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Danida**



Northern Uganda Resilience Initiative (NURI) 2018-2022

**Quality Assessment of NURI Rural Infrastructure and Water Resource Management
Activities**

FINAL REPORT

Submitted



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ACRONYMS & ABBREVIATIONS

CAO	Chief Administrative Officer
DANIDA	Danish International Development Assistance
DRC	Danish Refugee Council
HC	Health Centre
MoWT	Ministry of Works and Transport
MWE	Ministry of Water and Environment
NURI	Northern Uganda Resilience Initiative
O&M	Operation and Maintenance
UPGRADE	Uganda Programme for Governance, Rights, Accountability and Democracy
UPSIDE	Uganda Programme for Sustainable and Inclusive Development of the Economy
WUC	Water User Committees

EXECUTIVE SUMMARY

This report presents the findings and recommendations of the quality assessment of Northern Uganda Resilience Initiative (NURI) Rural Infrastructure and Water Resource Management (WRM) activities. The assessment was conducted in February 2021. It involved review of documents, meetings with NURI, DRC and District officials, field inspection of the infrastructure and focus group discussions with the beneficiaries. A total of 26 subprojects were visited comprising 9 community access roads, 3 market improvement, 3 protected springs, 7 food forests, 3 water ponds and 1 valley tank.

Key findings

Community Access Roads (CARs): the quality of road works including bush clearing, excavation to level, alignment, ditching, and culvert formation were as per specifications. However, there was backlog of compacting, spot gravelling and culvert installation which needs to be urgently addressed. Majority of the culverts were well installed by the masons; some were encased and others were not. However, some of them were poorly leveled, and are like big speed reducing humps. Road construction materials like gravel, sand and culverts were not being tested leading to rejection of the works. Resilience road design were piloted in West Nile. However, some community members were resisting constructing drainage pits and bioswales in their gardens. All roads lacked basic road furniture which compromised their safety.

Protected springs: Majority of the springs were functional except one which had dried up. The cause of drying up of the spring was attributed to construction of bioswale upstream. However, it may be due to poor identification and construction which affected the spring eyes. The catchment of the springs were not as per MWE standards and there is risk of pollution. This was attributed to shortage of land. Availability of adequate catchment land should be made precondition for spring protection. The design for protected springs were not inclusive and as such physically challenged persons were finding difficulties to draw water. The WUCs had not been trained on O&M. protection of the catchment in terms of planting grass and trees needs to be urgently addressed.

Water ponds: The works included machine excavation of the ponds, diversion channels, spillways, bioswales and filtration pits. The ponds were shallow with black cotton floors which have high water filtration rate. The average capacity is about 2000 cubic meters. Some ponds were single purpose (watering animals) and others duo purpose (watering animals and irrigation). There were no water troughs for animals to drink water and as such they have to access the water directly in the pond. The catchments were yet to be restored.

Market improvements: The works included fencing the market area, construction of 4 stance VIP latrine and gate house. Riki market (Arua) had two stance latrine instead of 4 stances provided for in the implementation Manual. Obeteni Market, old latrine was renovated. The District Engineer did not certify the works for the two markets pending remedial works. The quality of sand used did not meet specification. There were gaps in supervision of works which contributed to rejection of the works by the district Engineer.

Food forests: The work involved bush clearing the site, pitting, planting, and weeding. The size of the food forests ranged from 2 acres to 6 acres depending on the availability of land. The type of trees planted included Afzelia, Tamarindus, Mahogany, White and Indian Teak, Gmelina, Neem, Guava, Lemon, Mango, Oranges, Mvule, Giant Lira, Malian Arboria, Shea nut, Jack fruit, Acacia, Pinus, Coriander, Gmelina, Eucalyptus, Tamarind, Tangerine, Pawpaw, Bananas, Aloe vera and Hibiscus among others.

Water conservation measures in the food forests included construction of bioswales and smile berms. The survival rate of trees in West Nile was above 80% while in Kitgum as low as 30%. In West Nile, it was reported that planting was carried in April – May 2020 while in Kitgum it was done in July 2020. The drought which started around November up to the time of the assessment in February affected the food forests in Kitgum. Soil testing was not done to determine the tree that grow well in particular area. All food forests had bioswales in each acre but their functionality could not be assessed because the dry season. Recommended spacing of the different tree species was not followed.

A variety of tree species were planted in between the wide canopy trees without consideration of recommended spacing and sequencing of the planting. This will affect growth and yield due to stiff competition for nutrients and sun. All the food forests were properly fenced with barbed wire to prevent animals. The maintenance of the forests was being done by the groups and it varied across the districts. However, those in West Nile were better maintained than in Kitgum. Given the nature of trees planted, they require effective maintenance for at least 2 – 3 years for the majority of the trees to be able to survive on their own. Hand over maintenance of the trees to the institutions should be based on objective assessment of the stage of the trees, maintenance requirements and ability of the institutions to maintain the forest. All the forests visited did not provide for the fire line.

Valley tank: Akino Valley Tank is located in Rhino Camp Settlement. Its capacity is about 60 cubic meters. The works involves excavation which was substantially. What was remaining was construction of spillways, intake works, clearing the site and restoration of the catchment. DRC hired the equipment which was used for excavation and has a clerk of works who supervise the works. The valley tank involve major and complex construction works which should have independent Engineer to supervise it. DRC is the contractor working without independent Engineer.

Conclusion

The finding of the assessment show that majority of the infrastructure subprojects were implemented according to specifications and most of them meet the standards . The infrastructure was constructed at relatively low cost compared to the sector average costs. However, there are few areas that needs to be addressed as outlined in this report. If the identified shortcomings/ weaknesses are addressed, we have no reservation in concluding that DRC is doing an excellent job.

Recommendations

- i) Reduce the time lag between construction activities and ensure subprojects are completed on schedule.
- ii) The backlog for compaction of roads and culverts works should be addressed as soon as possible.
- iii) Materials like culverts, concrete poles, sand, and gravel should be inspected and tested to confirm they meet the standards before use.
- iv) Piloting of resilience designs should be accompanied by intensive software activities (community sensitization and mobilization) to foster adoption.
- v) Provision of adequate land for catchment protection should be a precondition for provision of water related infrastructure.
- vi) The design for protected springs should be inclusive to ensure physically challenged persons can draw water with ease.
- vii) There is need to do improvement on cattle drinking area for the water ponds
- viii) The District Engineer’s office should be well facilitated to intensify on the supervision of works during construction.

- ix) Establish the fire line of at least 10 meters around the food forests to protect the forest from bush fires.
- x) Deliberate effort should be made to involve students, school management committees, PTAs and education departments at all stages of tree planting where the forest is planted on school land to enable them to learn.
- xi) There is need for gap filling/ replanting to replace the seedlings that died.
- xii) NURI should consider hiring Independent Engineer to supervise and certify big complex works like Valley Tank to avoid possible litigation in case the dam gives way and there is loss of property and life.

1. INTRODUCTION

This report presents the findings and recommendations of the quality assessment of Northern Uganda Resilience Initiative (NURI) Rural Infrastructure and Water Resource Management (WRM) activities. NURI Coordination function contracted NEWPLAN Limited to carry out the quality assessment of the NURI activities. Fieldwork was conducted from 21 – 28 February 2021. It involved meetings with NURI, DRC and District officials as well as field inspection of the infrastructure.

The general observation was that the quality of the infrastructure meets the design specifications, the constructed facilities meet the engineering quality standards, and their cost was relatively lower than the sector average. However, there is need to strengthen supervision by the District engineering office and Ministry of Water and Environment.

The structure of the report is as follows: Section 2 of the report presents the background to provide the context of the assignment. Section 3 describes the methodology used in assessing the infrastructure. Section 4 presents the findings of the quality assessment. Section 5 outlines the major conclusions and recommendations.

2. BACKGROUND

Northern Uganda Resilience Initiative (NURI) is one of eight development engagements under the Denmark-Uganda Country Programme (2018–2022). Overall, the Country Programme aims to contribute to poverty reduction through inclusive and sustainable economic growth, promoting democracy, good governance and human rights, and support Uganda’s stabilizing role in the region.

The Country Program is divided into two Thematic Objectives: Uganda Programme for Sustainable and Inclusive Development of the Economy (UPSIDE) and Uganda Programme for Governance, Rights, Accountability and Democracy (UPGRADE).

NURI is one of the projects under UPSIDE. Its objective is enhanced resilience and equitable economic development in supported areas of Northern Uganda, including refugees and refugee-hosting communities. The outputs include (i) climate smart agriculture (ii) rural infrastructure, (iii) water resource management and (iv) programme coordination.

Geographically the programme covers 13 districts of Agago, Kitgum and Lamwo in Acholi sub region and Arua, Madi-Okollo, Terego, Pakwach, Nebbi, Zombo, Koboko, Moyo, Obongi and Adjumani in West Nile sub region. The settlements include Rhino Camp (Madi-Okollo), Imvepi (Terego), Palorinya (Obongi), Maaji and Mungula (Adjumani) and Palabek (Lamwo).

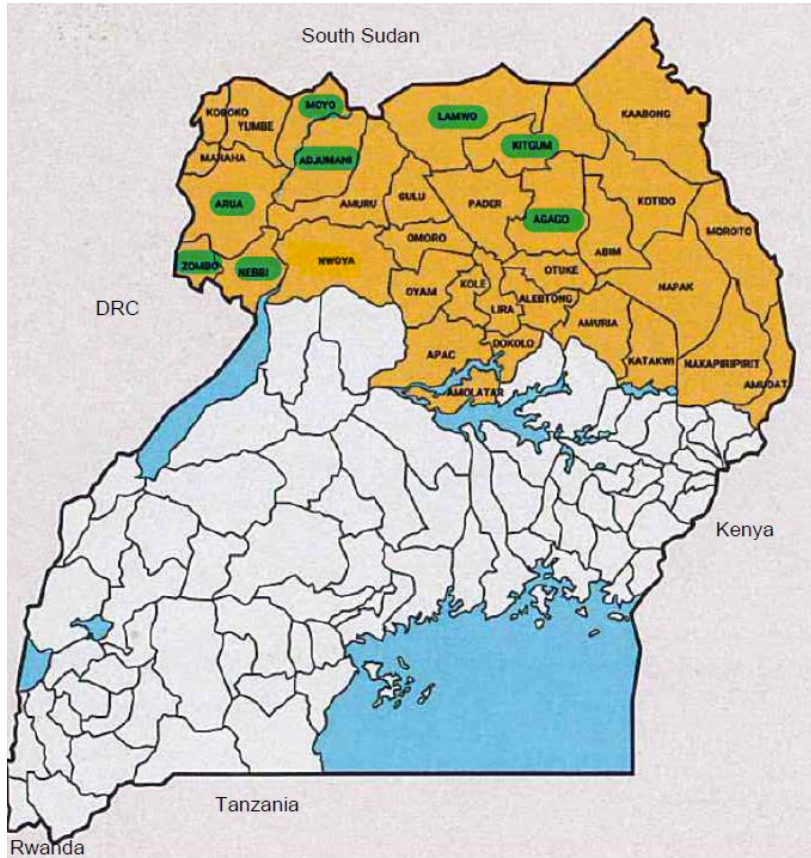


Figure 1: Map of Uganda showing areas of operation of NURI

The **purpose** of this assignment is to conduct quality assurance of a sample of infrastructure projects implemented by the Danish Refugee Council (DRC) under rural infrastructure and water resource management components of the NURI programme.

The **specific objectives** of this assignment are:

1. Assess quality and sustainability of a sample of rural and water infrastructure works implemented under NURI Outputs 2 and 3 and make recommendations for improvement.
2. Make recommendations that strengthen the quality assurance in the planning and implementation processes of on-going works.

Scope of work

- Review of NURI documents, including rural infrastructure / water resource management manuals and progress reports.
- Field assessment of infrastructure projects
- Conduct consultations with Engineering department staff of the district local governments and DRC field offices in the regions and districts.

- Conduct community engagement including focus group discussions with target communities.
- Visit 2 districts, one from South West-Nile and another from Acholi as well as 2 settlements where activities are implemented.

3. METHODOLOGY

3.1 Approach

The Consultant adopted a combination of methodologies involving desk review of relevant documents, fieldwork inspections, meetings, focus groups discussions and exit meetings. The justification was to enable triangulation of information and thereby providing informed recommendations.

3.2 Sampling

The sampling was done in consultation with NURI/DRC staff in Arua and Kitgum. It was realized that the initial sampling done by the consultant was too ambitious because of the distances between the projects. The team had initially planned to sample Palorinya Settlement in Obongi district but it was advised to replace it with Imvepi Refugee Settlement in Terego district which had more types of infrastructure projects. Table 1 provides a summary of the projects sampled in each district and settlement.

Table 1: Sampled districts and infrastructure projects

Region	District	Infrastructure/IWRM activities
South-West Nile	Arua	<ul style="list-style-type: none"> • 2 Community Access Roads • 2 Market improvement • 1 Food forest projects • 2 Spring protection
	Madi – Okollo	<ul style="list-style-type: none"> • 3 Food forest projects • 1 Spring protection • 1 Water pond
	Rhino camp settlement (Madi-Okollo district)	<ul style="list-style-type: none"> • 1Valley tank • 1 Community access road
	Imvepi refugee settlement (Terego district)	<ul style="list-style-type: none"> • 2 Community Access Roads • 1 Market improvement
Acholi region	Kitgum	<ul style="list-style-type: none"> • 4 Community Access Roads • 3 Food forests projects • 2 Water ponds

3.3 Methods

3.3.1 Desk review

Relevant documents were reviewed including programme documents, designs/specifications, drawings, construction manuals, reports, monitoring forms, national standards/guidelines, and Operation & Maintenance Manuals.

3.3.2 Meetings

Meetings were conducted with NURI/DRC officials, Arua District Engineer and Arua CAO. It was not possible to meet the District Engineers of Madi-Okollo and Kitgum because they were attending other meetings at the time of the visit to their districts.

3.3.3 Field Technical Inspections

Field technical assessment of quality of infrastructure was carried out covering 26 subprojects. The projects included 9 community access roads, 3 market improvement, 3 protected springs, 7 food forests, 3 water ponds and 1 valley tank. Many one-on-one discussions were held with beneficiaries and workers on the projects.

3.3.4 Focus Group Discussions

Two Focus group discussions were conducted with the beneficiary communities. The discussions focused on community participation, catchment protection, sustainability of the infrastructure, work rates, number of work days and resilience design on community access roads.
were.

3.3.5 Exit Meeting

After the field work, exit meeting was held with the NURI/DRC officials. They were briefed on key observations and suggestions for improvement.

4. FINDINGS

The detailed findings for each infrastructure visited is presented in Annex 1. The summary of the findings for each category of infrastructure is presented below.

4.1 Community Access Roads

Nine community access roads subprojects were visited: West Nile (5) and Kitgum (4). The length of these roads ranged between 3 – 5 km. Assessment of the quality of the major activities is summarized in Table 2.

Table 2: Assessment of the quality of road works in West Nile and Kitgum

Activity	West Nile	Kitgum
Formation and Shaping of the community access Roads	<ul style="list-style-type: none"> The works involved bush clearing, stump removal, excavation to level, alignment, ditching, culvert formation and compacting. This was largely done manually by the community groups using hand tools like hoes, spades, and pedestrian roller. However, for some roads, DRC used district graders for leveling. The work was done as per specifications and the quality was satisfactory. 	<ul style="list-style-type: none"> The works involved bush clearing, stump removal, excavation to level, alignment, ditching and culvert formation. This was largely done manually by the community groups using hand tools like hoes, spades, and pedestrian roller. However, for some roads, DRC used district graders for leveling. The work was done as per specifications and the quality was satisfactory.
Compacting roads	<ul style="list-style-type: none"> Compacting was done by pedestrian rollers. However, some roads e.g. in Rhino camp were not compacted. Given the passage of time, it may not be possible to compact them without reworking them. 	<ul style="list-style-type: none"> Compacting was done by pedestrian rollers. However, some roads were not compacted.
Spot Gravelling	<ul style="list-style-type: none"> The works was supposed to involve gravelling identified sections especially in swamps/poorly drained areas. However, at the time of this assessment, spot gravelling was yet to be carried out. Some roads were completed more than 6 months ago and may require bush clearing before spot gravelling. This is likely to increase costs 	<ul style="list-style-type: none"> The works was supposed to involve gravelling identified sections especially in swamps/poorly drained areas. However, at the time of this assessment, spot gravelling was yet to be carried out. Some roads were completed more than 6 months ago and may require bush clearing before spot gravelling. The supplier of gravel had cash flow issues

<p>Culvert installation</p>	<ul style="list-style-type: none"> • The works involved installation of single, double and in some cases three lines of cross culverts. • The size of culverts varied; 600mm, 900mm and 1200mm. • Drifts were constructed across streams. • Construction/installation was done by masons trained by the project. • There was no detailed hydrological survey carried out to determine the location and size of culverts installed. • Visual inspections and local knowledge was used. • Some the culverts were encased while others were not. <p>The assessment revealed that:</p> <ul style="list-style-type: none"> • Head walls built to specification. • Laying of the culverts was well done. • Invert levels well determined. • The spacing was at least one line of cross culvert per km. This was attributed to budget limitations rather than the drainage requirements of the different sections of the road. • Majority of the relief culverts were 600mm diameter except for the few installed in swamps which were 900 mm and 1200 mm. • The adequacy of the culverts could not be assessed without basic hydrological data. • Encasing of culverts is determined by overlay height, pipe rest and traffic load. • In our assessment, encasing culverts was justified because most of the project area is relatively flat and attaining a minimum height of 100 cm (1m) of overlay height above the culvert to allow sufficient traffic load distribution would be difficult/costly to attain. • Encasing also enhances the stability and minimizes the risk of the culvert being wash away by flash floods or broken by heavy trucks. • Although the traffic volume on project roads is very low, the few vehicles which uses these roads are heavy trucks that 	<ul style="list-style-type: none"> • The works involved installation of single, double and in some cases three lines of cross culverts. • The size of culverts varied; 600mm and 900mm. • Construction/installation was done by masons trained by the project. • There was no detailed hydrological survey carried out to determine the location and size of culverts installed. • Visual inspections and local knowledge was used. • Some the culverts were encased while others were not. <p>The assessment revealed that:</p> <ul style="list-style-type: none"> • Head walls built to specification. • Laying of the culverts was well done. • Invert levels well determined. • The spacing was at least one line of cross culvert per km. • Majority of the relief culverts were 600mm diameter except for the few installed in swamps which were 900 mm. • The adequacy of the culverts could not be assessed without basic hydrological data. • Our visual inspections revealed that some locations were relatively flat and a single line of cross culvert would not withstand flash floods common in Kitgum. If the budget allows, consideration should be given to increase the number of lines of culvert based on drainage requirements. • Encasing of culverts is determined by overlay height, pipe rest and traffic load. • In our assessment, encasing culverts was justified because most of the project area is relatively flat and attaining a minimum height of 100 cm (1m) of overlay height above the culvert to allow sufficient traffic load distribution would be difficult/costly to attain. • Encasing also enhances the stability and minimizes the risk of the culvert being wash away by flash floods or broken by heavy trucks. • Although the traffic volume on project roads is very low, the few vehicles which uses these roads are heavy trucks that
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	<p>imposes weight burden on the culverts as shown by broken culverts. Encasing culverts increases traffic load distribution.</p> <ul style="list-style-type: none"> • Compacting of gravel/marrum was not standard and there was no data to show that the minimum CBR was achieved. • The strength of compaction was visually determined based on compaction level. • Attaining compaction levels was equated to attaining compaction strength which is not the case. • Majority of the culverts approaches were properly leveled but there some which were like big speed reducing humps. • Installation of culvert was still ongoing on some of the roads more than 6 months after the labour-based groups completed their works. 	<p>imposes weight burden on the culverts as shown by broken culverts. Encasing culverts increases traffic load distribution.</p> <ul style="list-style-type: none"> • Compacting of gravel/marrum was not standard and there was no data to show that the minimum CBR was achieved. • The strength of compaction was visually determined based on compaction level. • Attaining compaction levels was equated to attaining compaction strength which is not the case. • Majority of the culverts approaches were properly leveled but there some which were like big speed reducing humps. • Installation of culvert was still ongoing on some of the roads more than 6 months after the labour-based groups completed their works.
Side drains	<ul style="list-style-type: none"> • Well done to drain off storm water • Some road had no drains due to resistance of community channeling storm water in their land 	<ul style="list-style-type: none"> • Well done to drain off storm water • Some side drains were not properly sited.
Resilience works	<ul style="list-style-type: none"> • At Kasikasi – Ewadri P/S Community Access Road had bio swells constructed after the miter drains to further absorb water into the soils thus enriching agriculture • The drains were not being desilted which was affecting their performance. 	There was no road with resilience designs implemented.
Bridges	<ul style="list-style-type: none"> • At Kasikasi – Ewadri P/S Community access road has 2 bridges Ania and Rara bridge. • Well trained mason were installing 90mm culverts at the time of visit. • Workmanship was excellent • The approach side drains require stone pitching/lining 	None of the roads visited had bridges
Road geometry	<ul style="list-style-type: none"> • Carriageway was 5.5m wide as per the specifications 	<ul style="list-style-type: none"> • Carriageway was 5.5m wide as per the specifications
Road furniture	<ul style="list-style-type: none"> • Road furniture (signs, guard rails etc) was not part of the works which is not consistent with sector standards 	<ul style="list-style-type: none"> • Road furniture (signs, guard rails etc) was not part of the works which is not consistent with sector standards

Vegetation control	• Due to delayed completion of works (spot gravelling and installation of culverts), the vegetation has overgrown for some of the roads.	Due to delayed completion of works (spot gravelling and installation of culverts), the vegetation has overgrown for some of the roads.
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There were some good innovations especially of the road on the road from Ewadri primary school to Kasikasi where the drained rainfall runoff was channeled into the pit and used for irrigation. This is a good design which will benefit the community. It should be extended to all other roads.

Issues that require attention

- 1) **Compaction of road and culvert installation works:** There were delays in compaction after culvert formation of up to six months. This means that the roads have to be reworked before compaction which will increase the cost. There was also no objective mechanism of measuring the strength of compaction.
Recommendation: (i) DRC should ensure that the backlog of compaction of roads and culvert installations is addressed as soon as possible. (ii) The project should establish mechanism for measuring the strength of compaction to ensure value for money.

- 2) **Delayed completion of works.** The time lag between the completion of labour based works by the groups and spot gravelling and culvert installation was long, more than 6 months in some cases. As a result, some of the road works have been washed away and the vegetation has overgrown. It has also delayed certification of the works by the District Engineer and handover of the roads to sub-counties for maintenance. This will necessitate redoing some of the works before handover which will increase the costs.
Recommendation: Reduce the time lag between the road construction activities.

- 3) **Culvert Installation:** Some of the installed culverts are not well leveled and are humps which affecting the riding quality. Some are a safety hazard particularly to first time users of the road. In addition, the rate of erosion of the gravel will be higher and the culvert will be left bare and prone to being washed away.
Recommendation: The approaches should attain the same level as the culvert.

- 4) **Lack of road furniture.** Lack of road signs and guard rails compromises the safety of road users. Some of the roads join main road and others have sharp corner without warning signs which might cause traffic accidents since the improvement of the road enable the vehicles to move at increased speed. Sections with bridges are narrow requiring guard rails and warning signings.
Recommendation: Basic road furniture should be installed on some of the roads to enhance road user safety.

- 5) **Quality of materials:** There was no evidence to show that materials were being tested.

Some few broken culverts were found on some sites which cast doubt on the quality of the materials supplied. Construction of the major structures like bridges required minimum site investigations and materials testing.

Recommendation: Materials like concrete and sand should be tested to confirm they meet the standards.

- 6) **Resilient design:** The resilience infrastructure designs was a good innovation which may contribute to climate change adaptation. However, the pilot of the designs was not accompanied with adequate software activities including community sensitization and mobilization to own and maintain the infrastructure. As a result, some of the bio-swells and infiltration pits were not being desilted to function well.

Recommendation: Enhance software activities (community sensitization and mobilization) as a key component of piloting the resilient infrastructure designs.

- 7) The time lag between shaping of the road surface and actual compaction leads to loss of loose material that is subjected to weather conditions for some time before compaction. The Delay happens because DRC has no compaction equipment. DRC relies on District equipment which is often committed elsewhere.

Recommendation: DRC to hire and have standby road compaction equipment.



Figure 2: Culvert at Angucaku-st.Bakita-Oludri road



Figure 3: Culvert at Angucaku-st.Bakita-Oludri road



Figure 4: Culvert along Tee-Neam-Akado Primary School road



Figure 5: Culvert along Tumattoo-Laborom Road



Figure 6: Community access Road Ewadri P.S to Kasikasi



4.2 Protected Springs

The protected springs were found in West Nile only. Three protected springs were visited in Arua and Madi-Okollo districts. Two of the three springs were found functional. One spring Bapa spring in Madi-Okollo had dried up. The causes of drying of up of a protected spring include poor identification (seasonal spring) and poor construction. It was reported that the construction of the bioswale within the catchment area could have affected the spring. This suggests that not enough investigation was undertaken before protecting the spring.

The springs were protected by sub-contractors engaged by DRC. The quality of masonry works including the retention wall and drains meet the specifications. However, some of the spring eyes were not well protected and as a result, water was seen oozing from the sides (Bapa and Goyiva springs). Some of the drains were short and had started developing cracks (Goyiva spring).

Some of the springs had small catchment area which do not conform to the sector standards. Goyiva springs for example has very small catchment area and farming activities were taking place upstream in distance of less than 50 meters. This may lead to pollution of the water and even drying up of the spring. Planting of trees or grass to protect the catchment had not been done. The WUC had not been trained on O&M.

The design for protected springs were not inclusive and as such physically challenged persons were finding difficulties to draw water.



Figure 7: Spring protected at Goyiva



Figure 8: Water pond at Goyiva spring



Figure 9: Spring protection at Oka



Figure 10: Seasonal spring at Bapa

Issues that require attention

Spring identification: To avoid drying up of the springs which is a loss of investment, there is need to assess the identified springs for at least two seasons; dry and wet seasons. The project should avoid relying entirely on the information provided by the community.

Catchment protection: Before construction of the spring, the community should provide land for the catchment protection as per the MWE standards. Without adequate catchment, the springs will be prone to contamination/pollution and drying up.

Recommendation: Community provision of land for adequate catchment area protection should be a precondition for protecting the spring.

Water quality: It was reported that the district water office carried out water quality test. However, there was no report on file to confirm this which cast doubt whether it was carried out. If the project facilitated water quality testing, then the results should be on file for reference and monitoring.

Software: Maintenance of protected springs is the most challenging because it is difficult to enforce compliance. There is urgent need to train WUCs on their role in O&M and appoint a caretaker to oversee the routine maintenance activities.

Inclusive design: The design of the protected springs was not inclusive. As a result, persons with physical disability could not access the water source.

Recommendation: Design and construct protected springs that are have access to disable people.

4.3 Water Ponds

The water ponds were found in Madi-Okollo (1) and Kitgum (2). The works included machine excavation of the pond, diversion drainage channels, spillways and bioswales with filtration pits. The ponds were shallow with wide surface area. This means that they are likely to loss water very fast through ground filtration and evaporation. The earth floor made of black cotton soils have high filtration rate. Their estimated capacity was about 2000 cumbic meter. Bapa water pond in Madi Okollo is one of the resilient designs. It is connected to the protected springs and a bio-swell which is supposed to trap and channel the storm water into the pond.

The works did not include cattle watering area/troughs. As such cattle is supposed to move in mud to access water in the pond. This will accelerate silting and some cattle getting stuck in the mud and breaking their legs. At the time of the visit, the ponds were substantially complete but dry waiting for rains to fill. The vegetation was yet to be planted to protect the embarkment and restore the catchment

Issues that require attention

Cattle watering area: Cattle directly accessing water in the pond will destroy the works, accelerate silting of the pond and cattle getting stuck in the mud. The design should be reviewed to provide for animal watering area or watering troughs.

Recommendation: There is need to do improvement on cattle drinking area. Either troughs added to the system or some hard surface for moving in and out of the pond to avoid getting stuck in the mud.

Protection of the embarkment and catchment area: The embarkment was bear which exposes it to erosion and being washing away. The catchment had not also been restored. There is need to plan the vegetation to protect the embarkment and catchment area.

Recommendation: Plant grass and trees to protect the pond embankment and catchment area

Quality of excavation: For Lanodyang water pond (Kitgum), the excavation stopped at black cotton soils. These soils are porous with low water retention capacity. The water retention capacity would increase if the excavation is extended to clay soils.

Recommendation: If resources permit excavation should reach the clay soils to enhance water retention of the pond. If this does not happen, the rate of siltation of these ponds will be higher and desilting will be difficult and costly.



Figure 11: Pond at Bapa



Figure 12: Pond being excavated at Lalwal

4.4 Market improvements

Three market improvement sub-projects were visited in Arua (2) and Imvepi Settlement (1). The works included fencing the market area, construction of 4 stance VIP latrine and gate house. The fencing was done with chain link of gauge 10 and 7 ft high with a concrete skirting and reinforced concrete poles. Riki market (Arua) had two stance latrine instead of 4 stances provided for in the implementation Manual. Obeteni Market, old latrine was renovated.

However, the quality of the masonry works and sand was not good and as result the District Engineer declined to certify the works for payment. The contractor was asked to undertake remedial works which he has not done.

The latrine had two stances (one for males and another for female). However, on a busy market day one stance is not adequate with no urinal. There were no stalls and women were selling food including fish in the dust.

Issues that require attention

Supervision: There were gaps in supervision by the district and DRC. The district Engineer comes at the end to certify the works for payment. This means mistakes are not detected early and remedial action

taken to reduce the loss in terms of materials and labour. That is why the contractor was reluctant to undertake remedial works at his cost.

Recommendation: The District Engineer's office should be well facilitated to intensify on the supervision of works. To avoid conflict of interest, facilitation for district engineer should be disbursed directly from NURI.

Quality of materials: There was no mechanism for testing the quality of materials to ensure they meet the requirements. The quality of sand was not meeting the specifications. Broken concrete poles were observed in Imvepi market and the gravel which was dumped could not meet the specifications

Recommendations: Materials should be inspected/tested and approved by qualified staff before use. Materials report should be on file.

Adequacy of sanitation facilities: The sanitation facilities did not meet minimum standards of having a urinal, washroom for women and adequate number of stances. There was a hand washing facility on one side of the toilet. There was not stance with facilities for physically disabled persons.

Recommendations: Construct sanitation facilities which meet minimum standards



Figure 13: Toilet at Andelizu Market



Figure 14: Fencing at Andelizu Market



Figure 15: Toilet with Rainwater Harvesting at Ombeteni



Figure 16: Fencing at Imvepi point J market

4.5 Food Forests

A total of 7 food forests were visited in West Nile (4) and Kitgum (3). The work involved bush clearing the site, pitting, planting, and weeding. The size of the food forests ranged from 2 acres to 6 acres depending on the availability of land. A combination of fruit and timber trees (wide canopy and shrubs) were grown. The forest design is 49 wide canopy and 250 fruit trees per acre. The type of trees planted included Afzelia, Tamarindus, Mahogany, White and Indian Teak, Gmelina, Neem, Guava, Lemon, Mango, Oranges, Mvule, Giant Lira, Malian Arboria, Shea nut, Jack fruit, Acacia, Pinus, Coriander, Gmelina, Eucalyptus, Tamarind, Tangerine, Pawpaw, Bananas, Aloe vera and Hibiscus among others. Water conservation measures in the food forests included construction of bioswales to trap storm water runoff and Smile berms. All food forests visited had bioswales constructed, at least one per acre. The smile berms were constructed around some trees in West Nile. All food forests visited were planted on land belonging to schools and churches. This was to ensure continued maintenance after the end of the project.

Assessment of the food forests show that in some forests, fruit trees were dominant while in others timber trees were dominant. For example, at Offaka Primary School food forest (Arua), shrub and timber trees were more than the fruit trees. This was attributed to the rocky nature of the soils.

The survival rate of trees in West Nile was above 80% while in Kitgum as low as 30%. This was attributed to the timing of planting. In West Nile, it was reported that planting was carried in April – May 2020 when it was raining heavily while in Kitgum it was done in July 2020 when the rains had reduced. The drought which started around November up to the time of the assessment in February affected the food forests in Kitgum.

Soil testing was not done to determine the tree that grow well in particular area. The project relied on the expert knowledge of the District Forest Officer and consultations with the beneficiary communities. This partly explains the low survive rate of planted trees. In Kitgum for example, the survival rate for Indian Teak, Mahogany and Mvule was low compared to West Nile. The reasons for not testing the soil properties were not provided but the investment lost due to low survival rate outweighed the cost.

Most of the bioswales seen were relatively new and because of the dry season, were not functional. However, there is no doubt, when it rains, the bioswales will be able to retain some storm water in the forest to be used by the trees. It was too early to assess the long term sustainability of bioswales. Construction of the smile berms was not done consistently, some trees had and others did not. Majority of smile berms were unrecognizable because of poor maintenance and as result were not performing effectively. The groups needs to be trained on construction and maintenance of smile berms.

Recommended spacing of the different tree species was not followed. For example, the recommended spacing of mango trees is 8m x 8 m which was not the case in the majority of the cases. A variety of tree species were planted in between the wide canopy trees without consideration of recommended spacing and sequencing of the planting. This will affect growth and yield due to stiff competition for nutrients and sun.

All the food forests were properly fenced with barbed wire to prevent animals. However, the poles used were not treated and as a result, are unlikely to last long because of the termites which had started destroying them.

The maintenance of the forests was being done by the groups and it varied across the districts. However, those in West Nile were better maintained than in Kitgum. Although the two subregions were experiencing dry weather, Kitgum was worse off and most of the trees did not survive. The forests need replanting and/or gap filling. Given the nature of trees planted, they require effective maintenance for at least 2 – 3 years for the majority of the trees to be able to survive on their own. Hand over maintenance of the trees to the institutions should be based on objective assessment of the stage of the trees, maintenance requirements and ability of the institutions.



Figure 17: Teak at Offaka PS food forest



Figure 18: Adribu COU food forest



Figure 19: Adyee Food Forest -hit by drought



Figure 20: Bio-Swells with filtration pit at Adyee Food forest

Issues that require attention

Fireline: All the forests visited did not provide for the fire line. Trees were planted up to the fence. Bush burning was common in the area and there was evidence of the fire reaching some of the gardens. There is high risk of losing the forests to fire if action is not taken to establish the fire line.

Recommendation: Establish the fire line of at least 10 meters around the food forests to prevent fire burning the trees.

Learning: The food forests were intended to demonstrate to the community including students on tree planting and maintenance. However, there was no evidence of involvement of students at the various stages for them to learn. The knowledge they would acquire would enable them to appreciate the importance of planting trees and possibly influence their parents to do so.

Recommendation: deliberate effort should be made to involve students at all stages of tree planting where the forest is planted on school land.

Low survival rate of tree raises the question whether right species were planted, soils tested or planting was done at the right time. In Kitgum where the survival rate is low, there is need to investigate the causes of low survival rate before replanting.

Recommendation: (i) There is need to investigate the causes of low survival rate of trees (ii) There is need for gap filling/ replanting to replace the seedlings that died.

Hand over maintenance: All the food forests visited were very young requiring effective maintenance. Majority require gap filling/replanting which reinforces the need for continued effective maintenance for at least one year. The institutions needs to be prepared and their capacity built to takeover in a phased manner.

Recommendation: The handover of maintenance of food forest should be based on the stage of the trees and capacity of the institutions to takeover.

Spacing and sequencing planting of trees: The spacing of trees was random and all tree species in the same forest were planted at the same time without consideration of the soil fertility and rainfall which affect the growth rate.

Recommendation: The project should adopt best practices in planting food forests to ensure the right mix of tree species, spacing and sequencing of planting.

4.6 Valley tank

Akino Valley Tank is located in Rhino Camp Settlement. Its capacity is about 60 cubic meters. The works involves excavation which was substantially. What was remaining was construction of spillways, intake works, clearing the site and restoration of the catchment. DRC hired the equipment which was used for excavation and has a clerk of works who supervise the works. It was reported that MWE personnel (Upper Nile Water Management Zone based in Lira) monitors the construction works.

Issues that require attention

Supervision: The valley tank involve major and complex construction works which should have Independent Engineer to supervise it. DRC is the contractor working without Independent Engineer. MWE is cannot take responsibility of Engineer in case major issues arise.

Recommendation: NURI should consider hiring Independent Engineer to supervise and certify big complex works like Valley Tank to avoid possible litigation in case the dam gives way and there is loss of property and life.

Lack of Project Bill Board: Building regulations require that such construction works should have a project sign post indicating the Client, Contractor, Supervising Engineer etc. This enable scrutiny and accountability.

Recommendation: Provide the project bill board/sign post as per the building regulations.



Figure 21: Equipment at Akinio Valley Dam-60 cubic metres



Figure 22: Valley dam under construction at Akinio

5. MEETINGS WITH DRC AND DISTRICTS

5.1 Meeting with DRC/NURI

Key issues/observations

- Water resources infrastructure projects had not commenced. The micro catchment plans had just been completed by the MWE.
- Testing of materials was not being done.
- The district Engineers are supposed to certify the works before payment. However, they complain about the allowances and come at the end to certify for payment.
- Piloting of the resilient designs is ongoing. However, there is need for intensive community sensitisation and awareness creation to sustain the infrastructure.

5.2 Meeting with Districts

Key Issues/Observations

- The district appreciated the work of NURI in improving the infrastructure.
- The District staff complained of little allowance provided (20,000) noting that it was not commensurate to the work they do and it delays being paid. As a result, the senior staff delegate their junior staff to monitor the works.
- Reported that some of the materials used do not meet the standards and as result, have rejected some of the works. Materials need to be tested to ensure they meet the standards.
- Requested for full gravelling instead of spot gravelling to ensure the road works last longer.
- Arua district Engineer said that the district is going to take over some of the project roads to ensure continued maintenance.
- District roads committee will prioritize maintenance of the project roads.
- Reported that the staff needed refresher training at MELTEC on labor based road maintenance contracts.
- Water quality tests were done but needs to be carried out at regular interval to ensure the community is drinking safe water.

5.3 Meetings with Community Groups/Beneficiaries

Discussions with leaders of community groups and beneficiaries revealed the following.

- The groups were happy with participation in the project activities.
- Each member worked for 20 – 25 days depending on the quantum of work allocated.
- Each day worked, they earned UGX 6,000 per day worked.
- Some group members saved part of the money with their saving associations/groups.
- Women reported that they used this money to pay school fees and meet basic household needs.
- The beneficiaries were also happy especially with the protected springs. Women testified that they used to share same source of water with animals and their children used to suffer from frequent incidences of diarrhea.
- The communities were also happy with road opened because distance and travel time were shortened to reach the neighboring villages. Some roads had been rendered impassable because of lack of culverts to cross rivers/streams.
- Some community members were resisting resilience road designs for fear of flooding their gardens with storm water.
- Road Users Committees will mobilize the community to maintain the roads. However, it was reported that community members were used to be paid for working on the roads may be reluctant to work for free.

- For markets, women were happy with the fencing but complained of lack of stalls and shelter from the sun.
- Inclusiveness was considered during the selection of group members. Each household provided one person and households with vulnerable persons were prioritized.

Issues that require attention

Community engagement needs to be enhanced. Some people resisted channeling storm water/surface runoff to their gardens and bioswales were not being maintained. There is need for more sensitization and mobilization of the community.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This assignment was intended to conduct quality assurance of a sample of infrastructure projects implemented by DRC under rural infrastructure and water resource management components of the NURI programme. The assessment was undertaken on a sample of 26 sub-projects and the general finding was that the infrastructure was implemented according to specifications and most of it meet the standards . The infrastructure was constructed at relatively low cost compared to the sector average costs.

However, there are few areas that needs to be addressed as outlined in this report. Notably delayed completion of subprojects, road safety, supervision, quality of materials, catchment protection and software activities. If these are addressed, we have no reservation in concluding that DRC is doing an excellent job.

6.2 Recommendations

- 1) Reduce the time lag between construction activities and ensure subprojects are completed on schedule.
- 2) The backlog for compaction of roads and culverts works should be addressed as soon as possible.
- 3) Materials like culverts, concrete poles, sand, and gravel should be inspected and tested to confirm they meet the standards before use.
- 4) Piloting of resilience designs should be accompanied by intensive software activities (community sensitization and mobilization) to foster adoption.
- 5) Provision of adequate land for catchment protection should be a precondition for provision of water related infrastructure.
- 6) The design for protected springs should be inclusive to ensure physically challenged persons can draw water with ease.
- 7) There is need to do improvement on cattle drinking area for the water ponds
- 8) The District Engineer's office should be well facilitated to intensify on the supervision of works during construction.
- 9) Establish the fire line of at least 10 meters around the food forests to protect the forest from bush fires.
- 10) Deliberate effort should be made to involve students, school management committees, PTAs and education departments at all stages of tree planting where the forest is planted on school land to enable them to learn.
- 11) There is need for gap filling/ replanting to replace the seedlings that died.
- 12) NURI should consider hiring Independent Engineer to supervise and certify big complex works like Valley Tank to avoid possible litigation in case the dam gives way and there is loss of property and life.

Table 3: Annex 1: Comparison of National Guidelines with NURI infrastructure Manual

Technology	National Guideline Document / manual	Adherence to National Guideline Yes / No	Remarks IN - Innovations Observed IM – Improvement Required
Community Access Roads	MoWT labour based Technology road construction Manual	Yes	IN - Bio swells and other water retention structures that feed into agriculture
Springs	MWE Design Manual 2013	Yes	IN – Ponds being created downstream of the spring which are immediately used by cattle and watering of crops. IM – The protected area above the spring is small. This needs to be improved
Ponds	MWE Design Manual 2013	Yes	IN – ponds constructed near the community access roads reduce on the run off that flood up the roads. The water is thus trapped for animals and excess for watering crops
Valley Tanks	MWE Design Manual 2013	Yes	IN – daily payment for workers while using hired equipment has proved way cheaper than use of private sector .
Food Forests	NEMA guidelines on afforestation	YES	IN – The idea of food forest is twofold. a) Reforestation thus improving on vegetation cover and b) Nutrition requirements improved. IM – Some species are not suitable for the soils. More research on appropriate species required particularly in Acholi subregion.
Local Markets	MoWT Building Regulations	Yes	IM – Provide for market stalls in the program so that vendors put their merchandise in hygiene environment

IN – Innovations observed, recommended for inclusion into current National manuals and guidelines

IM – Areas for improvement noted.

Table 4: Annex 2: Comparison of infrastructure with National costs

Technology	NURI cost	Estimated National costs	Remarks
Protected Spring	7,000,000	12,000,000	Project price low yet good workmanship
A km of Community Access Road Single and double lines of culverts	16,000,000 to 24,000,000	33,000,000 to 40,000,000	Half price yet very good workmanship
Water Pond	42,000,000	45,000,000 to 60,000,000	Project price lower
Food Forest (2.5 acre)	13,127,690	20,000,000	Project price lower

Reduced price yet workmanship and standard very good

Attributions:

1. Engaging the community to participate
2. Training locally available artisans to take on skilled labor
3. Advertising within the region.
4. Buying of some materials by the program not left to contractors (suppliers which escalate the costs)

Table 5: Annex 3: Community Access Roads (West Nile) and Kitgum

Community Access Roads	Coordinates	Sub county	Road shaping	Spot Gravelling	Culvert Installation	Side Drains	Project Length	Remarks
Kasikasi – Ewadri P/S	3.0789062: 30.9465781 Alt 1,199.94 masl	Manibe (Arua District)	Well done	Not yet done	All culverts installed. Culvert approach ok	Done	3.0 km	Innovation on this road. The mitre drains drain into the soil swells and ponds for further use (water) to crops (irrigation)
Angucuku – Bakita		Pajulu (Arua District)	Well done	Done	Done	Done	1.8km	Handles a lot of traffic. Carriage way well done
Dena TC – Abiriban market CAR (imvepi settlement)	3.3277857, 31.1869597 Alt	Odupi (Terego District)	Well done	Not yet done	Done	Done	4km	Culvert approaches okay Road in use
Aiivu – Joyia CAR	3.2937629, 31.1867441 Alt 944.83 masl	Odupi (Terego District)	Done	Not yet but good surface	Done	In process	5.1 km	Culvert approaches okay Road in use
Olujobo HCIII – Odoi landing site	3.0665749, 31.4049915	Rigbo (Madi - Okollo District)	Done well	Not yet done	10 lines installed	Done but no mitre drains	5.1 km	Drains well done and culverts well installed Road in use

Community Access Roads in Acholi Sub Region – Kitgum

Community Access Roads	Coordinates	Sub county (Kitgum District)	Road shaping	Spot Gravelling	Culvert Installation	Side Drains	Project Distance	Remarks
Opete Ps – Amida SS	3.2770832, 32.8938908 Alt 953.67 masl	Labongo Amida	Well done	Not yet done	5 lines of culverts installed out of 6	Done	3km	Road well shaped Road in use

Community Access Roads	Coordinates	Sub county (Kitgum District)	Road shaping	Spot Gravelling	Culvert Installation	Side Drains	Project Distance	Remarks
Mugila – Atimkikoma	3.3971967, 32.9970205	Mucwini	Shaping ok. Compaction to be improved	Not fully done	11 lines. Installation ongoing	Done	5.4 km	Taking a good shape Road in use
Tomatoo – Laborom CAR	3.3760542, 32.9155252 Alt 997.87 masl	Labongo Layamo	Shaping ok. Compaction to be improved	Not yet done	Culverts installed	Done	5.4 km	Road well shaped. Spot gravelling still required Road in use
Tee – Neam - Akado PS		Akwang	Road shaped well	Not yet done	6 out of 9 culverts installed	Done	5.3 km	Road shaped well. Already in use

Markets

Market	Coordinates	Sub Region	District	Chain link	Gate House	Presence of Sanitary facility	Garbage pit	Stalls	Remarks
Ombetini Market (53x41)		West Nile Pajulu	Arua	Installed on concrete poles but base concrete not good	Constructed. Well done	Yes both Men and Women with hand wash facility	Dug but not yet secured	No stalls. Vendors constructing	Market stalls not on program but required
Andelizu Market	2.9508335, 30.9218315 Alt; 1,217.92 masl	West Nile Vurra Sub county	Arua	Installed on concrete poles but base concrete not good	Well done	Yes, for both Men and Women. No hand was facility yet	Two pits dug but not yet protected	No Stalls (Makeshifts done by vendors)	Market stalls not on program but required
Imvepi Point J Market (100x100)	3.2654336, 31.276583 Alt 801.89 masl	West Nile Odupi sub county	Terego	Being installed	Not yet constructed	Yes, for both men and women and hand washing facility	Not yet dug	No stalls	Uniform market stalls required. Not makeshifts provided by vendors

Springs

Spring	Coordinates	Sub Region	District	Spring well secure (catchment)	Workmanship	Drainage around Spring	Accessibility and ease of use	Water User Committees present	Remarks
Okaa	3.1077609, 30.8105892 Alt: 1,252.67 masl	West Nile Ayivuni Sub County	Arua	Not enough	Good	Well drained	Accessible but no rump for special needs group	Not yet but Management committee in place	Advised to protect a bigger catchment than the 5x5 meter that is fenced off
Goyiva	3.0409618, 30.8759114 Alt: 1,186.83 masl	West Nile Ayivuni Sub County	Arua	Not enough	Very good	Well drained	Accessible but no rump for special needs group	WUC formed but not yet trained	Advised to protect a bigger catchment than the 5x5 meter that is fenced off
Baapa	3.1438045, 31.1272549 Alt: 802.80 masl	West Nile Uriama Sub county	Arua	Enough	Very good	Well drained	Accessible but no rump for special needs group	Not yet but Management committee in place	Some resilience design. Spring has pond for cattle. At the time of visit the spring had dried up. Need to further investigate

Ponds

Ponds	Coordinates	Sub Region	District	Capacity	Workmanship and general planning of the pond	Catchment and Drainage	Accessibility and ease of use	Water User Committee	Remarks
Lalwal water pond	3.3760542, 32.1038623 Embankment too needs to be protected	Acholi	Kitgum	Capacity 1235 cubic meters	Good workmanship and well planned with spillway	Catchment needs to be protected	Access through mud. Some modification will be required.	WUC present with 4 members 2 female	Some riprap may be required for cattle to access the pond well without getting stuck

Ponds	Coordinates	Sub Region	District	Capacity	Workmanship and general planning of the pond	Catchment and Drainage	Accessibility and ease of use	Water User Committee	Remarks
Lanodyang Water Pond		Acholi	Kitgum	Capacity 1200 cubic meters	Good workmanship and well sited	Catchment needs to be protected	Access through mud. Some modification will be required.	Management committee still in place. To be replaced after construction	500 tree seedlings to be planted at the garden created
Akinio Valley tank	3.0846534, 31.2739259 Alt: 668.70masl	West Nile	Terego	Capacity 60,000 cubic meters Excavation ongoing about 60% done Assistance from Ministry of water and environment (Upper Nile Basin Water Management Zone)	Good	Yet to do. Work ongoing	Still under construction	Management committee in place	Consultant advisable

Food Forest

Food Forest	Coordinates	Sub Region	District	Species of trees grown	Spacing (Meters)	Maintenance (weeding, beating, pruning) and protection (animals, Fire)	Pests and Disease control	Acreage planted	Remarks
Ombokoro	3.0129471, 30.9465781, Alt: 1,172.81 masl	West Nile Oluko Sub County	Arua	Jamaline, Afzeria, Neam, Teak, Olvera, Mango, Acacia, Tarmalindus, pine, Jackfruit,	3	Weeding done, beating to be done and pruning No fire barrier in place Fenced to keep off animals	Done naturally. No use of chemicals	6	
Offaka Ps Food forest	Coordinates:	West Nile Offaka Sub county	Arua	Guava, teak, Mango, Jamaline, Jackfruit,	3	Maintenance (weeding, beating pruning) yes done by the chosen groups	Pests and disease control: not done. No pesticide allowed	6 with 60 group members	Work done very well

Food Forest	Coordinates	Sub Region	District	Species of trees grown	Spacing (Meters)	Maintenance (weeding, beating, pruning) and protection (animals, Fire)	Pests and Disease control	Acreage planted	Remarks
Obiyo Chapel food forest	2.6878391, 31.1031895 Alt:10,030.02 masl	West Nile Okollo sub county	Madi-Okollo	Types of trees: Guava, teak, Mvule, Mango, Jamaline, Afzeria, Neam, Guava, Alvera, Acacia, Pine, Jackfruit,	3	Maintenance (weeding, beating pruning) done done by the group members well fenced off but no fire line	Pests and disease control: not done. No pesticide allowed	6 with 60 group members	Work done well
Adribu C.O.U food forest		West Nile Anyiribu Sub County	Arua	Types of trees: Guava, teak, Mvule, Mango, Jamaline, Afzeria, Neam, Guava, Alvera, Acacia, Pine, Jackfruit,	3	Maintenance (weeding, beating pruning) yes done by the chosen groups Fenced off to prevent animals But no fire line	Pests and disease control: not done. No pesticide allowed	Acreage planted: 3 acres with 30 members taking care of the group	Quality of Workmanship: good Some beating needed
Illi Food Forest	3.230187, 31.1164402 Alt: 919.84 masl	West Nile Uriama Sub county	Arua	Tree type: Jamaline, afzeria, Nim, Teak, Alvera, mango, acacia, Tarmalidus, pine, Jack fruit	3	2-meter fire line observed but not enough, we need about 5 meter	Pests and disease control: not done. No pesticide allowed	3 acres 60 people responsible and 29 are women	Some beating needed
Akworo PS food forest	Coordinates 3.2401169, 32.9155252 Alt: 953.67 masl	Acholi Akworo parish Labongo Amida sub county	Kitgum	Mvule, Tik, guava pawpaw	3	Fenced off but no fire line.	Pests and disease control: not done. No pesticide allowed	2 acres. One group of 30 people managing	Gap filling for fruit trees only required
Adyee PS food forest	3.2932433, 32.8770118 Alt: 3,087.87	Acholi Lamit parish, Labongo	Kitgum	All species have failed	3	Replanting needed	Pests and disease control: not done. No	3 acres 1 group	The district Forest officer needs to advise on species that can survive

Food Forest	Coordinates	Sub Region	District	Species of trees grown	Spacing (Meters)	Maintenance (weeding, beating, pruning) and protection (animals, Fire)	Pests and Disease control	Acreage planted	Remarks
		Akwang sub county					pesticide allowed		
Alune PS Food Forest		Acholi Lamit parish, Labongo Akwang sub county	Kitgum	50% survival rate. Most fruit trees did not survive The other trees too had less survival rate.	3	Replanting needed	Pests and disease control: not done. No pesticide allowed	3 acres	Replanting necessary The district Forest officer to advise on species for replanting.