Weaving baskets from sisal: women at work in Eastern Kenya. (William Critchley)

In a nutshell

To make Sustainable Land Management (SLM) and its products, impacts and services more valuable, and / or to connect SLM with emerging g l environmental issues, promising new technologies and opportunities need to be continually explored. Trends and opportunities encompass both technologies and approaches, and are based on new markets and market demands. They often involve new financial mechanisms.

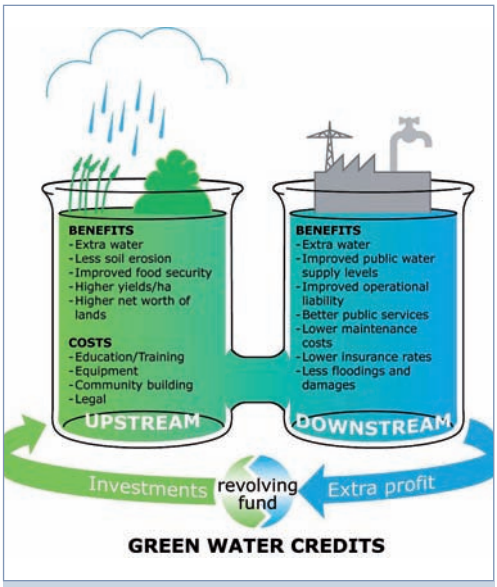
In various areas of agricultural production and agribusiness there is investment potential for small-scale land users, ranging from primary production and food processing to providing services. Some promising trends and opportunities in SSA include:

– Processing agricultural products or 'value chain' development
– New markets for certified agricultural products e.g. Fair Trade, Organic Farming, Forest Certification, etc.
– Markets for endemic plants grown under organic / fair trade conditions (e.g. rooibos tea in South Africa)
– Markets for medicinal plants (many indigenous to Africa, including 'devil's claw'; *Harpagophitis procumbens*)
– Origin labeling (e.g. traditional coffee varieties in Ethiopia, grown under shade)
– Biotechnology for higher yield, improved fruits, new varieties
– Genetically modified crops (BT Maize in South Africa) in combination with conservation agriculture
– Markets for ecotourism and agro-ecotourism
– Markets for bio-energy / fuel
– Markets related to compensation payments e.g. payment for ecosystem services (PES)
– Establishing training, research and agricultural information centers
– Productive gullies for producing cash crops

Furthermore, investment opportunities are related to support services such as establishing farm machinery and equipment plants; tractor hire centers; operating agriculture mechanisation centers; developing human and animal power technologies; seed multiplication farms; training of extension specialists and agricultural researchers. It is likely that increasing attention will be paid to addressing SLM concerns through new marketing opportunities, including wide ranging possibilities for accreditation and labeling schemes to command market premiums. Payment schemes based on PES are almost certainly forerunners for a new breed of programmes and projects. Currently the most promising and important trends and opportunities for SSA are organic farming, ecotourism and PES.

Payments for Ecosystem Services

Payments for ecosystem services (PES) are economic instruments designed to provide incentives to land users to continue supplying an environmental service that benefits society. The payments cover positive externalities, i.e. measures taken in one place that have positive impacts on another location, where currently people benefit from it without paying - which can be viewed as a 'market failure'. Therefore the costs can be internalised; those who benefit from the services pay and those who provide the services receive payment. PES includes voluntary transactions for well defined environmental or ecosystem services (ES) between an ES buyer and an ES provider. The transaction may vary from direct payments to upstream providers from downstream beneficiaries, or between companies paying to compensate for their emissions made in another country. What is being bought must be well defined and can be either a measurable service (e.g. tonns of carbon stored) or a change of land use. The payment will naturally only be made if the provider of the services implements the agreed changes. The voluntary nature of the 'transaction' differentiates PES from the conventional command-and-control approach of many governments. Many PES-projects have been started in SSA, paying for carbon storage in forests, watershed services, Green Water Credits, etc. However, there are still many constraints to implementing PES. These include the lack of clearly defined property rights; the measurable and quantifiable input and service that improved land management achieves; assessing and setting the price for ES; limited institutional capacity to set up payment systems, etc.



Example: Green Water Credits
Green Water Credits (GWC) attempts to bridge the incentive gap between upstream and downstream water users. The project implements a regular compensation system by water users to water providers for specified water management services (e.g. for hydropower and irrigation) (Source: ISRIC, 2010).

Ecotourism

Ecotourism can be defined as the purposeful travel to natural areas to understand the culture and natural history of the environment, taking care not to alter the integrity of the ecosystem, while producing economic opportunities that make the conservation of natural resources beneficial to local people. Ecotourism seeks to minimise impacts on the areas visited and contributes to the conservation of these locations and the sustainable development of adjacent areas and communities. Community involvement in ecotourism is important, providing income opportunities and compensating for protecting and limiting use of the ecosystem by the community. Africa is an important ecotourism destination, e.g. the Kenyan Wildlife Service recorded a revenue of US$ 54 million from wildlife tourism in 1995. The protection of forests and other natural habitats are an important aspect of ecotourism. However, the 'ecotourism carrying capacity' is usually not precisely known and facilities are often established without prior assessment of the likely ecological impacts. There is future potential for agro-ecotourism, where the focus of attention is on – for example – ancient terraces combined with traditional farming methods.

Elephants crossing the Samburu river in Kenya. (Hanspeter Liniger)

Biogas Production

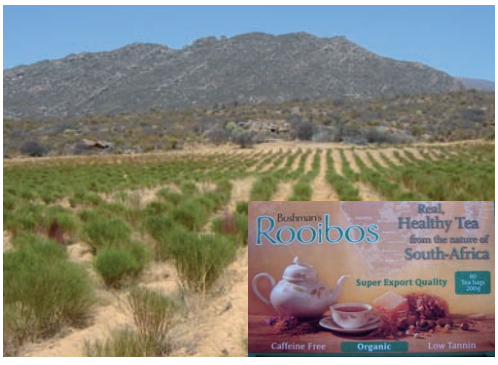
Biogas is gas that is naturally produced during the decomposition of organic waste. The gas is captured in a storage tank (on site) to be used for household energy needs such as cooking, heating and lighting. The most common form of input material is cow dung making it very appropriate for rural settings in SSA. The technology offers two major advantages: (1) On-site and low-cost energy production based on internal inputs; (2) Reduced usage of fuelwood which translates into less cutting down of trees leading to reduced deforestation and land degradation. The biogas plant generally consists of three main chambers: (1) The digester pit where all the microbiological reactions / decomposition of the material takes place; the digester has to be air-tight with the released gas only escaping into the gas holder; (2) The gas holder is connected to the digester through a pipe and collects all the gas that has been fermented; (3) The mixing pit is the input chamber where the dung is mixed with water and fed into the digester. Biogas is suitable either for a farm, cattle post or rural setting where the inputs (cow dung) are easily available. Energy can be saved at every level of use, i.e. individual or institutional. In Botswana for example this technology was introduced by the Rural Industries Innovation Center which is a government funded research institution.

Gas collection tank resting on the concrete-built digester. Pipes / tubes at the top of the gas tank supply the house with methane gas, Botswana. (Reuben Sebego)

Organic Agriculture

Organic agriculture is a holistic production management system that avoids the use of synthetic fertilizer, pesticides and genetically modified organisms. It minimizes nitrogen pollution, conserves soil and water, and optimizes the health and productivity of interdependent communities of plants, animals and people. Organic agriculture farmers need to implement a series of practices that optimize nutrient and energy flows and minimize risk. These include: crop rotations and enhanced crop diversity; different combinations of livestock and plants; symbiotic nitrogen fixation with legumes; application of organic manure; and biological pest control, such as 'push-pull'. All these strategies seek to make the best use of local resources. Findings in a 2008 report issued by UNEP that assessed 114 projects in 24 African countries stated that 'yields had more than doubled where organic, or near-organic practices had been used' and that soil fertility and drought resistance improved. Organic agriculture — with its emphasis on closed nutrient cycles, biodiversity, and effective soil management — has the potential to be more conducive to food security as well as sustainable in Africa than most conventional production systems and has the capacity to mitigate and even reverse the effects of climate change.

Demand for organic and fair trade products is increasing on the international market. These niche markets offer opportunities for small farmers in SSA. However, they demand high quality products and farmers need to meet certification requirements, which can be costly to establish. Furthermore, farmers depend closely on efficient marketing, and need support to access niche markets and fulfil the demand (for example) for specific organic products – including fibres as well as food. Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organisation established in 1972.



Top: Rooibos tea bushes in Western Cape, South Africa – and the product marketed in Europe. (William Critchley)
Bottom: Development agencies are promoting export of organic products from Africa. By now more than 50,000 certified organic growers in Uganda. (William Critchley)

Fair Trade

Fair trade is 'aimed at equitable social relations'. It aims to enhance trading conditions for small-scale businesses, improve labour conditions for employees and empower communities through ethical and sustainable trade. It includes producers, traders, retail, support organisations and, of course, consumers of fair trade products. Furthermore, it provides market access to otherwise marginalised producers, connecting them to customers and allowing access with fewer middlemen. Fair trade aims to provide higher wages than those typically paid to producers, as well as helping producers develop knowledge, skills and resources to improve their lives. Fair trade products are traded and marketed either by a 'MEDC* supply chain' whereby products are imported and / or distributed by fair trade organisations (alternative trading organisations, e.g. Max Havelaar) or by 'product certification' whereby products complying with fair trade specifications are certified by them, indicating that they have been produced, traded, processed and packaged in accordance with the standards. Use of labels or certifications for fair trade is mainly a market-driven approach. Fair trade governs land management through consumers' preferences and production demand. A label for organic production or for ecological wood production (FSC) serves as an incentive to implement SLM and allows the land user to gain a higher price for certain products. There are wide-ranging possibilities of labelling schemes. This may even go beyond fair trade and eco-labels and eventually into the realms of 'SLM-friendly' certified products.

The 'Fairtrade certification system' covers a growing range of products in SSA, including, coffee, cocoa, tea, cotton, fresh fruits, honey, spices, shea nut butter (*beurre du karité*), wine, flowers and handicrafts.

** 'Management and Executive Development Centre'*

FAIRTRADE

FLOWER
LABEL
PROGRAM

'Fairtrade' logos for fair trade products.

Example: Cooperation for Fair Trade in Africa – COFTA.

COFTA is a network of Fair Trade producer organisations in Africa involved and working with disadvantaged grass root producers to eliminate poverty through Fair Trade. COFTA was established by African producers in 2004 and aims to be the African voice in lobbying for greater market access and Fair Trade advocacy for African Producers, thus striving to empower the marginalised and disadvantaged to become organised, active and self-reliant African entrepreneurs. The cooperation is currently composed of over 70 member organisations from 20 African countries. COFTA members are predominantly handicraft producers, but are also involved in tea, coffee, vanilla, honey, dried fruit and juices, textiles among other income generating activities (COFTA, 2010).

Biotechnology and genetically modified crops

Non-GM (Genetic modification) biotechnological practices, such as traditional breeding, grafting / budding, cloning, radiation for mutations, where the organism's genes are manipulated indirectly, are more readily accepted and still have more potential in SSA. Practices that can improve the yield and quality of fruits e.g. grafted mangoes, grafted ziziphus, and budded citrus increase their value on local markets, and hence provide a good source of improved income.

Genetic modification (GM) is a specialised form of biotechnology and involves the manipulation of an organism's genetic make-up by introducing genes with desired traits from other species. GM is considered by some to be an opportunity because of its potential for 'pro-poor' production benefits. However, the whole debate about GM is still very controversial and any prospects for small-scale African land users are estimated to be 20 years away.

Productive gullies

Gullies can be rehabilitated for productive use: thus from an erosion problem they can be converted into a source of extra income. Untreated gullies can constitute a significant loss of productive agricultural land. Tree planting, natural grass regeneration and structural measures such as check dams of soil, stones, branches, and micro-basins are common practices that are used to avoid further soil erosion and for rehabilitation. In all cases the gullies then need to be protected from livestock. Such 'treated' gullies can furthermore offer an opportunity to produce more resource-demanding, higher yielding and better revenue crops e.g. fruit trees, banana and sugar cane (e.g. as in Tigray, Ethiopia), nut trees (e.g. cashew), vegetables, rubber, etc. Gully-gardens constitute rich 'micro-environments' being well supplied with water and sediment from above. For this practice to become upscaled, research is required to investigate resource ownership issues related to the gullies and runoff. There may potentially be upstream: downstream conflicts.

Ziziphus fruit in Africa wild (top) grafted (bottom); the grafted 'Pomme du Sahel' (*Ziziphus* sp.) is proving very popular and commands a good market both for fruit and graftlings. (William Critchley)

Diverse herbaceonsplants, bushes and trees turing the gullies into productive land. (Hanspeter Liniger)

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ORGANIC COTTON - BURKINA FASO

In the Ioba province of Burkina Faso, the production, storage, processing and marketing of organic cotton has been promoted since 2004 by Helvetas.
Organic cotton production adheres to the principles and standards of organic farming. Any application of synthetic fertilizers and pesticides and the use of genetically modified varieties are forbidden. Organic cotton relies on a combination of different measures: (1) the use of organic fertilizers (manure or compost) and recycling of organic matter; (2) crop rotation and / or intercropping; (3) careful selection of varieties adapted to local conditions (climate, soil, pests and diseases); (4) biological pest management (in combination with careful monitoring of crops); (5) clear separation of organic and conventional cropland, e.g. by growing border crops (to avoid contact with chemical substances through spray drift or surface runoff); and (6) soil and water conservation measures. Timely crop management (e.g. weeding) is very important.
In Ioba rotations crops include sesame (a cash crop), cereals and legumes (food crops), while intercrops include leguminous green manure and trap plants. The best adapted cotton variety is FK-37. Bio-pesticides are produced based on neem seeds (*Azadirachta indica*). The measures listed above help to improve soil fertility, reduce production costs (and thus financial risk) and avoid the negative effects of conventional farming: declining yields, resistance to pests and diseases, health hazards and environmental problems caused through the use of chemicals.
By relying on inputs available / produced on the farm and by getting a better price for certified organic products, profitability of the farm is improved in the long run despite of lower productivity compared to conventional or genetically modified (GM) cotton. Farms need to complete a 3-year conversion period to change their production system from conventional to organic. Farmers have to maintain records and documents for periodic inspection and certification (Internal control system).

SLM measure	Agronomic
SLM group	Trends and New Opportunities
Land use type	Annual crops / perennial crops
Degradation addressed	Fertility decline and reduced OM content; Biodiversity decline
Stage of intervention	Prevention and mitigation
Tolerance to climate change	Tolerant to climatic extremes due to higher water retention capacity of soils, reduced erosion and crop diversification (reduced risk of total crop failure)

Establishment activities

1. Purchase equipment (knapsack, etc).
2. Establish compost pits.

Remark: Certification requires a converting period of 3 years.

Maintenance / recurrent activities

1. Compost production.
2. Clear crop residues on fields where cotton will be planted, use for mulch or compost production (no burning).
3. Apply organic manure: 7.5 t/ha.
4. Ploughing (for incorporation of manure, pest and weed control).
5. Sow cotton and intercrops (such as *Hibiscus esculentus* – a trap plant for pests; or *Mucuna* – a green manure plant); Thin out cotton after 10-20 days (1-2 plants per pocket).
6. Weeding (3 to 4 times: 20/40/70/100 days after sowing).
7. Pest control (manual collection); Spraying of bio-pesticide (64 liters/ha, based on neem seeds): according to infestation: up to 3 times.
8. Ridging (form furrows and ridges using plough or manually).
9. Pre-harvest weeding.
10. Harvesting.
11. Cut cotton stems / residues and incorporate into the soil.

Labour requirements

For establishment: high
For maintenance: medium

Knowledge requirements

For advisors: high
For land users: medium

Photo 1: Land preparation using an oxen-drawn plough. (Helvetas)
Photo 2: Spraying bio-pesticides – one element of organic pest management. (Helvetas)
Photo 3: Harvesting cotton. (Jörg Böthling)

Case study area: Dano, Ioba province, Burkina Faso

Establishment inputs and costs per farm

Inputs	Costs (US$)
Labour: 2 person-days	2
Equipment / tools: 15-liter-knapsack	50
Agricultural inputs	na
TOTAL	**52**
% of costs borne by land users	100%

Maintenance inputs and costs per ha per year

Inputs	Costs (US$)
Labour: 145 person-days (at 1.1 US$)	160
Equipment / tools (see establishment)	0
Agricultural inputs: cotton & intercrop seeds, manure, neem seeds	28
TOTAL	**188**
% of costs borne by land users	100%

Remarks: Standard equipment (hoe, plough, wheel-barrow) is not included in costs, knapsack is provided by producer's association (UNPCB) on credit; transport bags are donated. Labour and other inputs for erosion control measures (e.g. stone bunds) are not included in costs. Neem biocide costs US$ 0.7 per liter; organic cotton seeds cost US$ 1.7 per 50 kg.

Benefit-cost ratio

Inputs	short term	long term
Establishment	slightly positive	very positive
Maintenance	very positive	very positive

Remarks: Establishment costs are higher than revenues due to investments & initial decrease in yield (conversion period). On the long term, advanced farmers can achieve same or even higher yields than conventional cotton systems.

Ecological conditions

- Climate: subhumid (tropical, with high rainfall variability)
- Average annual rainfall: 750-1,000 mm per year
- Soil parameters: medium soil fertility, medium organic matter content; sandy or sandy-clayey texture; medium drainage
- Slope: mainly flat (0-2%), partly gentle (2-5%)
- Landform: mainly plateaus / plains, valleys
- Altitude: 300-500 m a.s.l.
- Cotton prefers dry, hot and sunny climate, a minimum of 500 mm of rain distributed over the vegetation period (5 months), deep clay soils (vertisols)

Socio-economic conditions

- Size of land per household: average cotton production area ca. 1 ha
- Type of land user: individual small-scale farmers; men and women; certain activities carried out in mutual help groups
- Population density: 60 persons/km^2
- Land ownership: group (family clans) / state
- Land use rights: individual
- Level of mechanisation: mainly manual labour, partly animal traction
- Market orientation: mixed (organic products for market; other crops such as cereals, legumes and root crops for subsistence)

Production / economic benefits

+++ Improved income: better price due to organic premium (50% more than for conventional cotton) compensates initial decrease of yields
+++ Reduced production costs: less expenses for inputs (- 90% compared to conventional cotton), gross margin is 30% higher
++ Reduced financial risk, less indebtedness for input provision

Ecological benefits

\+ Increased soil fertility and increased soil organic matter
\+ Increased water holding capacity of soils
\+ Increased biodiversity; Eco-balance between pests and beneficial insects
\+ No pollution of the environment through toxic chemicals

Socio-cultural benefits

\+ Income opportunity for women
\+ Enhanced health of humans and livestock (no health risks due to pesticides, diversified and organic food crops)
\+ Enhanced organisation (farmers groups)

Off-site benefits

\+ Reduced water pollution

Weaknesses ➜ and how to overcome

- Coexistence of organic and GM cotton resulting in high risk of contamination ➜ intensify training of farmers; set up a coordination platform between organic and GM farms; establish a sampling and testing system.
- Insufficient application of manure / compost ➜ training on compost production; Promote supply / production of organic manure (e.g. through small enterprises).
- Large distance to cotton fields (resulting in high transportation costs) due to interfering of browsing livestock close to village ➜ hay-making and corralling of livestock.
- Lack of land, land ownership and land security ➜ promote land leasing; resolve tenure problem on political level.
- Lack of equipment (e.g. plough) ➜ access to credits for small-scale farmers.
- Lack of water ➜ establish water retention structures.

Adoption

Cotton is the top export product in Burkina Faso and other West-African countries (50-60 % of export revenues). The proportion of organic cotton is growing. Actually 1% is produced organically. Around 7,000 farmers are producing organic cotton in Burkina Faso, of whom 28% are women.

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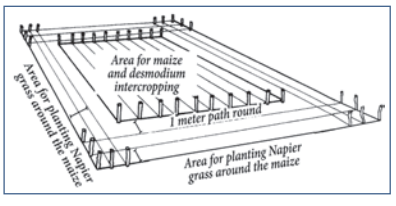
PUSH-PULL INTEGRATED PEST AND SOIL FERTILITY MANAGEMENT – KENYA

In the Lake Victoria region - like in many other parts of Sub-Saharan Africa – stemborer pests, striga weeds and poor soil fertility are the main constraints to efficient production of cereals. In combination they often lead to complete crop failure. The 'Push-Pull' technology efficiently controls the pests and progressively improves soil fertility. It involves intercropping maize with a repellent plant, such as desmodium ('push'); an attractant trap plant, such as napier grass (*Pennisetum purpureum*) is planted as a border crop around this intercrop ('pull').

The stemborer moths are attracted to volatile compounds emitted by the napier grass which at the same time serves as a haven for the borers' natural enemies. When moths lay eggs on napier grass a sticky substance secreted by the grass physically traps the moths' larvae. Napier is also an important carbohydrate-rich fodder grass. Desmodium, a perennial cover crop, produces repellent volatile chemicals that push away the moths, and the plant effectively suppresses striga weeds through its root exudates. Furthermore, desmodium fixes nitrogen, conserves soil moisture, enhances arthropod abundance and diversity and improves soil organic matter, thereby making cereal cropping systems more resilient and adaptable to climate change. Being a low-growing plant it does not interfere with the crops' growth.

Push-pull simultaneously improves cereal productivity; enables production of year-round quality fodder - thereby allowing for integration with livestock husbandry; diversifies income streams and enables smallholders to enter into the cash economy. It also improves soil fertility; protects fragile soils from erosion and enables a minimum tillage system. The technology is appropriate to resource-poor smallholder farmers as it is based on locally available plants, affordable external inputs, and fits well with traditional mixed cropping systems practiced in SSA.



SLM measure	Vegetative
SLM group	Trends and New Opportunities
Land use type	Annual cropping
Degradation addressed	Fertility decline and reduced organic matter content; Increase of pests / diseases
Stage of intervention	Prevention and mitigation
Tolerance to climate change	Technology is tolerant to climatic extremes

Establishment activities

1. Plant 3 consecutive rows of napier grass (*Bana* variety) around the plot: make planting holes, apply fertilizer (or manure), place 3-node canes or root splits, cover with soil (before rains).
2. Land preparation for desmodium: plough and harrow the land (to get fine soil), make furrows between the rows where the maize will be planted (using strong pointed stick; before rains).
3. Mix desmodium seed with super phosphate fertilizer (ratio 1:2), or alternatively with fine soil. Sow into the furrows and cover with soil (onset of rains).
4. Plant maize.
5. Weeding of maize, desmodium and napier grass (3 and 5-6 weeks after planting maize).
6. Manage napier grass: 1st harvest after 3 months (plants are 1-1,5 m high), leave stem height of 10 cm for quick regrow, start with inner row.
7. Cut desmodium for livestock fodder, leave a stubble height of 6 cm; or let it flower for seed production (and cut at a later stage for fodder).

Maintenance / recurrent activities

1. Land preparation for maize: carefully dig / plough between desmodium lines not to disturb / uproot the desmodium.
2. Plant maize.
3. Trim the desmodium so that it does not overgrow in between the maize plants (after 3 and 6 weeks).
4. Repeat activities 5.-7. listed under establishment.

Labour requirements

For establishment: medium
For maintenance: low

Knowledge requirements

For advisors: medium
For land users: low

Photo 1: A dense barrier of napier around the maize plot; Spacing of napier plants should be 75 cm between rows and 50 cm between plants within a row.
Photo 2: Desmodium is drilled in between maize rows at 75 cm row to row distance.
Photo 3: Overview of a push-pull plot (max 50 m x 50 m). (All photos by ICIPE)
Technical drawing: Layout of push-pull plot with1 m spacing between napier border and maize field. (ICIPE)

Case study area: Lake Victoria region, East Africa

Establishment inputs and costs per plot

Inputs	Costs (US$)
Labour: 8 person-days	10
Equipment / tools: planting stick / hoe	0
Agricultural inputs: 1,200 napier root splits or canes; 0.5 kg desmodium seeds; 47 kg superphosphate fertilizer	200
TOTAL	**210**
% of costs borne by land users	100 %

Maintenance inputs and costs per plot per year

Inputs	Costs (US$)
Labour: 6 person-days	7
Equipment / tools: planting stick / hoe	0
Agricultural inputs: 47 kg superphosphate fertilizer	32
TOTAL	**39**
% of costs borne by land users	100%

Remarks: Size of push-pull plot for the cost calculations above = 0.25 ha.
Input prices (in US$): 1 person-day = 1.2 US$; 1 napier root split / cane = 0.14 US$.; 1 kg desmodium seeds = 18.9 US$.; 1 kg superphosphate fertilizer = 0.68US$.

Benefit-cost ratio

Inputs	short term	long term
Establishment	positive	very positive
Maintenance	positive	very positive

Adoption

The technology is based on low external inputs and is adapted to the traditional mixed cropping systems in Africa. To date it has been adopted by over 29,000 smallholder farmers in East Africa, mostly without incentives. Where the technology is being introduced for the first time, farmers only need demonstration and technology information.

Ecological conditions

- Climate: mainly subhumid; bi-modal rainfall pattern, with main rainy season March-May; short rainy season October-November
- Average annual rainfall: 700-1,100 mm per year
- Soil parameters: low fertility, low to medium depth, medium drainage, low organic content; texture is mostly loamy clay, partly sandy
- Slope: < 10 %.
- Landform: mainly valleys, plains, and footslopes.
- Altitude: 1,200 – 1,250 m a.s.l.

Socio-economic conditions

- Size of land per household: 2 ha; production area: 0.9 ha
- Type of land user: small-scale; very poor to poor; mainly Individual farmers, some organised in informal groups
- Population density: 440-850 persons/km^2
- Land ownership: mainly individual (titled or not titled); communal; state
- Land use rights: mainly individual, leased; seldom communal (organised)
- Level of mechanisation: equally manual labour, and animal traction
- Market orientation: mainly subsistence (self-supply), starting small-scale commercial

Production / economic benefits

+++ Increased crop production: maize yields increase by 25-50% where stemborer is the only problem and by 300% in areas affected by stemborer and striga weed
+++ Increased fodder production: all-year round quality fodder for cattle (napier grass and desmodium)
+++ Increased income: selling cereal grains, desmodium seed, napier grass (if not fed to own livestock), and milk
+++ Reduced financial constraints: reduced fertilizer inputs thanks to nitrogen-fixing by desmodium
++ Reduced workload: weeding is minimised

Ecological benefits

+++ Increased soil fertility
+++ Increased soil organic matter
+++ Reduced soil loss: soil protected from erosion through desmodium (cover crop) and napier grass (barrier)
+++ Increased ground cover (cover crop, live mulch)
+++ Increased soil moisture (cover crop, live mulch)
+++ Reduced wind impacts due to napier barriers

Socio-cultural benefits

+++ Social capital generated through common learning and implementing agricultural 'best practices'

Off-site benefits

+++ Improved nutrition and both on-farm and off-farm employment

Weaknesses ➜ and how to overcome

- Napier grass is an aggressive plant that spreads through rhizomes under the ground ➜ regular control and weeding.
- The older napier stems and leaves are less palatable for livestock ➜ regularly cut young, tender leaves and stems.
- Minor adjustment of the smallholder farming system to introduce desmodium in traditional maize-bean intercrops ➜ desmodium (fodder crop) and beans (food crop, important protein source) can both be intercropped with maize. In areas where striga weed is not a problem, farmers can plant desmodium after every 3 or 5 rows of maize, and use the other rows for beans. Stemborers will still be repelled.

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EQUITABLE PAYMENTS FOR WATERSHED SERVICES - TANZANIA

Equitable Payments for Watershed Services (EPWS) is a programme using Payments for Ecosystem Services (PES) to improve rural livelihoods. Incentive mechanisms are used to reward upstream landowners for maintaining a beneficial land use or for adapting a particular land use practice which affects the availability and / or quality of downstream water resources. The EPWS approach has enormous potential to advance a new conservation revolution based on a compensation mechanism encouraging and financing conservation efforts as well as improving the livelihoods of the rural poor.

Equitable Payments for Watershed Services (EPWS) aims to spread SLM technologies to communities, to raise awareness of the benefits of SLM and to improve land productivity. Farmer groups are formed to lead the implementation of SLM. The approach includes supervision, support and training of farmers to ensure appropriate implementation of SLM and efficient soil erosion control. Methods include demonstration plots and farmer-to-farmer extension. Capacity building to farmers (on gender mainstreaming, good governance and relevant laws and policies) and monitoring of hydrological and livelihood status are important components of the approach. Efforts to ensure good women integration resulted in a relatively high proportion within the farmer groups (>35%).

A payment mechanism has been established to compensate farmers for delivering watershed services (in form of freshwater) through implementation of SLM. Compensation payments – paid in cash and through material support – are made first to establish land use changes, and thereafter for service delivery and maintenance. They are mainly covered through international donors (DANIDA) and 'buyers' from the private sector, investing in watershed management.

This PES approach is very new in the country and there is little expertise within the government – which therefore needs to take deliberate efforts to groom experts through seminars and courses on PES mechanisms and its operationalisation. The EPWS team consisting of CARE International, WWF staffs and short term workers (such as students) is always involving government staff in various activities to induce them to knowledge on EPWS in particular and the PES concept at large.

Type of approach
Traditional / indigenous and project / programme based.

Problems / constraints addressed
– Land cover changes due to extensive cultivations
– Deforestation and forest degradation
– Soil erosion, loss of soil fertility
– Low storage capacity of the Uluguru Mountains due to land cover change
– Declining amount of available water in the river coming from Uluguru Mountains
– Increase run-off and sediment load in water system due to bare lands

Aims and objectives
– Improve livelihoods through SLM
– Improvement of hydrological system
– Mechanism to ensure effectiveness, growth and sustainability of EPWS
– Enhance quality of program implementation

Target groups
Land users and land use groups (village farmers, women), SLM specialists (experts on hydrology, GIS, SWC, economics, forests, etc.), politicians and policy makers (district commissioners, ward councillors)

Participation and decision-making
– Interactive implementation and decision making
– Participatory feasibility studies to identify the core problems
– PRA to identify and agree on SLM technologies
– Government staff was involved in various activities e.g. planning, training, data collection and analysis, extension, etc.

Implemented SLM / other activities
Excavation of terraces (esp. *Fanya juu* / *chini*, bench terraces), agroforestry and reforestation, agronomic practices (intercropping, legume crops), grass strip planting, applications of manure and indigenous pesticides.
Apart from SLM sustainable livelihoods activities were implemented.

Implementing bodies
Care International Tanzania, WWF Tanzania Country Office, DAWASCO and Coca Cola KLtd, Morogoro district council through agriculture officers, communities

Land users' motivation for implementing SLM
Affiliation to the project, environmental consciousness, well-being and livelihoods improvement, payments according to PES.

Photo 1: Man observing maize growth after changing his practices to *Fanya juu* terraces. (Erasto Massoro)
Photo 2: Farmers excavating *Fanya juu* terraces to reduce run off and improve crop production. (Erasto Massoro)

Case study area: Uluguru Mountains, Morogoro, Tanzania; 10-100 km² covered by EPWS Approach

Costs and subsidies

Annual budget: 100,000 -1,000,000 US$

Approach costs were met by the following contributors / donors:

International (DANIDA)	60 %
Private sector (buyers)*	9 %
Local community (through labour power)	31 %
TOTAL	**100%**

**'buyers' are downstream beneficiaries who pay or provide rewards for managers of the watershed upstream (='sellers')*

Subsidies financed under the approach:
Farmers are being compensated (paid in cash) for labour and area provided for the implementation of SLM (opportunity costs). Material support through manure, seeds and working tools is given as well.

Externally financed inputs	
Labour	fully financed (paid in cash)
Agricultural inputs (seeds, fertilizers)	partly financed
Equipment	partly financed

Remarks: The PES system pays for delivering of watershed services which is freshwater (quantity and quality). Payments are made first as compensation to establish land use changes, later for service delivery. EPWS Tanzania is currently facilitating payments for establishment and maintenance of the land use change.

Training and awareness raising

Training was provided to land users by SLM specialists and agricultural advisors. Farmer-to-farmer exchanges with neighbouring communities have improved the capacity of local leaders and farmers' representatives on practical skills on SLM measures, leadership skills, governance, gender mainstreaming, policies and laws to ensure their understanding on the implementation of the EPWS project in their locality.

Advisory service

Included: technical support on monitoring, provision of extension services for improved land use, situation analysis, awareness creation, capacity building on legal issues and mapping of interventions.
People involved: University, foresters, hydrologists, Ministry of Agriculture, land use planners.

Research

Research is a main part of PES as an approach to facilitate SLM adoption and has been very effective in guiding programme design; it included SLM assessment, hydrological analysis, economic analysis, social and livelihoods assessment, etc. All interventions applied were proposed by research conducted before and during implementation.

Organisation / capacity development

Country with limited experts to operationalise the new PES approach. Government needs to take deliberate efforts to groom experts through courses. Government staff is involved in various activities to induce them with knowledge on EPWS.

Benefits of SLM Approach

The project is still in initial stage - impacts can not be fully assessed yet

++ Improved sustainable land management: increased production

++ Improved livelihoods / human well-being

++ Improved situation of socially / economically disadvantaged groups: women have gained training in improving land use practices

++ Poverty alleviation: through change of crop production

Strengths

- Approach rewards land users for providing watershed services
- PES as an additional argument for supporting property claims
- To ensure services are delivered and payments are made and a reliable monitoring mechanism has been put in place
- Poor people are in the centre of the objectives
- PES as an incentive for conservation, helping to change

Weaknesses ➜ and how to overcome

- May reduce the effectiveness of non-incentive based approaches as people will now demand rewards / payments ➜ awareness creation is important to all players including government and local communities.
- Payments / rewards are realised before service delivery ➜ ensure integration of PES with other approaches to ensure effectives short and long term benefits. Paying labour cost upfront while waiting for the service delivery rewards.

Sustainability of activities

Participant land users can continue the activity without additional support-maintenance costs are low and the technologies will improve productivity and resilience of the farming system. Upscaling to neighbouring villages will be facilitated by the establishment of networks of farmers groups to receive training by local extension services. A steering committee, with representatives of the farmers, investors and government offices will facilitate replication in other parts of the country.

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CONSERVATION APPROACH FOR KOURÉ GIRAFFES - NIGER

The giraffe population in Kouré, Niger is unique because: (1) it includes the last representatives of white giraffes (*Giraffa camelopardalis peralta*) worldwide; (2) it thrives in an unprotected environment without any natural enemy (besides man); (3) it is in direct contact with rural communities and its livestock. The giraffe, reduced to only 49 individuals in 1996, was in danger of extinction due to a variety of reasons, the main one being the progressive deforestation in their habitat: the *brousse tigré* savanna vegetation. From 1996-2000, a government programme funded by international development agencies (SNV*, FFEM and the EU) has been carried out to sustainably protect the giraffes and their habitat. This program is based on a participatory approach which actively involves local people in conservation activities, while simultaneously strengthening local development and promoting ecotourism. Its revenues are redistributed to all local actors. A main pillar of the approach was the transfer of responsibilities in natural resources management to local organisations. User groups, a guides' association, a project steering committee, etc. were formed and its members were trained.

Tourism and wildlife observation infrastructure was established – including a visitor's centre, lodging, watch towers, etc. – and tourism activities were organised: Guides are trained, registered and organised into an association. They receive a fixed salary and accompany tourists in turns. Furthermore they support project technicians and researchers in monitoring giraffes and collaborate with the network of government-employed foresters, which has been set up to control the conservation of the habitat.

Tourists pay an entry fee for wildlife watching tours. The revenues and donations are partly used for management and conservation of the giraffe habitat and partly for socio-economic development of the villages (such as infrastructure projects). These revenues are managed directly by the '*communes*' (municipalities).

Thanks to the protection of the savanna vegetation through enclosures for regeneration, prohibition of cutting and closing down of rural wood markets the giraffe population has recovered considerably, comprising 200 individuals in 2008.

**SNV: Netherlands Development Agency; FFEM: French Fund for World Environment; EU: European Union*

Photo 1: Giraffes around the village of Kouré. (Ahmed Oumarou and ECOPAS*) * ECOsystèmes Protégés en Afrique Sahélienne

Type of approach

Project based (PURNKO - *Projet Utilisation des Ressources Naturelles de Kouré*)

Problems / constraints addressed

– Conflicts between giraffes and local population (damage to crops)
– Extinction of giraffes
– Deforestation (giraffe habitat deterioration)
– Rural poverty
– Negative perception of fauna by the population
– Absence of titled land ownership and of adapted forestry laws

Aims and objectives

– Durable and sustainable conservation of the giraffe population in the Kouré area and protection of their habitat.
– Building organisational and management capacity of the local population for protecting the giraffes.
– Fight against poverty by offering supplementary revenue to population through ecotourism (diversification of income).

Target groups

– Agropastoral land users (individuals / groups)
– SLM specialists / advisors
– Planners and decision-makers
– Tourists, women, artisans, teachers and students, national visitors

Participation and decision-making

Initiation: Ministries of planning, environment, tourism and artisan, EU, Association of French Volunteers for Progress (AFVP), SNV, beneficiaries
Planning / implementation: Kouré Guides Association (AGK), groups of beneficiaries, project advisors and animators
Monitoring / evaluation: AGK, groups of beneficiaries, project advisors and animators, department of Environmental Protection
Research: French Center for Agricultural Research for Development (CIRAD), University of Niamey, National Agricultural Research Institute of Niger (INRAN), International Union for Conservation of Nature (IUCN) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Implemented SLM / other activities

SLM measures: planting of palatable trees, semi-circular micro-catchments and planting pits for water harvesting, rill and gully rehabilitation, trenches, small dams, stone lines, enclosures and assisted natural regeneration
Other activities: health, education, infrastructure, trade, micro-credit, river works, forest surveillance

Implementing bodies

International institutions / agencies, national and local government, local communities, land users, researchers

Land users' motivation for implementing SLM

Increased revenue, profitability, improved livelihood

Case study area: Kouré, Tillabéri / Dosso region, Niger; 840 km² covered by approach

Costs and subsidies

Annual budget: US$ 189,000

Approach costs were met by the following contributors / donors:

International: EU	63,3%
International NGO: SNV	18,9%
International: FFEM	17,8%
TOTAL	**100%**

Remarks: Contribution of local populations hadn't been estimated.

Subsidies financed under the approach:

Externally financed inputs	
Labour of populations	not financed
Labour of project technicians	fully financed
Agricultural inputs & construction material	fully financed
Infrastructure (tourism, etc.)	fully financed
Village development funds	fully financed
Giraffe habitat management	fully financed

Access to credits

Through village development fund; micro-credit was allocated without interest to women of women groups for agriculture or livestock production. Repayment occurred after six months. After termination of the project, 'Care International' continued giving credit however with interest.

Repartition of revenues (2007)

Repartition of tourism revenues: 50% for local communities / villages, 30% for giraffe habitat management and 20% for the government.

Training and awareness raising

- Beneficiaries of training program: members of community management committee, land users (women and men), professional guides, advisors
- Form: on-the-job, farmer to farmer, demonstration areas, public meetings, courses, site visits and field trips
- Topics: Conservation technologies and SLM, ecotourism, professional guide skills, organisation of associations, accountancy, agriculture

Advisory service

Dissemination of the approach was by rural animation tools (village planning, rapid PRA, etc.). The Youth Association for Preservation of Natural Resources (AJPREN), U.S. Peace Corps, AFVP and local departments for Environmental Protection ensured a continuous programme of training, environmental education and awareness raising of guides and local people.

Research

Research had been conducted on-farm in collaboration with local populations. Research topics treated were socio- economical, ecological, technical, giraffe habitat and genetics and agricultural.

Organisation / capacity development

The second phase of the project (1996-1998) was entirely dedicated to organisational development including creation of a Monitoring Committee, a decentralised Development Board, a professional Association of Guides, an Informants Network, an Association of Artisans, women groups, 20 management committees of village development funds, etc. On one hand partners have implemented capacity building programmes to train the different stakeholders and on the other hand for financial and logistic support.

Benefits of SLM Approach

+++ Improved sustainable land management: one director for the planning and management of the giraffe area was appointed

+++ Adoption of Approach by other land users / projects: the *ECOsystèmes Protégés en Afrique Sahélienne* (ECOPAS) project adopted (2002) this approach which became the basis for national planning action for giraffes in Niger

+++ Improved livelihoods / human well-being: 3,811 €/village had been distributed to the population of 20 villages through village development funds

+++ Improved situation of socially / economically disadvantaged groups: financial support to women for agricultural production

+++ Poverty alleviation: creation of 13 permanent guide jobs; 900 woman developed agriculture production for marketing

+++ Other: conflicts mitigation (between giraffes and population)

Strengths

- Populations organisation and mobilisation
- Economic, financial and ecological impacts
- Scientific research tools for decision making

Weaknesses ➜ and how to overcome

- Absence of local and national financial contribution ➜ provide regressive grants and promote endogenous funding of activities.
- Approach resulted from exterior initiatives ➜ awareness raising and environmental education to develop 'conservation behaviour' in Niger.
- Uncontrolled fast growth of giraffe population ➜ transfer of giraffes to other protected habitats in West Africa.

Sustainability of activities

After the project was terminated, land users continued this approach without external support based on local development organisations, *Association pour la Sauvegarde des Giraffes du Niger* (ASGN) and Kouré Guides Association (AGK). Since 2002, the research component is being continued by ECOPAS / EU.

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