

response to that parameter and good ones have higher scores.

The table below shows order of species with their arbitrary agroforestry values. Root depth is one of the most important values, but even though the study is not fully finished, it has nevertheless been included for the most promising species.

Table 19. Scoring matrix to show agroforestry value of indigenous species

SPECIES	Germn %	Growth rate	Survival %	Root Depth	Leaf Biom.	Nodn/Myco.	Total Score
<u>Tephrosia vogelii</u>	10	9	10	10	10	15	64
<u>Sesbania macrantha</u>	9	10	10	8	9	15	61
<u>Bauhinia petersiana</u>	8	9	10	12	5	15	59
<u>Crotalaria sp</u>	7	10	8	10	7	15	57
<u>Acacia polyacantha</u>	7	8	8	12	5	15	55
<u>Entada abyssinica</u>	6	6	7	10	5	15	49
<u>Cassia obtusifolia</u>	6	9	9	14	8	0	46
<u>Cassia singuena</u>	8	8	9	14	7	0	46
<u>Cassia petersiana</u>	8	7	9	14	7	0	45
<u>Acacia tortilis</u>	8	4	10	-	3	15	40
<u>Acacia sieberiana</u>	7	6	6	-	4	15	38
<u>Acacia gerrardii</u>	2	5	10	-	1	15	33
<u>Dichrostachys cinerea</u>	1	5	8	-	4	15	33
<u>Baphia bequaertii</u>	4	1	5	10	1	10	31
<u>Acacia nilotica</u>	4	3	3	-	3	15	28
<u>I. sutherlandoides</u>	7	4	5	-	1	10	27
<u>Markhamia obtusifolia</u>	3	2	8	-	3	10	26
<u>Acacia albida</u>	-	2	7	-	1	5	25
<u>Acacia karroo</u>	5	0	3	-	1	15	24
<u>Albizia adiantifolia</u>	6	7	6	-	3	0	22
<u>Erythrophleum</u>	5	4	8	-	5	0	22
<u>Swartzia</u>	1	3	6	-	2	10	22
<u>Dalbergia melanoxylon</u>	4	3	10	-	3	0	20
<u>Guibourtia coleosperma</u>	9	2	7	-	1	0	19
<u>Piliostigma thonningii</u>	4	5	7	-	3	0	19
<u>Cassia abbreviata</u>	6	2	5	-	2	0	15
<u>Azanza garkeana</u>	2	2	9	-	2	0	15
<u>Azalia guanzensis</u>	1	0	10	-	3	0	14
<u>Strychnos cocculoides</u>	1	3	8	-	1	0	13

Maximum score for column 1, 2, 3 & 5 = 10

Maximum score for column 4 & 6 = 15

Maximum total score = 70

Considering all the above factors along with the coppicing ability of the species it is summarised that, Cassia obtusifolia, Cassia petersiana, Cassia sinuata and Acacia polyacantha could be used successfully in alley cropping system. Also promising for alley cropping are: Entada abyssinica, Albizia adiantifolia, Bauhinia petersiana, Crotalaria sp (under this study) and Acacia sieberana. Coppicing ability studies for these species is necessary.

Sesbania macrantha and Tephrosia vogelii are considered suitable for improved fallow systems.

## PROPOSALS FOR FURTHER RESEARCH

For any agroforestry species the following characteristics are desired: (1) coppicing ability, (2) adaptability, (3) high nitrogen content in leaves and (4) deep rooting. These qualities are necessary for an alley cropping species and hence the following research proposals are suggested:

1. Pruning trial for candidate species.

This will involve subjecting the species to varying pruning frequencies and pruning heights, to find the optimum condition.

2. Adaptability trial for candidate species in different locations within the high rainfall areas.

Screening for adaptability in locations with differing soil properties within the high rainfall zone.

3. Chemical leaf analysis for candidate species.

The leaves to be analysed for major nutrients. From this C/N ratio can be determined.

4. Rooting habit for various other species in the arboretum which have not been studied.

This would be an extension of the work already begun.

5. Alley cropping and fallow trials for candidate species.

The candidate species will be planted in hedgerows and various companion crops will be interplanted in the alleys. The effects of the trees on crop productivity and on nitrogen build-up in the soil will be monitored.

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## APPENDIX I

## BIOMASS ESTIMATION FORMULAE

In any agroforestry system biomass production is of vital importance. In assessing such systems the estimation of biomass that might be obtained has a higher priority. Since there are only a limited number of plants in trials (such as in the present work), large scale destructive methods of biomass determination can not be tolerated. Hence, a non-destructive method whereby biomass might be estimated from readily measurable parameters would be very desirable.

The two easily measured parameters are height and root collar diameter (R.C.D.). It was hoped that, at least in the case of some species, a reliable multiple regression equation linking height and R.C.D. with the biomass of some or all of plant components (Whittaker & Woodwell, 1968). However, at this stage of the experiment, it was not prudent to sacrifice more than 3 plants from each species for biomass determination. Thus only a simple linear regression formula is mathematically possible at this stage. Next year more trees will be sampled, thus allowing the derivation of a multiple regression.

A matrix of all possible correlation coefficients between the following variables was calculated; leaf biomass, stem biomass, root biomass, total biomass etc. and is reproduced in table 18.

When the correlation coefficient was significant at the 5% level, (>0.997), the linear regressions were calculated and are reported below.

It was found (Table 18) that R.C.D. correlated significantly with some components of the biomass in some species. Significant correlation was also found between height and other biomass component.

1. Cassia petersiana

Root collar diameter has very good correlation with stem biomass.

For stem biomass

$$\text{Ln } B^* = -1.41 + 0.3298 \times \text{R.C.D.}^{**}$$

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\*B = Biomass in grammes

\*\*R.C.D. = Root Collar Diameter

Table 18. PRODUCT MOMENT CORRELATION COEFFICIENT (MATRIX) BETWEEN THE BIOMASS OF LEAVES (a), STEM (b), ROOTS (c), FRUIT (d) and TOTAL BIOMASS (e), HEIGHT (f), R.C.D. (g), & ROOT LENGTH (h)  
(Values significant at  $P \leq 0.05$  are marked with \*)

	Leaves (a)	Stem (b)	Root (c)	Fruit (d)	Total (e)	Height (f)	R.C.D. (g)	Root Length (h)
<u>Cassia petersiana</u>								
a	1.0000	0.9804	0.9996	1.0000	0.9996	0.8297	0.9622	1.0000
b	0.9804	1.0000	0.9854	1.0000	0.9855	0.9234	0.9970*	0.9823
c	0.9996	0.9854	1.0000	1.0000	1.0000	0.8446	0.9692	0.9998
d	0.9996	0.9855	1.0000	1.0000	1.0000	0.8449	0.9694	0.9998
<u>Tephrosia vogelii</u>								
a	1.0000	0.9987	0.9996	1.0000	1.0000	0.8975	0.5830	-.7737
b	0.9987	1.0000	0.9997	1.0000	0.9989	0.9186	0.5413	-.8048
c	0.9996	0.9997	1.0000	1.0000	0.9997	0.9094	0.5603	-.7910
d	1.0000	0.9989	0.9997	1.0000	1.0000	0.8993	0.5797	-.7763
<u>Entada abyssinica</u>								
a	1.0000	0.9616	0.8605	1.0000	0.9794	0.9531	0.9507	-.9187
b	0.9616	1.0000	0.6877	1.0000	0.8864	0.9996*	0.8291	-.7750
c	0.8605	0.6877	1.0000	1.0000	0.9456	0.6659	0.9761	-.9918
d	0.9794	0.8864	0.9456	1.0000	1.0000	0.8723	0.9937	-.9795
<u>Cassia sinquena</u>								
a	1.0000	0.9996	0.9686	1.0000	0.9956	0.8184	0.9742	0.9825
b	0.9996	1.0000	0.9755	1.0000	0.9979	0.8011	0.9671	0.9766
c	0.9686	0.9755	1.0000	1.0000	0.9877	0.6498	0.8874	0.9054
d	0.9956	0.9979	0.9877	1.0000	1.0000	0.7608	0.9487	0.9607
<u>Sesbania macrantha</u>								
a	1.0000	0.9291	0.2764	1.0000	0.9991	0.9919	0.3774	0.7999
b	0.9291	1.0000	-.0985	1.0000	0.9123	0.9687	0.0082	0.9651
c	0.2764	-.0985	1.0000	1.0000	0.3176	0.1518	0.9943	-.3556
d	0.9991	0.9123	0.3176	1.0000	1.0000	0.9854	0.4170	0.7733
<u>Baphia bequaertii</u>								
a	1.0000	0.9488	1.0000	1.0000	0.9989	0.9633	0.9335	0.8607
b	0.9488	1.0000	0.9482	1.0000	0.9623	0.9988*	0.7724	0.9775
c	1.0000	0.9482	1.0000	1.0000	0.9989	0.9628	0.9342	0.8598
d	0.9989	0.9623	0.9989	1.0000	1.0000	0.9746	0.9161	0.8832
<u>Crotalaria sp.</u>								
a	1.0000	0.9969	0.9857	1.0000	0.9988	0.9988*	0.9718	0.9849
b	0.9969	1.0000	0.9958	1.0000	0.9996	0.9919	0.9873	0.9683
c	0.9857	0.9958	1.0000	1.0000	0.9927	0.9763	0.9977*	0.9416
d	0.9988	0.9996	0.9927	1.0000	1.0000	0.9952	0.9822	0.9752

Cassia obtusifolia

a	1.0000	0.9507	0.9605	1.0000	0.9907	0.6292	0.4241	-.4522
b	0.9507	1.0000	0.8269	1.0000	0.8998	0.8392	0.6840	-.7064
c	0.9605	0.8269	1.0000	1.0000	0.9894	0.3882	0.1555	-.1862
d	0.9907	0.8998	0.9894	1.0000	1.0000	0.5179	0.2973	-.3269

Acacia polyacantha

a	1.0000	0.9970	0.7222	1.0000	0.9643	0.9999*	0.9578	0.9564
b	0.9970	1.0000	0.6669	1.0000	0.9411	0.9980*	0.9329	0.9761
c	0.7222	0.6669	1.0000	1.0000	0.8795	0.7127	0.8905	0.4889
d	0.9643	0.9411	0.8795	1.0000	1.0000	0.9606	0.9997*	0.8451

Leucaena leucocephala

a	1.0000	0.9984	0.9983	1.0000	0.9999	0.9130	0.9302	0.6880
b	0.9984	1.0000	0.9935	1.0000	0.9976	0.9345	0.9494	0.7276
c	0.9983	0.9935	1.0000	1.0000	0.9990	0.8878	0.9073	0.6446
d	0.9999	0.9976	0.9990	1.0000	1.0000	0.9078	0.9255	0.6787

Entada abyssinica

There is a correlation ( $P \leq 0.05$ ) between height and stem biomass.

For stem biomass

$$\ln B = -1.78 + 0.0857 \times R.C.D$$

Baphia bequaertii

There is a significant correlation between height and stem biomass but, none for other parameters.

For stem biomass

$$\text{Ln B} = -4.43 + 0.391 \times \text{Ht}$$

Crotalaria sp

There is a good correlation between height and leaf biomass, R.C.D and root biomass ( $r = 1.00$ ) yielding the following equations.

Leaf biomass

$$\text{Ln B} = -3.47 + 0.09 \times \text{Ht}$$

Root biomass

$$\text{Ln B} = 0.29 + 0.150 \times \text{R.C.D}$$

Acacia polyacantha

There is very high correlation ( $r = 1.00$ ) between RCD and total biomass, height and leaf and stem biomass.

Leaf biomass

$$\text{Ln B} = 0.752 + 0.034 \times \text{Ht}$$

Stem biomass

$$\ln B = 0.138 + 0.036 \times Ht$$

Total biomass

$$\ln B = 1.006 + 0.204 \times R.C.D$$

Even though this data is very preliminary with only 3 replicates from each species, it might be good to see how it may be used when the regression equations are based on sufficient replicates. Since Acacia polyacantha shows a significant regression of R.C.D. with total biomass, R.C.D. may be used to estimate biomass productivity in these species.

Example:

	MONTHS				
	1	2	3	4	5
<u>A. polyacantha</u> R.C.D. (mm (obs))	1.06	2.00	3.07	4.70	5.95
Tot. Biomass (est)	3.40	4.11	5.12	7.14	9.21

A similar estimation of leaf and root biomass may be carried out for Crotalaria.

## APPENDIX II

## POTENTIAL ZAMBIAN AGROFORESTRY SPECIES AND THEIR USES

The information outlined here has been extracted mainly from the species file index at the Division of Forest Research - Kitwe. Some of it has been obtained through questioning elderly persons and some from my own research and experience.

The Division of Forest Research has largest herbarium in the country. This herbarium was established by early workers like D.B. Fanshawe and is currently in charge of Mr. S.M. Chisumpa. Species index files were made from 1960's and information on almost every species is still piling up. Most of the information have not been published especially those with the bias of agroforestry. Mr. D.B. Fanshawe, used some of the information to make a number of publications which are now on the market, but, there is still a lot of information requiring exploration.

The distribution of the species has been indicated immediately after the species name, and the following abbreviation are used:

W - Copperbelt and North-Western Provinces

N - Northern and Luapula Provinces

E - Eastern Province

C - Central with Lusaka Province incorporated

S - Southern Province

B - Western Province

This is followed by a general description of the species, its flower appearance, flush, germination and regeneration; economic and traditional uses are also listed.

Cassia abbreviata Oliv.

Distribution: W N E C S B

It flushes in August, September, young leaves pale green, velvety; old pale yellow leaves appear in April: leaf fall is in April and May.

Yellow, showy flowers appear in July, August, September, October and November generally and casually in April, May, June. Fruits in May, June, July, August, September and the fruits persist on the tree for a long time.

Germination is epigeal; low 12-22% in 3-4 weeks when sown in July and August, germinated in August and September respectively. Grows easily from seed, is very fast growing, withstands drought in winter. In cold areas it should be planted in a warm,



protected north facing spot. Ordinary light garden soil with compost added is suitable.

Cattle and game avoid this species when browsing and the smell of fresh crushed leaves will even drive snakes out of their holes. Leaves, bark and roots are used medicinally to treat headaches, cholera, toothache, bodily pains, barrenness in women, fever, V.D., syphilis, dysentery, diarrhoea and small-pox.

The bark and roots are astringent and have been used in tanning.

Infusion of bark taken as medicine by Bembas to treat fever and V.D. Infusion of chopped root drunk by Valley Tonga to treat barrenness in women. Decoction of leaves as a steam bath is a cure for body pains. Five minutes root infusion warmed up and held in the mouth will relieve toothache. Five minutes infusion of roots used to treat abdominal pains. Overdose could be fatal.

Cassia sinqueana Del

Distribution: W N E C S B

Flushes in August with young leaves pale green. Leaves turn yellow in April and leaf fall is in May.

Yellow flowers in 6-15 fascicled axillary racemes, usually grouped at branch end, appear March, April, May and in June, July, August, September, October. Fruiting is in July, August, September, October and November.

Germination epigeal; very good, 70-80%, very fast in 1-2 weeks, sown and germinated in August or November. It grows rapidly and flowers within 4 years.

Foliage appears to be avoided by game. Infusion of leaves and flowers used to bathe sore eyes. Bark contains tannin.

It occurs on nickel and copper anomalies in Zimbabwe.

Droogmansia pteropus (Bak.) De Wild

Distribution: W N E C B

White to cream to pale mauve, pink-mauve or purple, striated darker flowers in long, terminal, occasionally branched racemes, 15-50cm, appear in June - November. This is followed by 1-4 jointed yellow-brown to pale brown velvety fruits in October-December.

The leaves are used as a poultice with mud, equivalent to plaster of Paris for mending of broken limbs (a belief derived from jointed leaves). Powdered leaves used as a poultice on burn sores 2 times per day.

Acacia nilotica (L) Del.

Distribution: N E C S B

Pale yellow leaves appear in June and fall off in July and fresh flush appear in November and December.

Fragrant yellow to orange balls of tiny flowers appear in axillary clusters in October - November. Flat oblong - linear, glossy black-brown pods constricted between the 9 - 14 oval,

biconvex, greeny-black seeds, embedded in a floury substance scented like carob bean, ripen 7 months later.

Germination epigeal, very low, 5% in 2-6 months untreated sown May, germinated in July. At 6 months, seedling stem 18 cm high, root to 24 cm long. Coppices moderately from base of trunk. The tree can be grown from root suckers.

Pods are nutritious and palatable to cattle, sheep, goats and game. Foliage is browsed by goats. The gum is edible and suitable for sweetmeats. A black dye for cloth and ink can be produced from the pods which contain 20-40% tannin. Bark of young trees can be used in place of strings. Decoction of bark used to treat dry coughs. Decoction of pods and roots used as ink. Decoction of bark and roots has an intoxicating effect and is used to give courage in youth and also as an aphrodisiac. The leaves, roots, bark and gum are used in various traditional medicines.

Acacia polyacantha Wild. ssp camplyantha Brenan.

Distribution: W N E C S B

The old leaves turn pale yellow and fall between April-June. The new flush appears before flowering commences in August-September. Young leaves are pale green.

White spikes of flowers are produced in October - December. The dark brown, flat oblong, thin shelled, smooth, glossy pods to 10cm long ripen in June - September and contain 4-8 round, flat, dark-green seeds.

Germination is hypogeous, poor. Only 10% germination obtained with fresh seeds, seeds sown in October after a pretreatment of hot water soaking (Ndola nursery). Seeds require no pretreatment.

It is apparently easy to establish on most soil types by direct sowing at stake. It grows fast. Can attain 90-120 cm height or even 180 cm per annum.

It is used for tool handles, paddles, rough furniture and mine shafting. It has a high calorific value as fuel. Roots are used to treat snakebite and gonorrhoea. Roots have a persistent smell intensely disliked by snakes. Chopped roots put in water to

drive away crocodiles. The gum is sucked for sore throat. It has reputed aphrodisiac properties. Gum is pale yellow to reddish-brown, glassy or opaque on surface, mostly soluble and yields a good adhesive mucilage suitable for confectionery. Gum good for making malam's ink.

Acacia karroo Hayne (sweet thorn)

Distribution: C S

Golden yellow flowers in spherical heads 8-12 mm diameter clustered in axils of young leaves towards the end of branchlets forming a pseudo-raceme, appear in August-November. The pods ripen in May - July. Flush in September with pale green young leaves.

Germination hypogeous, 12%, sown June, germinated in September. Growth is rapid, a seedling advanced from 15 cm to 1.8m in one season. It is known to reach 3m in 3 years under good conditions. Coppices vigorously. Roots always associated with underground water.

The tree is an excellent fodder. It is an excellent source of nectar for bees. Roots chewed as an aphrodisiac. Infusion of root for 24 hours taken with food to treat gonorrhoea. A bark

infusion is given to cattle as a remedy for tulp poisoning. The tree yields an edible gum.

Acacia gerrardii Benth

Distribution: W N E C S

White to cream to pinkish flowers in fascicled, stalked, axillary globular capitula appear in November-March and pods ripen in June-September. Old pale-yellow leaves appear in July-August and fall off in August-September.

Germination epigeous, poor, 26% over 5 months, sown October, germinated in 5 days. Growth up to 45 cm in 12 months. Limited coppice regeneration from base of trunk.

A browse plant but not greatly valued. Leaves pounded in water and liquid used to wash newly born twins, also used for madness. Infusion of roots used to wash patients suffering from rheumatism 3 x per day for 1-2 months. After washing, patient anoints himself with oil mixed with powdered root.

Acacia sieberana DC.

Distribution: W N E C S B

White, creamy or yellow flowers in spherical heads on slender stalks, solitary or in clusters, appear generally in September-November/December and casually February-June. Ripe pods can be collected in July-October. It flushes in July-September new leaves being pale green.

Germination epigeal 12-20% in 1 month, sown July and October, germinated August and November respectively. Seed is best prepared for sowing by scorching the pods in a small fire (FD).

Pods are palatable and greedily consumed by cattle, antelope, buffalo, elephants and rhino. Foliage valued as fodder. Yields a clean gum of good quality commonly used in making ink (gumarabic type). Root, occasionally bark, is used as vermifuge for tapeworm and remedy for urethral troubles. Roots have a strong, persistent unpleasant smell. Infusion of leaves used to treat coughs. Sitting in a cold infusion of roots helps to relieve abdominal pains in women. Pods used for tannin. A bark decoction use to treat gonorrhoea. Decoction of roots taken as a purgative.

The wood is used for rough furniture, utensils, mortars, packing



cases, hut building, tool handles and roots for spear shafts.

Acacia tortilis Hayne

Distribution: N E C S

White, cream or pale yellow flowers in spherical heads in axillary stalked clusters appear generally in November-January and casually in April and May. Pods ripen in May-October. The tree flushes in September-October. Young leaves are pale green.

Germination poor, 10% in 4 weeks sown November, germination November. Easily raised from seed, extremely hard and drought resistant, rather slow growing. Pairs of hooked thorns usually alternate with pairs of straight thorns or otherwise.

Leaves of young trees are browsed by game and domestic stock. The pod is also relished by game and domestic stock. The tree yields an edible gum. Parts of the tree have been used in tanning.

Guibourtia coleosperma Benth ex J. Leonard

Distribution: W S B

White flowers in solitary axillary or terminal racemes or panicles appear in November-January/February. Flat, semi- or biconvex or oval-biconvex greenish pod with one red-brown seed ripen in June-October.

Germination epigeous, reasonably good, 55% in 3-4 weeks sown in September (Ndola nursery). By the end of first year seedlings are 8cm long with a taproot to at least 30cm and probably 45cm or 60cm long.

It is used for general construction, joinery, furniture, tool handles, railway sleepers and parquet flooring. The seeds are cooked and eaten by the local people. Foliage eaten by elephants. The aril contains an edible oil. Aril made into a drink.

Infusion of roots used to treat stomach troubles. Infusion of bark is used as an enema. Oil from the fruits is used to stain furniture. Decoction of leaves or bark are used to treat eye diseases. Roots and leaves are used as strengthening medicine for the baby and for treating coughs. One hour decoction of the bark is used to bathe and clean the sores of syphilis patients.

Two minutes decoction of bark is used as a mouth wash 4 times per day for 5 days in nose bleeding patients. Temporary madness is treated by inhaling steam from decoction of roots and sipping at intervals of infusion of root in beer or water.

Tephrosia vogelii Hook. f.

Distribution: N E

White, red or violet-purple flowers in short dense terminal or axillary racemes appear almost all year round as do the fruits.

Germination epigeous, very good, 60-90% in 1-2 weeks sown July or October germinated July or November.

Pounded roots or leaves are used to poison fish. This plant is a most effective fish poison. Cattle death resulting from the animals drinking from the poisoned pond have been reported. Symptoms are paralysis of the hind quarters, internal haemorrhage and death by paralysis of the respiratory organs (Fanshawe, unpublished). Action is very fast, just in 5 minutes.

The leaves and bark contain tephrosin and a volatile oil (tephrosal) used as insecticide, emetic and purgative. Leaves

are reputedly parasiticide against fleas, lice and ticks.

Sesbania sesban (L) Merr. ssp. sesban

Distribution: W N E C S B

Pale yellow, nearly always streaked or spotted with violet purple or red flowers in lax axillary racemes appear from March to October and pods mature from May to November.

Germination hypogeal, very low, 4-6% in 2 weeks to 3 months sown August or October germinated August or January. Germination can be very high 92% in 5 days - 2 months sown in May germinated May.

It is browsed by game and domestic stock. The whole plant except root is used as a vegetable (F.D.). The plant contain a saponin and is used locally as a fish poison with a stupefying action. (Fanshawe, unpublished). The dried leaves and flowers are the chief relish of the valley Tonga. The stem yields a useful fibre.

Piliostigma thonningii Milne-Redhead

Distr: W N E C S B

Off-white to pink fragrant flowers in terminal or axillary rusty pendent racemes appear in November-March followed by large flattened oblong dark red-brown, leathery, smooth indehiscent pods in June-August.

Germination epigeal, low, 20% in 3-4 weeks, sown October, germ. November.

Farmers mix the crushed pods with molasses and mineral salts for cattle food. A red dye can be obtained from crushed bark or boiled roots. The Masai once used it to colour their leather shields. A blue dye is obtained from the pods and seeds. Bark and roots yield up to 18% tannin. The mealy portion of the pod is eaten by children under the name of monkey bread. Seeds are eaten in famine times. The inner bark can be used to make string and rope.

The leaves, bark and fruit are medicinally used to treat colic rheumatism, V.D., gum infection, dysentery, coughs, throat and chest troubles, conjunctivitis, malaria, blood poison, toothache, hookworm, diseases of the spleen, leprosy and small-pox. Inhalation of vapour from leaf decoction used to treat malaria.

Erythrophleum sauveolens Brenan.

Dist: W N B

Flushing is in September/October with dark green or red young leaves. Old yellow leaves appear in July/August and fall in August/September.

Creamy to greenish white flowers in terminal, short pubescent panicles of yellow-brown tomentose racemes, to 27cm long appear in August, September, October. Fruiting is in April, May, June, August and September.

Germination epigeal, very low, 7% in 2 months sown October germinated in December. Seedling 3 months old, 10-13 cm high with 15 cm long taproot. Fast growing stool shoots but poor form. Regeneration absent or rare.

It is one of the common trees surrounding the Chiefs' burial ground at Shimwalule in Chinsali district, along with Parkia and Newtonia.

The bark contains alkaloids, cassaidine, cassaine, cassamine,

casminic acid, erythroplamine, erythroplein, homophleine (U.S Dept. Agr. Tech. Bull. 12:34).

Odeal by Mwafi - infusion of the bark, red in colour, with salt added to increase toxicity is administered to those accused of witchcraft. Vomiting indicates innocence. The person who does not vomit may die from the effect of poison. The bark is used in West Africa for tanning and a red dye is produced from the bark (Greenway).

Baphia bequaertii De Wild

Distribution: W N B

White flowers with yellowish spots in axillary fascicles appear between August-November and fruits are ripe in July-September.

Germination is hypogeal, 40% in 4-6 weeks, sown October, germinated November. It is reasonably fast growing. Occasionally reaches 1.8m in one year. It is a host plant for caterpillars of Pachypaoa sp which defoliate pines. It is fire resistant- 20-30% mortality after 20 years of burning regimes in Ndola sample plots.

Used for toy making and handcraft, hurdles, fencing, tool handles, gun butts, bows. The bark and roots are used in traditional medicine. The leaves and twigs when burnt provide a rich, saline relish.

Swartzia madagascariensis Desv.

Distribution: W N E C S B

Old yellow to yellow brown leaves appear in June-August and leaf fall is followed in August-September. A new flush of pale green young leaves appear in September/October.

White flowers solitary or in few-fascicled axillary racemes to 10cm long, erect or reflexed, appear with the young leaves in September-December generally and casually in March-May. The beans ripen in May-October.

Germination epigeal, low, 13% in 2 months, sown July, germinated September. Germination high, 70% in 4 weeks-2 months. Sown July, germinated August. Seedlings of 7 months have a stout root, yellowish 5mm wide to 18cm long. The rootlets are many up to 10cm long. Leaves 1-3 foliate ovate, glabrous above and pubescent below. Seedling very slow growing, 4 months, 2.5-5cm



high. Natural regeneration almost non-existent.

Pods are eaten by eland and cattle but they cause milk and butter to be tinted. Powdered heartwood soaked in hot water produces a redish dye (FD). The bark, roots, leaves and pods are used as traditional medicine. Leaves and pods used for control of bilharzia snails.

Dalbergiella nyasae Bak. f.

Distribution: W N E C S B

Leaves become pale cream and fall off in June, July and a new flush of pale yellow-green to crimson young leaves follow almost immediately in July-August.

Pale pink, pale mauve or white spotted with crimson flowers appear in July-September. Fruiting follows two months later in September-November.

The fresh bark contains a fish poison. The unbeaten strips of the bark are placed in stagnant pools of water to stupefy fish. Human poisonings have occurred. Roots are purgative and used in the treatment of diarrhoea, dysentery, syphilis, stomach troubles, ulcers, chest complaints and eye troubles.

Dalbergia nitidula Welw. ex Bak.

Distribution: W N E C S B

Old leaves fall in July - September and new ones appear in September - October. The young leaves are mostly pale green.

White, very fragrant flowers appear in August - October. Fruits appear in November - January.

Used for marquetry, turnery, sticks, posts, tool handles. A red dye is obtained by soaking the bark and roots in water. Roots ground to powder, inserted in skin incision, relieve spleen pains. Bark infusion or decoction used on sores and wounds. Infusion of roots drunk as cure for coughs. Leaves rubbed on to cure abscesses. A root decoction used to treat gonorrhoea and as a laxative. Infusion of powdered roots with porridge used to treat constipation; 6 tsp adult, 4 tsp children and 1 tsp for babies 2x per day (Watt & Breyer-Brandwijk, 1962). Powdered bark rubbed into incisions on the chest will cure pneumonia in a day.