Tree on farm economic

How and how much agroforestry benefit to smallholder coffee farmers in the Aberdare (Kenya) ?

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Materiel and method

- **Study area**

=> Kenya - Murang'a district

- **Tree inventory and data collection**

=> (Farmer's interview) : 62 coffee farms randomly chosen

- **Determination of agroforestry product's price**

=> survey market in the area : 7 markets
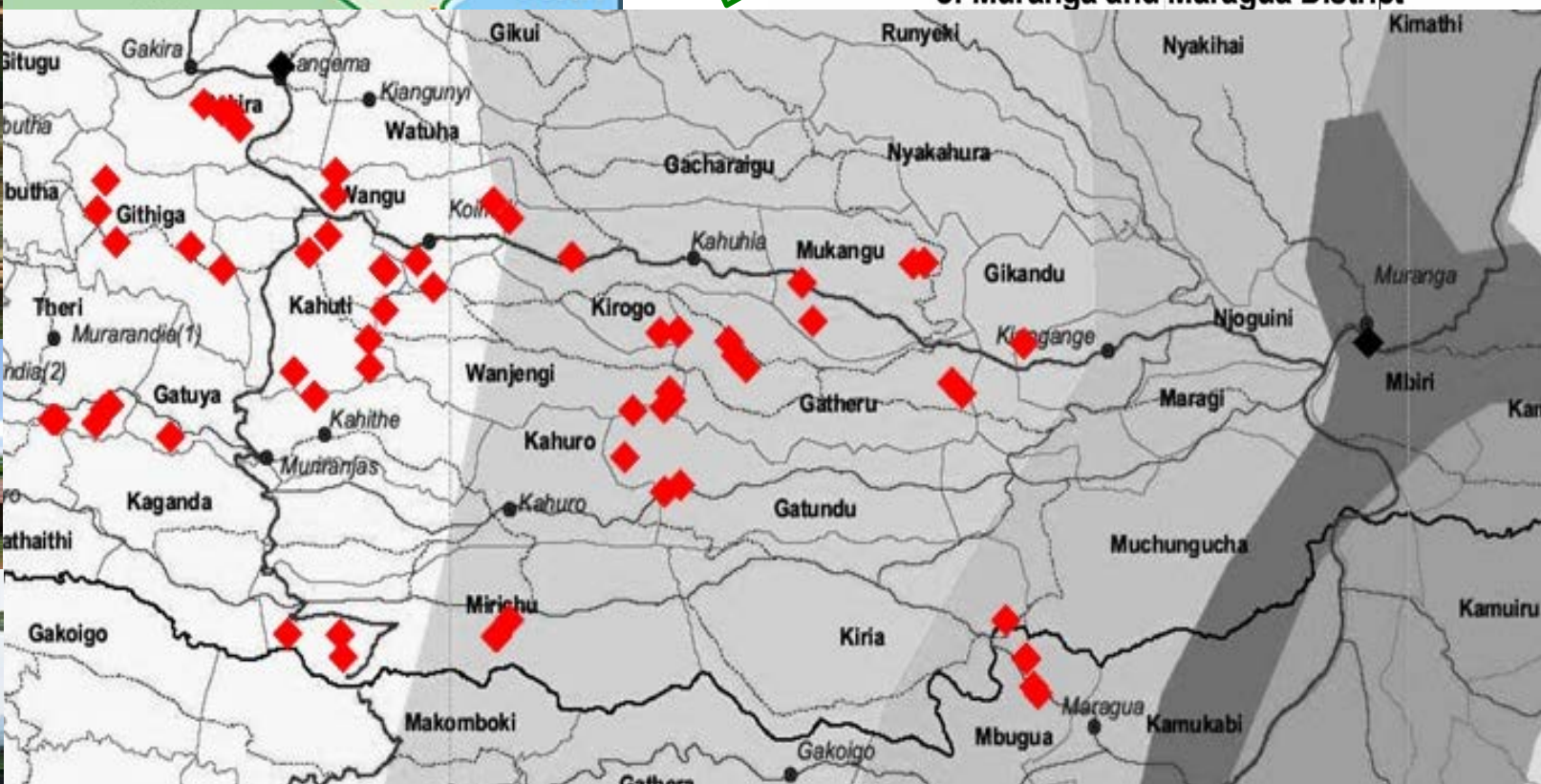
- **Coffee prices and production per farms**

=> factories

- **Cost benefit analysis**

Materiel and method : Study area

Map of Agro-Ecological Zones and Road network of Muranga and Maragua District

Economical context

- Exportation
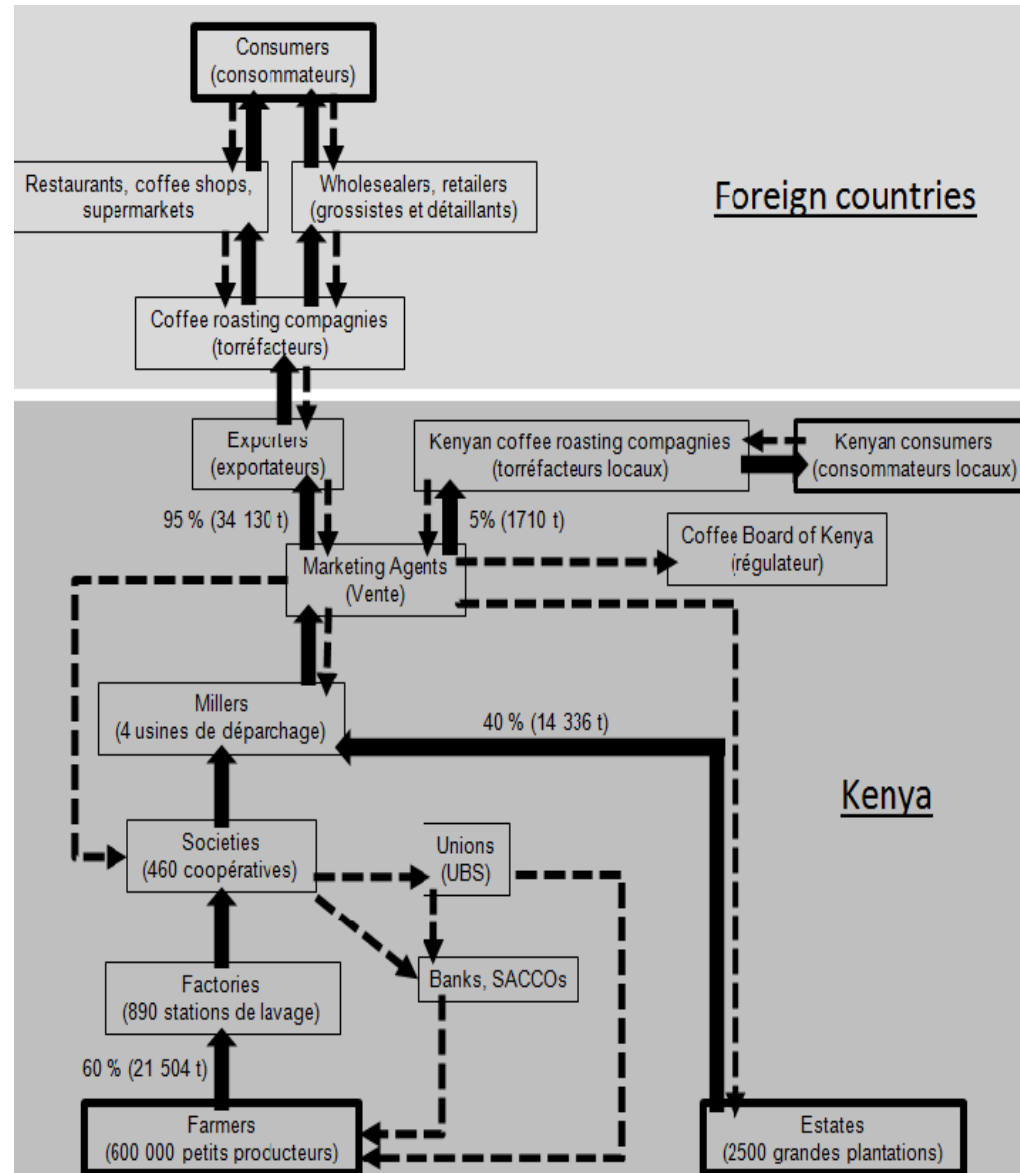- Value-added capted by industries
- Crisis (2000) and post crisis

→ Economic situation of smallholder coffee farmer weak

Diversification as an option to increase economical input
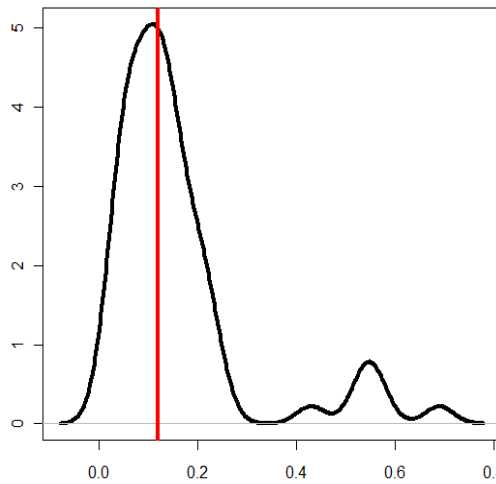
Agroforestry
= > is it profitable ?

✓ Low economical risk
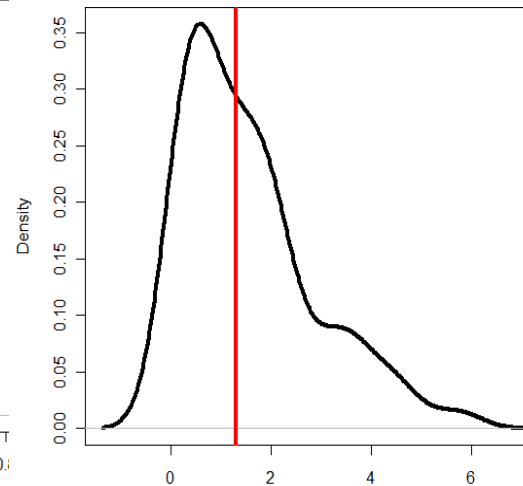✓ Low input
✓ Level of vegetation

Karanja & Nyoro, 2002
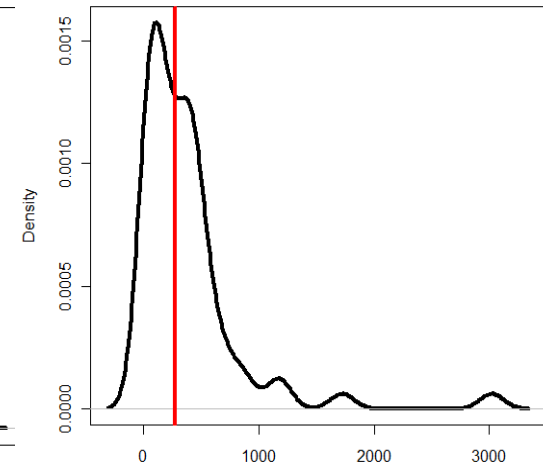
State of the coffee plantation

Characterisation of the coffee plantation in the sample
(Density curves – Medians are shown in red)

Surface of the coffee plot (Ha)   *Yield per coffee tree (Kg/tree)*   *Coffee production (Kg)*

→ Surface of the coffee plot, coffee yield and production are low for most of the farms

→ Moreover 50 % of the farmers don't use chemicals fertilisers and 80 % no pesticides

→ **Coffee plantation : neglected state**

Agroforestry profitability

Agroforestry Products

- Firewood
- Timber
- Fruits
- Charcoal
- Fodder

Profitability ?

- Home consuption (SAVING)

- Sell local market (EARNING)

Benefit cost analysis :

Calculation method for one farm of the profitability (Saving+earning) for one year

Quantities
- **Farmer's interview : determination of the agroforestry products (quantities)**
  - For each species
  - For each products (Firewood, Timber, Fruits, Charcoal, Fodder)

Destination
- **Farmer's interview : destination of the production**
  - Home consumption
  - Sell

Input ?
- **Farmer's interview : determination of the cost of the production (per species) (INPUT)**
- Most of the time = 0 KsH

Price
- **Survey market : determination of the price of the products**
  - Saving (Home consumption) : Market Selling price
  - Earning (Sell) : Market Buying price

Benefit cost analysis
- **Saving : Sum (per species and product)[(Sell price*quantity)- input]**
- **Earning: Sum(per species and product)[(Buy price*quantity)-input]**
- **Agroforestry Profitability = Saving + Earning**
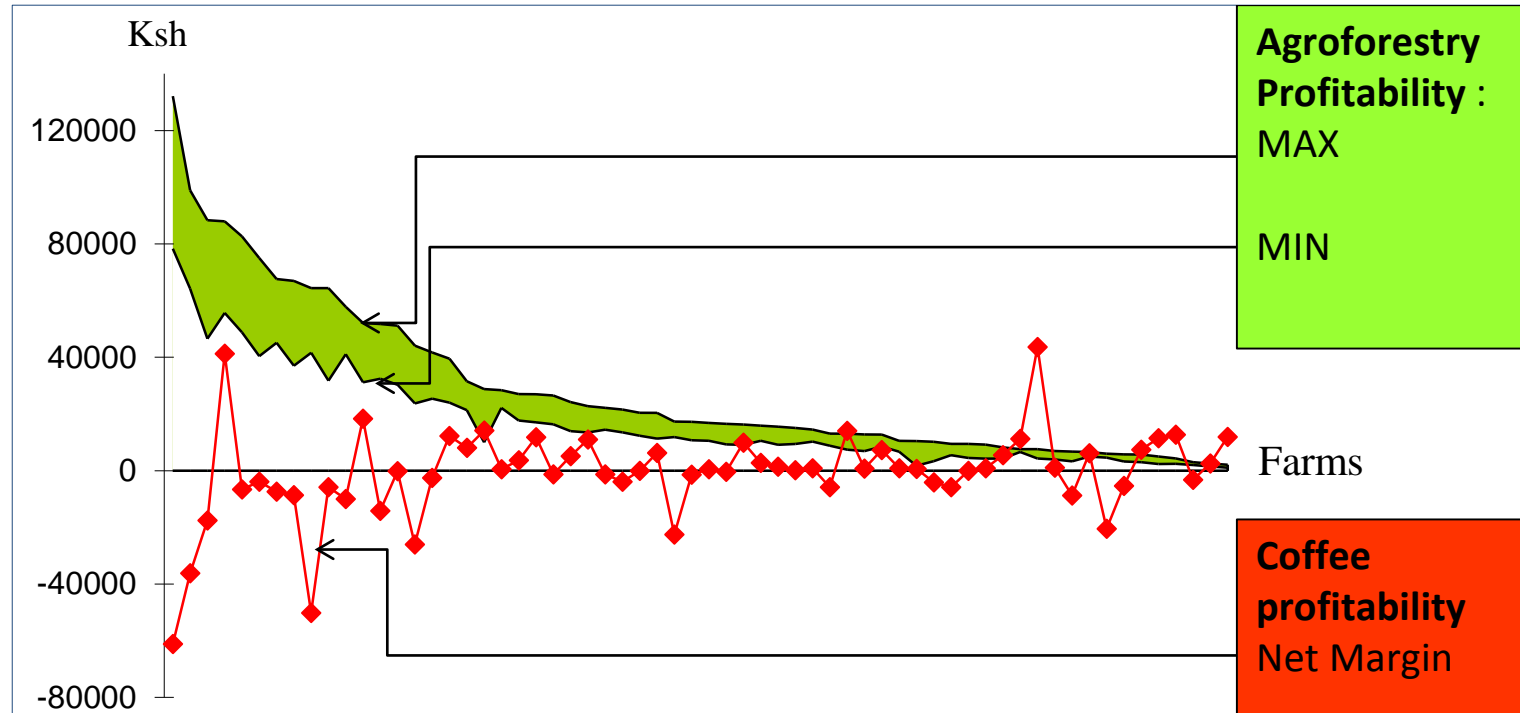
Agroforestry profitability

Mean profitability per farm of the agroforestry products
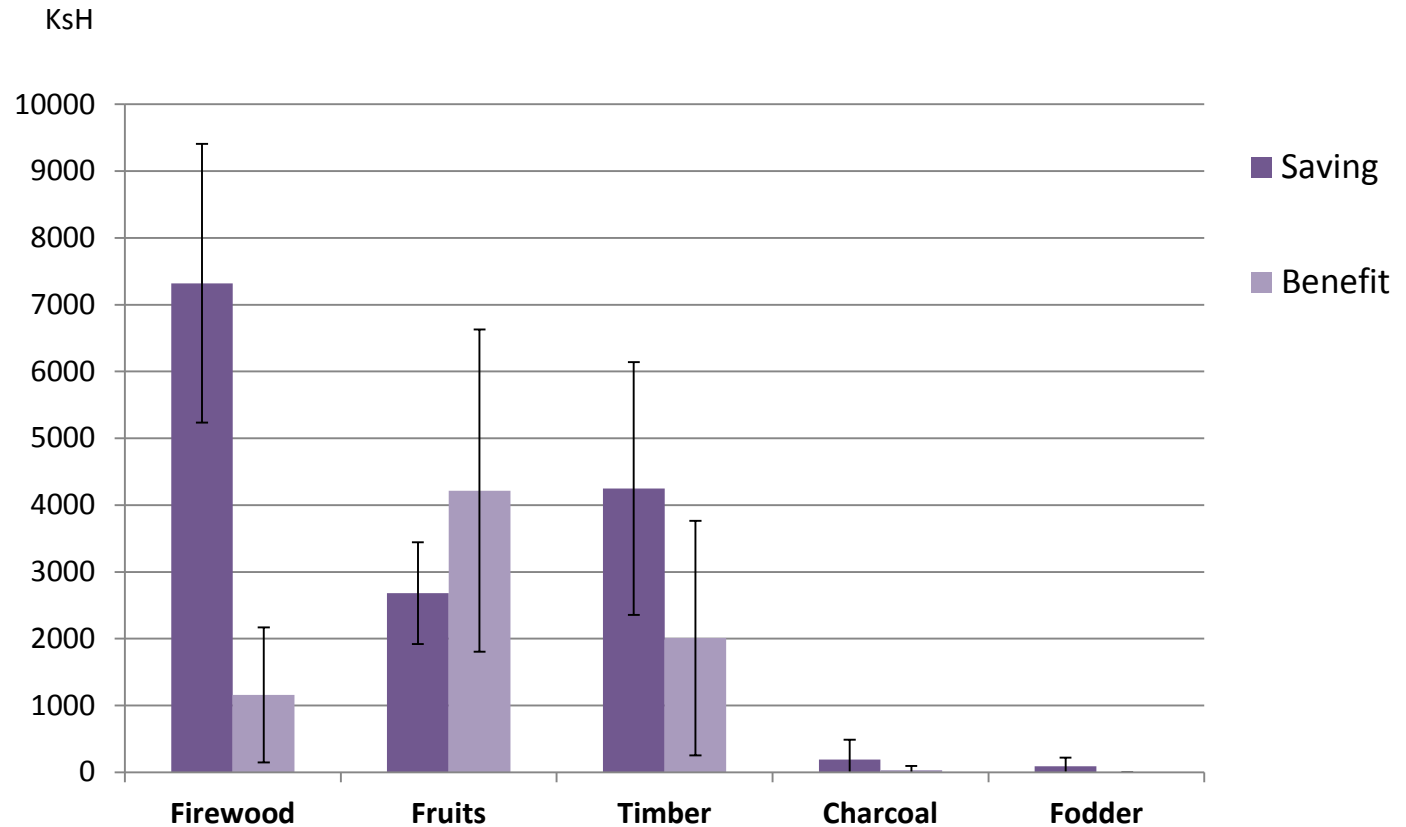
- Total Saving (900 809 KSH) > Total Earning (459 823 KSH)
- Agroforestry is mainly used to produce Firewood, Fruits and Timber
- Firewood saving > Firewood Earnings(p_value < 0.5)

Comparison between agroforestry and coffee profitability

Agroforestry profitability : Benefit-cost analysis with MIN and MAX prices found on the market

Coffee NM (NET MARGIN) = Production(Kg)*Price (KSH/Kg) – Q input (Kg)*P input (KsH/Kg) – number of working day * price of a working day

- **Coffee profit are very low**
- **Profit from agroforestry are, for most of the farm, higher than coffee profit**

Agroforestry :

▪ **System profitable for most of the farm :**
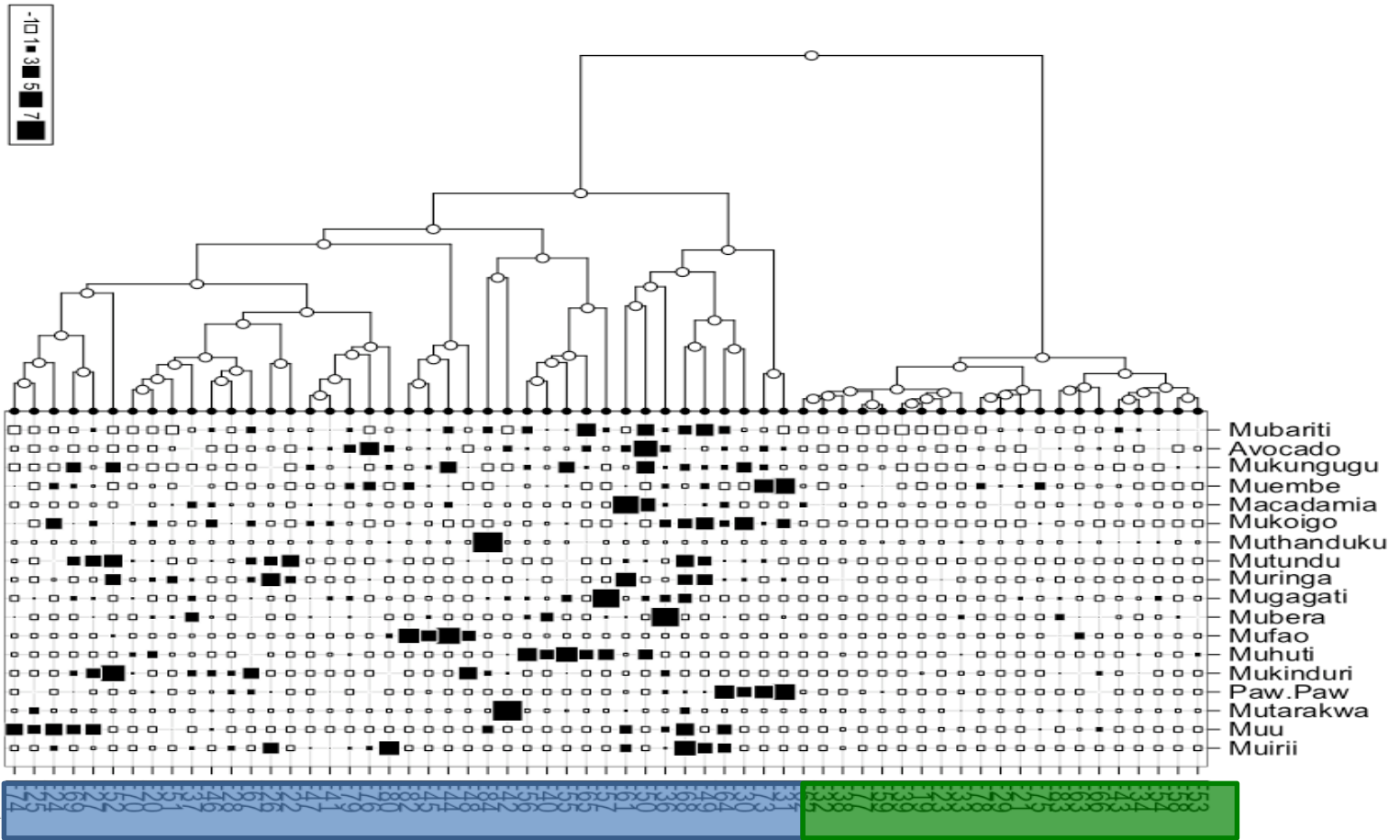   **=> Do farmers use different strategies ?**

- **Previous analysis of the tree diversity in the farm :**
  - 2 groups of farms in regard of their tree population
  → Cluster

- **Characterisation of the strategies used by farmers in term of agroforestry products and species**

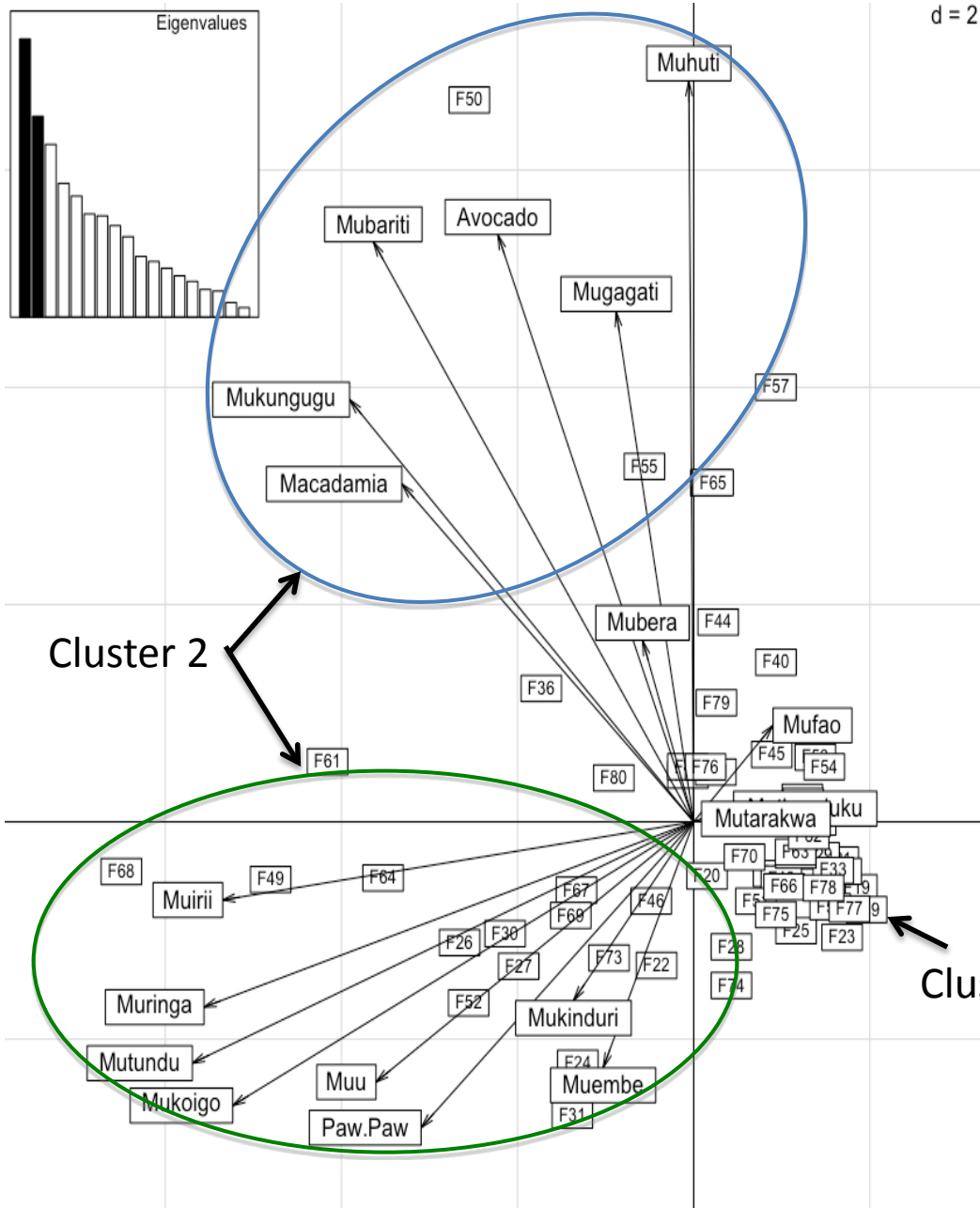# Cluster analysis

Study based on the 18 main species and tree with DBH > 2cm
(which are represented 96% of the landscape)
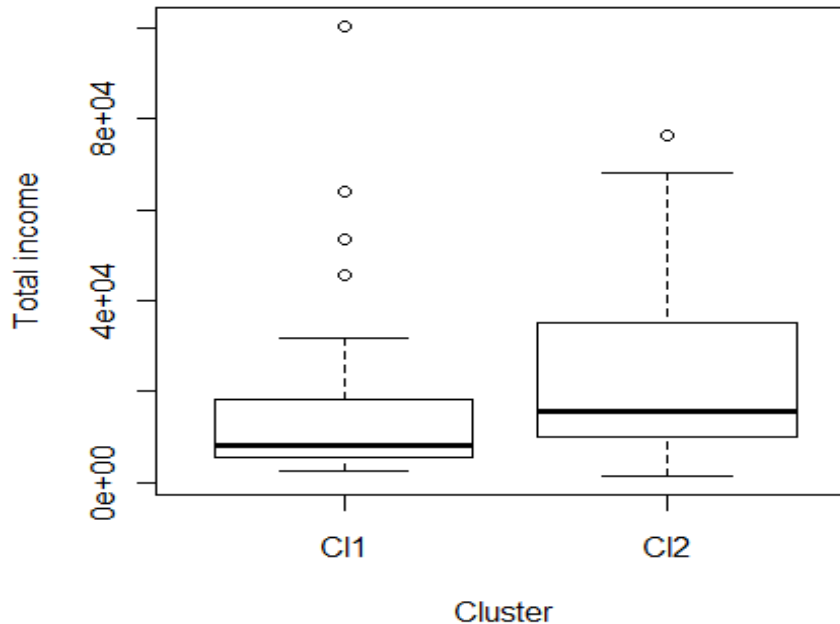

Cluster 2   Cluster 1

Cluster analysis

- The 2 axis represent nearly 40% of the total diversity

- 2 groups of trees, maybe representing different farmers' stratégies ?

Distribution of agroforestry profitability per cluster

Farm Income distribution per cluster

No significant difference
(KRUSKALL WALLIS test)
between the 2 clusters

	CL1	CL2
Number of farm	21	40
Mean size (Ha)	1,01	0,433
Mean density (Tree/Ha)	121	306

CL2 :
 Smallers farms with more trees

Profitability of agroforestry products per cluster
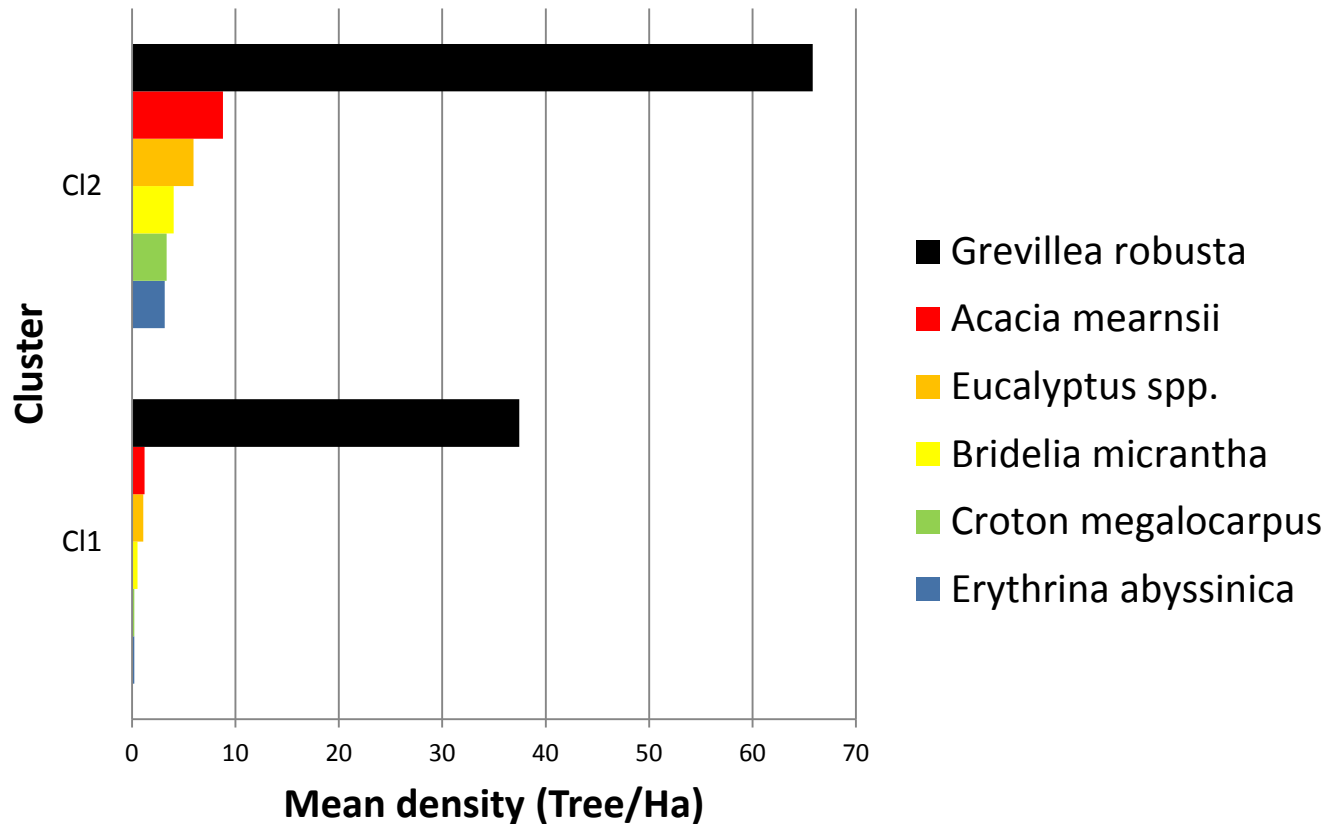## Agroforestry products strategy ?
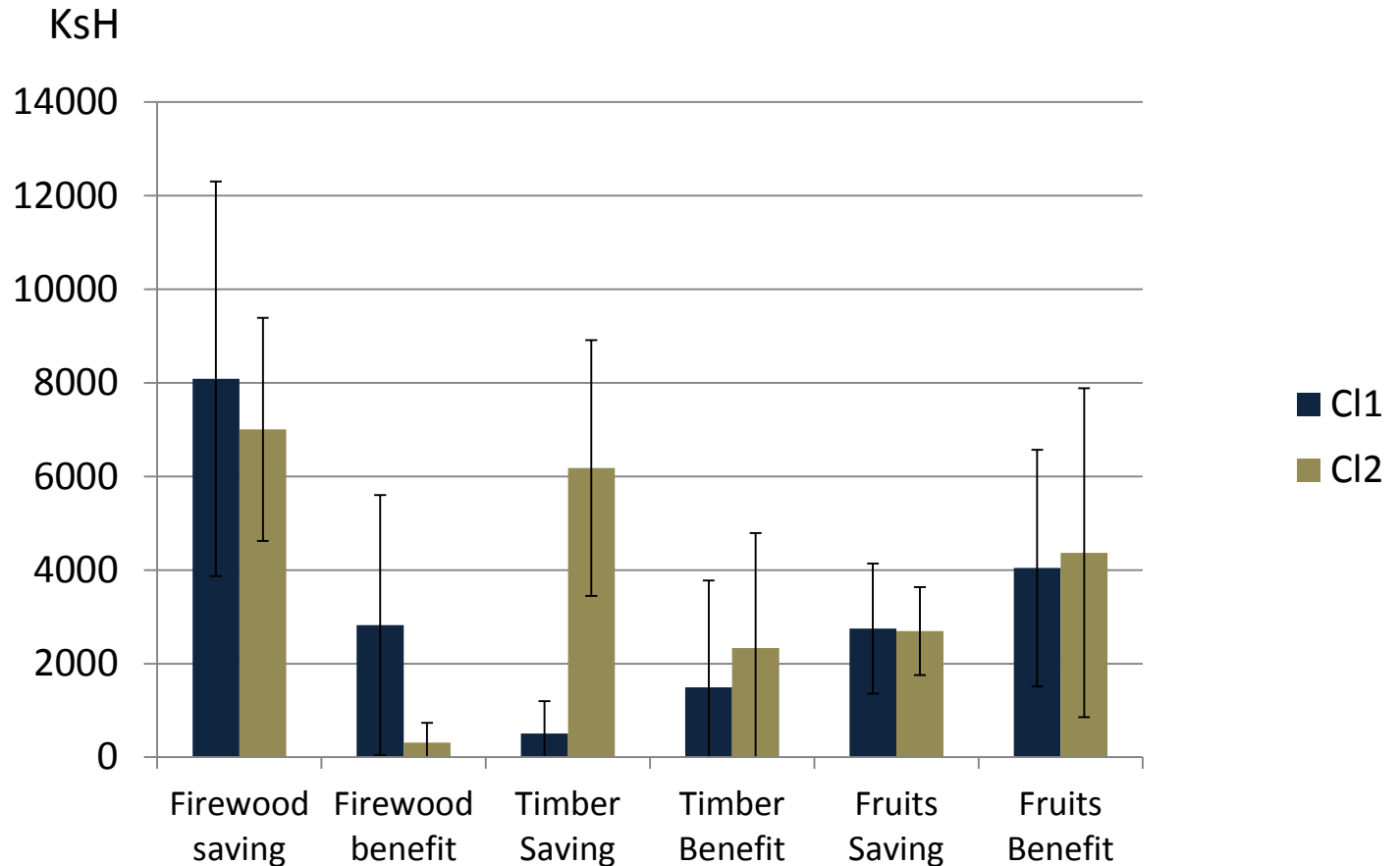
There is a significant difference (Kruskal Wallis test) between the 2 clusters ONLY for timber saving which are more important in the CL2.

Profitability of agroforestry products per cluster
Agroforestry firewood species strategy ?

Firewood species : mean density of mature (DBH>10 cm) per farm

Legend:
- Grevillea robusta (black)
- Acacia mearnsii (red)
- Eucalyptus spp. (orange)
- Bridelia micrantha (yellow)
- Croton megalocarpus (green)
- Erythrina abyssinica (blue)

X-axis: Mean density (Tree/Ha)
Y-axis: Cluster (Cl1, Cl2)

CL2 : Tree density more importante but no differences in term of species

Profitability of agroforestry products per cluster
Agroforestry timber species strategy ?

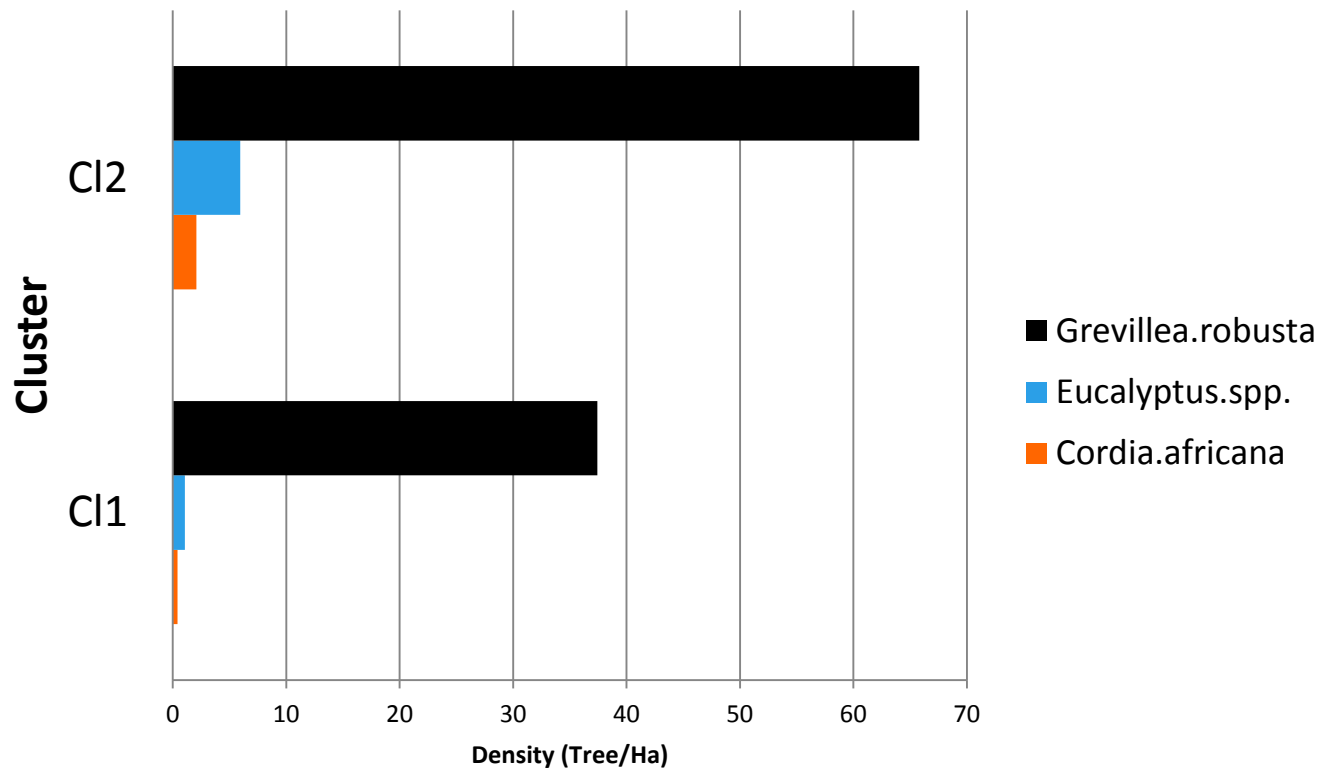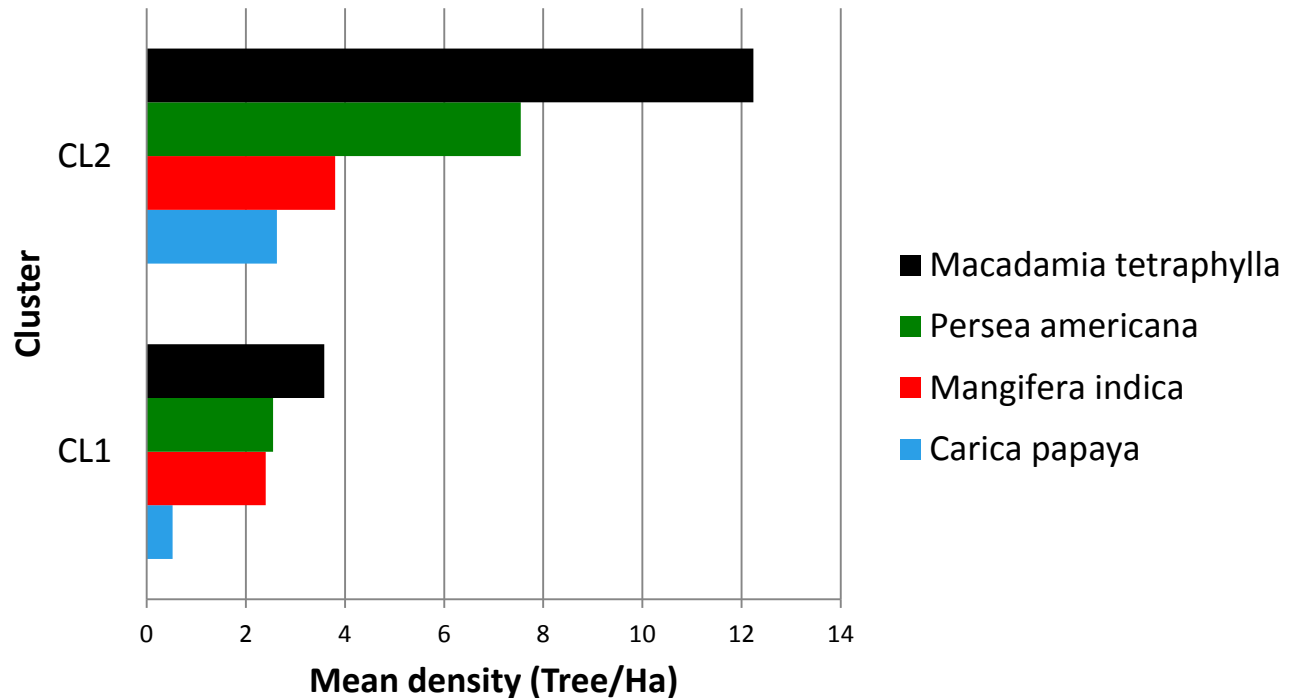**Timber species : mean density of mature (DBH>10 cm) per farm**

CL2 : Tree density more importante but no differences in term of species

Profitability of agroforestry products per cluster
Agroforestry fruits species strategy ?

Fruits species : mean density of mature (DBH>10 cm) per farm

CL2 : Macadamia and Avocado in a higher density

Agroforestry strategy : Profitability per specie

Abundance of mature tree	Species	Main use	Origin	Saving (KsH per tree)	Earning (KsH per tree)
1635	*Grevillea robusta*	Firewood	e	304	101
281	*Macadamia tetraphylla*	Fruits (Nuts)	e	**6**	**721**
277	*Commiphora zimmermannii*	Fodder	i	8	0
163	*Persea americana*	Fruits	e	239	246
107	*Mangifera indica*	Fruits	e	632	73
103	*Bridelia micrantha*	Firewood	i	203	0
99	*Acacia mearnsii*	Firewood	e	241	208
79	*Eucalyptus spp.*	Firewood	e	687	97
63	*Cordia africana*	Timber	i	**996**	**0**
63	*Neoboutonia macrocalyx*	Firewood	i	156	0
57	*Croton megalocarpus*	Firewood	i	366	97
52	*Eriobotrya japonica*	Firewood	e	216	19
50	*Carica papaya*	Fruits	e	544	197
50	*Erythrina abyssinica*	Firewood	i	18	0

Determination of the main usage per specie (farmer's interview) :
number of individuals of one species used for one usage / numbers of individuals of this species used for all the usages

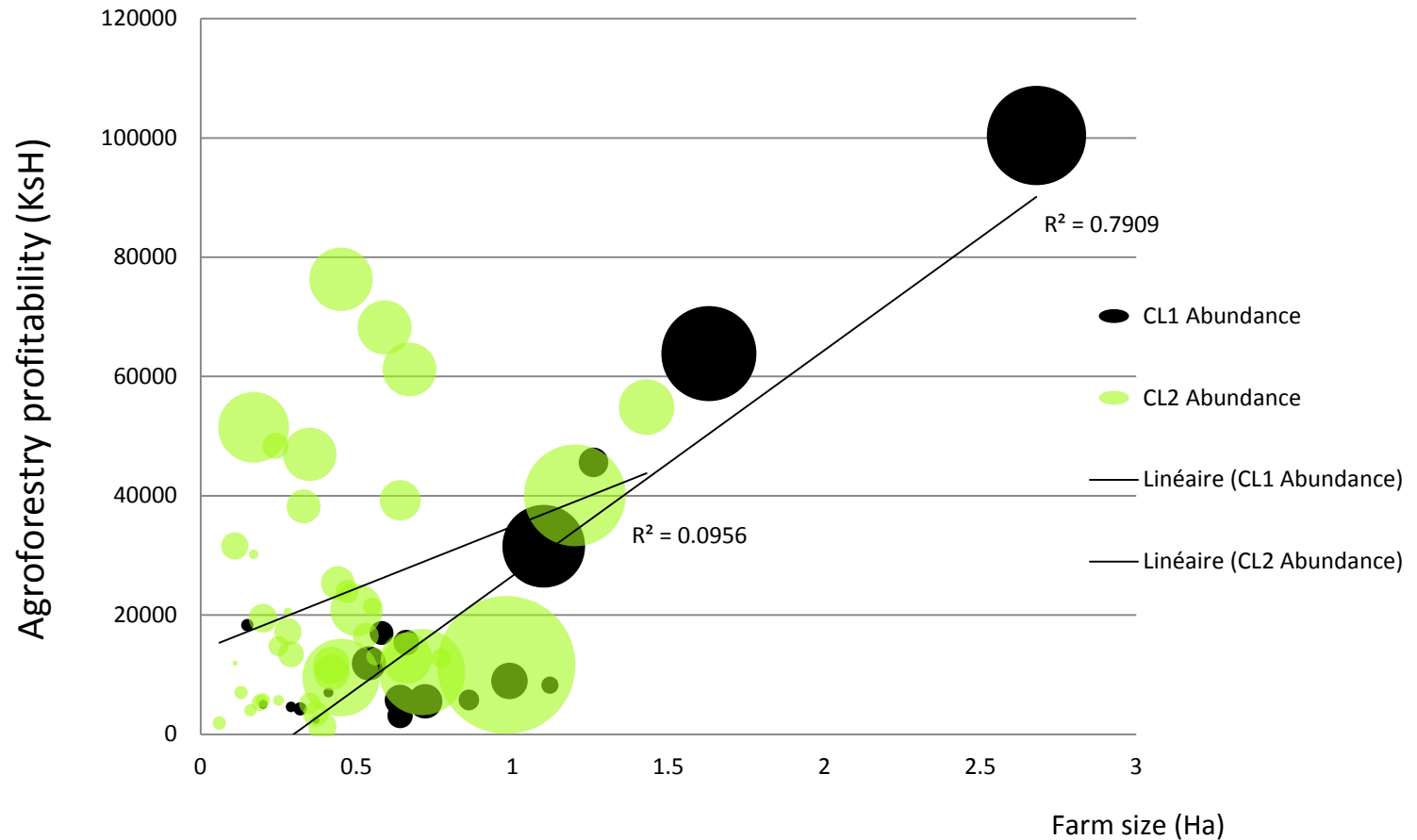**Indigenous trees :**
- Profitable
- Only for home consumption

Exotic trees :
. Selling fruit

Agroforestry strategy : size of the farm and tree abundance ?

Agroforestry profitability : farm surface and tree abundance (DBH<10cm)

- CL1 : Strong positive correlation between size of the farm, profitability and tree abundance
- CL2 : Smaller farms, more trees => Intensification

Profitability of agroforestry and strategy

- **Profitability of agroforestry**

  → Agroforestry > Coffee

  → Saving > Earning

  → Main profitable products : Firewood Timber and Fruits

- **Strategy**

  → No differences in term of species or activity between the 2 clusters
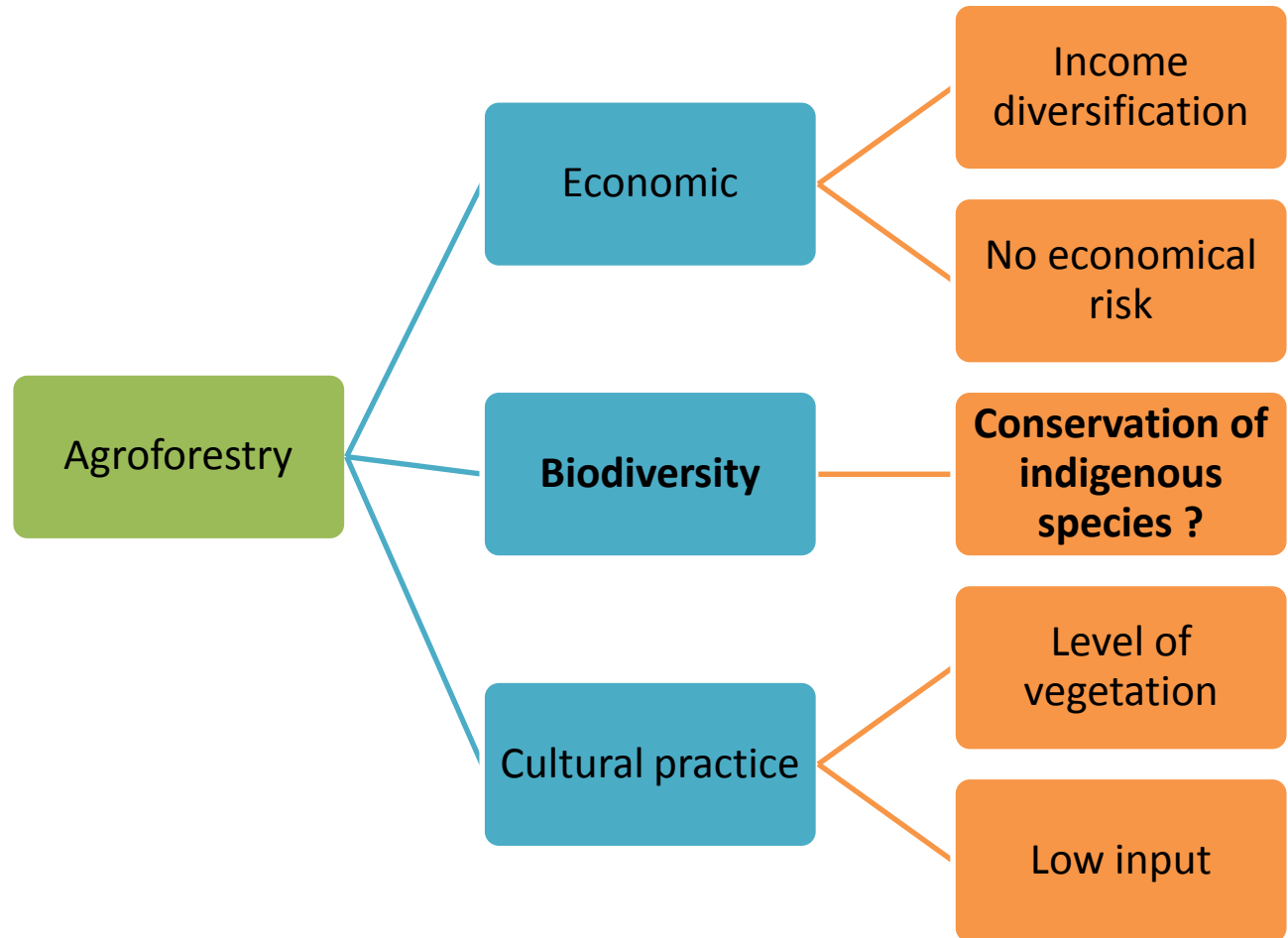
  → Farms belonging to the cluster 2 : Agroforestry more intense

  Hypothesis : as Farm belonging to CL1 are larger
  => crops (other source of income)

Conclusion

Agroforestry → Economic → Income diversification

Economic → No economical risk

Agroforestry → **Biodiversity** → **Conservation of indigenous species ?**

Agroforestry → Cultural practice → Level of vegetation

Cultural practice → Low input

Agroforestry : a **profitable** and although **sustainable** practise ?