Project Update: July 2014

Landscape degradations have negatively impacted on human livelihoods and long-term sustainability. Global Partnerships on Forest Landscape Restoration (GPFLR 2011) ranks Uganda as critically in need of restoration. Northern Uganda has acute ecosystem degradation. Yet gaps in knowledge and skills in landscape restoration remain major challenges. We provide baseline ecological and anthropological information, to aid in the landscape restoration process.

The existing vegetation cover on the Muni Hill landscape was mapped and planted with 400 seedlings of tree species which included *Swietenia mahogani* (mahogany), *Milicia excelsa/Chlorophora excelsa* (mvule), *Grevillea* sp., and *Eucalyptus* sp. These are species that are indigenous and/or adapted to the landscape, and are of ecological and economic value.

Soil samples were taken at various depths and analysed for pH, total nitrogen, available phosphorus, exchangeable potassium, and exchangeable calcium prior to planting, to provide an insight into the nutrient composition and the levels of degradation of the soils in the study site. The results of the soil analysis showed that the soils in the landscape are very low in pH, total nitrogen, available nitrogen, exchangeable potassium, and exchangeable calcium.

Tree seedlings were planted in pits measuring approximately 1.5 ft. (diameter) by 2 ft. (depth) filled with topsoil. Pit spacing was 6 m apart. Over 450 seedlings were planted in the first season. More are expected to be planted in the main rainy season.

1.0 Background

Ecosystem restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed (SERIS, 2004). Degraded landscapes worldwide have obvious impacts for both human health and welfare since almost half the world's population is dependent on fisheries, forests, and agriculture for jobs (UNEP, 2007). It is estimated that 60% of the world's ecosystem services are in the process of degradation or are being used in an unsustainable manner. Moreover, most of these damages have occurred within the lifetime of this generation (Telesetsky, 2013). Globally, Africa is ranked highest with the greatest potential for landscape restoration given the high rate of landscape degradation on the continent (PROFOR, 2011).

The Global Partnership on Forest Landscape Restoration (GPFLR) estimates that a range of landscape restoration approaches could be applied to cover 715 million ha of degraded landscape in Africa. The GPFLR (2011) categorises Uganda and the West Nile region as critical, requiring extensive landscape restoration. It is estimated that over 90,000 ha of forest cover are lost per year in Uganda, primarily to agriculture, logging, and wood-fuel. Consequently, Uganda's forest cover has dropped from 4.9 million ha in 1990 to 3.6 million ha in 2005, accounting for a deforestation rate of 1.9% (NFA, 2011). Deforestation is particularly rampant

in northern Uganda where it has resulted in loss of biodiversity, increased soil erosion, declines in agricultural productivity, degradation of wetlands and overall climate change. Moreover, the high Ugandan population growth rate, estimated at 3.6%, is expected to increase the demand for nutritious food from agriculture and other natural resources (NR). Therefore, landscape restoration of degraded sites is critical to ensure sustainable NR and other biodiversity conservation in order to adapt to climate change. There is limited understanding and practical skills on the topic of landscape restoration in Uganda. In addition, no adequate landscape restoration exercises with the goal of nature conservation have been carried out over the years in Uganda. This project seeks to fill these gaps.

This progress report is based on *Phase I* of reforestation/afforestation activities aimed at achieving object 1 of the project. The goal was to map the existing vegetation cover on the Muni Hill landscape for reforestation and afforestation with indigenous tree species of ecological and economic value.

1.1 Project goal and objectives

The goal of this project is to restore and conserve landscapes in northern Uganda where communities are heavily dependent on NR. The objectives are to:

1. Restore degraded landscapes and ecosystems through promotion and conservation of suitable and endangered tree species with a focus on *Khaya* spp., *Cacia* spp., *Albizia* spp. and other indigenous tree species.
2. Address socio-economic issues in landscape management, NR conservation, and agriculture through development of behavioural change strategies.
3. Determine the influence of the restored landscape and ecosystem on water quality and on the composition and abundance of biodiversity in the Muni landscape.

2.0 Materials and Methods

2.2 Project area

Location

The project site is located in Arua district, in northwestern Uganda. Arua district lies between latitude 20° 30' N and 30° 50' N and longitude 300° 30' E and 310° 30' E. It is bordered by Maracha district to the north west; Yumbe district to the north east; the Democratic Republic of Congo to the West; Nebbi district in the south; Zombo district to the south east; and Amuru and Adjumani districts to the east. The district covers a total area of 4,274.13 km^2, 87% of which is arable. The area under forestation is 178,480 ha.

Climate, relief, and vegetation

Annual rainfall in the district ranges from 750-1,000 mm. Atmospheric temperature ranges from 25-32°C. Relative humidity ranges from 60-65%.

Demography
The population projection of Arua district as of 2011 is 776,700 (403,000 female and 373,700 male). The district has four counties and 27 sub-counties. The major languages spoken in Arua district include Lugbara, Alur, Kakwa, Nubi, and Madi.

2.2 Data collection

2.2.1 Soil sampling

Prior to reforestation/afforestation, soil samples were collected and analyzed for pH, total nitrogen, available phosphorus, exchangeable potassium, and exchangeable calcium, to provide an insight into the nutrient composition and the levels of degradation of the soils in the study site. The soil samples were collected using a soil auger. Samples were taken at depths of 25 cm, 50 cm, 75 cm and 85 cm, respectively. During sampling, observations on soil characteristics on colouration, texture, and adhesiveness were also recorded.

2.2.2 Boundary mapping

Three line transects were used to map the boundary of the study area as follows: a) north-west (along River Asa), b) south-west, and c) north-east. The line transects mark the boundary of the study area. The north-south boundary is marked by a national road highway.

Points along the three transects were marked for reference and physical features using a hand-held Global Positioning System (GPS, Garmin GPSMAP 62s) (Table 1). In addition, Observations are made on escarpment, natural resource degradation (soil erosion), River Asa catchment coverage (distinct catchment width) and extend of human encroachment. Mapping was done using foot trekking.

Table 1.0 GPS readings for reference points along the line transects within project area

SN	Point reference	Elevation (m)	Northing	Easting
1	Footpath on northern boundary along national road highway	1195	02° 59 931’	30°55 591’
2	Escarpment along the River Asa catchment system	1188	02°59 947’	30°55 518’
3	Access foot bridge across River Asa	1183	02°59 916	30°55 491’
4	Proposed Arboretum site	1184	02°59 838’	30°55 460’
5	University-NTC boundary	1190	02°59 767	30°55 442’
6	University Library	1199	02°59 760’	30°55 510’
7	National road highway	1200	02°59 772’	30°55 641’

2.2.3 Reforestation/Afforestation

Following the mapping of the study area boundary, a passive restoration process started with the mobilisation of volunteers. Three groups have so far endeavoured to participate in the afforestation programme. This formed *Phase I* of reforestation/afforestation. Pits measuring approximately 1.5 ft. (diameter) by 2 ft. (depth) were dug and filled with topsoil. Pit spacing was 6 m apart, which is the recommended spacing by the National Forest Authority in Uganda.

2.2.4 Consultative meetings with key Stakeholders

(Arua district environment officers, Agricultural officer, local leaders, community focal persons, NEMA, and UNATCOM).

3.0 Results and Discussions

3.1 Soil analysis

Soil pH

On average, all soil samples were acidic except those taken at the bridge, which were neutral (Table 3.0). The results suggest that the soils are not favourable for production of most crops. However, they could be improved through liming.

Total nitrogen

In general, the soils in the study area are low in total nitrogen, suggesting that the soil in the landscape is low in organic matter content. This could be attributed to the heavily degradation of the soil through erosion. The low total nitrogen content is not adequate for optimum crop production.

Available phosphorus

The soils are very low in available phosphorus, hence not adequate for crop production. For good crop yields, additional phosphorus input through fertilisation is recommended.

Exchangeable potassium and exchangeable calcium

Both levels of exchangeable potassium and calcium were found to be very low. This could be attributed to the low pH levels in the soils, which negatively affects potassium and calcium levels in soils.

3.2 Reforestation/Afforestation (Phase1)

More than seven plant species of which six tree species were planted along the north-west (along River Asa) and South-West boundaries on three separate occasions. More than 450 seedlings of five tree species, namely *Swietenia mahogani*, *Milicia excelsa* or *Chlorophora excelsa*, *Ficus benjamina*, *Jacaranda mimosifolia, Grevillea robusta* and *Eucalyptus grandis*, were planted in intervals along the established line transects. Others included herbaceous

plants of medicinal or ornamental values. The relative numbers of each species planted are shown in Table 2.0 the choices of tree species were determined by characteristics and values of the species. Reforestation/afforestation was carried out in partnership with the Rotary Club of Arua (affiliate of Rotary Club International), National Forest Authority, District Forest Office, District Environment Office, and the beneficiary community.

3.3 Consultative meetings

Consultative meetings with key stakeholders (Arua District environment officers, agricultural officer, local leaders, community focal persons, NEMA, and UNATCOM) was held in Arua early 2014. Ideas were exchanged and guidance was received from the NEMA and UNATCOM team on the best approaches to be used in restoration of the River Asa and its landscape and community involvement. That the project team should employ passive restoration approach by planting and mobilising communities to plant trees.

Table 2 Tree species planted in *Phase I* of reforestation/afforestation of the Muni Hill landscape

SN	Tree species	Number planted	Comments
1	*Swietenia mahogany*	50	Indigenous timber species
2	*Milicia excelsa/Chlorophora excels*	100	Indigenous timber species
3	*Ficus benjamina*	05	Indigenous and ornamental
4	*Grevillea* robusta	50	Exotic-timber, pole, wind break, soil conservation, species
5	*Eucalyptus grandis*	200	Exotic timber, firewood, wind break and poles
6	*Jacaranda mimosifolia*	45	Exotic ornamental/medicinal
7	*Aloe vera and herbaceous*	-	Ornamental and medicinal value

Table 3 Levels of pH, total nitrogen, available phosphorus, exchangeable potassium, and exchangeable calcium in soil samples taken from the Muni Hill landscape

SN	Details	pH	Nitrogen (%)	Phosphorus (mg/kg)	Potassium (cmol/100g)	Calcium (cmol/100g)
1	Library (85 cm)	5.69	0.093	0.451	0.918	4.5
2	Library (50 cm)	6.88	0.117	3.030	0.865	6.0
3	Library (75 cm)	6.23	0.093	0.644	1.263	5.25
4	Library (25 cm)	6.41	0.070	0.580	0.897	5.25
5	Source 1 (50 cm)	7.28	0.070	0.451	0.410	2.25
6	Source 1 (25 cm)	5.19	0.070	3.993	0.615	3.75

7	Source 1(85 cm)	6.68	0.047	0.837	0.615	3.0
8	source 1 (75 cm)	7.13	0.023	0.580	0.404	2.2
9	Source 2 (85 cm)	6.66	0.140	1.996	0.865	2.2
10	Source 2 (75 cm)	5.47	0.070	0.837	1.99	3.0
11	Source 2 (50 cm)	5.61	0.117	1.030	0.837	3.0
12	Source 2 (25 cm)	5.40	0.140	1.417	0.801	2.25
13	Arboretum (85 cm)	6.05	0.070	1.868	0.571	2.25
14	Arboretum (75 cm)	6.69	0.070	0.902	0.455	2.25
15	Arboretum (50 cm)	6.50	0.930	1.159	0.673	2.25
16	Arboretum (25 cm)	7.17	0.070	2.333	0.673	2.25
17	Bridge (85 cm)	6.73	0.070	1.546	0.929	2.25
18	Bridge (75 cm)	7.17	0.070	3.992	0.564	10.50
19	Bridge (50 cm)	6.87	0.117	3.027	0.256	4.50
20	Bridge (25 cm)	7.36	0.117	0.966	0.769	9.75
21	NISA (85 cm)	5.85	0.140	0.839	0.590	6.00
22	NISA (75 cm)	5.38	0.117	0.773	0.853	3.75
23	NISA (50 cm)	5.65	0.630	1.996	0.974	3.75
24	NISA (25 cm)	5.81	0.187	0.515	0.865	6.00

4.0 Ongoing Activities

a) Further assessment of water quality of River Asa.
b) Data analysis of socio-economic activities of households.
c) Mobilisation of other segments of communities to plant trees.
d) Creation of awareness.

5.0 Planned Activities

a) More planting during rainy season.
b) Community mobilisation and awareness creation.
c) Final report writing.

6.0 Challenges

a) Limited funds for research equipment and chemicals.
b) Long distance (535 km Arua-Kampala) from specialised stores and laboratories renders it costly to travel for the team to travel and conduct laboratory analysis.
c) Continuous drought is jeopardising the survival of planted seedlings.

Figure 1.0 Seedlings, ready for planting

Figure 2.0 Volunteers planting trees

Figure 3.0 Rotarians led by Rotary President Proscovia Arima in planting trees (May 2014)