THE ECONOMICS OF LAND DEGRADATION

A GLOBAL INITIATIVE FOR SUSTAINABLE LAND MANAGEMENT

The Economics of Land Degradation and Sustainable Land Management

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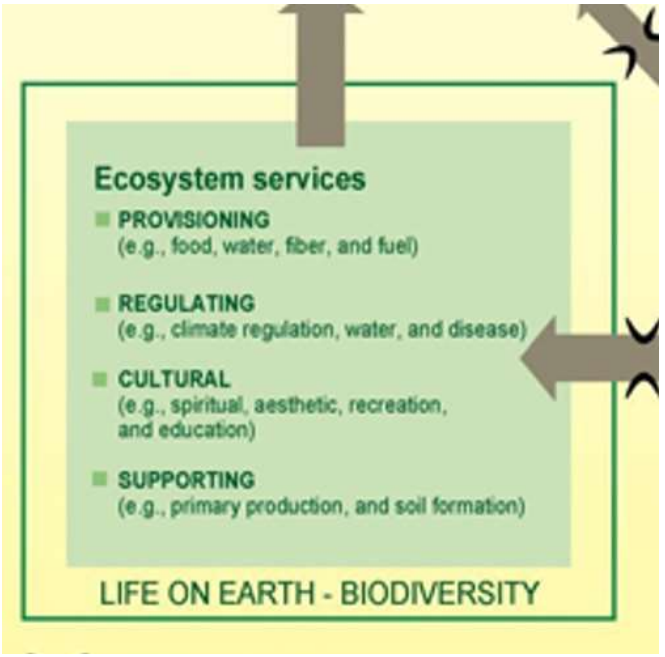
THE ECONOMICS OF LAND DEGRADATION

Ecosystem services and land degradation

- Benefits to humans from the environment
- Land productivity losses linked to ecosystem service degradation cost an estimated $42 billion/ year (ELD, 2015)
- Poor suffer the most from degradation



Valuing ecosystem services (1)

- Often unaware that ecosystem services are being lost until it is too late
- Valuation can help us make better land management decisions
- What is a particular place worth to society?
- How do different stakeholders value the same place?
- What policy measures can support stakeholders to make sustainable land management decisions?

Valuing ecosystem services (2)

- Goes beyond market value and includes the whole range of benefits gained from land at different scales over different periods of time
- Valuation can help determine how much to invest to reduce land degradation and the costs of failing to address degradation
- Provides decision makers with information about costs of action/inaction and can aid selection amongst different options
- Range of different methods can support provision of this information

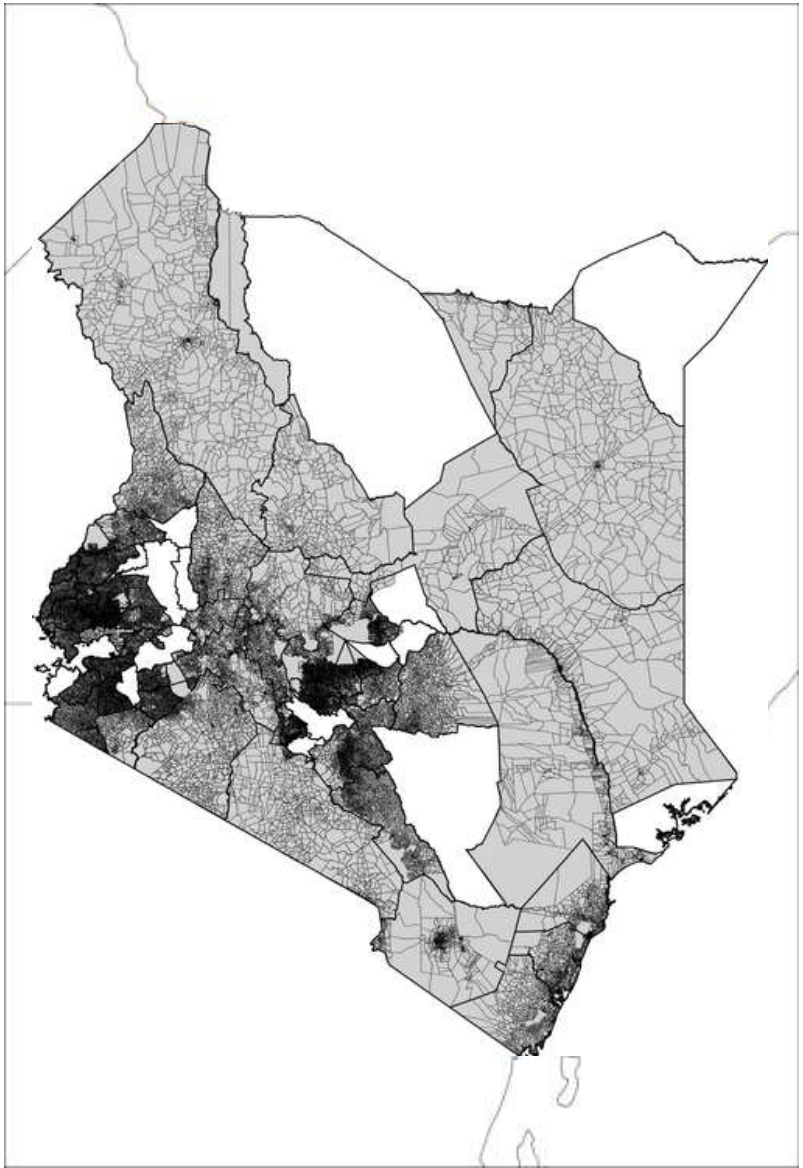
ELD 6+1 in western Kenya: cost & benefits of Sustainable Land Management uptake for individual farmers

- Why individual farmers
- Why western Kenya
- What a cost-benefit analysis helps us understand in this context & scale
- What are the costs & benefits of SLM implementation?
- Policy implications for Kenya Soil Policy Group (feed in to the “+1”)

- https://www.youtube.com/watch?v=fqmoWC4Hs9s&feature=youtu.be

Western Kenya

- National policy is implemented at county-level, so county-level recommendations essential
- High, and increasing, human population (500+ people/km^2)
- Fragmented land use & ownership
- Small farm sizes (0.5 – 2 ha)



Western Kenya

- Poor yields & low productivity
  - Maize averages 1t/ha (potential is 8)
- Soil fertility decline
  - “No input” yields down 70% in last 11 years
- How can the emerging national Soil Policy help reverse these trends?

Cost-benefit analysis

- For a given SLM practice, implemented over a defined area of land for a specified period of time:
  - Add up costs (labour, materials, opportunity costs)
  - & benefits (increased yields, reduced labour)
  - Discount future costs & benefits
  - Calculate a net present value and return on investment period
  - Does it makes financial sense to invest in SLM?

An economic case for action

- For a specific SLM practice, implemented over a defined area of land for a specified period of time:
  - Which SLM practices give the best value for farmers
  - How costs, benefits, return on investment periods, net present value vary between different farms
  - Could policy interventions increase uptake?

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Data collection: which farms

- The most common crops
- In the most widespread agro-ecological zone
- Stratified random sample of 60 farmers
- Farmers were:
  - Smallholders (~ 1-2 ha)
  - Subsistence
  - Not known for their SLM use

Data collection: which SLM practices

SLM practice not requiring construction	SLM practice requiring construction
Soil testing and liming	Vegetative strips
Manuring	Physical terraces
No tillage	Agroforestry
Mulching	Ditches
Intercropping	Water harvesting/ storage
Rotation	
Fallowing	
Trash heaps/lines	

Quantifying benefits of SLM

- Requires yield/gross margin data covering pre & post implementation
- Farmers do not keep records
- Farmer decisions based on perceptions of changes to inputs & outputs

Quantifying benefits of SLM

- Yield
- Labour required for the cultivation activity
- Intercropping: additional income from second crop
- Agroforestry & vegetative strips: fodder, timber

Is it worth investing in SLM?

- Costs incurred, and benefits obtained, happen over time

- (i) define a time period
  - SLM practice implementation between 2015 & 2030
  - Parallels Kenya's "Vision 2030" & the policy lifespan
- (ii) discount costs & benefits to present values
  - three discount rates (3.5%, 5%, 10%)

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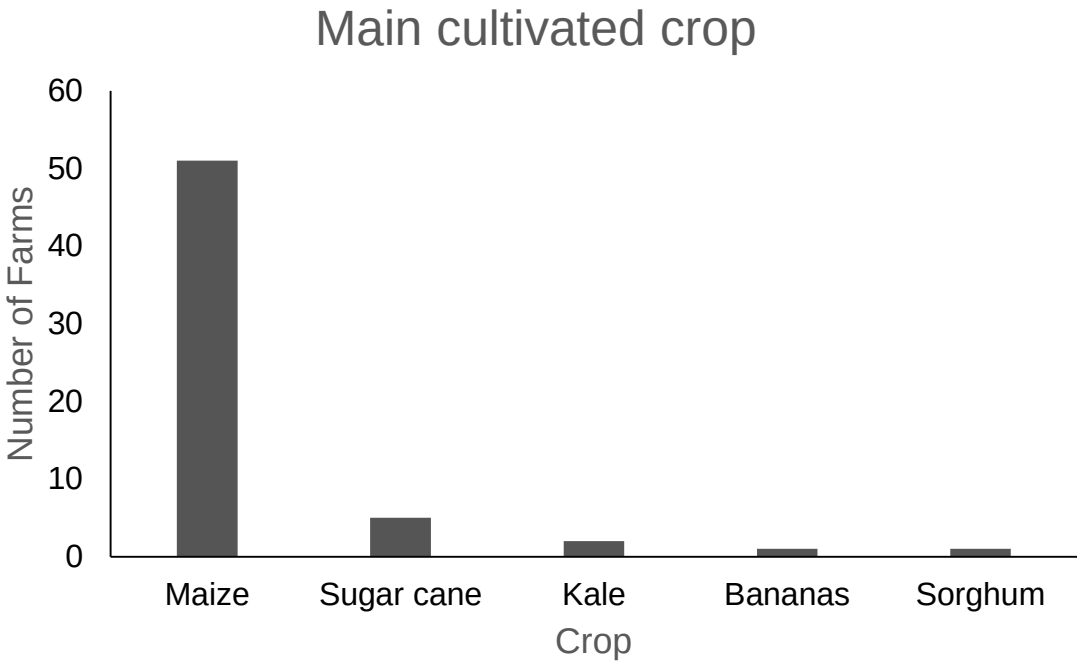
Results: the surveyed farms



- Grew between 2 & 6 crops
- Had an average of 3 head of cattle
- Nearly all farmers employed at least one SLM (59 from 60)

Results: the surveyed farms

- Median size ~1.2 ha
- Maize plots ~0.55 ha
- Yield ~2500 kg/ha
- ~1/3rd sold

- Cultivation profit & labour costs highly variable within & between counties
- SLM implementation is labour intensive
- Cost of implementation vary by county

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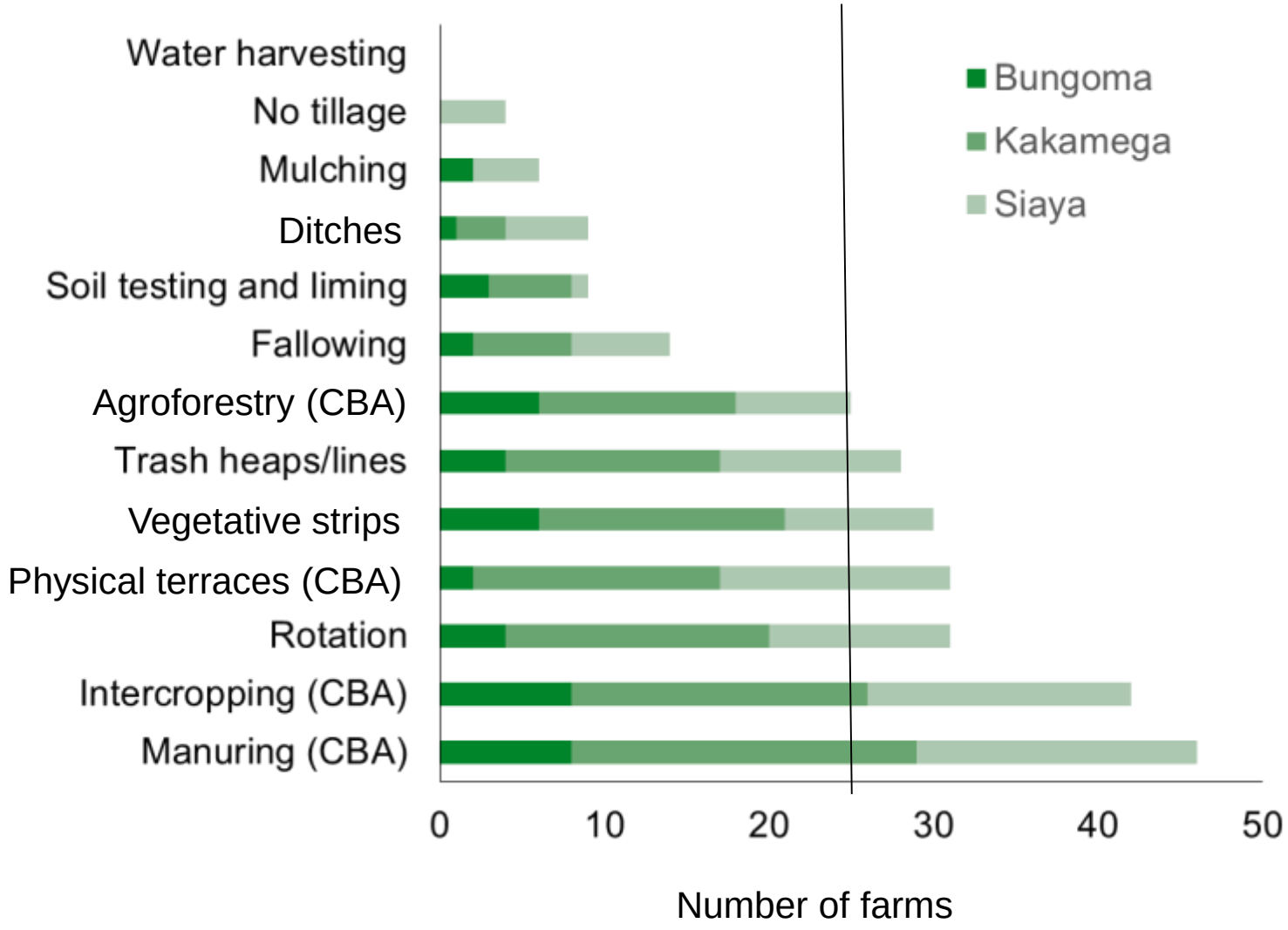
Results: SLM practice uptake



Results: SLM perceived benefits

- A change from an equivalent field where the SLM practice was not in place
- Variability in perceived impacts on:
  - Labour
  - Yield
  - Profits
- Use these data to perform the cost benefit analysis

Results: manuring perceived benefits

- High perceived benefits across all three counties
- Benefits in increases in yield & decreases in labour use

	Bungoma	Kakamega	Siaya	Three counties
Annual cost (labour Ksh/acre)	3,980	1,650	2,760	2,450
Perceived benefit (increase in yield kg/acre)	878	624	485	626
Perceived benefit (decrease in labour hrs/acre)	35	52	8	29
Perceived benefit (Ksh/acre)	29,880	21,310	14,350	20,640

- 1000 Ksh/acre ~ US$25/ha

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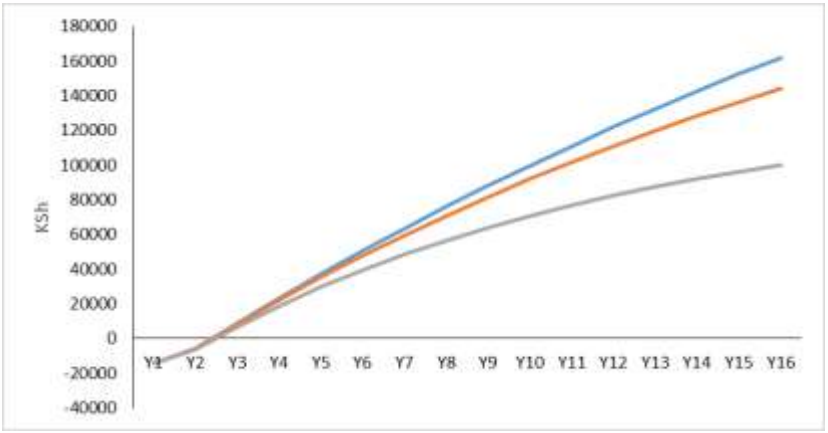
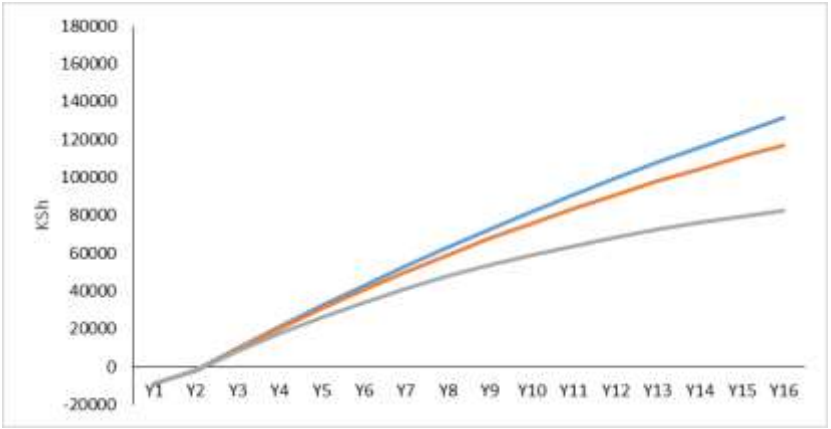
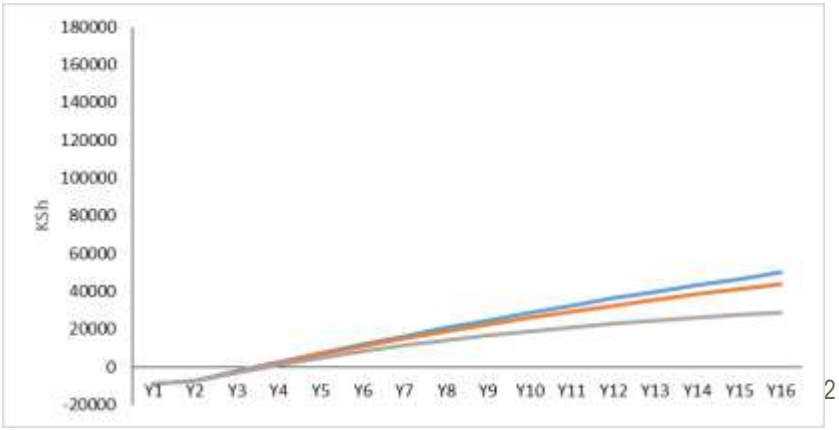


- Bungoma



- Kakamega



- Siaya

Manuring

- Return on investment: payback period always short, regardless of discount rate or county
- NPV varies between counties

Results: intercropping perceived benefits

- Overall positive perceived benefits
- Additional income from second crop

	Bungoma	Kakamega	Siaya	Three counties
Annual cost (labour Ksh/acre)	1,610	2,320	2,260	2,160
Perceived benefit (increase in yield kg/acre)	-85	67	87	46
Perceived benefit (decrease in labour hrs/acre)	51	-3	1	9
Gross profit from second crop (Ksh/acre)	9,800	4,950	6,830	6,590
Perceived Benefit (Ksh/acre)	9,030	7,110	11,740	9,240

- 1000 Ksh/acre ~ US$25/ha

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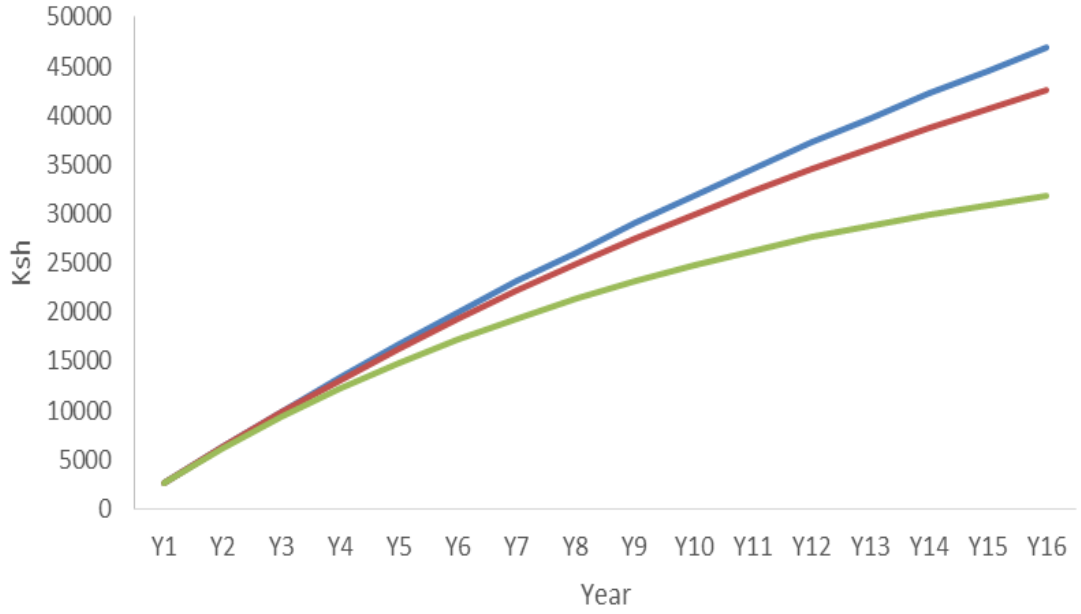

Intercropping

- Return on investment: payback period immediate regardless of discount rate
- Same pattern across all counties

Results: physical terraces perceived benefits

- Perceived benefit varies widely
- Yield improvements & labour requirements

	Bungoma	Kakamega	Siaya	Three counties
Cost of construction (labour Ksh/acre)	4,500	1,980	2,390	2,250
Annual cost (labour Ksh/acre)	750	1,080	1,300	1,160
Perceived benefit (increase in yield kg/acre)	1,080	310	90	250
Perceived benefit (decrease in labour hrs/acre)	31	22	22	22
Perceived Benefit (Ksh/acre)	41,380	12,210	3,920	9,830

- 1000 Ksh/acre ~ US$25/ha

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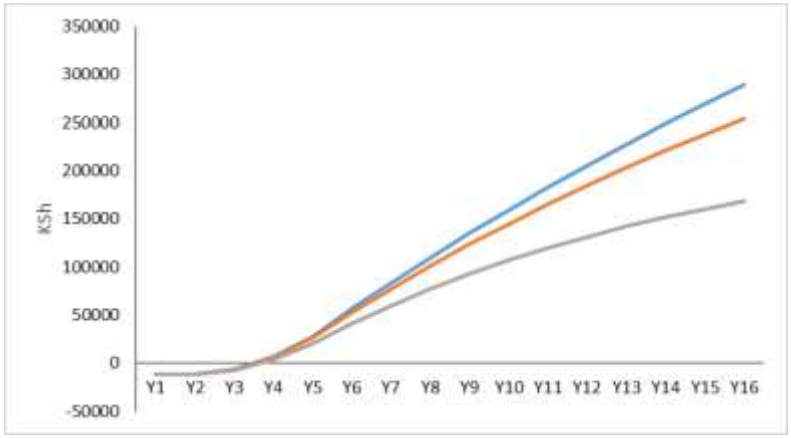
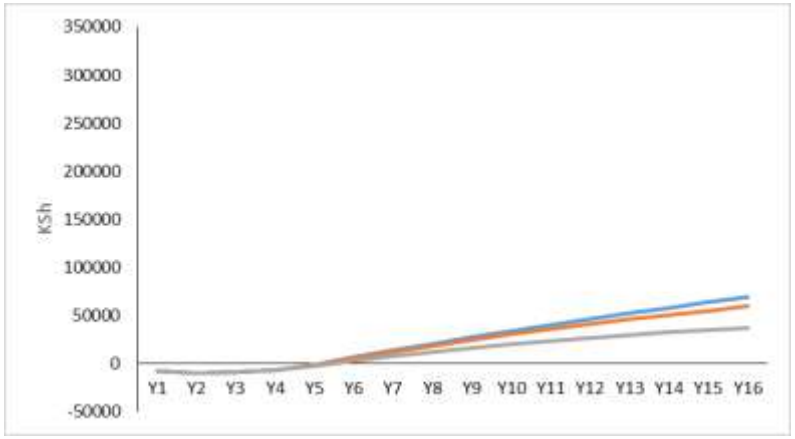
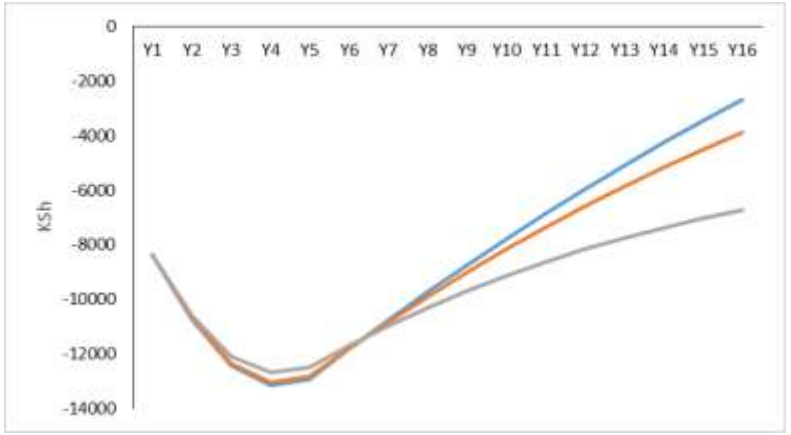


- Bungoma



- Kakamega



- Siaya

Physical terraces

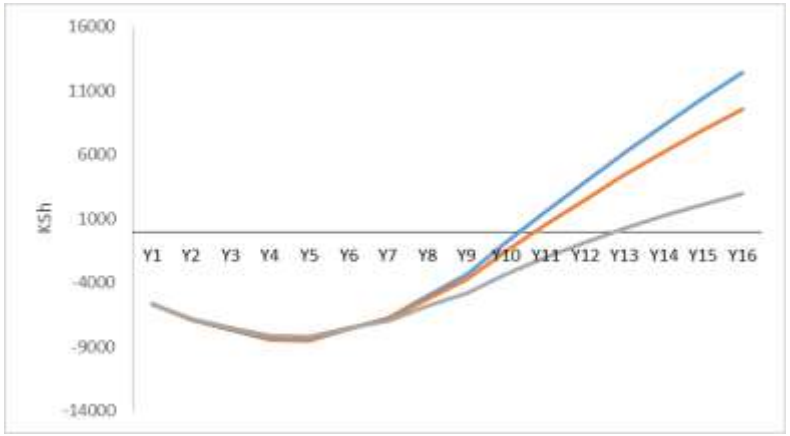
- Return on investment: payback period highly variable
- Farmers in Siaya do not see their investment repaid

Results: agroforestry perceived benefits

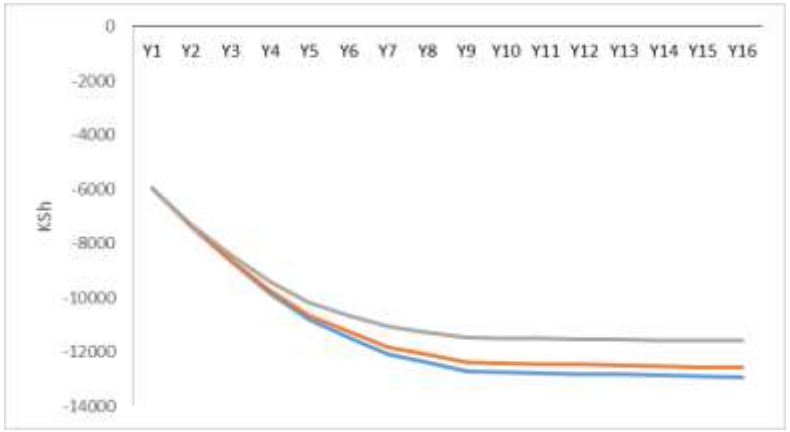
- Monetary value of perceived benefit generally low
- Can require more labour for the cultivated crop
- Yield increases perceived to be low

	Bungoma	Kakamega	Siaya	Three counties
Cost of construction (labour Ksh/acre)	520	790	810	750
Annual cost (labour Ksh/acre)	170	280	0	170
Perceived benefit (increase in yield kg/acre)	160	50	20	60
Perceived benefit (decrease in labour hrs/acre)	0	85	-50	27
Perceived Benefit (Ksh/acre)	4,840	1,510	570	1,820

- 1000 Ksh/acre ~ US$25/ha



- Bungoma



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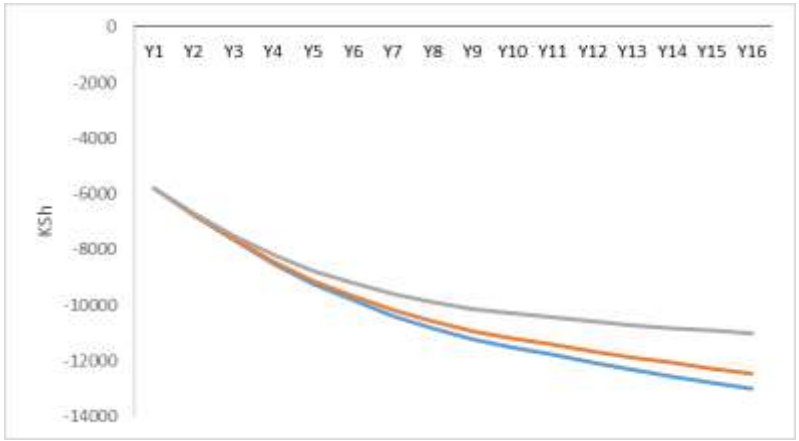

- Siaya

Agroforestry

- Return on investment: payback period ~ 10 years in Bungoma
- Farmers in Siaya and Kakamega do not see their investment repaid

Pen portraits: SLM practices (no construction required)

- **Manuring**
- Yield increases & labour reductions
- High NPVs
- Quick return on investment period

- **Intercropping**
- Can have negative impacts on the yield & labour used for cultivating the main crop
- High NPVs
- Immediate return on investment

Pen portraits: SLM practices (construction required)

- **Physical terraces**
- Yield increases & labour reductions
- NPVs not universally positive
- Return on investment period can be long
- In Siaya farmers do not see a return on their investment

- **Agroforestry**
- Small yield increases; labour does not always decline
- Only farmers in Bungoma experience positive NPVs
- Does not provide a return on investment for farmers elsewhere

CBA: the importance of scale

- Yield benefits accrue to individual farmers
- Not all benefits quantifiable in terms of yield for individuals
- Wider societal values beyond the farm would change findings
- Costs of SLM implementation are entirely carried by individual farmers who have no incentive to consider wider society

Policy suggestions

- Policy should target promoting the right SLM practices to the right areas
- Promote simple, low cost, practices for maximum impact on individual farmers
- Policy needs to recognise wider societal gains and ensure farmers do not carry all the costs
  - Subsidy schemes
  - Payments for ecosystem services