

**Forest mapping and pre-inventory of the Sudanese refugee
hosting areas in Maban and Pariang counties, South Sudan
(24 April – 12 May 2014)**



Mission report part A

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List of abbreviations

ACTED	Agency for Technical Cooperation and Development
DRC	Danish Refugee Council
EG	SDC's Expert Groups
HAFL	School of Agricultural, Forest and Food Sciences
IP	Implementing Partner (UNHCR)
MAFCRD	Ministry of Agriculture, Forestry, Cooperatives and Rural Development
NGO	Non-Governmental Organisation
OCHA	Office for the Coordination of Humanitarian Affairs
RSL	Remote Sensing Laboratories (University of Zurich)
RSS	Republic of South Sudan
SAFE	Safe Access to Fuel and Energy
SDC	Swiss Agency for Development and Cooperation
UNEP	United Nations Environment Programme
UNHCR	United Nations High Commissioner for Refugees
UNOSAT	UNITAR Operational Satellite Applications Program
UNITAR	United Nations Institute for Training and Research
WFP	World Food Programme

Contents

Executive summary	5
1. Introduction.....	6
2. Biogeography of the Sudanese refugee hosting areas.....	7
3. Methodology	9
4. Findings.....	12
4.1 Ground truthing and forest pre-inventory	12
4.2 Capacity building	12
4.3 Community Forest Management	13
4.3.1 Fire.....	13
4.3.2 Forest revenue.....	15
5. Conclusions and outlook	16
6. Recommendations.....	17
6.1 Recommendation for strengthening the environmental unit.....	17
6.1.1 UNHCR	18
6.1.2 Possible support from SDC.....	18
6.2 Operational recommendations	18
7. Bibliography.....	19
Annexe A: Terms of reference.....	20
Annexe B: Mission programme	21
Annexe C: List of organisations and persons met	24
Annexe D: Overview maps for field survey	25
Annexe E: Land cover sites	26
Annexe F: Vegetation sites	28
Annexe G: Trees and shrubs recorded in Maban and Pariang counties (June 2013 and April/May 2014).....	33

Executive summary

A forest mapping and inventory has been recommended for the Sudanese refugee hosting areas in Maban County (Upper Nile) and Pariang County (Unity States) by both, the multi-party rapid environmental assessment in November 2012 and UNHCR's environmental inception mission in June 2013.

The aim of the forest mapping/inventory is to estimate the total amount of accessible wood resources for defining a sustainable use of poles and fuelwood for the Sudanese refugees and local communities. The forest maps and inventories will serve as a basis for identifying potential harvest areas and for defining a community forest management where the locals take the lead in the sustainable management of their wood resources. This approach will also contribute to reduce the conflict potential between refugees and locals competing for the same natural resources.

A field mission has been carried out from 24 April – 12 May 2014 by a team composed of Dr. Urs Bloesch (SDC/HA, team leader), Charles Jalan Taban Lino (UNHCR Environmental Focal Point in South Sudan), John Ater Maker Dhalbeny (UNHCR Assistant Environmental Officer, Maban County), Mustafa Kur Lueth (UNHCR Assistant Environmental Officer, Pariang County), and Simon Dralley, Forest Officer at the Directorate of Forestry, MAFCRD. The team has been supported in Maban County with representatives from the agricultural and forest service including Abraham Hassan, Peter Tako and Edins Kor.

The reporting from the field verification and forest pre-inventory is split in two parts.

Part A (this report) includes mainly the description of the vegetation and land cover sites and the planning of the next steps of the forest mapping/inventory. The forest and land cover maps will be presented later in **Part B** of the report, once the Remote Sensing Laboratories from the University of Zurich have completed the mapping process (deadline 30 September 2014). Part B will also include the definite methodology for the full forest inventory and a first estimation of the standing stock and number of poles for the potential wood supply areas of the Sudanese refugees.

In total, 20 vegetation sites and 17 land cover sites have been described for the ground truthing and for taking the dendrometric measurements as a basis for a forest pre-inventory. The team members have been trained systematically in the field in order to build in-country in view of carrying out the subsequent full inventory largely autonomously. Some recommendations regarding further strengthening of UNHCR's new environmental unit are presented.

The full forest inventory is scheduled for October/November 2014 based on the final vegetation maps of Maban and Pariang counties. Prior to the start of the full forest inventory, a 3-days training workshop will be organised by UNHCR in Juba.

1. Introduction

A forest mapping and inventory has been recommended for the Sudanese refugee hosting areas by both, the multi-party rapid environmental assessment in November 2012 (UNHCR, UNEP, OCHA & RSS 2012) and UNHCR's environmental inception mission in June 2013 (Bloesch et al. 2013). The 210,000 Sudanese refugees in Maban County (Upper Nile) and Pariang County (Unity States) are by far outnumbering the local host communities. Since host and displaced communities are using the same local natural resources, the risk of overexploitation of the increasingly scarce natural resources in the refugee hosting areas is imminent what may lead to conflicts between locals and refugees.

As a result of escalating violence in South Sudan during December 2013 more than 1 million people are internally displaced and about 370,000 people have fled to neighbouring countries. In total, 4 million people are in need of assistance (OCHA 2014). Despite the tightened security situation, UNHCR/SDC have maintained this technical mission in line with the UN policy to keep up its presence and implementation of the Programmes and Projects as far as possible in order to appease the fragile situation.

The overall goal of the environmental inception mission was to identify the key environmental challenges and to draft a first environmental action plan. One of the key recommendations from the inception mission (Bloesch et al. 2013) was to carry out a forest mapping and inventory in both counties as a prerequisite for a sustainable planning of a wood supply.

The **aim** of the forest mapping/inventory is threefold:

- Estimating the total amount of accessible wood resources (and its spatial distribution) which can be used for poles; this figure is essential for defining a sustainable shelter programme based on the use of local materials where appropriate.
- Estimating the total amount of accessible firewood (charcoal) and its spatial distribution; this figure is a prerequisite for a sustainable use of firewood.
- The forest maps and inventories will serve as a basis for identifying potential harvest areas and for defining a community forest management where the locals take the lead in the sustainable management of their wood resources. This approach will also contribute to reduce the conflict potential between refugees and locals competing for the same natural resources.

Following UNHCR's request, SDC/HA accepted to support the remote sensing part of the forest mapping/inventory and to deploy a team leader for the field verification (ground truthing) of the satellite analysis done by the Remote Sensing Laboratories of the University of Zurich and for carrying out a forest pre-inventory (see ToR in Annexe A). An important task of the team leader was the on the job training in the field to build in-country capacity of the forest services at county level, the national Ministry of Agriculture, Forestry, Cooperatives and Rural Development, and the environmental section of UNHCR in view of carrying out the subsequent full inventory largely autonomously.

The field mission has been carried out from 24 April – 12 May 2014 (see mission programme in Annexe B and list of organisations and persons met in Annexe C) by a team composed of Dr. Urs Bloesch (SDC/HA, team leader), Charles Jalan Taban Lino (UNHCR Environmental Focal Point in South Sudan), John Ater Maker Dhalbeny (UNHCR Assistant Environmental Officer, Maban County), Mustafa Kur Lueth (UNHCR Assistant Environmental Officer, Pariang County), and Simon Dralley, Forest Officer at the Directorate of Forestry, MAFCRD. The team has been supported in Maban County with representatives from the agricultural and forest service including Abraham Hassan, Peter Tako and Edins Kor.

The reporting from the field verification and forest pre-inventory is split in two parts. Part A (this report) includes mainly the description of the vegetation and land cover sites and the planning of the next steps of the forest mapping/inventory. In addition, some thoughts are outlined about the introduction of a community forest management fire focussing on the fire regime and the shelter programme. Moreover, some recommendations regarding further strengthening of UNHCR's environmental unit and possible support by SDC are presented.

The forest and land cover maps will be presented later in **Part B** of the report, once the Remote Sensing Laboratories from the University of Zurich have completed the mapping process (deadline 30 September 2014). Part B will also include the definite methodology for the full forest inventory and a first estimation of the standing stock and number of poles (per main tree species) for the potential wood supply areas of the Sudanese refugees.

The full forest inventory is scheduled for October/November 2014 based on the final vegetation maps of Maban and Pariang counties. Prior to the start of the full forest inventory, a 3-days training workshop will be organised by UNHCR in Juba. In addition, land cover maps will be elaborated for both counties which are very useful for general planning purposes of the county authorities and the humanitarian actors.

2. Biogeography of the Sudanese refugee hosting areas

The biogeography of the Sudanese refugee hosting areas (see Fig. 1) in Maban County (Upper Nile) and Pariang County (Unity States) has been described in detail in the environmental inception mission report (see Bloesch et al. 2013).



Fig. 1. Sudanese refugee-hosting areas in Maban County (Upper Nile) and Pariang County (Unity States) of South Sudan

The total Sudanese refugee population has increased from 190,939 to 209,355 people since June 2003 (see Bloesch et al. 2013) due to new arrivals of refugees and high natural population growth within the refugee population (see current figures in Table 1 and 2). The population growth was different in Maban and Pariang counties with an increase of 7.6% and 12.8%, respectively. Yida settlement is still the most populated and these refugees remain reluctant to be transferred to the more safe Adjuong Thok camp. Yida is a spontaneous settlement in the insecure border area where UNHCR is only supporting life-saving activities to encourage voluntary relocation to Adjuong Thok.

Table 1. Sudanese refugees in Maban County (UNHCR 2014)

Camp	Coordinates	Refugee number (9 June 2014)	Households (9 June 2014)
Doro	9°58'26.79"N / 33°45'06.88"E	48,653	12,152
Yusuf Batil	9°59'01.11"N / 33°35'03.41"E	39,366	9,232
Gendrassa	9°59'04.44"N / 33°36'48.86"E	17,362	4,146
Kaya	10°05'30.67"N / 33°35'54.52"E	21,033	5,018
Total		126,414	30,548

Table 2. Sudanese refugees in Pariang County (UNHCR 2014)

Camp	Coordinates	Refugee number (9 June 2014)	Households (9 June 2014)
Yida	10°06'13.12"N / 30°05'02.12"E	70,865	15,842
Adjuong Thok	9°57'09.76"N / 30°16'18.99"E	12,076	4,303
Total		82,941	20,145

3. Methodology

The field survey has been jointly carried out with representatives from the national line ministry (MAFCRD) and the local forest services. The local authorities have been consulted before going to the field (see programme in Annexe B).

The RSL from the University of Zurich has been mandated by SDC to carry out the remote sensing part of the forest mapping/inventory in Maban and Pariang counties. The RSL has identified typical sites for the field verification (ground truthing). In total 49 vegetation sites and 33 land cover sites nearby the refugee camps (settlement) and along the access roads have been located on digital map sections using high resolution World View II satellite data provided by UNOSAT (only for Maban County) and Landsat-7&8 satellite data for both counties (see maps in Annexe D).

For the ground truthing, mainly sites having a certain distance to the refugee camps (settlement) have been surveyed in order to avoid ongoing disturbances by tree cutting which complicate any calibration of the satellite data. The vegetation and land use sites have been located using both, a Garmin GPS map (62S) and a Samsung Galaxy Tab3 with GPS showing the digital map sections with the corresponding sites. Arriving at the sites, a homogenous area within the marked zone of interest has been selected for the survey and its centre has been recorded with its coordinates. Systematically, a picture has been taken for each cardinal point from the centre of the site (respectively sample plot for the vegetation sites) using a GPS camera (Panasonic Lumix DMC-TZ10). For the land cover sites only a general description of the land use and the vegetation cover has been made (see Annexe E).

For each vegetation site, a circular sample plot of 10 ares (radius of 17.85m) has been surveyed including a detailed vegetation description and dendrometric measurements for the forest pre-inventory (see Fig. 2):

- Each tree/shrub species with a DBH¹ ≥ 7cm has been identified and its diameter recorded. The diameter of multi-stemmed trees has been taken for each single stem (DHB ≥ 7cm). Only mature Doum palm (*Hyphaene thebaica*) having a trunk mostly free of the long-persisting leaf sheaths have been recorded. A plant list of all recorded specimen has been elaborated (see Annexe G).
- The basal area² per hectare has been recorded using the moti software programme for android smartphones (Smartphone Samsung Galaxy 4 GT-19295) developed by the

¹ Diameter at breast height, or DBH, is a standard method of expressing the diameter of the trunk or bole of a standing tree at 1.3m height.

² Area occupied by the cross-section of stems at DBH.

School of Agricultural, Forest and Food Sciences HAFL / Bern University of Applied Sciences (HAFL 2014).

- The total number of trees (not stems) has been recorded.
- The tree height of the dominant trees has been estimated visually using a levelling rod of 2.5m height as a reference at the base of the trunk. The height measurements, obtained with both, the optical device of the moti programme (HAFL 2014) and the laser device (Leica Disto™ X310) were not consistent. Proper application of the optical devices was difficult because of the bright tropical sunlight, the loose leaf surface of the crowns, and the visibility of the tree top.
- The tree/shrub cover³ has been recorded assuming that all trees/shrubs are in full foliage.
- Vegetation cover and photosynthesis greatly vary depending on the seasons. Both values peak at the end of the rainy season. Such variations complicate the analysis of the satellite data. Therefore, it is pertinent that the seasons are routinely considered while interpreting the satellite images. The foliage of each tree and shrub species has been assessed reflecting the actual vegetation cover at the time of the survey in order to facilitate the interpretation of the satellite data. The following scale has been used:
 - 0: No leaves
 - 1: 1-20% of full foliation
 - 2: 21-40% of full foliation
 - 3: 41-60% of full foliation
 - 4: 61-80% of full foliation
 - 5: 81-100% of full foliation
- The recent fire history of the sites was briefly assessed based on a) the scorch marks on the vegetation/soil, b) fire impact (e.g., stage of resprouting grasses) and c) the knowledge of the local forest service.
- Any sign of recent tree cutting on the site was noted.

³ Percentage of the soil surface covered by vertically projected tree and shrubs crowns.



Fig. 2. Delimitation of circular plot for dendrometric measurement

- The classification of the vegetation types follows mainly the criteria of Yangambi (Scientific Council for Africa South of the Sahara 1956) considering the crown cover of the woody plants and geomorphological characteristics:
 - Grassland⁴: $\leq 10\%$ crown cover
 - Tree/shrub savanna: 10-30% crown cover
 - Savanna woodland: 30-60% crown cover
 - Woodland: $\geq 60\%$
 - Riverine forests: larger forest patch usually inundated during the rainy season, most of tree and shrub species are evergreen; two types may be distinguished: monospecific stands of the Doum palm and high canopy mixed forest (*Ficus* spp.).

As far as possible, the species composition will be considered in the classification of the vegetation types. The locally dominant tree species, including the Doum palm (*Hyphaene thebaica*), the Red acacia (*Acacia seyal*), and the Dessert date tree (*Balanites aegyptiaca*), may form virtually monospecific vegetation units. Other dominant species which occur mainly in woodlands include Silak (*Anogeissus leiocarpus*), Guok (*Combretum* spp.), and Piok (*Terminalia* spp).

⁴ Usually, the delimitation between grassland and savanna is at 2% tree/shrub cover. Here, we set the delimitation at 10% cover which can be determined more accurately.

4. Findings

4.1 Ground truthing and forest pre-inventory

In total, 20 vegetation sites and 17 land cover sites have been described for the ground truthing and for taking the dendrometric measurements as a basis for a forest pre-inventory (see Annexe F). All sites for the field survey have been well-chosen by RSL in essentially homogenous vegetation or land cover units. Therefore, the definite centre of the site was mostly taken close to the coordinates given by RSL.

The dominant tree height varies mostly between 8 and 14m. Tree stands with Silak (*Anogeissus leiocarpus*) can reach 16-18m, while mixed riverine forest can have a canopy height of 20-22m. The basal area has been determined for the 17 sites and varies between 5 m² and 19 m²/ha with an average of 10.2 m²/ha per tree stand.

Northern South Sudan belongs to the phytogeographical Sudan zone (see Bloesch et al. 2013). The recorded tree and shrub species are typical for this savanna landscape which has quite a uniform species composition from Senegal up to South Sudan. The recorded woody species are listed in Annexe G including also the species recorded during the environmental inception mission (Bloesch et al. 2013).

Poles are made of stems having usually a diameter of 15-20 (25) cm. We estimate that in average 1-2 poles can be made out of one tree. Poles out of Silak (*Anogeissus leiocarpus*) are most valued since they are termite-resistant. A first estimation of the standing stock and number of poles (per main tree species) for the potential wood supply areas of the Sudanese refugees will be given in report B.

4.2 Capacity building

The whole team has been systematically introduced to the methodology of the survey including the proper use of the different devices. Simon Dralley from MAFCRD played an active part in the training of the other team members since he has profound practical knowledge from carrying out forest inventories in Western Equatoria.

The two newly recruited Assistant Environmental Officers from UNHCR got a good basis for playing a leading role in the foreseen full inventory of Maban and Pariang counties planned for the end of this year.

However, there is still a need for further capacity building of the recently established environmental unit, including the participation in technical trainings, all the more, since the support from the SDC senior environmental expert took an end on 2 May 2014. The environmental staff of the implementing partners should be systematically involved in any capacity building activity.

The environmental unit might need support in the planning and implementation of the environmental action plan for complex issues such as the programming for the Country Operational Plan 2015, the defining of the approach for community forest management, the implementation of the SAFE strategy in close collaboration with WFP, and the elaboration of technical guidelines.

4.3 Community Forest Management

A strong participative approach is a prerequisite for successfully managing natural resources in the mid and long run as outlined in the environmental inception mission report. A successful introduction of a community-based management of forests will also greatly contribute to appease the conflict potential over natural resources between host and displaced communities (Bloesch et al. 2013).

Natural forest formations on communal land in Maban and Pariang counties belong to the locals. A new forest policy has been approved on 8 February 2013 (RSS 2013). The new policy urges RSS and State Governments to enter into collaborative forest management agreements and arrangements with communities for sustainable management of forests, in ways that also ensure increased benefits to communities from forests. The communities may delineate and gazette forests in their communal land to be managed as Community Forests.

Some thoughts about the fire regime and the sharing of the forest revenue in relation with the introduction of a community forest management are outlined below.

4.3.1 Fire

The environmental inception mission estimated from aerial view that more than 50% of Maban and Pariang counties have been burnt during the dry season 2012/2013 (Bloesch et al. 2013). During this assessment we found 65% of all surveyed sites (21 sites out of 32 sites outside settlements) have been burnt during the dry season 2013/2014 (see Fig. 3). This impression has been confirmed by aerial views (see Fig. 4). Based on these findings, we assume that annually more than half of the total area of Maban and Pariang counties is burnt. Most of the fires happen at the end of the dry season (March to May) most probably set by pastoralists. These hot fires may kill trees and shrubs which are most sensitive to fire damage at this period since many woody plants sprout well before the beginning of the rainy season. As a result, late dry season fires open the savannas thereby favouring grass growth (Bloesch 2002). The understanding of the fire history is essential for heading towards a sustainable forest management and land use in general. Without a better control of fire, the natural regeneration of trees and shrubs is set back annually and any afforestation programme is at risk. A more rationale use of fire considering also the protection of forest is only possible with a community forest management and a strong commitment of the locals.



Fig. 3. Hot late dry season fire (April 2014) in Doum palm stand, near Yabus River (Maban County)



Fig. 4. Large areas burnt by hot late dry season fires near Yida settlement, Maban County

4.3.2 Forest revenue

Community forest management offers additional revenue to the local communities. A collaborative forest management should define the allocation of the forest revenue between the forest service (royal fees, permits) and locals from the selling of their forest products. Major revenue should include the selling of poles for UNHCR's shelter programme and of Red acacia tree stands to business men for charcoal making (see Fig. 5). The forest service should technically support the local communities in the elaboration and implementation of a community forest management plan.

In the meantime, a more community-based approach should be promoted thereby facilitating the introduction of a community forest management. UNHCR should review the tendering process for pole sellers in Maban County in order to ensure that some community members benefit directly from this business and not only as labour for the tree cutting.



Fig. 5. Large-scale charcoal making (*Acacia seya*) near Jam-Jang, Pariang County

5. Conclusions and outlook

The field work was very successful, despite the tight security situation and the beginning of the rainy season. The logistics for the field work was very well planned by UNHCR what allowed to adhere to the tight mission programme.

In total, 20 vegetation sites and 17 land cover sites have been described for the ground truthing and for taking the dendrometric measurements as a basis for a forest pre-inventory. The field data are currently analysed by the RSL in order to define the vegetation and land use units for the corresponding maps for Maban and Pariang counties. The forest map will serve to define a sustainable use of the wood resources (mainly poles and fuelwood⁵) based on community forest management plans.

In a second report (Part B), the forest and land cover maps will be presented, once the Remote Sensing Laboratories from the University of Zurich have completed the mapping process (deadline 30 September 2014). Each defined vegetation type will be illustrated with a characteristic picture and described in detail including typical species composition, tree height and basal area. Part B will also include the definite methodology for the full forest

⁵ "Woodfuel" is taken to cover both firewood and charcoal

inventory including the determination of the number of sampling plots per stratum (unit). Moreover, a first estimation of the standing stock and number of poles (per main tree species) for the potential wood supply areas of the Sudanese refugees will be given.

Table 3. General time schedule (see also recommendations)

N°	Activities/ milestones	2014							Responsibility
		6	7	8	9	10	11	12	
1	Backstopping of environmental unit								SDC, EG Env. & DRR
2	Analysis of field data (calibration)								RSL (Forest expert)
3	Definition of vegetation and land use units								RSL (Forest expert)
4	Elaboration of vegetation and land use maps for Maban and Pariang counties (Report Part B)								RSL
5	First estimation of wood resources (Report Part B)								Forest expert (RSL)
6	3-days training workshop about forest inventory								UNHCR (Forest expert)
7	Full inventory in Maban and Pariang counties								UNHCR (Forest expert)
8	Assessment of total wood resources in Maban and Pariang counties							→	UNHCR (Forest expert)

6. Recommendations

6.1 Recommendation for strengthening the environmental unit

Recently, UNHCR has recruited a national assistant environmental officer for both, the Maban and Pariang County. At Juba level, a national Environmental Focal Point is coordinating the environmental activities. However, the Environmental Focal Point is also part of the reintegration unit and his workload for the environmental unit should not go beyond 50% of his workload.

Following the environmental inception mission in June 2013, SDC has deployed a senior environmental expert for the support of the environmental unit from 3 November 2013 – 2 May 2014. However, the tense security situation in South Sudan has led to a longer interruption of the secondment from 6 December 2013 to 11 February 2014 and compromised the implementation of the environmental action plan in general and complicated daily routine work in particular.

Mainstreaming environmental management activities within UNHCR is still a great challenge. The newly established environmental unit with two new officers needs to be fully integrated within UNHCR's operation. Instalment of a remote technical backstopping for the new environmental unit on demand for specific topics is advisable to enhance an environmental management according to the state of the art. The presence of a senior backstopper would also stimulate a regular exchange on technical issues within the environmental unit and allow an on-the-job training.

The following recommendations which base on the joint debriefing with the senior management of UNHCR and SDC in Juba on 12 May 2014 are put forward to UNHCR South Sudan in order to further strengthen the environmental unit:

6.1.1 UNHCR

- 1) Review the integration of the environmental unit in the rehabilitation unit at Juba level in view of favouring environmental mainstreaming in all sections of the operation.
- 2) Maintain the Environmental Focal Point at national level (at least 50% part-time).
- 3) Allocate sufficient funds for the implementation of environmental activities according to the Country Operational Plan (COP) 2015 including the preparation of a community-based forest management.
- 4) Carry out the full forest inventory together with the local forest service and the implementing partners dealing with environment (October/November 2014). The national forest service at Juba level should closely be involved in this process leading to a community-based forest management. The hiring of Simon Dralley from the national forest service as a national consultant to support the implementation of the forest inventory in Maban and Pariang counties should be considered. Simon Dralley greatly contributed to the success of the field assessment of our mission by his knowledge and commitment.
- 5) Organise a 3-days training workshop about the forest inventory methodology in Juba (October 2014) for the forest service, the environmental staff from UNHCR and its implementing partners, UNEP as well as other interested organisations (prior to the beginning of the full forest inventory).
- 6) Identify additional technical trainings at national and regional level for its environmental staff and that from the implementing partners.

6.1.2 Possible support from SDC

- 1) Upon demand, offer remote backstopping from its Expert Group Environment & DRR to the environmental unit of UNHCR South Sudan (approximately 1-2 man-days per month).
- 2) Support the initiation of the full forest inventory in Maban and Pariang counties by a senior environmental expert.
- 3) Support the 3-days training workshop about the forest inventory methodology in Juba with technical expertise.
- 4) Mandate the Remote Sensing Laboratories of the University of Zurich to analyse the trends of the fire history of Maban and Pariang counties over the last 10 years using MODIS (Moderate Resolution Imaging Spectroradiometer) satellite images.

6.2 Operational recommendations

- 1) UNHCR should review the procedure of the tendering process for pole sellers in Maban County. The selection of the certified sellers by the authorities should be based on a first list of potential sellers established by the local communities to ensure that community members benefit directly of this business and not only as labour for the tree cutting.
- 2) The dissemination approach of fuel-efficient stoves has to be reviewed. In consultation with WFP, the SAFE strategy has to be introduced systematically in all camps

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Annexe A: Terms of reference

Terms of Reference for Environmental Specialist – Forest Inventory

The overall expected outcome by the Environmental Specialist will be the ground truthing of the draft vegetation maps and a pre-inventory of the woody biomass in the vicinity of the Sudanese refugee camps in Maban and Pariang counties thereby contributing to the implementation of the UNHCR environmental strategy and action plan.

Under the overall supervision of the UNHCR Deputy Representative and in close coordination with the Senior Reintegration Officer and collaboration with relevant Government Departments, UNEP and NGOs the Environmental Specialist (team leader) will perform the following duties:

1. Carry out a detailed vegetation description in at least 5 sites in the vicinity of each Sudanese refugee camp (4 in Maban and 2 in Pariang county, respectively) which will serve to verify the draft vegetation maps (ground truthing) elaborated by the Remote Sensing Laboratories of the University of Zurich.
2. Carry out a forest sampling (same sites as for the vegetation description) by recording all shrubs/trees within the forest sample (species identification, height, diameter, number of poles/sticks); this will serve to get a first estimate of the potentially available firewood and construction wood (poles/sticks for shelter) in the vicinity of the Sudanese refugee camps (pre-inventory).
3. Lead on the job training to build capacity in-country in collaboration with the forest services at County level, the national Ministry of Agriculture, Forestry, Cooperatives and Rural Development, and the environmental section of UNHCR. In addition, the active participation from UNEP and ACTED will be highly desired to ensure a harmonized approach.
4. Assist the Remote Sensing Laboratories of the University of Zurich in the final definition of the vegetation units for the elaboration of the vegetation maps of the entire areas of Maban and Pariang counties (in Switzerland).
5. Define the final methodology for the full forest inventory to be carried out jointly by the environmental section of UNHCR together with the local forest services.

Annexe B: Mission programme

Period: 23 April – 13 May 2014

Team leader: Dr. Urs Bloesch (SDC)

Participants Mr. John Ater Maker Dhalbeny (UNHCR Assistant Environmental Officer,
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Mr. Abraham Hassan (Agriculture Director, Maban County)

Mr. Peter Tako (Assistant Agriculture Director, Maban County)

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Participants Mr. John Ater Maker Dhalbeny (UNHCR Assistant Environmental Officer,
Pariang County: Maban County)

Mr. Charles Jalan Taban Lino (UNHCR Juba, Environnemental Focal Point)

Mr. Mustafa Kur Lueth (UNHCR Assistant Environmental Officer, Pariang County)

Date	Meeting /topics	Organisation / location	Remarks
Wednesday April 23rd	9:25 Flight Zurich – Nairobi (arrival time 18:05) Staying overnight in Nairobi (Eka Hotel)		
Thursday April 24th	14:20 Flight Nairobi – Juba (arrival time 16:05)		
	Briefing with UNHCR environmental unit	UNHCR Juba	Organisation of fieldwork
	Staying overnight in Juba (Arkel Hotel)		
Friday April 25th	Briefing with Ass. Rep. (Operation)	UNHCR Juba	Strengthening of Environment Unit
	Briefing Administration		IT, registration, ID card
	Briefing with SDC Country Team	SDC Juba	Political situation / security
	Staying overnight in Juba (Arkel Hotel)		
Saturday April 26th	Preparation field work	UNHCR Juba	
	Environmental Action Plan		Update of implementation
	Security Briefing		Security update
	Staying overnight in Juba (Arkel Hotel)		
Sunday April 27th	Preparation field work	Arkel Hotel, Juba	Updating forest inventory methodology; documentation reading

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

	Staying overnight in Juba (<i>Arkel Hotel</i>)		
Monday April 28th	Preparation field work	UNHCR Juba	
	Briefing Representative from Directorate of Forestry (MAFCRD) for field work	MAFCRD Juba	Methodology forest mapping and inventory
	Briefing with Head of Office UNEP	Juba	Methodology forest mapping and inventory; future collaboration
	Briefing with UNHCR Senior Programme Officer	UNHCR Juba	Challenges in shelter programme
	Staying overnight in Juba (<i>Arkel Hotel</i>)		
Tuesday April 29th	9:45 Flight Juba - Bunj, Maban County (arrival time 11:20)	Maban County	
	Briefing with Head of UNCHR Suboffice	UNHCR Maban	Discussion goal of mission and field programme
	Vegetation survey around Doro camp	Maban County	Demonstration vegetation and land cover survey
	Briefing with County Commissioner	Bunj	Discussion goal of mission and field programme
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Wednesday April 30th	Security briefing	Maban	Update
	Vegetation survey around Doro camp	Maban forest service	Description of vegetation and land cover sites
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Thursday May 1st	Vegetation survey around Doro camp	Maban forest service	Description of vegetation and land cover sites
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Friday May 2nd	Vegetation survey around Batil-Gendrasa camps	Maban forest service	Description of vegetation and land cover sites
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Saturday May 3rd	Vegetation survey around Batil-Gendrasa camps	Maban forest service	Description of vegetation and land cover sites
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Sunday May 4th	Preparation field visit Pariang	Maban	GPS coordinates
	Briefing with DRC Team leader	Bunj	Methodology forest mapping and inventory; shelter programme
	Staying overnight in Maban (<i>UNHCR Suboffice compound</i>)		
Monday May 5th	Vegetation survey around Kaya camp	Maban forest service	Description of vegetation and land cover sites
	Briefing with ACTEED Team leader Representative of REACH programme	Gendrasa	Methodology forest mapping and inventory; shelter programme

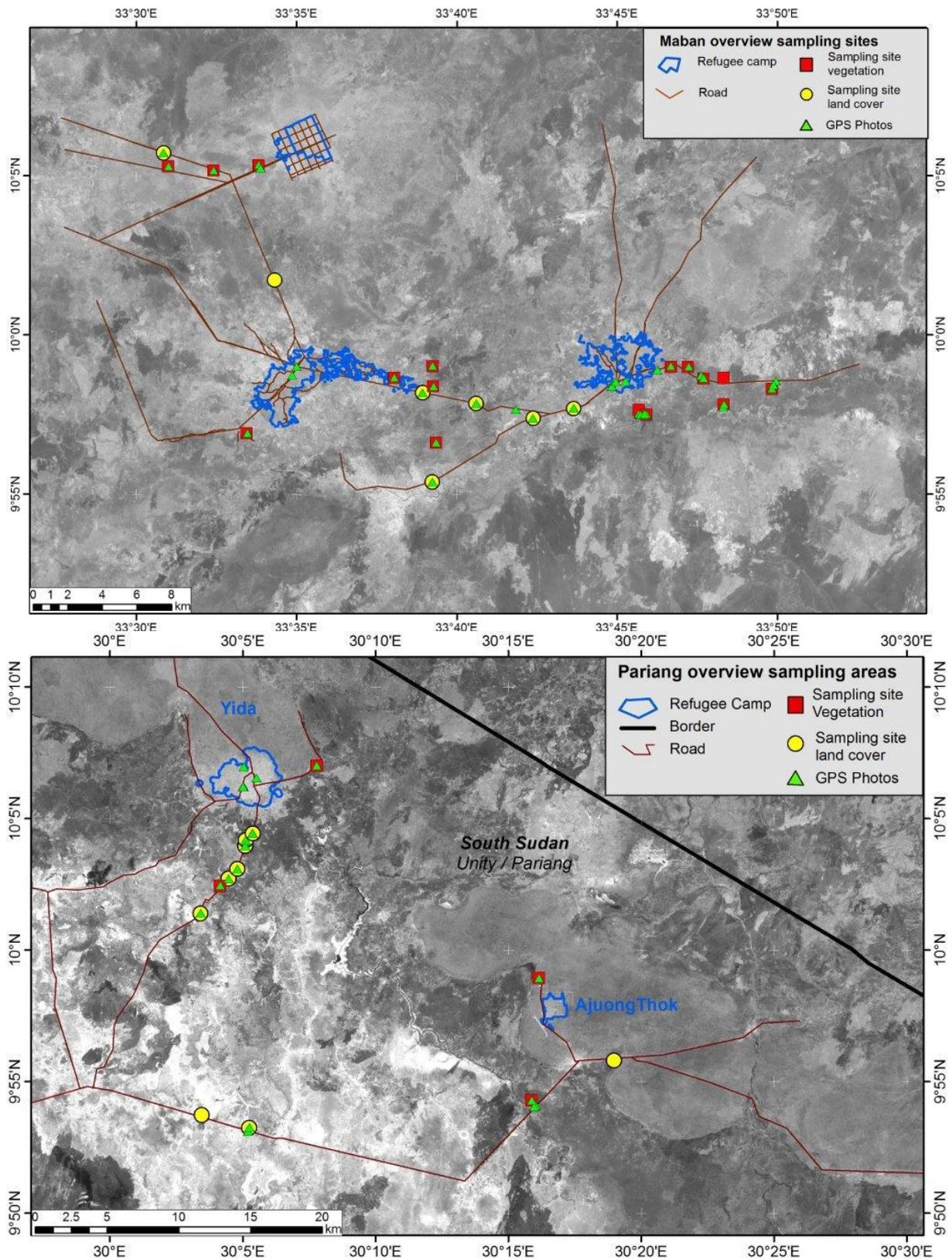
Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

	Briefing Director of Forestry, Maban County	Bunj	Importance of forest mapping and inventory
	<i>Staying overnight in Maban (UNHCR Suboffice compound)</i>		
Tuesday May 6th	Meeting with UNHCR Physical Site Planner	UNHCR compound	Shelter programme
	<i>12:45 Flight Bunj – Juba (arrival time 14:20)</i>		
	Meeting SDC		
	<i>Staying overnight in Juba (Arkel Hotel)</i>		
Wednesday May 7th	<i>9:15 Flight Juba- Yida, Pariang County (arrival time 10:40)</i>		
	Briefing with Head of Field Office	Pariang County	Discussion goal of mission and field programme
	Vegetation survey around Yida settlement		Description of vegetation and land cover sites
	<i>Staying overnight in Yida (UNHCR Compound)</i>		
Thursday May 8th	Briefing with Acting County Commissioner	Pariang County	Discussion goal of mission and field programme
	Vegetation survey along road to Ajuong Thok and in the surroundings of the camp	Pariang County	Description of vegetation and land cover sites
	Briefing with Care International	UNHCR compound	Role of Care International as a new environmental IP
	Meeting with UNHCR Physical Site Planner		Shelter programme
	<i>Staying overnight in Yida (UNHCR Compound)</i>		
Friday May 9th	<i>11:15 Flight Yida-Juba (arrival time 12:40)</i>		
	<i>Staying overnight in Juba (Arkel Hotel)</i>		
Saturday May 10th	Debriefing with UNHCR and SDC senior management	UNHCR Juba	Outcome of field work and next steps
	<i>Staying overnight in Juba (Arkel Hotel)</i>		
Sunday May 11th	Elaboration of brief note and report writing	Arkel Hotel, Juba	
	<i>Staying overnight in Juba (Arkel Hotel)</i>		
Monday/ Tuesday May 12/13th	Debriefing team	UNHCR Juba	Next steps
	Report writing	Airport Nairobi	
	<i>15:25 Flight Juba-Nairobi-Zurich (arrival time 13 May 6:25)</i>		

Annexe C: List of organisations and persons met

Organization	Name
ACTED	Jean-François Pron, Team Leader
	Nicolas Hurlburt, REACH Programme
Care International	Alex Simon Mogga, Project Manager
County Commission Maban	County Commissioner
County Commission Pariang	Abel Dak, Acting County Commissioner
DRC	Edward Hughes, Team Leader
MAFCRD, Juba	Simon Dralley, Forest inventory specialist
Forest service Maban County	Walla Mango Liwe, Director
	Edins Kor, Forest Inspector
Agricultural service Maban County	Abraham Hassan, Director
	Peter Tako, Assistant Director
SDC	Philippe Besson, Head of Cooperation Office
	Magdalena Lesjak, Deputy Head of Cooperation Office
	Jonathan Brünggel, Program Officer PV
	Andy Marshall, Security Advisor
	Robert Kenyi, National Programme Officer
UNEP	Khan Arshad Samad, Officer in Charge
UNHCR Juba	Chanda Cosmas, Representative
	Ajith Fernando, Assistant Representative – Operations
	Aksakalova Marina, Senior Programme Officer
	Khuri Sulayman, Senior Field Safety Advisor
	Tornieri Giorgia, Information Management Officer
	Arnold Egli, Senior Environmental Expert (SDC)
UNHCR Sub Office Maban	Adan Ilmi, Head of Sub Office
	Le Couster Gwenolenn, Programme Officer
	Radev Biser Beorgiev, Field Safety Advisor
	Hussain Azhar, Site Planner
	Ajang Joseph Okony, Programme Associate
UNHCR Field Office Yida	Cleophas Mubangizi, Head of Field Office
	Silvestro Gworit Lado, Field Safety Advisor
	Jimmy Obomba, Associate Programme Officer
	Nnamdi Nnaji, Physical Site Planner

Annexe D: Overview maps for field survey



Annexe E: Land cover sites

ID	Date	Coordinates	Altitude	Land use	Observations
ML6	2.5.14	N 9°57'41.8" E33°43'39.4"		Center of Bunj town	
ML8N	2.5.14	N 9°57'23.4" E33°42'23.1"		Moi Khartum area of Bunj town	
ML7N	2.5.14	N 9°55'23.0" E33°39'14.7"		Tall grass savanna (<i>Andropogon gayanus</i> , <i>Hyparrhenia cymbaria</i> , <i>Hyperthelia dissoluta</i> , <i>Panicum maximum</i>); waterlogged, not cultivated, used a pasture	41m from ML7; area burnt in March
ML5	2.5.14	N 9°57'51.0" E33°40'36.8"		Open tree savanna, tree/shrub cover: 15% (<i>Acacia nilotica</i> , Asey, BA, PR, ZM, <i>Calotropis procera</i>)	Area partially burnt in late March; resprouting grasses (tall grasses 2-3m; similar ML4
ML4	2.5.14	N 9°58'11.4" E33°38'56.3"		Open tree savanna, tree/shrub cover: 10%: Asey, BA, CF (4), PR, ZM; thicket clumps (<i>Capparis tomentosa</i> , ZM, <i>Cissus quadrangularis</i>) on termitaria	Similar ML5
ML3N	5.5.14	N10°01'43.1" E33°34'19.4" Camera readings different!	439m a.s.l.	Open tree savanna, tree/shrub cover: 5-10%: Asey (1), BA (E), ZM (0); waterlogged area (black cotton soil)	On the other side of the road Tree/shrub savanna with Asey (90% of species); area burnt (late dry season fire in early April); GPS
ML1N	5.5.14	N10°05'43.1" E33°30'51.1"	431m a.s.l.	Tree/shrub cover: 20%: Asey, BA (CF) Herb layer (lying down): 60%	No fire, no tree cutting
PL8	7.5.14	N10°01'24.5" E30°03'25.4"		Grassland, tree/shrub cover <1%; pasture (low height); bare soil	Village (tukuls); rainfall
PLA1	7.5.14	N10°02'43.3" E30°04'28.8" First 2 camera readings different!		Pasture: grass height 2m (<i>Setaria aurea</i>), herb layer: 90%; no trees (swamp)	Area burnt, resprouting grasses
PL11	7.5.14	N10°03'05.1" E30°04'48.7"		Village, near borehole; 50% bare soil; almost no trees; low height grasses;	
PL9	7.5.14	N10°03'58.2" E30°05'06.5"		sorghum fields (permanent)	
PL12	7.5.14	N10°04'11.1" E30°05'07.1"		Savanna woodland with pure Asey (3) (only 1 Apol); tree/shrub cover: 30-40%; tree height: 8-10m	Windfall; area burnt in February; resprouting grasses
PL10N	7.5.14	N10°04'26.9" E30°05'23.4"		Savanna woodland with pure Asey (4) (only 1 Apol); tree/shrub cover: 40-50%; tree height: 9-12m	Windfall; area burnt in February(?); resprouting

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

					grasses
PL13	8.5.14	N 9°53'44.5" E30°03'28.4" Camera readings different!		Swampy area, tall grass pasture, height 3m; no trees	No burning
PV8	8.5.14	N 9°53'15.9" E30°05'15.9" Camera readings not coherent!	403 m a.s.l.	Swampy area, tall grass pasture, height 3m; no trees	Area burnt in April
PL18	8.5.14	N 9°53'15.9" E30°05'15.9" Camera readings not coherent!		Village (tukuls)	No photographs PL13-PL18: Tall grass pasture (black cotton soil)
PL20N	8.5.14	N 9°55'48.9" E30°18'59.1"		Grassland, tree/shrub cover: 5% (PR(2), CF (3); pasture, tall grasses: 3-4m (Hyparrhenia cymbaria)	No photographs; area burnt in January

Annexe F: Vegetation sites

ID	Date	Coordinates / altitude	BHD per species (cm); foliage degree in brackets; basal area	N trees (≥ 7cm)	Vegetation type / Tree/shrub cover Height dominant trees	Surrounding area /observations
D7N	30.4.14	N 9°59'00.8" E33°46'41.1" 460 m a.s.l.	Asen (5): 18, 20 Asey (3): 13, 19, 21 AX (5): 25/29 CI (5): 114 HT (E): 25, 27(2x), 29, 33(2x) Lannea (1): 14 Lonchocarpus (5): 13 TA (2): 15/19/21 ZM (1): 8(2x, 1 cut), 10(2x), 12(cut), 15(cut), 18, 11/19 Basal area: 10 m²	24	Gallery forest (watercourse only during inundations)/savanna woodland Tree/shrub cover: 50% HT regeneration: 25% Herb layer: dry (Asparagus sp.) Tree height: 12-14m	Streambed N-S, 80-100m wide; outside streambed tree savanna; Starting of tree cutting by refugees
D8N	30.4.14	N 9°59'00.7" E33°47'13.3" 464 m a.s.l.	AL (1): 52, 15/21 Asen (4): 13, 19 Asey (3): 13, 22(2x) AX (4): 17/18 BA (E): 7, 11, 36, 13/13 HT (E): 34, 36, 37 ZM (2): 13/15 Basal area: 11 m²	16	Tree savanna Tree/shrub cover: 25% HT regeneration: 5% Herb layer: dry, 50% (Asparagus sp.) Tree height: 8-10m	Starting of tree cutting; site on the stream bank of temporary water course SW-SE of 30-40 width (water only during inundations), watercourse similar D7N; outside plot burnt (late dry season fire)
D15 N	29/30.4.14	N 9°58'18.9" E33°49'50.7" 472 m a.s.l.	Asen (3/4): 18, 25 Asey (2): 19 AX (4): 39 CF (1): 7, 10(4x) GT (0): 7/7, 9 Lannea (1): 10(2x) TG (1): 7, 12(2x, 1 cut), 13, 16, 18, 24, 27, 33 ZA (1): 7, 9(2x), 14, 17 Kùlei (0): 9/11/12/15/17 Janjomu (0): 26 Basal area: 15 m²	29	Woodland Tree/shrub cover: 80-90% HT regeneration: 5% Herb layer: burnt (late dry season fire) Tree height: 10-12m	Woodland, some tree cutting by locals, see D15N6; PR outside plot; photographs (D15N2 - D15N5) possibly not strictly according the cardinal points; D15N1 outside plot, now D1

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

D13	30.4.14	N 9°57'49.6" E33°48'20.9"	NO DETAIL DESCRIPTION! Dominant trees: HT, Ficus platyphylla, Ficus small leaf (see edible near airstrip, Trichilia emetica (all trees evergreen!))		Riverine forest along a seasonal tributary of Yabus River (permanent) Tree/shrub cover: 80-90% Tree height: 20-22m	Site 160 from Yabus River; site partially burnt (late dry season fire) Photographs not according the cardinal points
D12N	1.5.14	N 9°58'39.9" E33°48'20.9" 468 m a.s.l.	Apol (0): 7 Asey (2-3): 8(2x), 9(2x), 10(2x), 11(2x), 12(3x), 13(2x), 14(3x), 16, 19, 20(2x), 23, 24, 10/18, 12/12 BA (E): 15, 18 ZM (1): 9/10, 9/9/10/12, 15/17, 8/42 Basal area: 9 m²	31	Savanna woodland with Acacia seyal Tree/shrub cover: 50-60% Herb layer(dry): 20% (Talgona, Mabanese) Tree height: 10-12m	Some trees cut last rainy season (locals), cut trees not recorded
DA1	1.5.14	N 9°58'38.4" E33°47'42.5" 462 m a.s.l.	NO DETAIL DESCRIPTION! HT regeneration in open area		Tree/shrub cover: 5% (BA) HT regeneration: 30% (potentially savanna woodland/riverine forest with Hyphaene thebaica)	Outside village of Gasmalla
D4N	1.5.14	N 9°57'39.9" E33°45'41.0" 475 m a.s.l.	AD (1): 26 Asey (2): 19, 23 AX (3): 50 HT (E): 23, 26(2x), 27, 31, 32, 35(2x), 37(2x),16/23 Rwaga/Lonchocarpus sp. (3): 11 Basal area: 13 m²	16	Riverine forest with Hyphaene thebaica Tree/shrub cover: 60% HT regeneration: 15% Tree height: 10m (HT); (AX: 14m)	Between D4 and D5, HT highly dominating (≥90% of species); area burnt (late dry season fire)
D5N	1.5.14	N 9°57'30.0" E33°45'55.9" 477 m a.s.l.	HT dominating (more than 90% of all species)		Riverine forest with Hyphaene thebaica Tree/shrub cover: 60-70% HT regeneration: 15% Tree height: 12-14m	Between D4 and D5, HT highly dominating (≥90% of species); area burnt (late dry season fire)
BG12 N	2.5.14	N 9°56'37.7" E33°39'21.5" 449 m a.s.l.	Asen (4): 15 Asey (2-3): 11, 12, 15, 19(2x), 20, 21, 12/18, 14/18, 15/21 BA (E): 40 ZM (1): 8, 9, 10(2x), 22 CF (1): 16 Basal area: 8 m²	18	Savanna woodland with Acacia seyal Tree/shrub cover: 40-50% Tree height: 9-10m Herb layer (dry): 50% (Andropogon g., Hyperthelia d., Hibiscus)	Partially burnt (November-December); Tall grass savanna in open areas (3-4 m heigh): Andropogon g., Hyperthelia d., Panicum m.

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

					sp.)	
BG11 N	2.5.14	N 9°58'23.0" E33°39'16.3" 457 m a.s.l.	Asey (3): 17, 18, 10/10, 7/11, 28/28 BA (E): 8(2x, 1 cut), 9, 11(cut), 14, 16, 29, 47, 7/15, FV (E): too small Basal area: 9 m²	14	Tree savanna on termitaria Tree/shrub cover: 20% Tree height: 12-14m	Area burnt (late dry season fire in March); resprouting grasses currently grazed; ongoing tree cutting (BA, Asey) outside plot Wung (3)/Lansea (edible) see BG11.W
BG9N	3.5.14	N 9°59'01.8" E33°39'15.5" 452 m a.s.l.	Asen (1): 38 Asey (1-2): 11 AX (3): 43 CA (3): 8, 7/9 FV (E): 10, 7/9 PR (E): 23, 9/9/11, 11/12, 11/15/28 ZM (1): 16, 8/9/14, 10/14/15 Basal area: 5 m²	14	Gallery forest Tree/shrub cover: 25% Tree height: 12-14m Herb layer: Achyranthes aspera, Hibiscus sp.	Ravine 12m wide; area burnt (late dry season fire in early April); resprouting grasses; surroundings: open tree savanna (termitaria)
BG7N	3.5.14	N 9°58'39.8" E33°38'03.7" 451 m a.s.l.	BA (E): 11, 19, 20, 23, 29(2x), 32, 34, 24/37 Asen (5): 22 Basal area: 7 m²	10	Tree savanna with BA on termitaria Tree/shrub cover: 25% Tree height: 9m Herb layer: Asparagus sp.	Resprouting grasses; outside plot: Albizia chevalieri small
BGA1	3.5.14	N 9°56'55.2" E33°33'27.9" 443 m a.s.l.	Asen (5): 20 BA (E): 12(2x), 13(2x), 14(2x), 15, 18, 19, 24, 40, 80, 9/10/13, 13/20 CF (3): 29 Basal area: 8 m²	16	Tree savanna with BA on termitaria Tree/shrub cover: 30% Tree height: 8-10(12)m Herb layer (dry): 50% Cissus quadrangularis	
KA1	5.5.14	N10°05'10.3" E33°32'25.7" 434 m a.s.l.	CF (0): 8, 15, 16, 11/23 AL (0): 10, 17, 20, 25, 39 BA (E): 30, 39 Cussonia/Gaaga (0): 20, 23, 31 Basal area: 10 m²	14	Savanna woodland Tree/shrub cover: 40% Tree height: 12m Herb layer (dry, lying down): 90% (Hyperthelia d., Hyparrhenia sp.)	50m from ML2 (not recorded); not burnt; termitaria; outside plot: Dichrostachys cinerea

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

K1	5.5.14	N10°05'18.0" E33°31'00.8" 432 m a.s.l.	Asey (1): 7, 8(4x), 9(6x), 10(3x), 11(3x), 12, 13(3x), 14, 15(3x), 16, 17, 20, 9/10, 11/13, 12/14, 9/15, 11/11/16, 8/16/16 BA (E): 7, 17 Basal area: 10 m²	36	Shrub savanna with <i>Acacia seyal</i> Tree/shrub cover: 70% Tree height: 8m Herb layer (dry): 40% (<i>Beckeropsis uniseta</i>); Understorey: <i>Capparis tomentosa</i> , <i>Albizia chevalieri</i> small, ZM	Not burnt; outside plot: <i>Ximenia americana</i> , <i>Acacia polyacantha</i> <i>Albizia</i> sp. (near road)
K4N	5.5.14	N10°05'20.7" E33°33'49.7" 447 m a.s.l.	AL (2): 30, 33, 38(2x) BA (E): 28 TA (0): 14, 21, 27, 28, 29, 33(3x), 36 CF (1): 8, 11, 13, 15 Basal area: 15 m²	18	Savanna woodland Tree/shrub cover: 50% Tree height: 12-15m Herb layer: 5% (<i>Asparagus</i> sp., <i>Mondraute</i>)	Kaya Camp: mostly AL Tree cutting; area burnt (late dry season fire in March)
PV9N	7.5.14	N10°02'27.8" E30°04'10.6" 412 m a.s.l.	Asey (2): 8, 11, 12(2x), 13(4x), 14(3x), 16(2x), 17(2x), 18, 19(2x), 20(2x), 21, 23, 25, 26, 28, 9/10, 9/11/12, 10/13, 8/9/15, 12/16, 15/18, 15/19, 16/20 Basal area: 11 m²	33	Woodland with <i>Acacia seyal</i> Tree/shrub cover: 70% Tree height: 10-11m Herb layer (dry): 70% (<i>Thil</i> , <i>Andropogon gayanus</i>)	No fire, no cutting
PV11 N	7.5.14	N10°07'01.7" E30°07'48.0" 411 m a.s.l.	AL (3): 19, 36, 49, 58, 61 GT (0): 8/11 TI (5): 21 CF (1): 12, 19, 27, 32 <i>Ficus/Kuel</i> on AL Basal area: 11 m²	11	Savanna woodland Tree/shrub cover: 40% Tree height: 16-18m <i>Asparagus</i> sp.	2.32 km from PV11: area burnt; resprouting grasses (grazing); no tree cutting
PV5N	8.5.14	N 9°54'17.9" E30°15'53.5" 400 m a.s.l.	BA (E): 7, 8(2x), 9(3x), 11(2x), 12(2x), 13, 14, 15(2x), 16, 17, 18, 19(2x), 20, 22, 25(2x), 27, 29, 42, 8/9, 13/20, 8/20/21, 11/23, 18/23 Basal area: 19 m²	31	Woodland with BA Tree/shrub cover: 60-70% Tree height: 8-10m Herb layer: 85% (grasses, <i>Commelina</i> sp. <i>Achyranthes aspera</i>)	Area burnt (fire in January); resprouting grasses
PVA1	8.5.14	N 9°58'57.2" E30°16'10.7" 412 m a.s.l.	AL (4): 38, 14/23, 26/42 CG (4): 7, 14, 16, 21, 29, 18/26 TG (3): 35, 19/41 Guok (1 circular leaf)(4): 12	12	Savanna woodland Tree/shrub cover: 60% Tree height: 16-18m Herb layer: 50%	970m from PV7; area burnt (fire in December/January); sandy soil; outside plot:

			Basal area: 13 m²		(Asparagus sp.)	Dichrostachys cinerea
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Abbreviations trees and shrubs

AL	Anogeissus leiocarpus
Apol	Acacia polyacantha
Asen	Acacia senegal
Asey	Acacia seyal
AX	Acacia xanthophloea
CA	Crataeva adansonii
CF	Combretum fragrans
CG	Combretum glutinosum
CI	Celtis integrifolia
FV	Flueggea virosa
GT	Gardenia ternifolia
HT	Hyphaene thebaica
PR	Piliostigma reticulatum
TA	Terminalia avicennioides
TG	Terminalia glaucescens
TI	Tamarindus indica
ZA	Ziziphus abyssinica

Foliage degree

0:	No leaves
1:	1-20% of full foliation
2:	21-40% of full foliation
3:	41-60% of full foliation
4:	61-80% of full foliation
5:	81-100% of full foliation

Annexe G: Trees and shrubs recorded in Maban and Pariang counties (June 2013 and April/May 2014)

Latin name	Common name	Arabic name	Local name (M=Mabenese; D=Dinka)	County M=Maban P=Pariang
<i>Acacia nilotica</i>		Sunt Giarad, Garad		M
<i>Acacia polyacantha</i>		Hasshbi		M, P
<i>Acacia senegal</i>	Gum arabic tree	Sunt Hashab		M, P
<i>Acacia seyal</i>		Tellah		M, P
<i>Acacia xanthophloea</i>		Tellah	Teno (M)	M, P
<i>Adansonia digitata</i>	Baobab	Tebeldia		M, P
<i>Albizia chevalieri</i> small tree				
<i>Anogeissus leiocarpus</i>		Ameth, Silak		M, P
<i>Balanites aegyptiaca</i>	Desert date tree	Heglig, Lalob, Thou		M, P
<i>Borassus aethiopum</i>		Deleib		P
<i>Boscia angustifolia</i>		Rejdena		P
<i>Bridelia ferruginea</i>				P
<i>Cadaba farinosa</i>				P
<i>Calotropis procera</i>				M, P
<i>Capparis tomentosa</i>				M
<i>Crataeva adansonii</i>			Malangan (Mabanese)	M
<i>Celtis integrifolia</i>		Tekey	Shaw (Mabanese)	M
<i>Combretum fragrans</i>		Habil	Burdon (Mabanese)	M, P
<i>Combretum collinum</i>			Guok (Dinka)	P
<i>Combretum glutinosum</i>			Guok (Dinka)	P
<i>Combretum molle</i>			Guok, Ner Apiath? (Dinka)	P
<i>Cussonia</i> sp.			Gaaga (Mabanese)	M
<i>Dalbergia melanoxydon</i>	African blackwood	Babanus		M, P
<i>Detarium microcarpum</i>				P
<i>Dichrostachys cinerea</i>		Umkadat, Kiir		M, P
<i>Ficus platyphylla</i>				M
<i>Ficus</i> (small leaf, yellow bark)		Jumez	Nguawm (Mabanese)	M

Forest mapping and pre-inventory 24/4 – 12/5/2014, South Sudan

<i>Ficus</i> sp.(„strangler“)			Kuel (Dinka)	P
<i>Gardenia ternifolia</i>			Dong (Dinka)	P
<i>Grewia</i> sp.				M, P
<i>Guiera senegalensis</i>				P
<i>Hymenocardia acida</i>			Akumoro (Dinka)	P
<i>Hyphaene thebaica</i>	Doum palm	Doum	Akot (Dinka)	M
<i>Kigelia africana</i>	Sausage tree		Abosodo (Mabanese)	M
<i>Lannea humilis</i>				P
<i>Lannea acida?</i>				M
<i>Lannea barteri</i>		Biel	Gummel (Dinka)	P
<i>Lannea</i> sp.			Wung (Mabanese)	M
<i>Lonchocarpus laxiflorus</i>			Gokkoba (Dinka)	M, P
<i>Lonchocarpus</i> sp.			Rwaga (Mabanese)	M
<i>Piliostigma reticulatum</i>			Pacha (Mabanese)	M, P
<i>Prosopis africana</i>	Akumoro		Gier (Dinka)	P
<i>Sclerocarya birrea</i>			Hamed (Dinka)	M, P
<i>Strychnos spinosa?</i>				P
<i>Tamarindus indica</i>	Tamarind		Chuei (Dinka)	M, P
<i>Terminalia brownii</i>		Drot?	Piok (Dinka)/ Kolkon (Mabanese)	M, P
<i>Terminalia glaucescens</i>		Drot?	Piok (Dinka)	M, P
<i>Tetrapleura tetraptera</i>				P
<i>Ximenia americana</i>			Mila (Dinka)	P
<i>Ziziphus abyssinica</i>	Jujube	Man-Lang, Nabak		M, P
<i>Ziziphus mauritiana</i>	Jujube	Man-Lang, Nabak		M, P
			Janjomu (Mabanese)/ Kambilo (Moro) D15	