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Abrupt Changes in Ecosystem Services and Wellbeing in Mozambican Woodlands

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Ecosystem services for poverty alleviation: a forest based case in Mozambique

Frank Vollmer and Pedro Zorrilla-Miras

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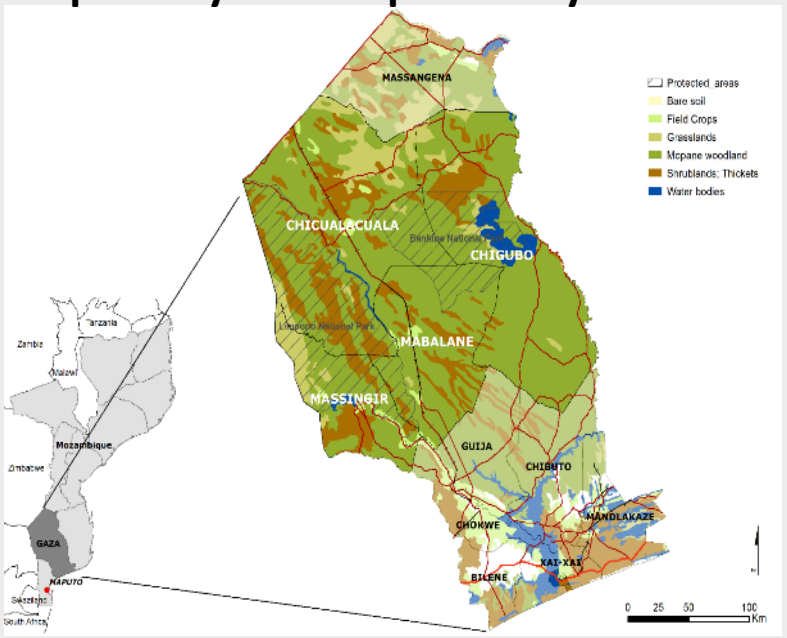
This work (ACES project, NE/K010395/1), was funded with support from the Ecosystem Services for Poverty Alleviation (ESPA) programme. The ESPA programme is funded by the Department for International Development (DFID), the Economic and Social Research Council (ESRC) and the Natural Environment Research Council (NERC).

RATIONALE

- Extensive woodlands, high rates of unidimensional poverty
- Woodland derived ecosystem services (ES) are crucial for livelihoods: food, construction material, energy, etc.
- Link ES and livelihoods: “needs-driven” woodland reliance; “opportunity-driven” commercialisation of woodland resources
- Charcoal making: Opportunity for rural villagers in Mozambique - driver of Land Use Change (LUC)

Map 1: Physical map of study area



Map: Courtesy of Ana Luz

Impacts of (abrupt) LUC on multidimensional poverty unknown

Study Area: 7 villages selected along a gradient of land use intensity

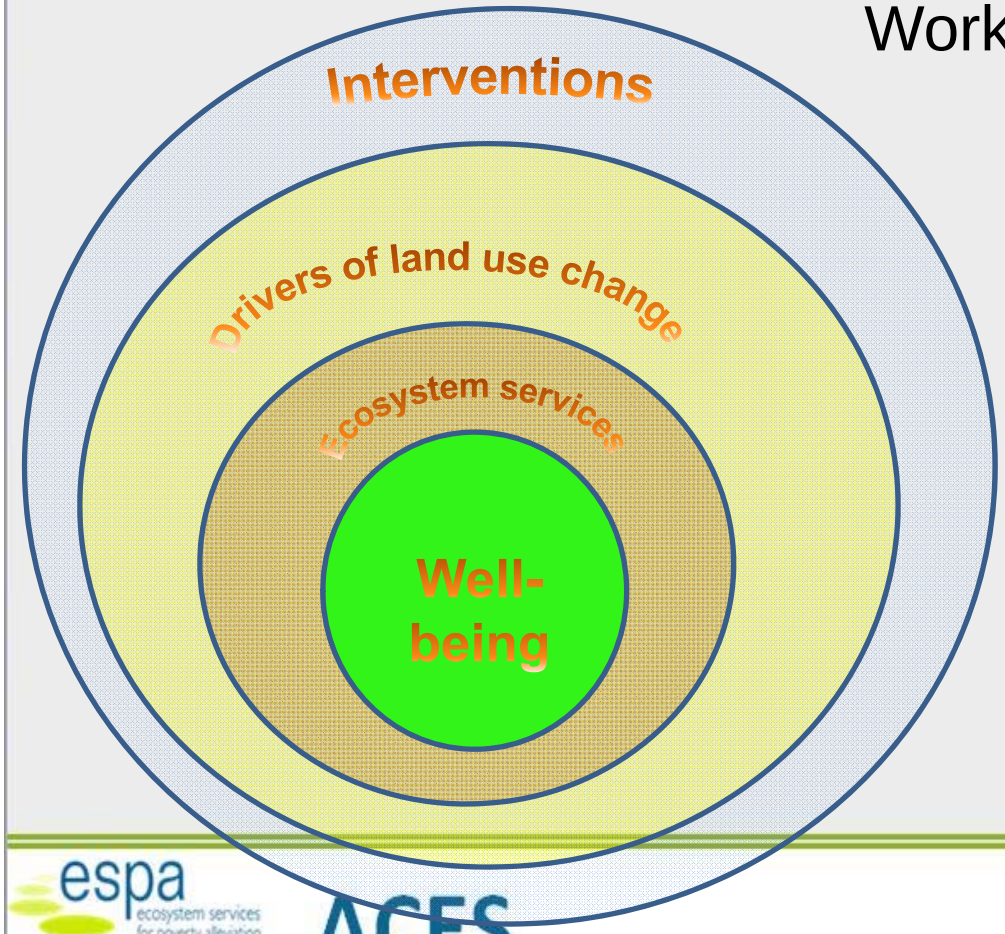
< 140 households per village

Use of multiple methodologies for the collection and analysis of biophysical and social datasets.

Probabilistic modelling approach

First internal model draft → Workshops → Analysis → Adaptation to data availability → Population with data → Evaluation and corrections

Workhops at 3 scales



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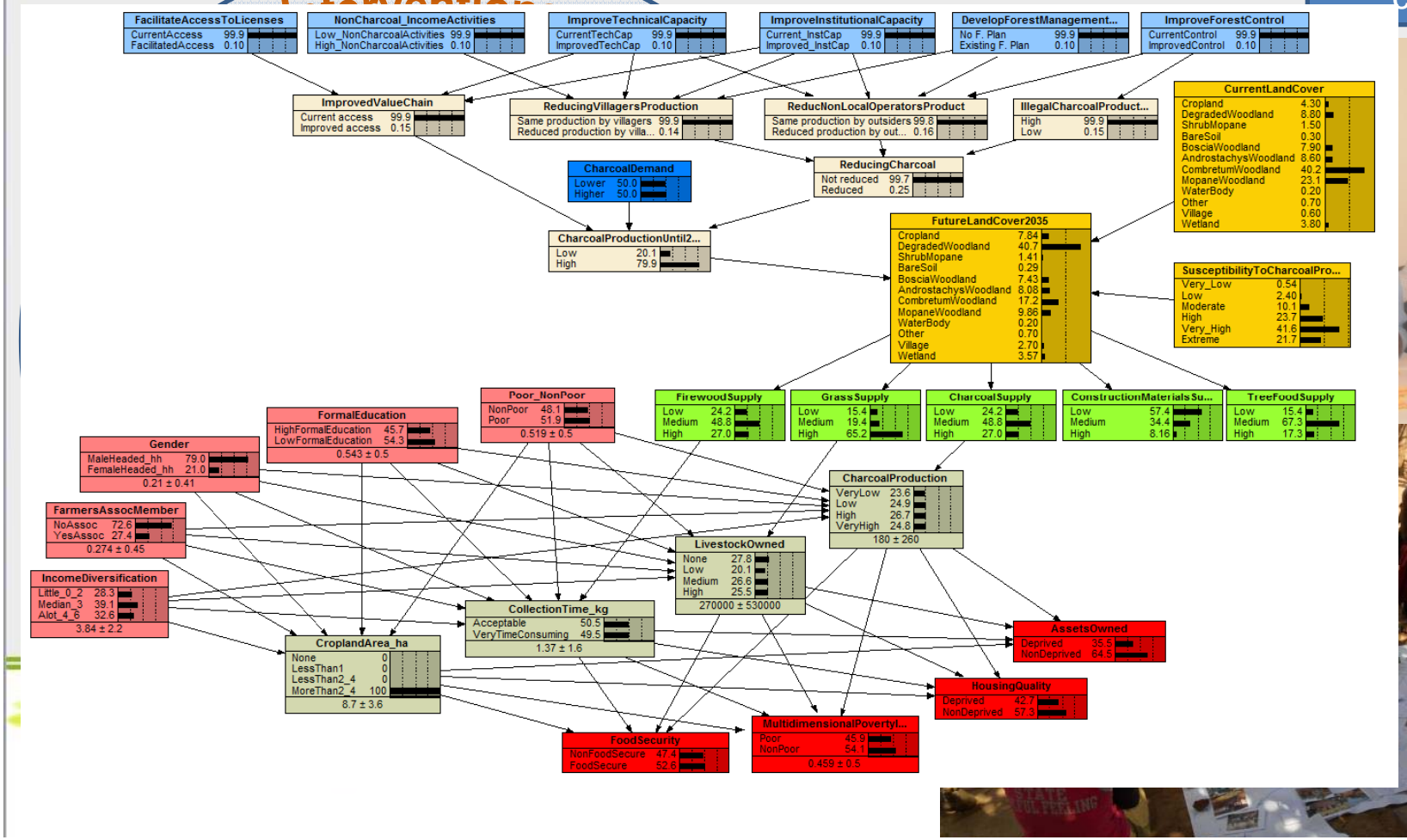

ACUTE MULTIDIMENSIONAL POVERTY (AMP) IDENTIFICATION

Table 2: Well-being components captured in focus group discussions

Well-being components	No of times mentioned at village, national and provincial level			
	Total	Village	National	Provincial
Food Security	9	3	3	3
Good quality farm	6	3	2	1
Cattle	3	3	0	0
Access to drinking water	6	2	2	2
Good quality housing	3	2	1	0
Health care	2	2	0	0
Purchase capacity	3	1	2	0
Education	2	1	0	1
Achieve your dreams	1	1	0	0
Freedom	1	1	0	0
Peace	1	1	0	0
Energy availability	3	0	0	3
Protection against extreme weather events	2	0	1	1
Wild food	1	0	1	0

Table 3: Wealth ranking results (%)

	Poorest	Poor	Better-off	Rich	Total
A	39	36	9	15	100
B	53	23	7	17	100
C	33	18	38	11	100
D	17	22	22	39	100
E	56	19	15	11	100
F	49	25	18	7	100
G	30	15	37	19	100
Total	40.69	22.41	21.38	15.52	100

"Wordle" of Top 35 words used in wealth ranking

Table 2: Courtesy of Pedro Zorrilla

| AMP AGGREGATION ALKIRE-FOSTER METHOD

Table 4: List of well-being dimensions, Indicators, cut-off lines and weightings

Dimensions	Indicators	Deprived if…	Nested weighting scale
Human capital	1. Sanitation	1. The household´s sanitation facility is not improved (according to the MDG guidelines), or it is improved but shared with other households	0.66 (6.7)
	2. Water	2. The household does not have all-year long access to clean drinking water (according to the MDG guidelines) or clean water is more than 30 minutes walking from home (roundtrip)	0.66 (6.7)
	3. Health 1 (under-five mortality)	3. Any child has died in the household	0.66 (6.7)
	4. Health 2 (access to health care)	4. The household does not have access to equitable health care	0.66 (6.7)
	5. Formal Education (illiteracy, highest qualification achieved)	5. No household member is able to read and write and achieved at a minimum grades 1-5 of a primary education degree or attended the Portuguese colonial school system*[2].	0.66 (6.7)
Social capital	1. Food security	1. Household did experience a food shortage in the past	1.665 (16.6)
	2. Access to services, associations and credit	2. The household did not receive advice from an extension agent during the last 12 months, and did not receive a credit in the last 12 months, and is currently not a member in an agricultural or forestry association.	1.665 (16.6)
Economic capital	1. Assets owned	1. If do not own more than one of: radio, TV, telephone, bicycle, bed, motorbike or refrigerator and do not own a car or truck	1.665 (16.6)
	2. Housing (floor, roof, walls)	2. The household has sand or smoothed mud floor, the household has grass or poles roof; the household has sand, mud, grass or poles walls	1.665 (16.6)

Combined social factors with an influence on charcoal production

Factors	States	Charcoal production
		Low / High
Gender, association, diversification	Male, associated and middle diversified	37% / 61%
	Female, non- associated and little diversified	71% / 29%
All factors	Male, Associated, Middle diversified, High educ., Non-Poor	47% / 54%
	Female, Non associated, Little diversified, Low education, Poor	68% / 32%

Being part of associations and having different income streams: catalysts when charcoal production arrives to the village

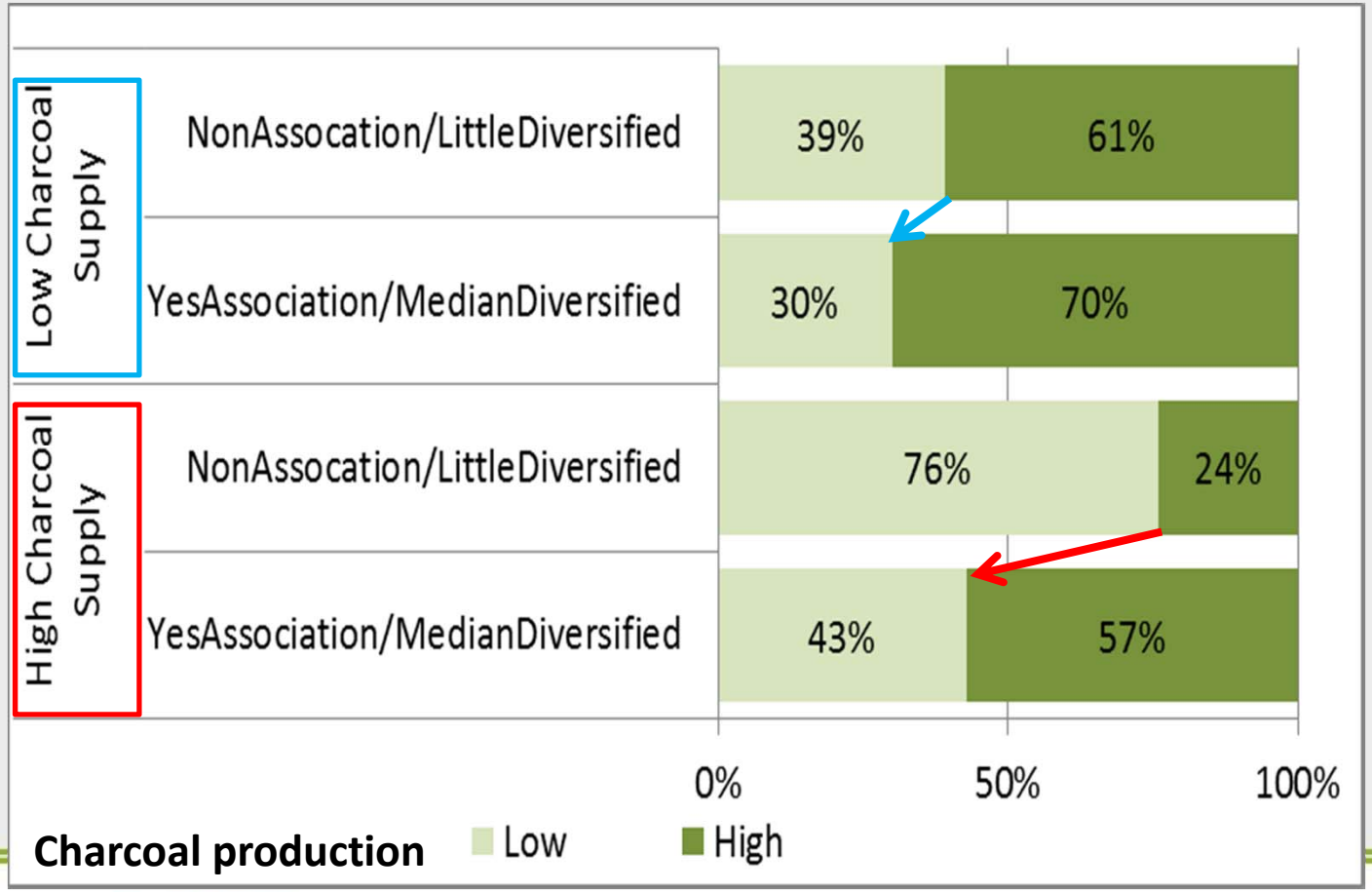

Table x: Income distribution against Y_i

Income from Charcoal	$Y_i = 1$ (%)	$Y_i = 0$ (%)
20%	64	36
40%	66	34
60%	75	25
80%	66	34
100%	59	41
100 households without income from charcoal past 12 months	61	39

- We find that 59% of the fifth quintile are considered to be in AMP (Yi=1), whereas 39% of the non-charcoal producing households are considered non-AMP (Yi=0)
- A Kruskal-Wallis equality-of-populations rank test revealed a statistically non-significant difference in charcoal income over Yi=1

MAIN RESULTS

- Charcoal producing households
  - are more resilient to shocks and have a higher number of personal assets
  - however, local charcoal production does not contribute to the alleviation of multidimensional poverty
- Within villages, income from charcoal production is highly unequal. Large-scale charcoal operators from outside the production area profit most from charcoal production.
- Harvesting for charcoal production is highly selective and currently the area has still a high forest cover. Both things allow a continued provision of ES such as firewood, grass, construction materials and even charcoal.

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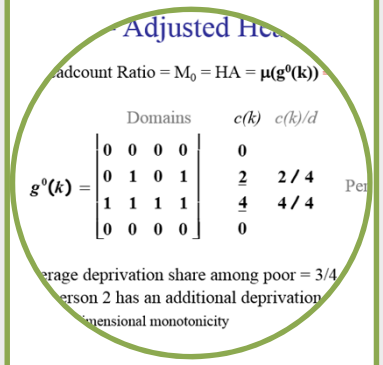
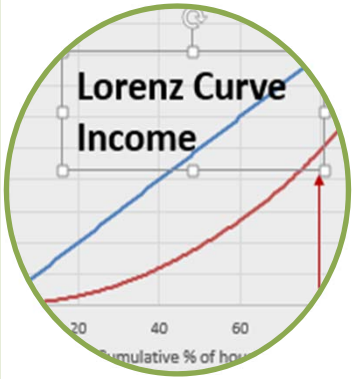
METHODS DATA ANALYSIS

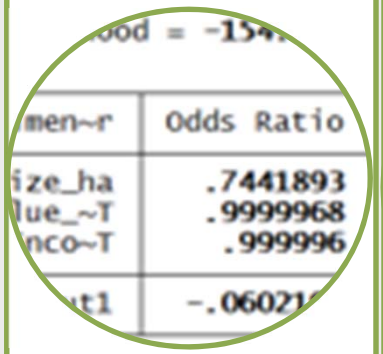
Participatory wealth rankings, focus groups discussions and structured secondary literature review for AMP identification



Alkire-Foster Method for AMP aggregation



Horizontal analysis of income distribution from charcoal making (Lorenz curve and Gini coefficient)



Multivariate analysis (Multiple logistical regression, matching) conducted to assess functional relationships of AMP at the household level with key socio-economic and demographic variables

Results triangulation with trend line analyses and key informant interviews

Using mixed methods we find:

- Charcoal producing households are more resilient to shocks and have a higher number of personal assets; however, local charcoal production does not contribute to the alleviation of multidimensional poverty.
- Large-scale charcoal operators from outside the production area profit most from charcoal production. Within villages, income from charcoal production is highly unequal.
- Harvesting for charcoal production is highly selective and currently the area has still a high forest cover. Both things allow a continued provision of ES such as firewood, grass, construction materials and even charcoal.

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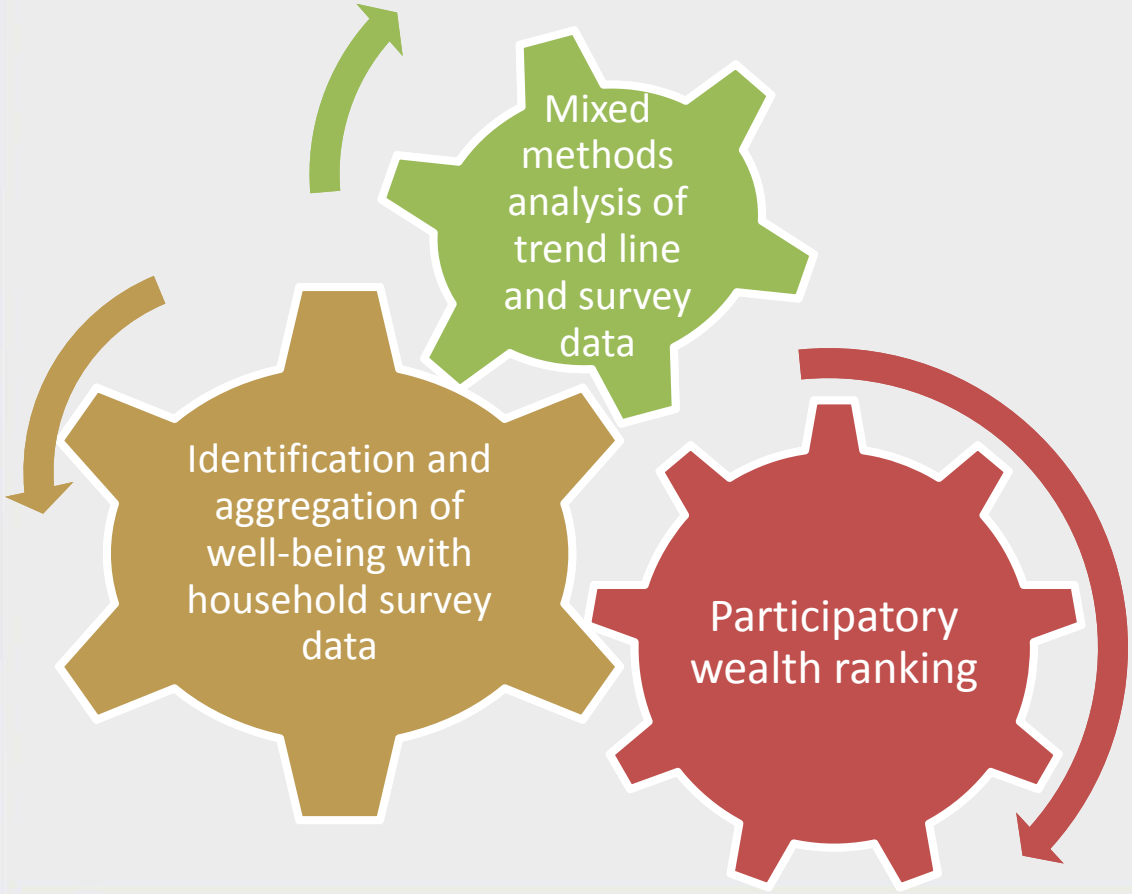
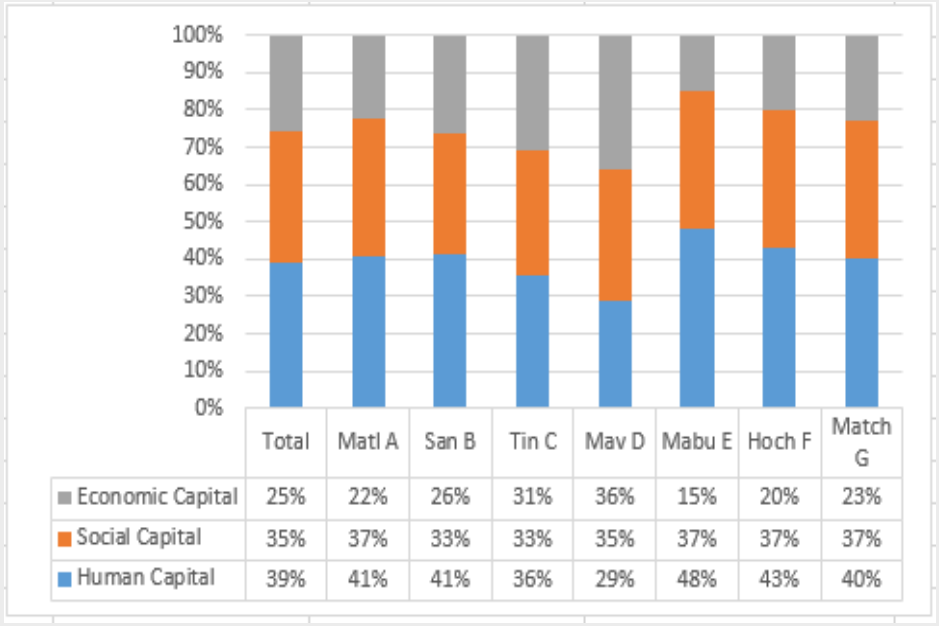


Integration

- Participatory wealth rankings and key focus group discussions on well-being used for identification of well-being dimensions and indicators
- Well-being aggregation via household survey data
- Mixed methods analyses of trend line, seasonal calendar and household survey data, *inter alia*

| AMP AGGREGATION: AF-METHOD

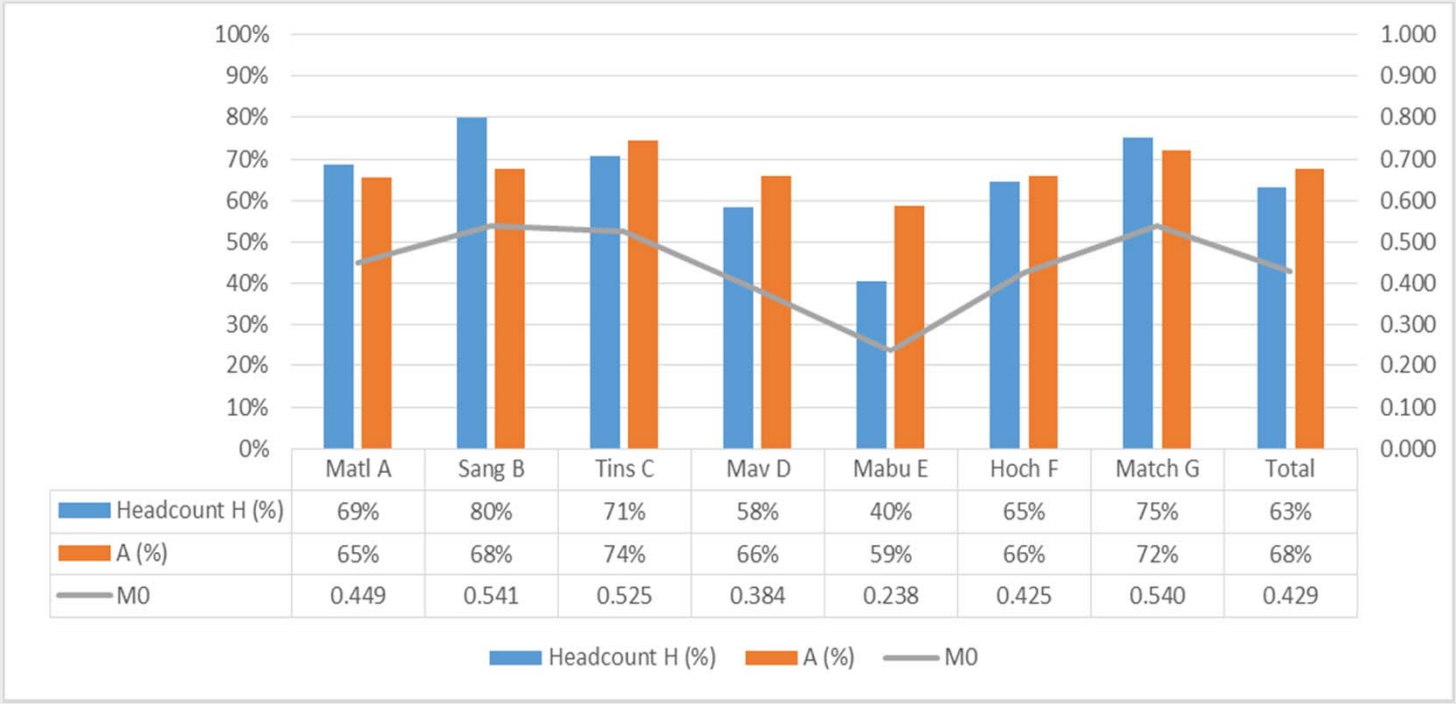


	Total	Matl A	San B	Tin C	Mav D	Mabu E	Hoch F	Match G
Economic Capital	25%	22%	26%	31%	36%	15%	20%	23%
Social Capital	35%	37%	33%	33%	35%	37%	37%	37%
Human Capital	39%	41%	41%	36%	29%	48%	43%	40%

Chart 3: Dimensional contribution to M0 decomposed by village (nested weights)

AMP AGGREGATION: AF-METHOD

K = 40%



	Matl A	Sang B	Tins C	Mav D	Mabu E	Hoch F	Match G	Total
Headcount H (%)	69%	80%	71%	58%	40%	65%	75%	63%
A (%)	65%	68%	74%	66%	59%	66%	72%	68%
M0	0.449	0.541	0.525	0.384	0.238	0.425	0.540	0.429

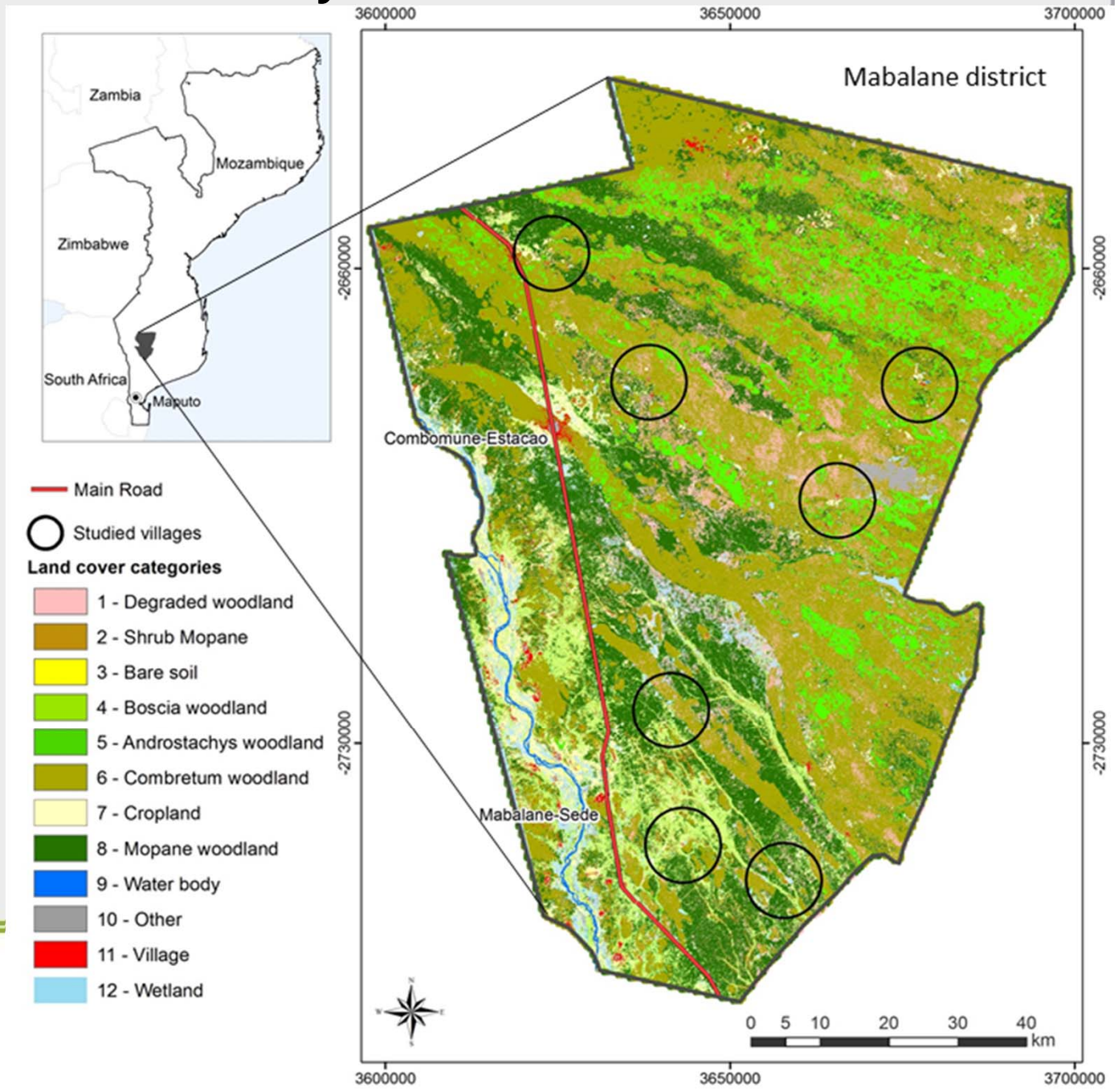
Chart 1: Poverty class decomposed by village

Study area

We investigated the links between human wellbeing, ecosystem services (ES) and land use change.

Mabalane District (Southern Mozambique) where most of Maputo's charcoal is produced.

-low levels of human development
- smallholder agro-pastoralism



espa ecosystem services for poverty alleviation

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We investigated the interconnection of human wellbeing and ecosystem services (ES) in Mabalane District in Southern Mozambique. The area is characterised by low levels of human development, smallholder agro-pastoralism, and is a production stronghold in the local and regional charcoal trade. Using multiple methodologies for the collection and analysis of biophysical and social datasets we attained following results: