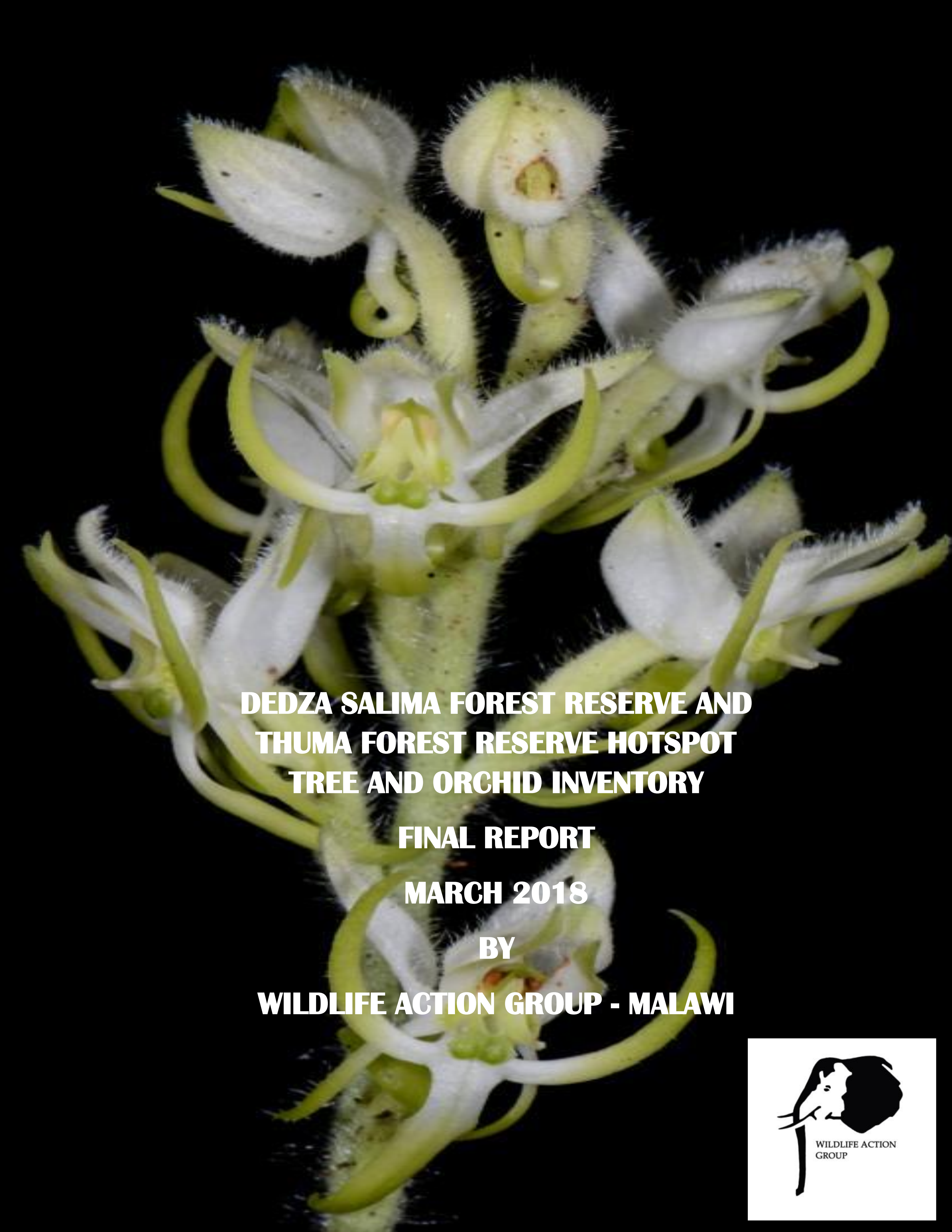

DEDZA SALIMA FOREST RESERVE AND THUMA FOREST RESERVE HOTSPOT TREE AND ORCHID INVENTORY

FINAL REPORT

MARCH 2018

BY

WILDLIFE ACTION GROUP - MALAWI

WILDLIFE ACTION GROUP

Wildlife Action Group (WAG) is a registered non-governmental, non-profit organization working in Malawi to support the Government to protect wild areas and the wildlife that live there. WAG are directly responsible for two forest Reserves in the central region, Thuma Forest Reserve and Dedza Salima Escarpment Reserve, covering a total area of over 500km2. (52,000 hectares).

Our major stakeholders are the Department of Forestry and the Department of National Parks and Wildlife, along with the local communities.

Both forests have suffered immense deforestation and due to the high poaching incidences, most wildlife were on the verge of becoming extinct.

Due to the ongoing efforts through law enforcement, mitigation of human elephant conflict and community relationships, these areas have seen positive conservation and social economic impacts.

In 2017, an area of approx 8,000 hectares have been reclaimed, dramatically reducing deforestation with rangers patrolling daily.

Our vision is to see both Reserves returned to their former glory; the habitat rehabilitated and restocked with wildlife, and local communities benefiting and assisting to protect these areas, making them Malawi's premier Forest Reserves for future generations.

Wildlife Action Group (WAG) Malawi is a non-governmental, non-profit organization under the Trustees incorporation rules, in Malawi since 1994.

Its main objectives are "*to protect Malawi's wildlife and environment, and to assist and support the Malawi Government in protecting areas like National Parks, game and forest reserves*". WAG Malawi is a grassroots NGO. We manage two contiguous forest reserves (approx. 500km^2) of forest in the **Eastern Afromontane Biodiversity Hotspot**: Thuma Forest Reserve (TFR) and Dedza-Salima Forest Reserve (DSFR) (**CEPF Priority Site 43**) as seen in Figure 1**.** . Our aim is to protect, preserve and restore the reserves from illegal activities which threaten the local & national biodiversity.

DSFR is listed as a Key Bio diverse Area (KBA), however TFR, despite being adjacent to DSFR, is not listed. Besides compiling a up-to-date inventory of trees and orchids in both reserves, we trust the data found and recorded will demonstrate the uniqueness of TFR biodiversity, identifying it as a biological priority upgrading TFR to a KBA.

Both TFR and DSFT provides valuable ecosystem services—the most important ecosystem services these forests provide is fresh water via the major watershed function, which supplies fresh water to most villages outside the forests, and the major rivers along the boundaries flow directly into Lake Malawi. Malawi has been seeing catastrophic, effects from climate change. Fuel wood and charcoal is the principal source of energy for cooking and heating all over Malawi, and most forests and protected areas are under serious pressure from deforestation, TFR and DSFR has seen its fair amount.

WAG has been collecting and logging data on patrols, wildlife, reptile etc, however, had not really been in a position to record much data on trees or plants due to lack of skills and also due to prioritising law enforcement to protect the forests. We have a growing database along with photographic evidence, and also have been logging all data under a IUCN listing specific to both reserves (see attached). In an ongoing effort to manage both Reserves, Malawi grasslands are particularly rich in orchids, including more than 500 species, and plants of the genus protea, no recorded research has been carried out in either of these Forest Reserves to date, despite the habitat being on a par with other bio diverse rich area. Therefore only a very small fraction of the total number of species in both reserves had been assessed.

WAG applied for and was successful in winning funding through CEPF, for a total amount of $18,779 ($15004 has been received into our bank account), to implement a baseline tree and orchid inventory in DSFR and finally conduct a more indebt orchid survey in TFR. DSFR is listed as a KBA (priority site 43), however, TFR is not listed. The main aim of the project is to compile an up-to-date inventory of trees and orchids in DSFR and orchids in TFR, which could be used to further the prioritization listing of DSFR, as well as add TFR to be listed as a new KBA. Additionally, the information can also help inform WAG on the management of the two reserves.

The project estimated duration was originally 14 months (April 2016 to Ma y 2017), however, an extension was kindly approved to conduct a specific orchid inventory in TFR which ended the project in Feb 2018.

Two activities have taken place to document the forest flora species:

1) Forest Inventory
2) Orchid Survey

Both surveys have been analysed separately in this report.

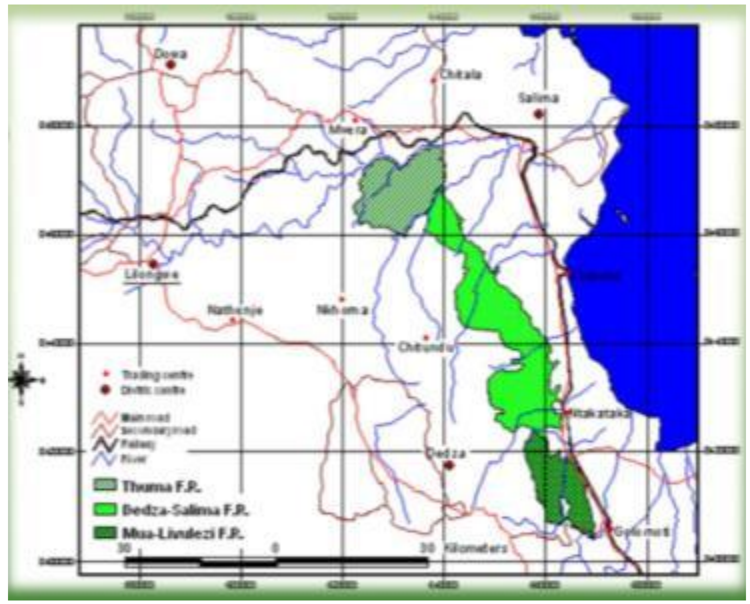

Figure 1 Map of Thuma Forest Reserve and Dedza Salima Forest Reserve.

Forest Inventory Report

This is the first Forest Inventory of this type that has been carried out in both Thuma Forest Reserve and Dedza Salima Escarpment. Sound forest management depends on quality and quantity of the information available, and prior to this project there was none.

The purpose of the Forest Inventory was to plan, implement, record and assess the current extent, state and composition of the forests, train WAG scouts in field inventory technique by building capacity with the long term goal of repeating the same process every three to four years as part of monitoring to compare to future remeasurement data in compilation of statistical change estimates (e.g., tree growth/mortality)

This forest inventory has provided information of the whole area and qualitative and quantitative information of the stock which will in turn assist us to make good management decisions.

We discussed with other partners and stakeholders prior to conducting the inventory to share ideas and best methods to be used. The Department of Forestry has started conducting Forest Inventory's in other forest throughout Malawi with the aim to have a National Forest Inventory. We felt is was best for us to tap into this resource and keep in line with current practices. Thereof, we used SOP, forms as in line with the National Forestry Inventory data collections.

Aims: The aim of this project was to carry out base line surveys in both reserves

<u>Short term impacts are summarised below:</u>

- Conduct a baseline inventory in both Reserve
- Train scouts on flora identification.
- Train scouts on flora documentation.
- Train scouts forest inventory procedure
- Increase the knowledge of Tree, plants and Orchids

<u>Long term impacts are listed as:</u>

- increased knowledge of the tree and orchid diversity and distribution in DSFR

- increased knowledge of the tree and orchid diversity and distribution in TFR
- Increased scientific forest inventory capacity of WAG scouts in veg ID and survey techniques
- Baseline data on current composition of the forests
- Requesting extension of KBA MW1 in include TFR

<u>Expected Results:</u>

- Trees within specific areas to be identified,
- Scouts to improve knowledge on flora
- Data to be shared with National Forestry Inventory (NFI)
- Increased knowledge of tree diversity and distribution in both reserves
- Improved capacity building in WAG scouts in vegetation identification and survey techniques
- baseline inventory for both reserves

Project activities:

- Conduct wet season Forest Inventory field survey (trees and orchids)
- Compile Forest Inventory findings, including GPS maps, ID key for species, and description of unknown species (if found)
- Conduct desk study of current knowledge TFR ad identify survey areas
- Conduct Forest Inventory field survey of TFR (orchids)
- Compile Forest Inventory finding of Forest Inventory field surveys, including GPS maps, ID key for species, and description of unknown species
- Identify key scouts to take part of training (from the known shortlist)
- Scouts accompany FRIM teams for DSFR surveys
- Scouts lead TRF orchid survey (Dec, Jan, Feb 2018)
- Scouts to work in conjunction with research team in order to familiarize with key Forest Inventory findings and ID skills

Forest Inventory Summary :

Carbon baseline surveys and biodiversity studies are now integral to management of forests more especially considering how key forests are to mitigation of climate change despite facing some rapid degradation and loss that is now contributing to about 20% of global emissions. Besides immensely contributing to global emissions through pressures like charcoal production and encroachment for agricultural production, some forest areas in Malawi remain undocumented. This brief report provides information on forest inventories that were recently conducted in Thuma and the Dedza-Salima Escarpment Forest Reserves that are located in Salima, Dedza and Dowa Districts in the Central Region of Malawi. Specifically the inventory aimed to:

- Assess biodiversity in the Thuma and Dedza Salima forest swath
- Determining the carbon stocks in the two forest reserves
- Evaluate the regeneration potential of the reserves
- Identify species of significance to the forest landscape (as an auxiliary but important objective)

The exercise was also envisaged to provide information for:

1. Improvement of the management plans for the forest reserves
2. Provide the necessary data with higher precision for Malawi's NFI.

Detailed planning of the Forest Inventory was crucial to ensure the short and long terms aims of this project were achieved.
CEPF terms, conditions and guidelines aided to guide us through this process.
WAG consulted and partnered with other stakeholders throughout, to ensure we could achieved our aims and also to build in-house capacity with our rangers. Professional consultants (FRIM- Forest Research Institute Malawi)were hired to guide us through and be part of the field work and we used Standard operating procedures(SOP) adopted for continuity with other Forest Inventories that had been carried out in other forests in Malawi (methods deployed in Malawi by SADC GIZ project).
SOPs included : Inventory Approach, Forest Carbon field measurement and forest carbon inventory.
Prior to the field work taking place, equipment, forms, training, Health and Safety procedures were adhered to (see attached docs).
MSU assisted with mapping of random plots to achieve viable sampling. From this WAG created mapped to be used during the survey. Equipment such as GPS, torches, printers, cameras were purchased for use.

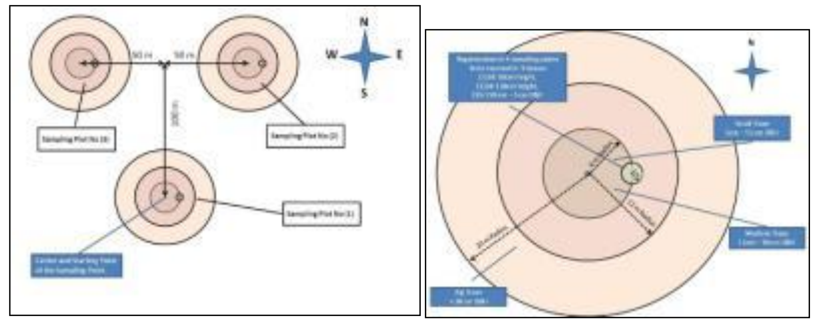

Figure 1: The employed 'T' sampling design (left), and the plot design (left)

plot required three forms which included Miombo species listing, Tree inventory form, plot metadata form, regeneration circle & dead wood form and special species forms were prepared for each plot.

A work sequence was followed :

I. Navigation to plot,
II. conduct a site assessment,
III. record meta data, regeneration,
IV. assessment in 6m plot,
V. assessment in 12m plot,
VI. assessment in 20m plot
VII. PSP marking.

Within each sample plot a variety of primary attributes were assessed and data measured and recorded.

1. diversity
2. density
3. carbon biomass
4. canopy cover (crown measurement
5. species specie's

Tree Measurements. The estimation of forest biomass (and timber volume) was based on tree characteristics that were measured and assessed at [on] the sample trees:

I. Species – all trees
II. Diameter at breast height – all trees
III. Canopy height – all trees > 15 cm (only at the primary plot) Canopy projected area – all trees > 15 cm

Deadwood Assessment. The dead wood assessment covers two types of dead wood that occur in the sample plots:

1. standing dead wood
2. dead wood lying on the ground.

Measurement of Aboveground Live Biomass

- Tree Measurements
- Stem Diameter Measurements
- Height Measurements.

Seedlings for Regeneration The use of a 2m plot can be for collection of seedling information. This information provides estimates of regeneration potential.
Standing and Down Dead Wood. Dead wood is the non-living woody biomass that is too big to be included in the litter pool. The dead wood pool includes both standing dead wood and wood lying on the surface ≥15cm diameter
Other Non-Tree Components of AGB. There are several other non-tree components of the above ground biomass pool including shrubs and other herbaceous plants.
Special Species - Orchids etc
The inventory included the entire area of both reserves covering just over $500km^2$. The cluster plot design of three individual plots located in a "T" shape meant that the total number of individual plots for each forest reserve would be:

- Thuma = 33
- Dedza-Salima = 66

Data Management:

As this activity was being carried out in the rainy season some control actions were put in place to ensure we did not lose any of the information collected, ie. forms destroyed by rain etc. The data was of the utmost importance and at the end of each day, a photograph was taken of each sheet.
Every four days forms were collected and brought back to the office.
Each form was scanned so WAG had a softcopy on computer and a hard copy in our files.
A photocopy was produced and delivered to Lilongwe for data input, originals kept in WAG files.

Results:
With expert assistance from FRIM, technical support from the USAID funded PERFORM project and Michigan State university (MSU). all data was input and analysis producing the first baseline data.

Plot inventory data were input into the MRV Toolbox (mrv.carbon2markets.org) for all two reserves. An assessment of the plot inventory data were completed using the MRV Toolbox for estimating the AGB and BGB carbon stocks (tC) and the emission factors (tCha^{-1}). This assessment did not include standing deadwood and down deadwood

See below:

MRV Toolbox Report of Total Carbon Stock and Forest Carbon Emission Factors (EFs) for Three Forest Reserves

Tier 3 - Carbon Stocks by Parcel

Parcel Descriptors Values below in ha		Carbon Density Values below in tC/ha					Carbon Stocks Values below in tC					
ID	Area	AGB	BGB	SOC	Litter	Deadwood	AGB	BGB	Soil	Litter	Deadwood	Total
DedzaSalimaEFR	10,380.12	38.75	10.29	0.00	0.00	0.00	381,885.01	106,927.80	0.00	0.08	0.00	488,812.81
ThumaFR	15,787.33	24.13	6.76	0.00	0.00	0.00	380,493.95	106,538.31	0.00	0.08	0.00	487,032.25
Project Totals							762,378.96	213,466.11	0.00	0.08	0.00	975,845.06

Yellow rows indicate Parcels containing Plots with rejected data. Calculations may be erroneous due to faulty plot data

Summary Information for Field Inventory

	Thuma	Dedza-Salima Esc.	Total
Expected number of clusters (plots)	11 (33)	22 (66)	33 (99)
Actual number of clusters (plots)	10 (30)	22 (66)	32 (96)
Number of clusters rejected	1	0	1
Number of plots moved	30	15	71
Number of clusters from oversample pool	0	0	0
Number of days to complete data collection	4	17	21
Number of plots with regeneration data	16	49	65
Number of plots with tree height measurement	10	23	33
Number of trees with DBH and height measurement	19	43	62

Forest Reserve Emission Factors and Total Carbon Stock from the First Assessment

Forest Reserve	Mean AGB (tC/ha)	Mean BGB (tC/ha)	Emission Factor – AGB+BGB (tC/ha)	Car (tC) EF
Dedza Salima Escarpment	36.75	10.29	47.04	488,[illegible]
Thuma	24.13	6.76	30.89	487,032.25
				975,845.06

Summary Statistics for Canopy Cover from Tree Crown Measurements (Figures in % Canopy Cover)

Forest Reserve	Minimum	Maximum	Mean	Standard Deviation
Dedza-Salima Escarpment	13	95	63.14285714	33.50337581
Thuma	17	86	56.53846154	23.358137

Mean and Standard Deviation of AGB and BGB Values for Each Forest Reserve

Forest Reserve	Mean AGB (tC/ha)	AGB Standard Deviation	Mean BGB (tC/ha)	BGB Standard Deviation
Dedza Salima Escarpment	36.75	18.6	10.29	5.2
Thuma	24.13	13.1	6.76	3.67

Species Counts and Dominant Species by Forest Reserve

Forest Reserve	Total Number of Species Identified	Five Most Dominant Species	Species Count
Dedza Salima Escarpment	88	Brachystegia manga	79
		Diplorhynchus condylocarpon	79
		Brachystegia bussei	71
		Bauhinia petersiana	55
		Pseudolachnostylis maprouneifolia	46
Thuma	54	Brachystegia bussei	34
		Combretum apiculatum	31
		Brachystegia utilis	29
		Brachystegia manga	20
		Markhamia obtusifolia	12

Mean and Standard Deviation of AGB and BGB Values for Each Forest Reserve

Forest Reserve	Mean AGB (tC/ha)	AGB Standard Deviation	Mean BGB (tC/ha)	BGB Standard Deviation	Number of Plots N=
Dedza Salima Escarpment	36.75	18.6	10.29	5.2	66
Thuma	24.13	13.1	6.76	3.67	30

Tree Density by Forest Reserve

Forest Reserve Name	Number of Cluster Plots	Stem Density (per ha)	Estimate of Total Stock (Number of Trees)
Dedza Salima Escarpment	22	112	1163811
Thuma	10	107	1685048

Forest Inventory Assessment

	Dedza-Salima Escarpment	Thuma
No of Clusters (plots)	22 (66)	10 (30)
Stem Density[2] (trees/ha)	112	107
Estimate of Total Stock[3] (no of trees)	1,163,811	1,685,048
Emission Factor[4] (tC/ha) +/- var	47.04	30.89
Estimate of Total Carbon Stock[5] (tC)	488,812	487,032
Mean Biomass[6] (t.d.m./ha)	104	122
Estimate of total Biomass[7] (t.d.m.)	2,808,489	1,153,489
No of Species	88	54
Dominant Species	*Brachystegia manga*	*Brachystegia bussei*

Table 21. Summary Statistics for Tree Density per Reserve

	Dedza Salima Escarpment	Thuma
Min stem density (trees/ha)	53	29
Max stem density (trees/ha)	238	135
Mean stem density (trees/ha)	112	70
Standard Deviation stem density	42	30

Table 22. Carbon Uncertainty Assessment

	90% C and 10% Error	95% C and 10% Error	Actual Number of Plots
Dedza Salima Escarpment		22	66
Thuma		11	30

Challenges encounters and recommendations

There were some challenges faced during the Inventory. The nature of the terrain, steep slopes, thick vegetation and weather conditions made some plots extremely difficult to negotiate. The remoteness of some of the plots led to some logistical challenges but all of these were overcome and the teams remained equipped and supplied for the duration of the project. Despite all of the challenges the teams maintained a high standard or work, most days beginning at 4am.

There are several important lessons learned from the implementation of the field campaign. Here we highlight a few key points in specific thematic areas.

PRE-FIELD CAMPAGNE

- The addition of terrain information (slope) for the random plot allocation data is extremely useful. This is easily done using ArcGIS and ASTER DEM data (freely available)
- Over-sample plots are required
- Training should also include navigation to plots and the use of maps with GPS
- Logistics require more efforts
- Improvements to the field data sheets can be made (e.g. densiometer field; comments space, marked tree/plot locator fields, etc.)
- Vetting of field teams is required to ensure stamina levels are sufficient to participate in the strenuous work associated with field data collection in sometime very difficult terrain

DATA COLLECTION IN THE FIELD

- All data should be clearly recorded on the field sheets
- Rejected plots should include a metadata sheet and complete details for the rejection status
- Navigation to field plots would benefit from using maps or digital hi-res data on a laptop in combination with GPS

RECOMDATIONS

- Recommended frequency/timeline to re-inventory
- Recommendations on sampling (plot number and allocation) to meet management objectives, and to ensure confidence interval/margin of error
- Recommendations on forest inventory team composition/training/etc.

Conclusion

This project was the first of its kind to be carried out in both reserves and by WAG staff. The planning process we followed along with capacity building side has greatly improved local staffs knowledge.
All objectives and aims have been achieved as shown in this report.
This project conformed to the objectives, provided adequate precision and expertise, the methodology followed was sound and was on track with statistical sampling criteria.
In 2017 WAG was visited by Birdlife International, who made a through overview of the how the project was run and checked that WAG kept a comprehensive and transparent reporting and documentation records and trail.
WAG now have baseline data which has given us a starting point and we have good clear processes and procedures to follow. Further inventories will be carried out following the same pattern and principles which will enable us to assess on the ground changes.
The inventory has also brought most knowledge of the trees, plants and orchids which we did not have before. One rangers has become expert on tree identification and knows scientific names, others are showing more interest. We have has tree name signs made and have them nailed on trees around camp so we can all learn. Several rangers took a major interest in the orchids and are still finding plants, taking photos to show at HQ.
The data collected has also been submitted to the Department of Forestry to joint other forest inventories in the Malawian National Forest inventory.
Our 10 year management which is work in progress is also being driven by the findings and knowledge from this project.

Aims	Short Term Impact	Long Term Impact
Conduct wet season Forest Inventory field survey (trees and orchids)	data collected recorded and analysed	Knowledge gained on forest areas and trees and plants
Compile Forest Inventory findings, including GPS maps, ID key for species, and description of unknown species (if found)	Baseline findings have been accomplished including density, distribution of trees and plants, tree listing, canopy cover etc	WAG has a full understanding of the forest current composition which will be used for further management plans, decision making tool and marker for future comparison,
Conduct desk study of current knowledge TFR ad identify survey areas	WAG leant to plan a forest inventory including creating Maps, SOPs, random plots and how to plan an inventory	All procedures and data is on file and ready for use again.
Conduct Forest Inventory field survey of TFR (orchids)	Some orchids found, however it highlighted the need for a more indept, species specific survey	Knowledge and protection of vulnerable areas gained
Scouts familiarize with key Forest Inventory findings and ID skills	WAG scouts were trained and took active part for first time in an inventory, gain valuable knowledge	Capacity building wihtin WAG, more required

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Orchid Survey Jan, Feb 2018

During the original survey certain areas of TFR was identified as orchid rich areas and WAG requested for an extension of the project period.
We were sure there was more orchids in Thuma than originally found in the 2017 inventory and wanted to conduct a more orchid specific search and identify our findings and with this information we could then include this long term ongoing protection of these areas from fire in particular in our management plans.
We had access to several books, "Malawi Orchids" by La Croix (1983), "Orchids of Malawi" by La Croix(1991) and "Some ground Orchids" of Zomba Mountain which was used to guide to train all team members prior to the inventory to help identify the flowers and leaves.
WAG scouts and rangers pooled their knowledge and plotted on maps, areas where they had seen or know orchids to be. Other factors taken into consideration was the different habitat zones which are known for orchids- Riverine, woodland, Mid Altitude forests, lowland forests.

Aims: The aim of this survey was to find and identify orchids in Thuma Forest Reserves.

<u>Short term impacts are summarised below:</u>

- Train scouts on orchid identification.
- Train scouts on orchid documentation.
- Increase the knowledge of orchids and their role in the eco-system

<u>Long term impacts are listed as:</u>

- Increased knowledge of the orchid diversity and distribution in TFR
- Increased scientific forest inventory capacity of WAG scouts in veg ID and survey techniques
- Requesting extension of KBA MW1 in include TFR

<u>Expected Results:</u>

- Identify all Orchids found within research area
- Scouts to improve knowledge on orchids
- Updated Orchid inventory
- Increased knowledge of orchid diversity and distribution in both reserves
- Improved capacity building in WAG scouts in Orchid identification and survey techniques

Project Activities:
A Orchid survey form was prepared which would allow us to collect as much data as possible.
Besides photographic documentation we wanted to collect other data which was plotted on our form:

- date
- area
- ID number
- GPS co-ordinates
- elevation
- Habitat
- Description of location
- Photos numbers
- tree or ground orchid
- tree species
- no of plants of same species
- plant height
- leaves - amount, length, width,
- Flower - colour, amount, petal count, stage
- Comments

Teams were selected and deployed to each areas where extended line searches were carried out.
When a orchid was found it was marked on the GPS, the flower photographed, measured and recorded on the orchid survey form. (see blank orchid form) .
The teams then moved into a extended line and continued to search in that area. Any additional flowers found were marked, measured and photographed.
In some cases the plant was found , however it was not yet in flower so the plots was marked and returned to several time until we were able to photograph the flower.
Our findings identified certain areas most likely to have orchids which assisted in further search plots. the plateau area up to the top of Mount Thuma at 1547mtrs, in dense miombo and deforested miombo areas, marshy areas and also riverine areas. We also found that most orchids were found in areas open and semi open where the grasses are not the usual grasses which cover most of Thuma such as udsu or tsakala (elephant grass), but are grasses which are fine and do not grow so high.

Two main orchid groups were found, terrestrial and Epiphytic orchids. Four epiphytic orchids were found, mainly along main rivers and 21 terrestrial orchids were found.
During the identification process we were in most cases able to identify the genus, however, species proved more complicated and we are still waiting for confirmation for some of the findings.

All orchids genus found are classed under two subfamilies:

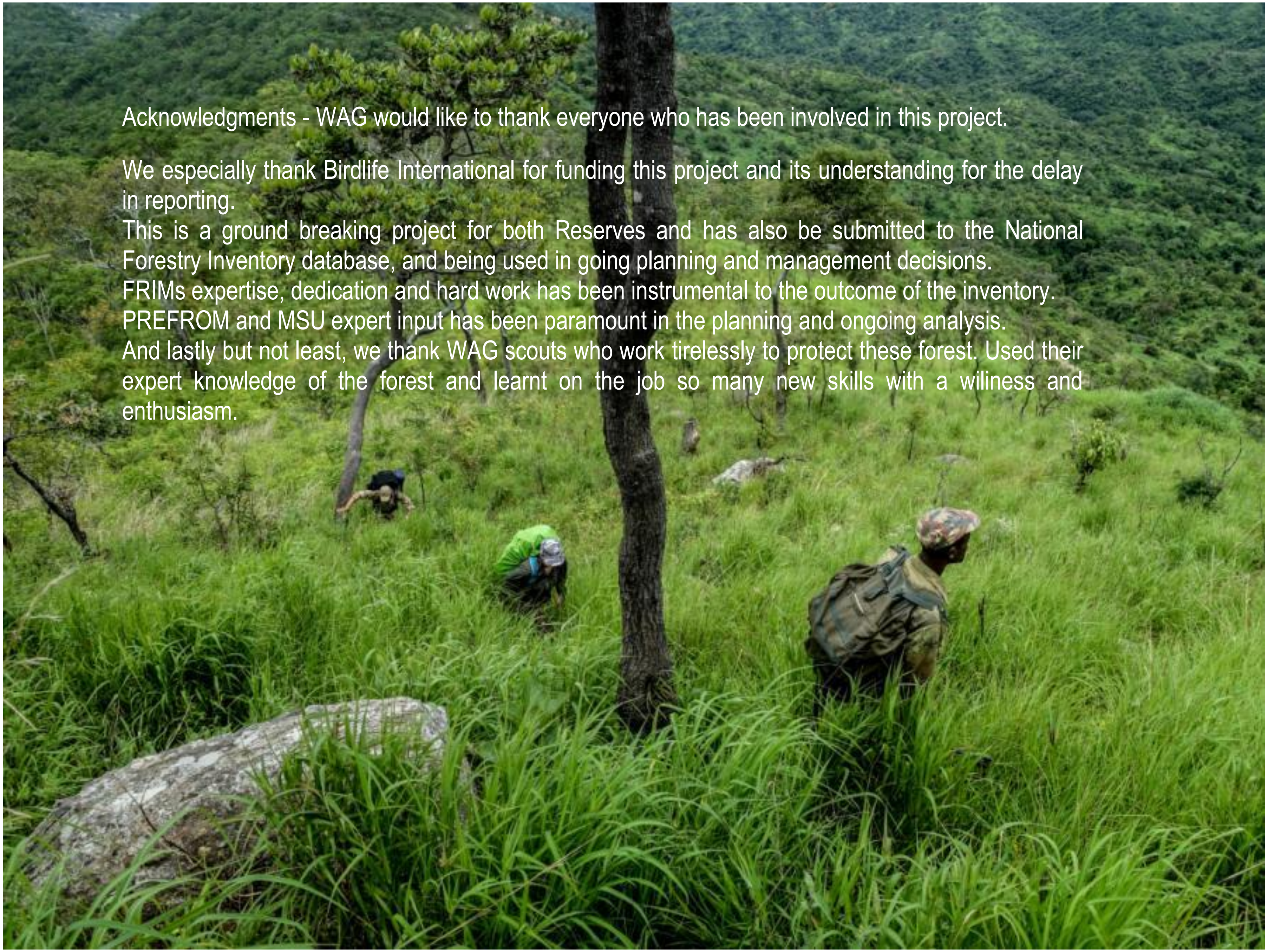
- **Subfamily Orchidoideae -** Habernaria, Disperis, Satyrium, platycoryne
- **Subfamily Vandoideae -** acampe, calyptrochilium, microcoelia, Eulophia, Aerangis

13 out of the 25 orchids found belong to the Habermaria subfamily were found in TFR and a further 2 habermaria orchids not found in TFR were found in DSFR which although was not involved in the orchid survey was found by rangers and reported so have been included in this report (see maps)
One area at the old hospital we found orchids however we missed the flowering time of these orchids and were unable to ID them. This area will be returned to starting Nov and Dec 2018.
2 Satyrium orchids were found, 1 in TFR and 1 in DSFR.
.Orchids found ranged in altitude from 762mtrs to the highest at 1547mtrs.
Finding experts to assist with identification was our next challenge.
WAG first contacted the National Herbarium of Malawi in Zomba requesting assistance in the identification of the first flowers found. However, we found that the identifications they returned to us were questionable.
At this stage we decided to start posting the photos on FB, looking for input from orchid enthusiasts "Orchids of South Africa".
This is when Mr Judd Kirkelweltwich (Bontanacial guide in SA and administrator of the FB platform) and Dr Benny Bytebier, curator of Bews Herbarium, University of KwaZulu Natal (Author of "Orchids of South Africa contacted us and has been assisting us to identify each orchid.
This process is still ongoing, however we have managed to 100% identify 15 of the 25 to date. One (sp no 9) could be a new species or abnormal sample of habernaria debeerstiana, we are still waiting for confirmation.
Maps have been prepared to show overview of findings.

Conclusion:

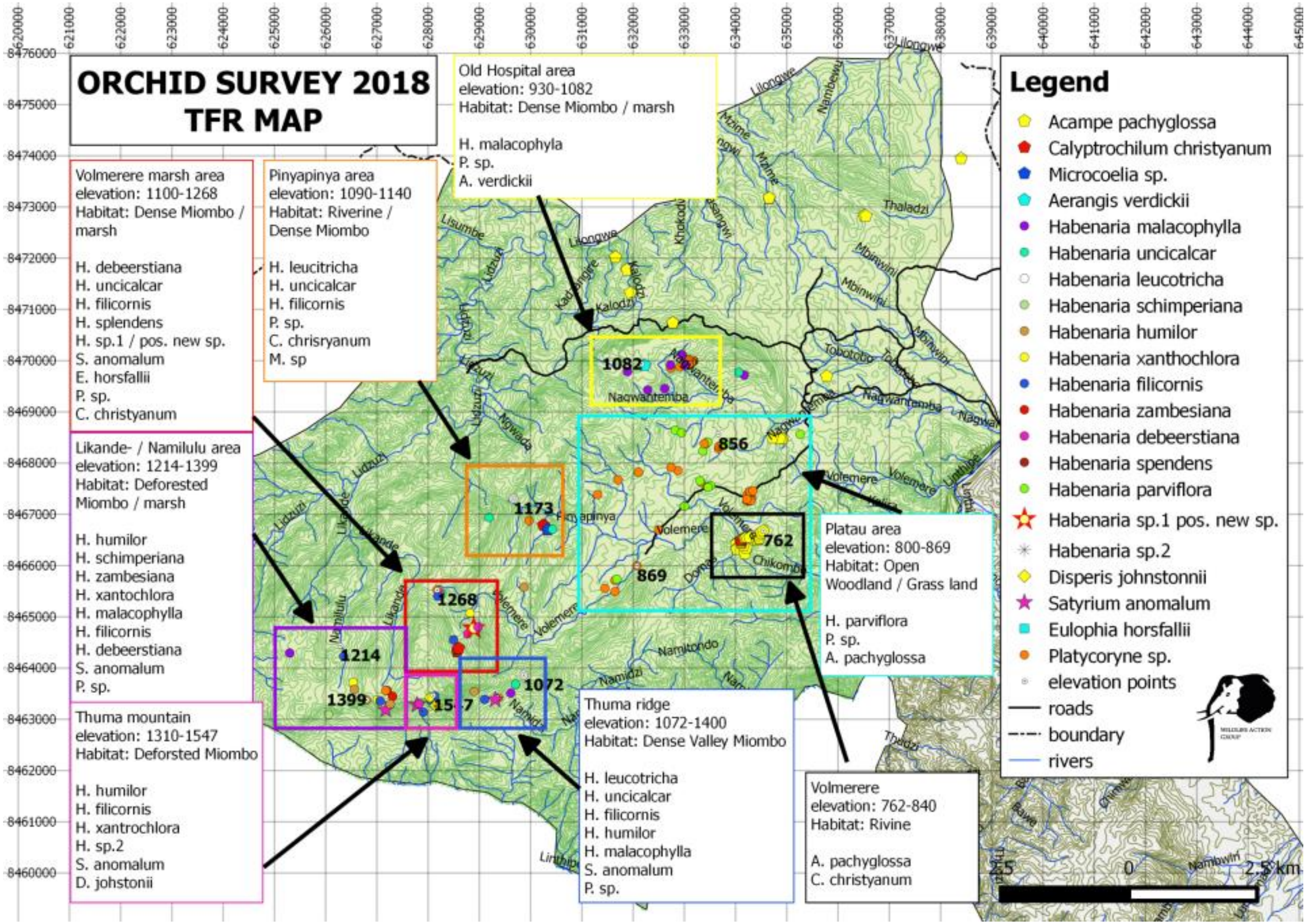
Prior to 2007 a volunteer had conducted some surveys on orchids, however, no records expect for three photos remain.
The extension of this whole project enabled us to discover new species of orchids not known to this area.
The project findings have identified vulnerable and important habitats, which need more protection.
Our scouts have gained no only more knowledge on orchids and many now are showing a great enthusiasm for these special, beautiful flowers.
Our aims have all been met, which was to identify and record orchids in Thuma Forest reserves, increase the scouts capacity of knowledge of orchids.
We have indentified 25 species on Orchid in Thuma Forest Reserve under this project and already had three, totallying 28 orchid species to date.
This project is only the start, fire management plans will incorporate these fragile areas and the plants, and this coming year we are already planning to start surveys earlier .
Once all species have been positively identified we will produce a booklet for staff and visitors alike. Already our FB posting has ignited much interest from orchid enthusiast.
Our 10 year management which is work in progress is also being driven by the findings and knowledge from this project.

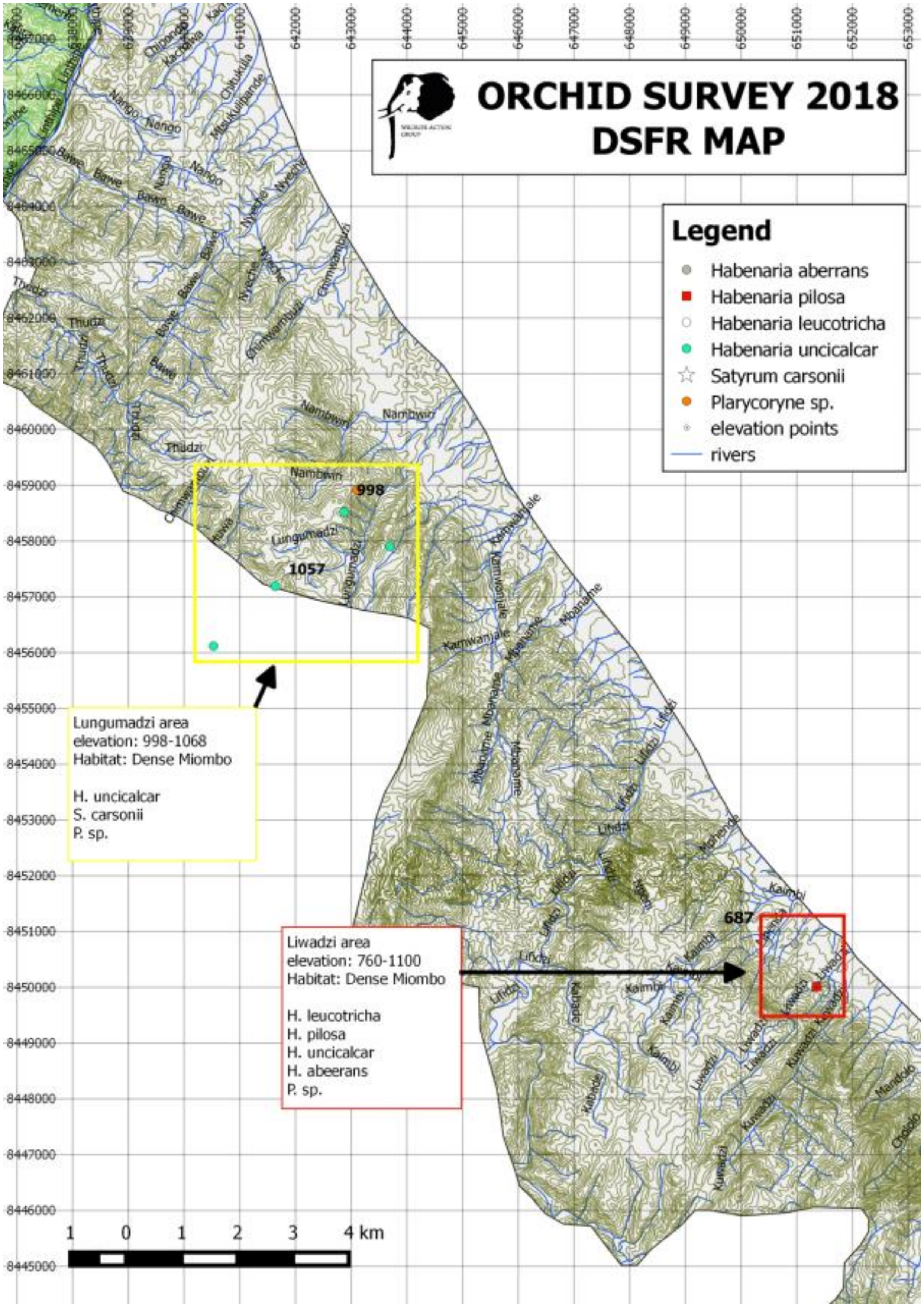
Aims	Short Term Impact	Long Term Impact
Carry out Orchid Survey in Thuma FR	Conducted an orchid survey in TFR in 2018 finding 25 species	Fragile areas where orchids found now known and will be improved manner , orchid habitats management improved, added to management plan and new habitat zones being created
Build capacity of scouts to identify orchid	Scouts trained on Orchid Identification	Staff more knowledgeable and motivated and active
		International interest
		Possibilities of funding



Acknowledgments - WAG would like to thank everyone who has been involved in this project.

We especially thank Birdlife International for funding this project and its understanding for the delay in reporting.
This is a ground breaking project for both Reserves and has also be submitted to the National Forestry Inventory database, and being used in going planning and management decisions.
FRIMs expertise, dedication and hard work has been instrumental to the outcome of the inventory.
PREFROM and MSU expert input has been paramount in the planning and ongoing analysis.
And lastly but not least, we thank WAG scouts who work tirelessly to protect these forest. Used their expert knowledge of the forest and learnt on the job so many new skills with a wiliness and enthusiasm.


ORCHID SURVEY 2018
TFR MAP
Old Hospital area
elevation: 930-1082
Habitat: Dense Miombo / marsh
H. malacophyla
P. sp.
A. verdickii
Volmerere marsh area
elevation: 1100-1268
Habitat: Dense Miombo / marsh
H. debeerstiana
H. uncicalcar
H. filicornis
H. splendens
H. sp.1 / pos. new sp.
S. anomalum
E. horsfallii
P. sp.
C. christyanum
Pinyapinya area
elevation: 1090-1140
Habitat: Riverine / Dense Miombo
H. leucitricha
H. uncicalcar
H. filicornis
P. sp.
C. chrisryanum
M. sp
Likande- / Namilulu area
elevation: 1214-1399
Habitat: Deforested Miombo / marsh
H. humilor
H. schimperiana
H. zambesiana
H. xantochlora
H. malacophylla
H. filicornis
H. debeerstiana
S. anomalum
P. sp.
Thuma mountain
elevation: 1310-1547
Habitat: Deforsted Miombo
H. humilor
H. filicornis
H. xantrochlora
H. sp.2
S. anomalum
D. johstonii
Thuma ridge
elevation: 1072-1400
Habitat: Dense Valley Miombo
H. leucotricha
H. uncicalcar
H. filicornis
H. humilor
H. malacophylla
S. anomalum
P. sp.
Platau area
elevation: 800-869
Habitat: Open Woodland / Grass land
H. parviflora
P. sp.
A. pachyglossa
Volmerere
elevation: 762-840
Habitat: Rivine
A. pachyglossa
C. christyanum
Legend
Acampe pachyglossa
Calyptrochilum christyanum
Microcoelia sp.
Aerangis verdickii
Habenaria malacophylla
Habenaria uncicalcar
Habenaria leucotricha
Habenaria schimperiana
Habenaria humilor
Habenaria xanthochlora
Habenaria filicornis
Habenaria zambesiana
Habenaria debeerstiana
Habenaria spendens
Habenaria parviflora
Habenaria sp.1 pos. new sp.
Habenaria sp.2
Disperis johnstonnii
Satyrium anomalum
Eulophia horsfallii
Platycoryne sp.
elevation points
roads
boundary
rivers
1082
1173
856
762
869
1268
1214
1399
1072
2.5
0
2.5 km


ORCHID SURVEY 2018
DSFR MAP
Legend
Habenaria aberrans
Habenaria pilosa
Habenaria leucotricha
Habenaria uncicalcar
Satyrum carsonii
Plarycoryne sp.
elevation points
rivers
Lungumadzi area
elevation: 998-1068
Habitat: Dense Miombo
H. uncicalcar
S. carsonii
P. sp.
Liwadzi area
elevation: 760-1100
Habitat: Dense Miombo
H. leucotricha
H. pilosa
H. uncicalcar
H. abeerans
P. sp.
998
1057
687
1 0 1 2 3 4 km