Valuing investments in sustainable land management using an integrated modelling framework to support a watershed conservation scheme in the Upper Tana River, Kenya

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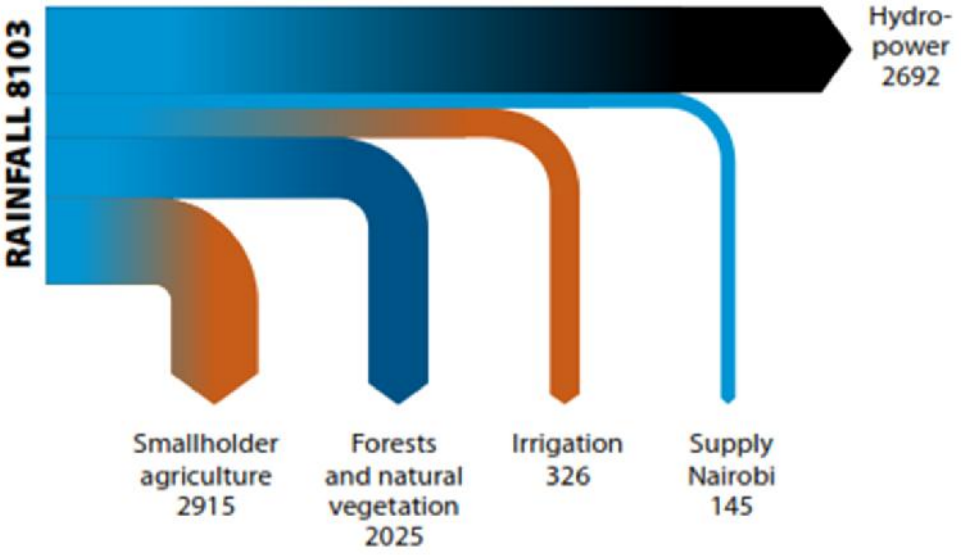
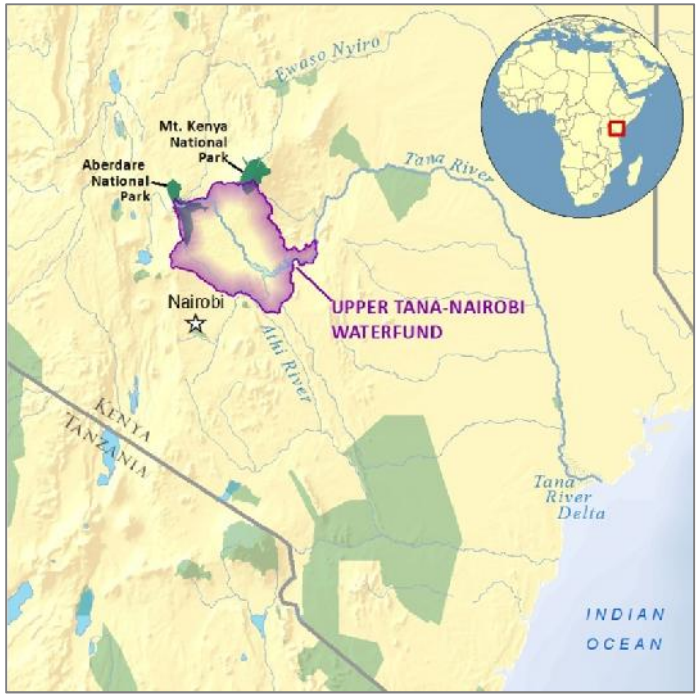
The Nature Conservancy

natural capital PROJECT

FutureWater

Land and water in Upper Tana, Kenya





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Timeline

First scoping study Green Water Credits, led by ISRIC

Business case development

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Official launch

2005 2010 2015 2020 2025

Board of trustees

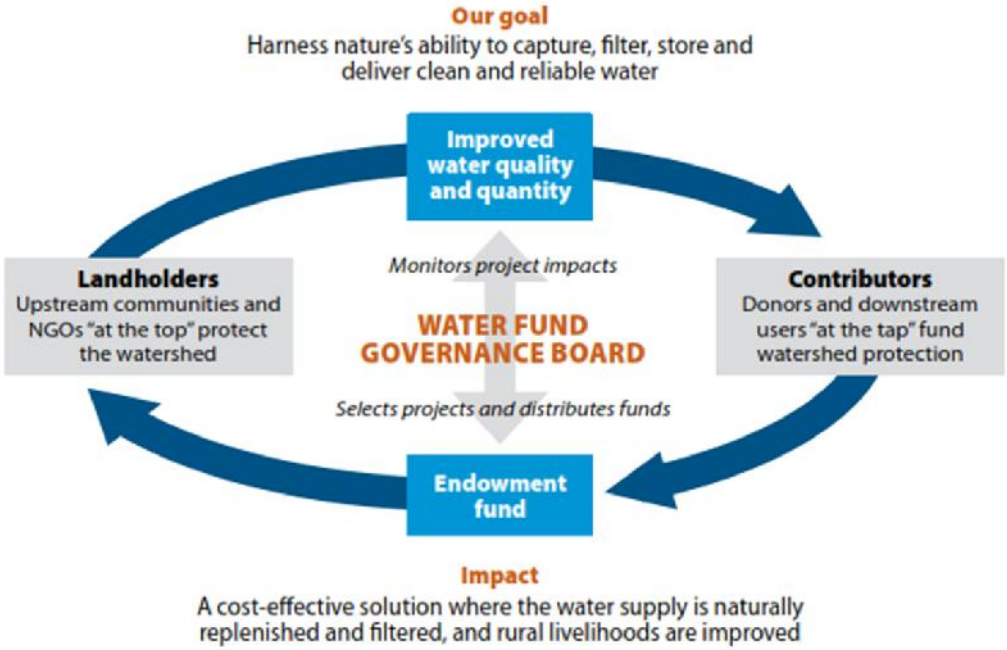
Fully operational

Start on-the ground activities

Steering Committee

PENTAIR · CIAT · eabl · KenGen · gef · FRIGOKEN · Coca-Cola Africa Foundation

How a water fund works



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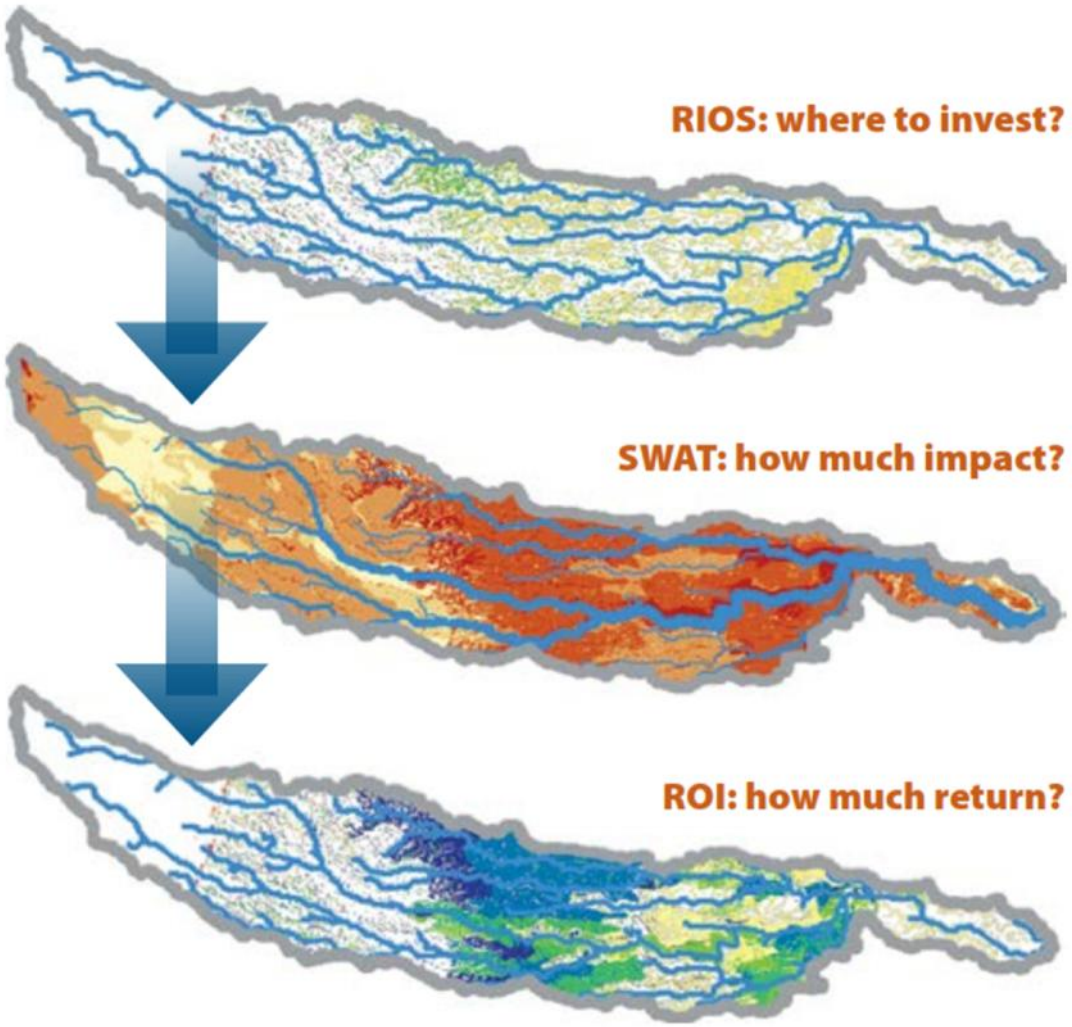
Business case, modeling framework



RIOS

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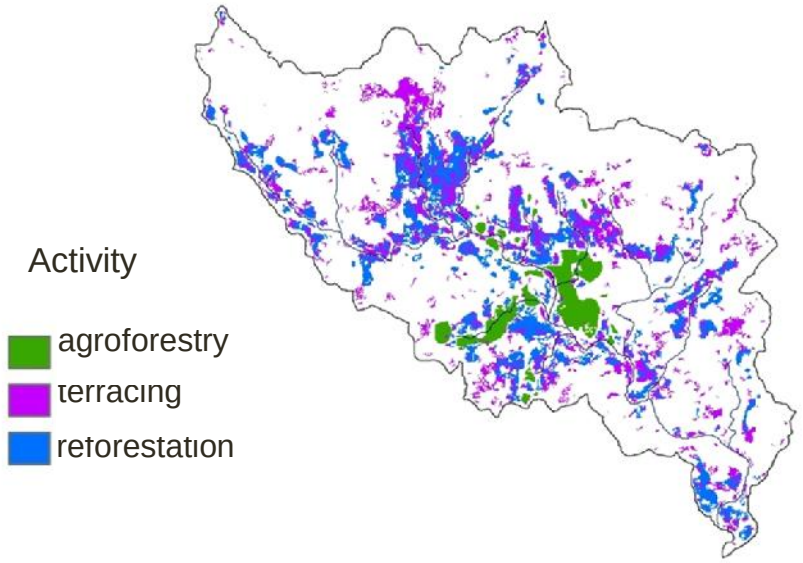
What and where to invest

- Investment portfolios for (total budget over 10 yrs):
  - $2.5 million USD
  - $5 million USD
  - $10 million USD
  - $15 million USD



Activity	Allowed on
Riparian management	15m buffer alongside streams, except urban, agroforestry, roads, and natural areas. Not allowed within the border of Kenya Forest Service lands.
Agroforestry	Bare soil, grassland, and croplands (except pineapple)
Terracing	Bare soil, croplands (except tea), and agroforestry lands with >12% slope and >15m from stream channel.
Reforestation	Grassland, shrub, and croplands (except pineapple) located within 500m inside the border of Kenya Forest Service lands (anti-encroachment strategy)
Grass strips	Bare soil, croplands (except tea), and agroforestry lands with <12% slope
Road mitigation	Unpaved roads

Impacts of investments

IN

OUT

Businesss as usual

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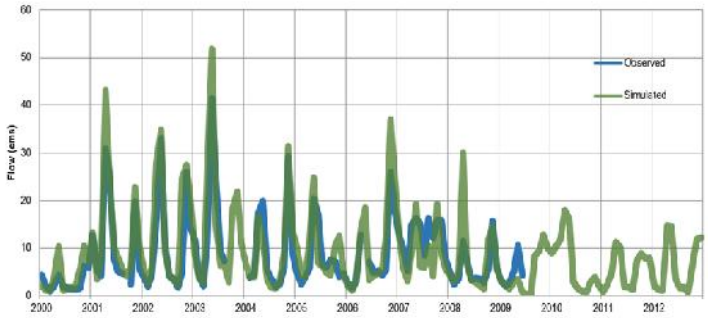

Investment portfolios

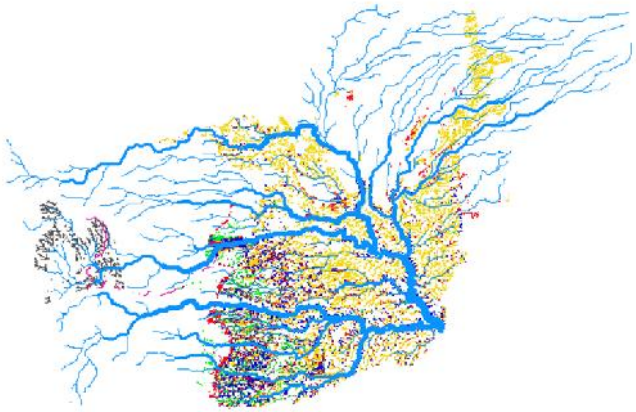

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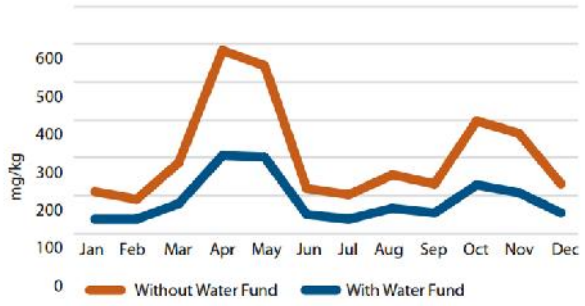
Figure 11 Average sediment concentration by month at the Mwagu intake (mg/kg), the water primary intake for Nairobi, showing sediment concentration reduced by 50–60% depending on the month.



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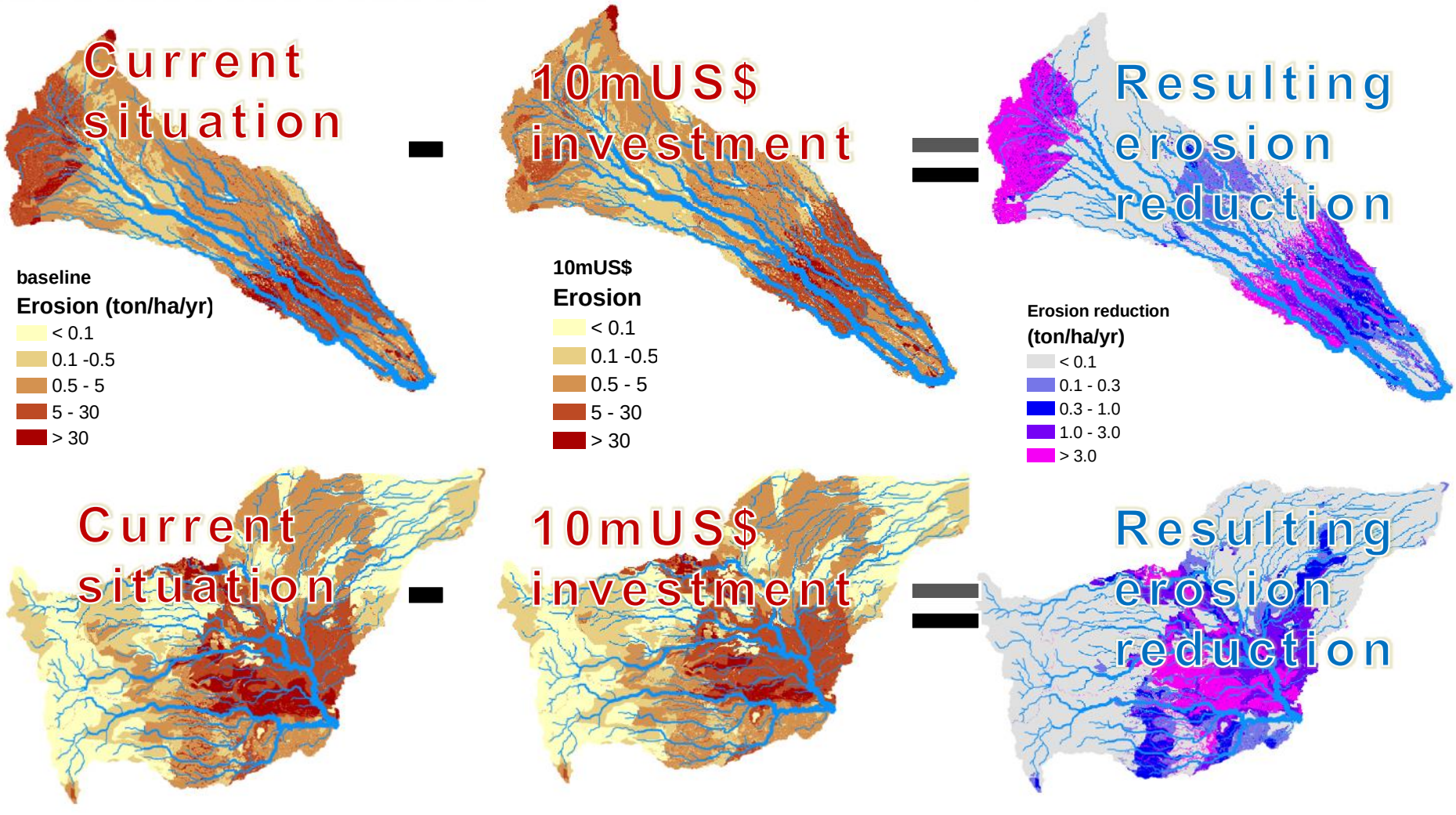
Erosion reduction after investing



Downstream benefits

- For water supply, three main cost savings quantified in the Business Care are:
  - 1. Avoided use of flocculants
  - 2. Avoided electricity costs
  - 3. Greater water revenue from reducing use of processed water in backwashing

Figure 11 Average sediment concentration by month at the Mwagu intake (mg/kg), the water primary intake for Nairobi, showing sediment concentration reduced by 50–60% depending on the month.

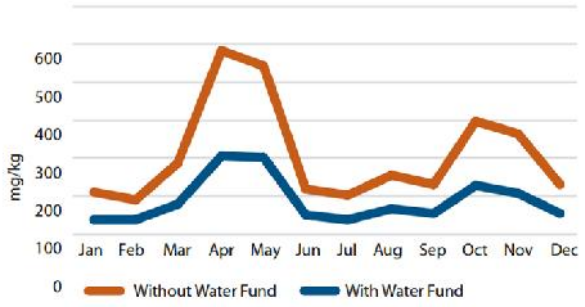
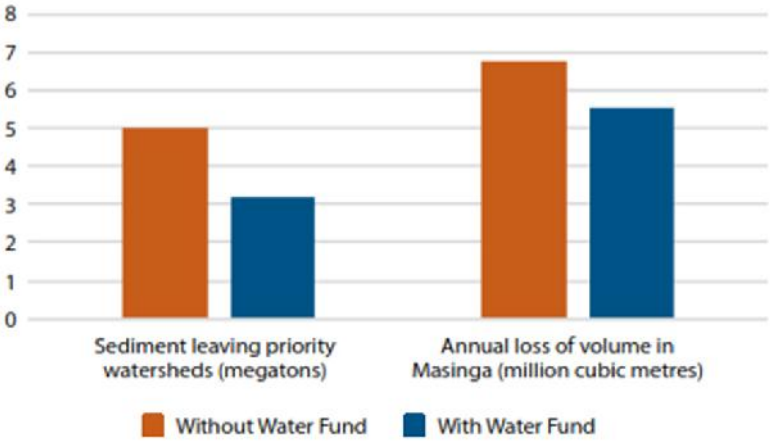


Figure 12 Sediment export from the priority watersheds and implication for lost reservoir volume



For hydropower, benefits quantified were:

- Increased power generation from increased water yield.
- Avoided interruptions in electricity generation.

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Upstream agricultural benefits

- SWAT output for each calculation unit and scenario
  - Soil loss
  - Crop transpiration
- Soil maps
  - Water retention capacity
  - Organic matter content
- Economic Water Productivity based

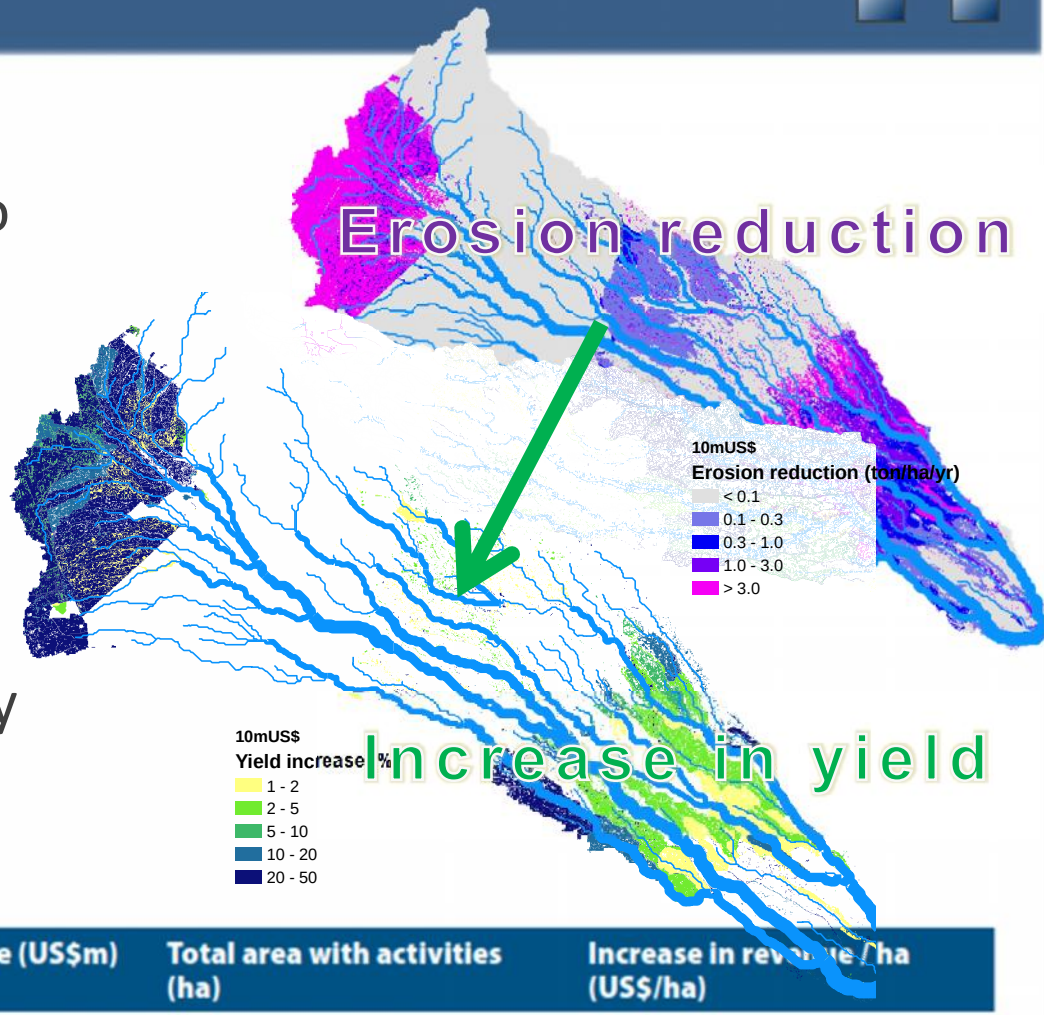

Table 3 Annual increases in revenue by crop type

Land use	Increase in revenue (US$m)	Total area with activities (ha)	Increase in revenue/ha (US$/ha)
Coffee	1.7	6,280	264
General agriculture	0.9	13,295	68
Tea	0.4	814	479

Return on Investment

Figure 17 Total annual benefits and costs over time including continued maintenance after 10 years (in USD million)

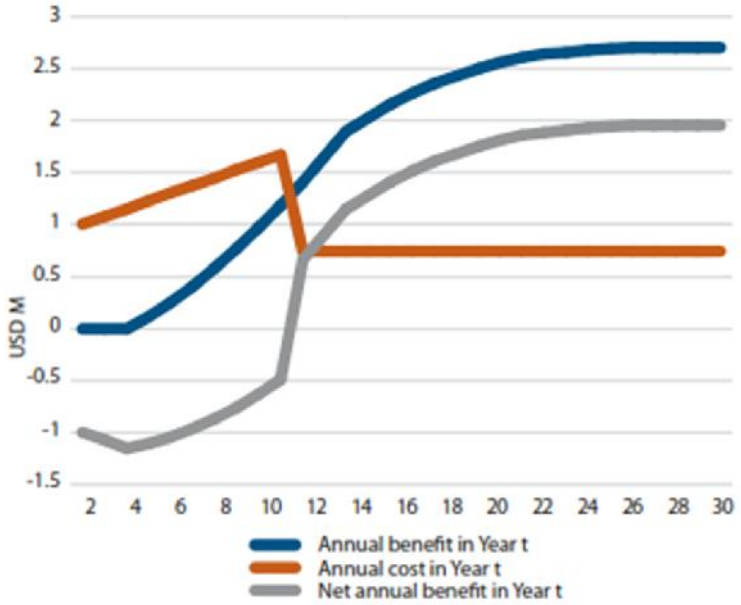

Figure 18 Annual net benefits and Net Present Value of the Water Fund as a whole (in USD million)

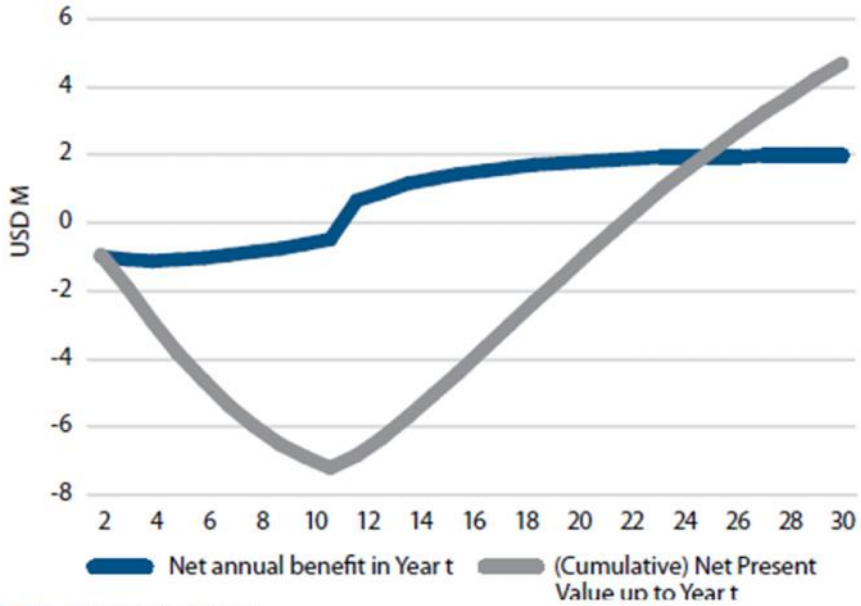

Table 5 Cumulative benefits across benefit streams

Stakeholder	Benefit/Cost	USD
Water Fund	Investment cost	(7,110,000)
Ag producers	Net additional cost (maintenance, etc)	(8,520,000)
Ag producers	Upstream farmers	12,000,000
NCWSC	Avoided flocculant costs	394,000
NCWSC	Avoided electricity costs	36,700
NCWSC	Net revenue from saved process water	2,090,000
NCWSC	Total NCWSC benefits with scale-up	3,390,000
KenGen	Avoided interruptions	281,000
KenGen	Increased generation from increased water yield	5,870,000
KenGen	Total KenGen benefits	6,160,000
	Present Value of Benefits	21,500,000
	Present Value of Costs	(15,600,000)
	Net Present Value	5,900,000

Table 6 Non-monetised benefits

Stakeholder	Benefit
NCWSC	Reduction in wet sludge disposal
NCWSC	Avoided service interruptions
NCWSC	Increased dry season flows
Other water suppliers	Lowered sediment levels
Municipal water processors	More reliable water supply
KenGen	Reduction in reservoir sedimentation
KenGen	Avoided turbine intake maintenance costs
Upstream farmers	Increased fodder for livestock
Upstream famers	Additional income and employment opportunities
Urban private sector processors	Improved water supply
Local communities	Cleaner drinking water
General: Ecosystem services	More habitat for pollinators
General: Ecosystem services	Increased carbon storage in new trees planted

Conclusions

- An integrated modeling framework was used to identify key locations to implement a set of SLM measures and economic impact of these interventions was modelled for three key stakeholder groups (farmers, water supply, hydropower)
- Over 50% reduction in sediment concentration in rivers (varying by watershed and time of year); An 18% decrease in annual sedimentation in Masinga reservoir; Up to US$3 million per year in increased agricultural yields for smallholders and agricultural producers; Approximately US$250,000 in cost savings a year for water supply stemming from avoided filtration
- Business case demonstrates a clear economic basis for the establishment the Water Fund, and should boost support from donors, water users and local stakeholders – critical to a final "mature" water fund

European Geosciences Union
General Assembly, April 2015

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For more info and reports:
http://www.nature.org/ourinitiatives/regions/africa/nairobi-water-fund.xml

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