COMMERCIAL FORESTRY IN SEMI-ARID KENYA

The case of *Melia volkensii*

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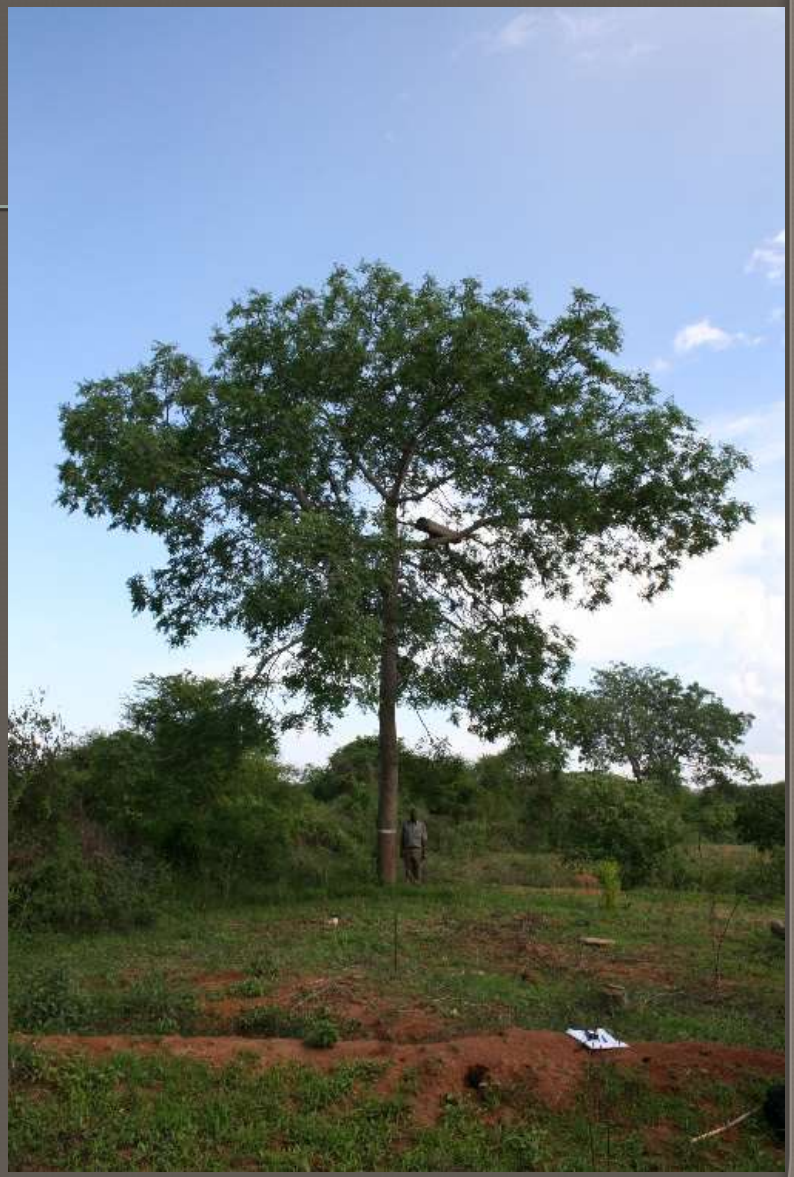
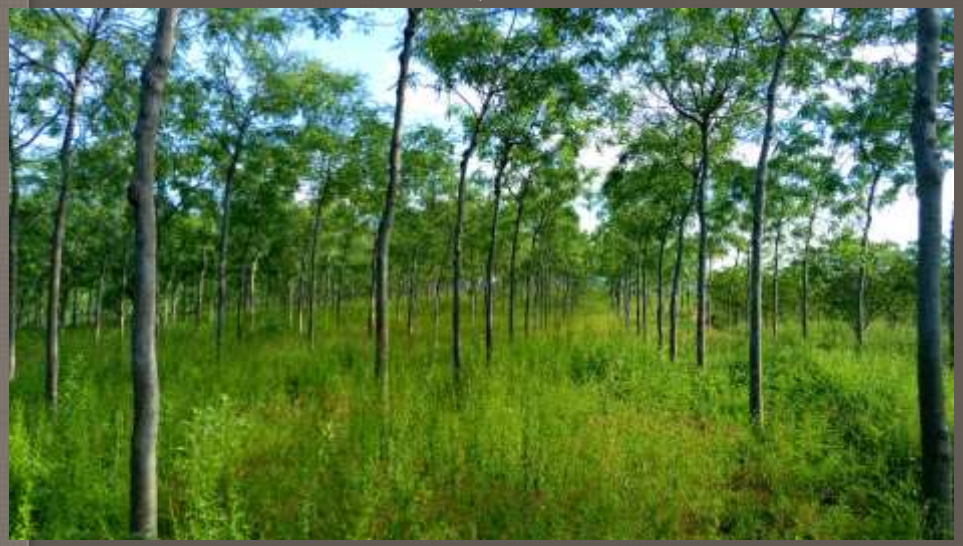


Silvicultural characteristics

- Grows well in semi-arid lands (mean annual rain 350 - 900mm)
- A light demanding species with a spreading crown
- It is fast growing, especially before 10 yrs (rotation 15-20 years)
- Can be managed through pruning and thinning to produce commercial product of timber
- It is possible to make a choice between plantations (close spacing) & agro-forestry (wide spacing with crops in between)



Pruning

- **Objective: produce** branch-free stem of 5.5 to 6m length;
- 10 pruning cycles over the first four years
- Pruning scars accepted in the inner core of the log (10cm diameter)

Table 1: General pruning schedule

pruning	Age (yrs)
1st	1
2nd, 3rd, 4th	2
5th, 6th, 7th	3
8th, 9th, 10th	4

Table 2: Pruning schedule with heights

pruning	age	Approx tree heig	pruning height
1st	6-12 months	1-2m	not defined
2nd	13-16 months	2-3m	1m branch-free
3rd	17-20 months	3-4m	1.5m branch-free
4th	21-24 months	4-4.5m	2m branch-free
5th	2-2.3 years	4.5-5.5m	2.5m branch-free
6th	2.3-2.7 years	5.5-6m	3m branch-free
7th	2.7-3 years	6-7m	3.5m branch-free
8th	3-3.3 years	7-7.5m	4m branch-free
9th	3.3-3.7 years	>7.5m	4.5m branch-free
10th	3.7-4 years	>7.5m	5.5m branch free

Thinning in plantations

No thinning minimal diameter growth

- Proposed: 2 thinnings during a 18-20 years rotation
- Table 3 shows results of a thinning trial in a 4 x 4m stand at 4 years
- Reduction in Basal Area 20%, thinning intensity 24% of trees removed

Table 3: results of a mock thinning at 4 years in Kiambere

parameter	Before thinning	After thinning	difference	difference %
DBH (cm)	11.9	12.1	+0.2	2%
Basal Area (m^2)	6.89	5.54	-1.35	20%
Commercial height (m)	5.40	5.51	+0.11	2%
Volume (m^3/ha)	26.6	21.67	-4.9	18%
Trees/ha	625	472	-153	24%

- Alternative scenarios possible, table 4 shows the option with 2 heavy thinnings, leaving 42% of the initial planting density of 625 trees/ha
- Remaining trees have average growing space of 38m2.
- More research needed to fine-tune this option

Table 4: Option 3: two heavy thinnings

Age (yrs)	trees /ha	Trees cut	% cut	Growing area /tree (m^2)	Canopy diameter (m)
1	625	-	-	16.0	4.0
4	419	206	33%	23.9	4.9
8	261	158	25%	38.3	6.2
16	-	261	42%	-	-

Agro-forestry lay-out

- Ideal for small-holders (min 2 acres approximately 1ha)
- Wide spacing (min 7x7m, up to 10x10)
- Intercropping with agricultural crops
- Pruning as in plantations
- After pruning (>5 years): lopping, topping

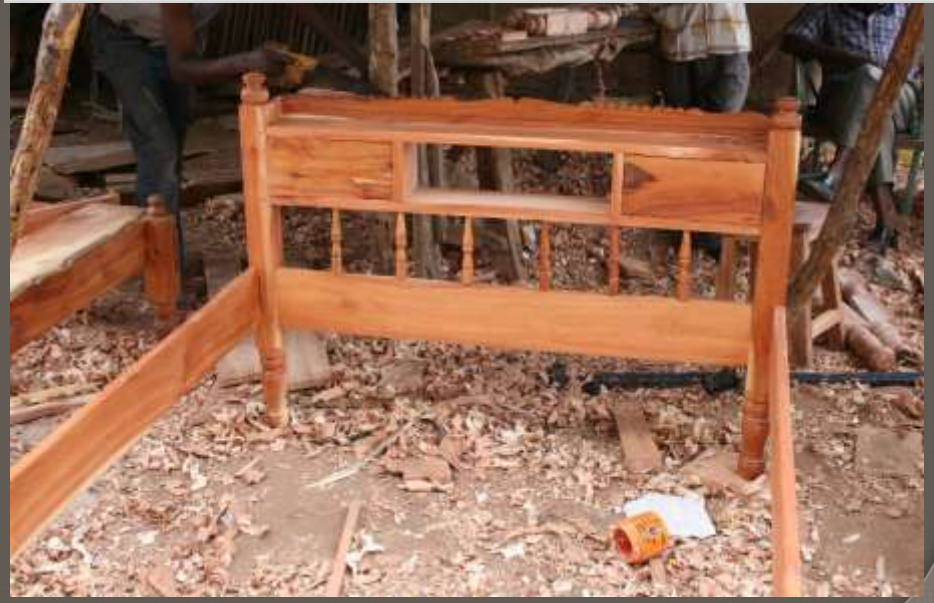
Yield and financial information
1. Present situation

- Stumpage price highly variable
- Between 5,000-10,000Ksh/tree
- Timber produced by chainsaw
- Quality poor in general
- DRC mahogany timber more expensive

Table 7: timber prices of melia vs DRC mahogany (and cypress)

timber size (inches)	Ksh/ft			details
	melia	DRC mahogany	cypress	
2x2	70	-		
2x3 (Z)	100	-		
3x3 (Z)	120			
2x4 (Z)	110	-	70	
6x1 (Z)	100	160	50	common size for DRC timber
6x2 (Z)	220	300	110	common size for DRC timber
8x1 (Z)	130	-		very rare for melia
8x2	200	-		very rare for melia
10x1	160	-		very rare for melia

(Z): Zombe Wood Furniture Ltd, Kitui town, Nov 2021

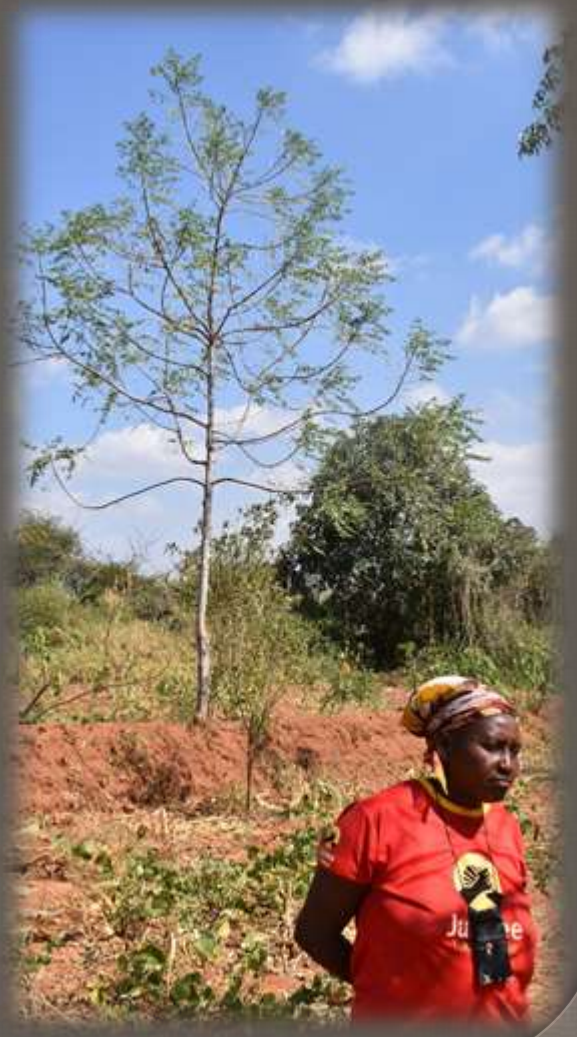


Yield and financial information
2. Agro-forestry model

Table 8: stumpage cost of wood on farm in an ideal agro-forestry set-up

Item	Unit	Quantity	Details
avg vol/tree	m3	0.585	DBH 45cm, comm height 5.5m, taper 0.7
rotation	years	18	variable 15-20 years
trees/farmer	nr	100	on 0.8 ha (2 acres)
vol/farmer	m3	58.511	on 0.8 ha (2 acres)
MAI	m3/ha/yr	4.063	
stumpage cost/tree	Ksh	10,000	variable
value for farmer	Ksh	1,000,000	at stumpage cost
annual equivalent value	Ksh	21,930	at 10% average annual interest rate
cost/m3 of wood	Ksh	17,091	at stumpage cost

- These figures can only be attained with proper capacity building (assumption: all trees survive)
- Farmer must be convinced to wait for 18 years before selling
- Mean annual increment realised is low but complemented by additional income streams (crops, grass)



Yield and financial information
3. Processing

Table 9: stumpage cost of timber per m3

item	unit	quantity	details
conversion	%	30	chainsaw
conversion	%	40	bandsaw
timber/tree	m3	0.234	with bandsaw
trees/m3 of timber	nr	4.27	
cost/m3 of timber	Ksh	42,727	

- Investment in sawmill with bandsaw (capacity 7,000m3 of logs/year): about 100,000 USD
- Raw material requirement from 5-6,000 farmers in agro-forestry model
- Above cost excludes felling, transport, sawing, etc; only stumpage (purchase)

Table 10: potential processed timber and its price from a 5.5m log of 45cm diameter

size "	quantity	ft	price Ksh/tree
2x4	4	17	7,480
2x3	2	17	3,400
1x8	2	17	4,420
1x10	4	17	10,880
TOTAL			26,180

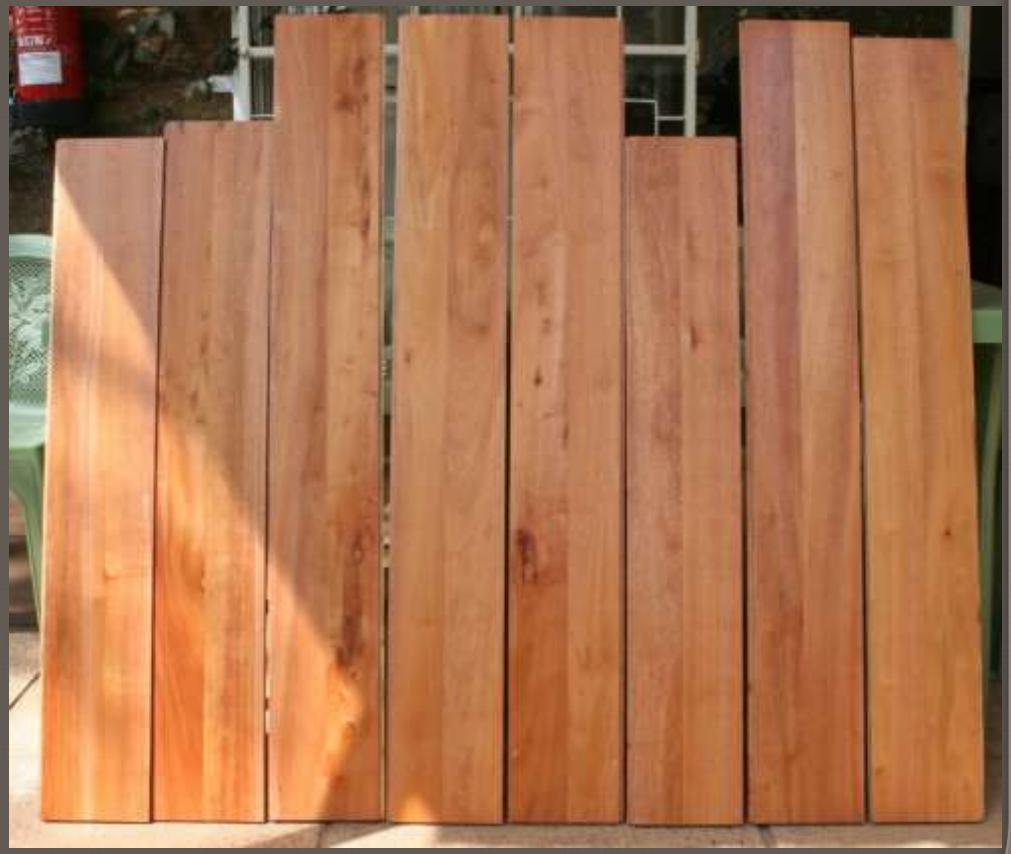
- Sizes and quantities based on conversion with bandsaw and trained personnel
- Prices based on table 7 (previous slide)
- Total price more than double than stumpage to cover costs of farmer organisation, value adding and profit

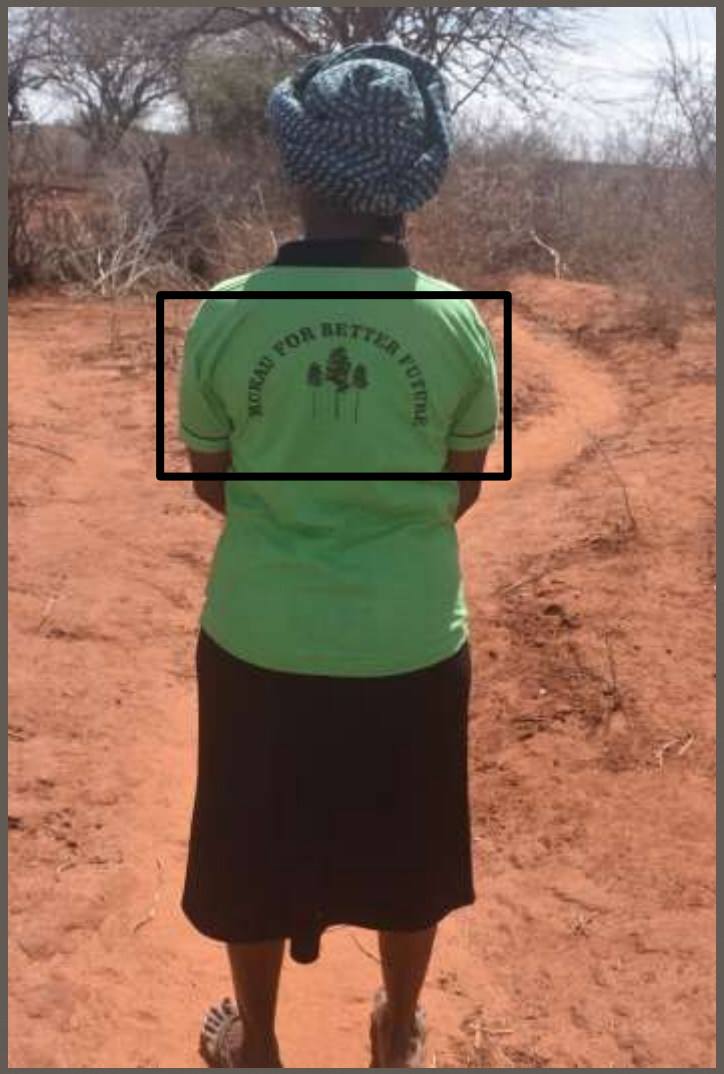
Up scaling agro-forestry tree planting

- Most conditions are in place (land, farmers, technical prescriptions)
- NOT present is **investment**, in:
  - Farmer organisation (groups are the ideal vehicle)
  - Capacity building (which kind of extension services?)
  - Seedling production (better quality, lower price, close to farmers)
  - Suggestion: consider carbon sequestration funding
  - Carbon present in 45cm DBH tree: 0.56 tonnes (KEFRI), both above and below ground
  - At 10 USD/tonne, 560 Ksh per tree

Conclusions

- Potential for commercial timber production in drylands exists based on *Melia volkensii*
- *Manag*ement techniques notably thinning require more fine-tuning
- Agro-forestry shows good promise, must be up scaled on farms
- Present trees available on farms are few & of poor quality
- Future processing to be based on sawmill with bandsaw
- Based on current timber prices, agro-forestry is profitable
- Up scaling possible through carbon sequestration funding





THANK YOU