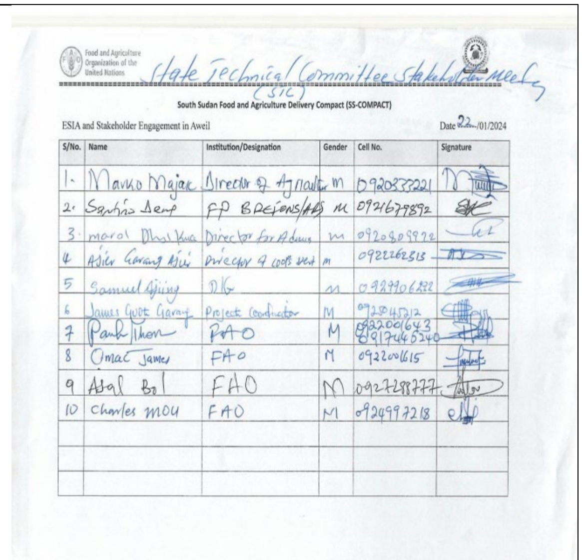
ESIA and Stakeholder Engagement in Aweil

Date 20/01/2024

S/No.	Name	Institution/Designation	Gender	Cell No.	Signature
14	Dut Thou Machar	ARS Farmer			
15	Aleu Ker Aleu	Farmer		0929222071	
16	Udut Ngor Mou	Farmer			
17	Bol Wel Machar	Farmer			0922151779
18	Akech Dhal Akhon	Farmer			
19	Noon Thuou Aruop	Farmer			

(2)

Meeting With Community (Farmers and traders)



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State Technical Committee Stakeholder meeting (STC)

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil

Date 22/01/2024

S/No.	Name	Institution/Designation	Gender	Cell No.	Signature
1.	Marko Majak	Director of Agriculture	M	0920333221	
2.	Santino Deng	FP BRACIONS/ABS	M	0921679892	
3.	Marol Dhal Kuol	Director for Admin	M	0920809922	
4	Ajier Garang Ajier	Director of coops devt	M	0922262313	
5	Samuel Ajiing	DG	M	0929906222	
6	James Guot Garang	Project Coordinator	M	0928045212	
7	Paul Thon	FAO	M	0922001643 0917446240	
8	Omar James	FAO	M	0922001615	
9	Agal Bol	FAO	M	0927298777	
10	Charles Mou	FAO	M	0924997218	

Meeting Aweil rice scheme management

Meeting community

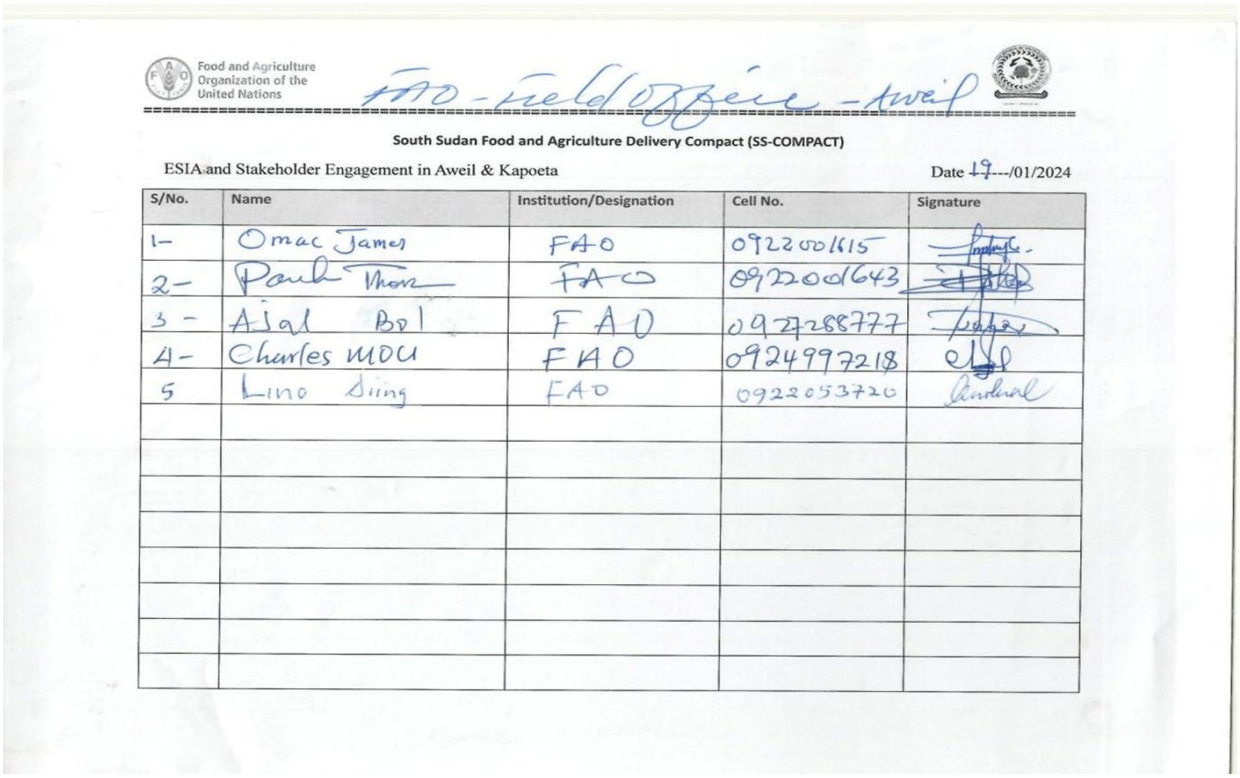
Appendix 2: Summary of consultation events

TIME	INSTITUTION
1	Aweil FAO field Office
2	State Ministry of Agriculture, Environment and Forestry (SMoAEF) and State Ministry of Cooperatives and Rural Development (SMCRD) – Northern Bahr El Ghazal State – Aweil
3	Aweil Rice Scheme Management
4	Aweil Community/Public Participation in Aweil Rice Scheme
5	FAO field office – Aweil – Meeting with State Technical Committee (STC)
6	County Coordination Office, Meeting with Kapoeta South and Kapoeta North Government officials and Opinion leaders/farmers Uniion
	Second Aweil FAO field Office
7	Second Stakeholders meeting Aweil Rice Scheme Management
	Second Aweil Community/Public Participation in Aweil Rice Scheme

Appendix 3: List of widely banned or restricted pesticides

1	2,4,5,-T	Herbicide	Banned
2	Ethylene dibromide	Soil fumigant	Banned
3	Chlordimeform	Insecticide	Banned
4	Mixture of Hexachlorocyclohexane (CHC)	Insecticide	Banned
			Restricted use for seed dressing only
6	Chlordane	Insecticide	Banned
7	Heptachlor	Insecticide	Banned
8	Endrin	Insecticide	Banned
9	Toxaphene	Insecticide	Banned
			Restricted use to Public Health only for mosquito control, banned for
11	Captafol	Fungicide	Banned
12	Parathion methyl/Parathion ethyl	Insecticide	Banned

Appendix 4 FAO Field officers Aweil



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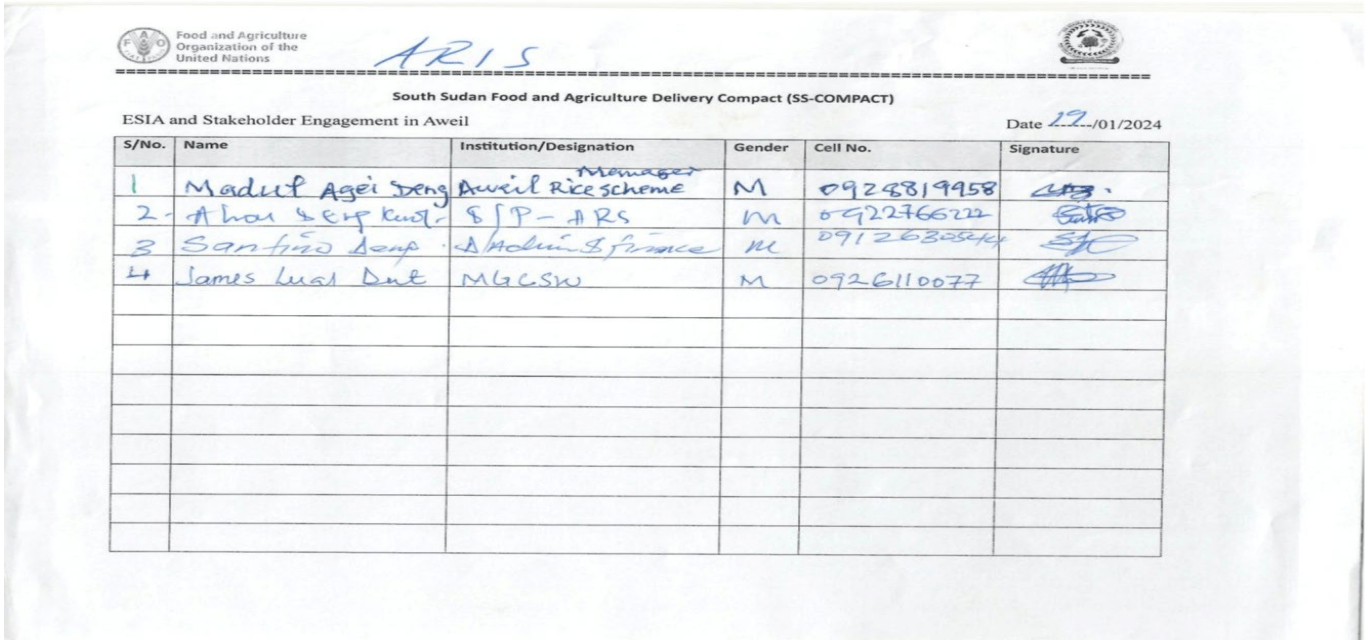
FAO - Field Office - Aweil

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil & Kapoeta

Date 17---/01/2024

S/No.	Name	Institution/Designation	Cell No.	Signature
1-	Omac James	FAO	0922001615	
2-	Paul Thon	FAO	0922001643	
3-	Ajal Bol	FAO	0927288777	
4-	Charles MOU	FAO	0924997218	
5	Lino Siing	FAO	0922053720	



Food and Agriculture Organization of the United Nations

ARIS

South Sudan Food and Agriculture Delivery Compact (SS-COMPACT)

ESIA and Stakeholder Engagement in Aweil

Date 22---/01/2024

S/No.	Name	Institution/Designation	Gender	Cell No.	Signature
1	Madut Agei Deng	Aweil Rice Manager scheme	M	0924819958	
2-	Athai Deng Kuol	SSP - ARS	M	0922766222	
3	Santino Deng	Admin & finance	M	0912630544	
4	James Luai Dut	MGCSW	M	0926110077	

Appendix 4 Encounter with the fisherman