This factsheet presents an idea of how to fund the long term implementation of effective improvements in agricultural practices linked to improving environmental services.

Adding value to smallholder farmers practicing conservation agriculture through PES for carbon sequestration and improved water infiltration.
Showing project area in Kenya and sample of LDSF data collection site.

Adding value to smallholder farmers practicing conservation agriculture through PES in Kenya

Overview

Global crop production needs to double by 2050 if the world is to meet the projected demands of rising populations [1]. As D K Ray et al state *'…Boosting crop yields to meet these rising demands, rather than clearing more land for agriculture has been highlighted as a preferred solution to meet this goal…'.* The greatest challenge for the developing world is to provide incentives for farmers that increase agricultural production efficiencies at farm gate level.

Traditionally, slash & burn practices and the migratory nature of African farming practices provided recovery (fallow) periods that were long enough for the land to recover. Over the past 5 decades, changes in land tenure laws, finite land resources and rising populations have reduced the viability of these systems. These factors compounded with the lack of investment in agricultural support services and infrastructure have further reduced farm gate productivity and increased rural poverty. Simple and innovative ideas are urgently required it Africa is going to be able to feed itself whilst protecting its delicately balanced finite natural resources.

Conservation Agriculture (CA)* is a simple process that improves yields and reduces environmental degradation. Its implementation across agricultural heartlands will improve farm gate efficiencies and productivity. Adding effective landscape scale Payments for Ecosystem Services (PES) across Africa's agricultural heartlands to monitor and incentivise the ecosystem improvements would provide the seed capital required to implement CA and embed it within agricultural policy and development strategies. Yet the growth of landscape scale PES has been hampered due to various factors. To overcome these constraints, we propose a **PES scheme that could offer cost effective monitoring of changes in land health across landscapes, building on the land health monitoring methods developed at ICRAF.**

Timely agricultural practices go hand in hand with the minimum tillage concepts of CA.

- Planting as early to the start of the rains as is possible, maximizes the crops potential
- Less disturbance of soil results in a lower weed burden
- Accurate fertilizer and/or manure application improves crop nutrient utilisation
- Overtime, crop residue retention improves above and below ground biological diversity, further reducing environmental degradation and improving water infiltration
- Soil carbon sequestration of up to 1.8 tons CO_2 per hectare per year can occur[2]

The implementation of CA will lead directly to improved food security[3] and enhanced environmental ecosystems. Expansion of CA across Kenya will come at an expense. As Nyanga P. H, identified in his analysis of CA in Zambia[4], the effectiveness of CA uptake involves a combination of regular trainings and farmer contact meetings and an increase in the availability of CA equipment.

* In the discussions in this document the words Conservation Agriculture (CA) are used in the context of minimum tillage techniques that are currently being implemented in Kenya.

Background

Behavioural change in any community takes time[5]. Donor funds can be effective in providing the seed capital required to start the process but long-term change is only possible through long-term commitment. To tackle this expense, the development of a market for the PES (improved C sequestration and water infiltration) generated from the implementation of CA, offers commercially attractive investment opportunities in the third world whilst also improving livelihoods.

The growth of landscape scale PES has been hampered due to:

1) High monitoring costs of the smallholder holdings that predominate.
2) The lack of a scientifically rigorous methodology to establish an effective baseline and provide a statistically representative model of changes in the environment over time.
3) The Seed capital to develop, test and market an effective landscape scale PES system based on soil fertility and water infiltration.

The authors of a UNDP report [6] on PES define it as follows;;

1. a voluntary transaction in which
2. a well-defined environmental service (ES), or a form of land use likely to secure that service
3. is bought by at least one ES buyer
4. from a minimum of one ES provider
5. if and only if the provider continues to supply that service (conditionality).

The requirement in any PES scheme for designated boundaries i.e. '…a well-defined environmental service, or a form of land use…' to ensure transparency, minimise leakage and provide commercially viable quantities of credits is understandable and not disputed. The costs of developing and establishing such projects can be prohibitive, however, and many smallholder farmers are not in a position to comply with requirements unless intensive support and assistance from intermediaries is assured [7]. Whilst donor funds can provide the seed capital for this development, these funds tend to be time-bound and community-targeted. This limits the expansion of the PES beyond the project(s) designated boundaries and thus denies many smallholders the benefits of obtaining PES.

To overcome these constraints, we propose a **PES scheme that offers cost effective monitoring of changes in land health across landscapes, building on the land health monitoring methods developed at ICRAF.** Using this framework [8], rigorous scientific baselines can be established and change over time can be monitored (Figure 1) at individual smallholder farm level (Vågen, Winowiecki, Abegaz, & Hadgu, 2013 [9]). **Through the implementation of CA practices across the landscape where the monitoring is being conducted, changes in ecosystem services can be accounted for and monitored at 3 to 5 year intervals.**

[1] Yield Trends Are Insufficient to Double Global Crop Production by 2050: Deepak K. Ray et al, Institute on the Environment (IonE), University of Minnesota, Saint Paul, Minnesota, United States of America*

*[2]SOIL CARBON SEQUESTRATION IN CONSERVATION AGRICULTURE, A Framework for Valuing Soil Carbon as a Critical Ecosystem Service, Conservation Agriculture Carbon Offset Consultation – West Lafayette, Indiana, USA, 28-30 October 2008
United Nations Food and Agriculture Organization (www.fao.org) and Conservation Technology Information Center (www.conservationinformation.org)*

[3]An African success: the case ofconservation agriculture in Zimbabwe, Lungowe Sepo Marongwe1 et al, Earthscan 2011*

[4]Factors Influencing Adoption and Area under Conservation Agriculture: A Mixed Methods Approach, Sustainable Agriculture Research; Vol. 1, No. 2; 2012, ISSN 1927-050X E-ISSN 1927-0518, Published by Canadian Center of Science and Education

[5]J Winefield, Recommendations for behaviour change programs, to reduce GHG impact in SA,(2005)

[6]Payments for Ecosystem Services Getting Started: A Primer, May 2008, © 2008 Forest Trends, The Katoomba Group, and UNEP, ISBN: 978-92-807-2925-2Job Number: DEP/1051/NA

Ecosystem Services

The benefits of Conservation Agriculture (CA), which have been highlighted by Hobbs [10], (amongst others) are: yield gains, more efficient use of labour thus increasing productivity, improve water and nutrient use efficiencies and increased biotic diversity in the soil.

The introduction of CA will reduce tillage, increase crop retention and improve soil structure. The project will measure and quantify these improvements through GIS monitoring, backed up by ground truthing using the Land Degradation Surveillance Framework (LDSF). Improvements in Soil Organic Carbon (SOC) over time will be valued and Carbon (C) sequestration per unit area will be established.

PES payments will be undertaken in arrears. Participating farmers will have their farming practices monitored over two seasons. Based on these cropping practices, estimate C sequestration and improvements in water infiltration will be calculated. Farmers will receive payments based on 50% of this potential C sequestration. With every year a farmer continues using CA he/she will be improving the soil structure, sequestering more C and improving water infiltration. The environmental baseline established using the land health methods in year one will be used to guide these calculations.

The project will develop partnerships with organisations establishing Water Resources User Associations (WRUAs) in the areas that it operates in. Working closely with these organisations the project will develop and value the ecosystem services provided by the improvements in water infiltration, resulting from the implementation of CA. Leveraging these relationships the project will work closely with county governments to develop an equitable system for payment for these services by the counties.

Further ground truthing assessments using the LDSF reference points established during the baseline, will be undertaken every 5 years. The results from these additional baselines will be used to assess the accrued benefits across the landscape. At this stage farmers who have continuously used CA will be offered additional payments based on actual C sequestered and improvements in water infiltration. This new baseline will then be used to assess further improvements as the project progresses.

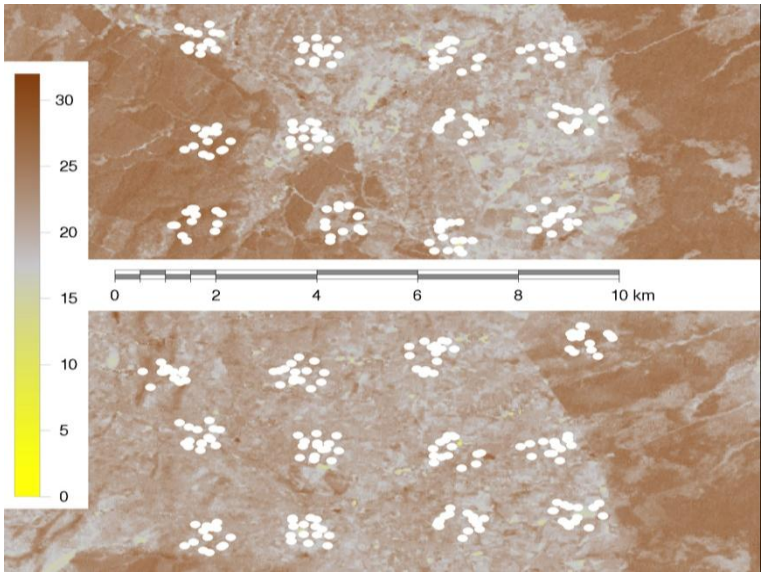


Figure 1. Map of Nyahururu showing predicted soil organic carbon (SOC) in 1986 (top) and 2006 (bottom) based on land health field surveys (white dots) in the project area.

Key:
1) White spots are LDSF survey sites
2) Darker areas are forest area – hence higher C stocks
3) Yellow areas indicate very low C stocks
4) Comparing the two pictures the 'contrast' in the lower picture is lower i.e. difference between shades of grey. This indicates a general lowering of C stocks over the years.
5) The fragmentation of the farms over the period is also obvious.

The potential market and its contracts

The Market

Ensuring the rigorous monitoring & evaluation needed to ensure that the PES on offer actually deliver, is an essential and costly component of all PES schemes. Traditionally the cost effective method to undertake this has been to define a project area i.e. watershed and then incorporate all farmers within this area into the project. This however limits the opportunity of other small-scale farmers outside the defined project area, who may also want to capitalise on the economic opportunities presented. This constraint can be overcome by using satellite and state of the art GIS programming. It enables individual small holders to identify and define their farm as a "project" site. Monitoring the land tillage techniques, cropping patterns, crop management, crop development and crop yields through the use of GIS technology will greatly reduce Management, Reporting and Verification (MRV) costs whilst providing real time assistance to farmers.

Contract

As mentioned above behavioural change takes time. Payments for farmers who practice and continue to practice CA will be tiered such that farmers get an increased percentage the longer that they practice CA. The balance surplus of the funds will be used by the project developers to fund an 'extension services' to increase the expansion of CA within farming communities, expand the safe use of agro-chemicals within these CA farmers and provide project management fees for MRV and the fund administration.

A typical contractual agreement between the sellers and the buyer includes name and details of the farmer, their next of kin, payment terms and methods etc. In addition, it will include the following key elements;

1) Proof of Land Ownership and / or tenure.
2) Period dates that clearly identify CA implementation start dates.
3) Clear understanding of the farming techniques to be employed.
4) Clear understanding of the MRV procedures, both GIS and ground truthing to be used.
5) Arbitration rules and their implementation in case of a dispute

Regulation

Currently Kenya has no formal PES regulatory framework. This project will therefore use the UNDP and World Bank PES guidelines to monitor and develop the most appropriate practices.[11]

[7] B Maza, J Barkman, F Von Walter, R Maggraf: Efficiency and Distributional impacts of protected area planning using PES schemes in the Biosphere Reserve "Podocarpus-El Condor, Ecuador; Georg-August-University Gottingen, Germany. Page 1 "…we conclude that the severe trade-offs between cost efficiency and poverty alleviation are likely to impact PES application…"
D K Willy, A Kuhn, K Holm-Mueller: Payments for Environmental Services (PES) and the Characteristics of Social Ecological Systems: the case of the Lake Naivasha Basin: Agricultural and Research Economics, Discussion Paper 2012:5. Institute for Food and Resource Management, University of Bonn, Germany. Page 15 "…due to prohibitively high transaction costs there is no possibility for a user to act alone…"

[8]Tor G. Vagen, L Winowiecki, L T Desta, J E Tondoh. Land Degradation Surveillance Framework, Field Guide. (2010). http//worldagroforestry.org, http://africasoils.net

[[9] Vågen, T., Winowiecki, L. A., Abegaz, A., & Hadgu, K. M. (2013). Landsat-based approaches for mapping of land degradation prevalence and soil functional properties in Ethiopia. Remote Sensing of Environment, 134, 266–275. 9]

10] Conservation Agriculture: What Is It and Why Is It Important for Future Sustainable Food Production? Hobbs P R, Department Crops and Soil Sciences, Cornell University, Ithaca NY, 14853 USA

[11]eg: Getting Started PES UNDP.pdf; World Bank PES guidelines

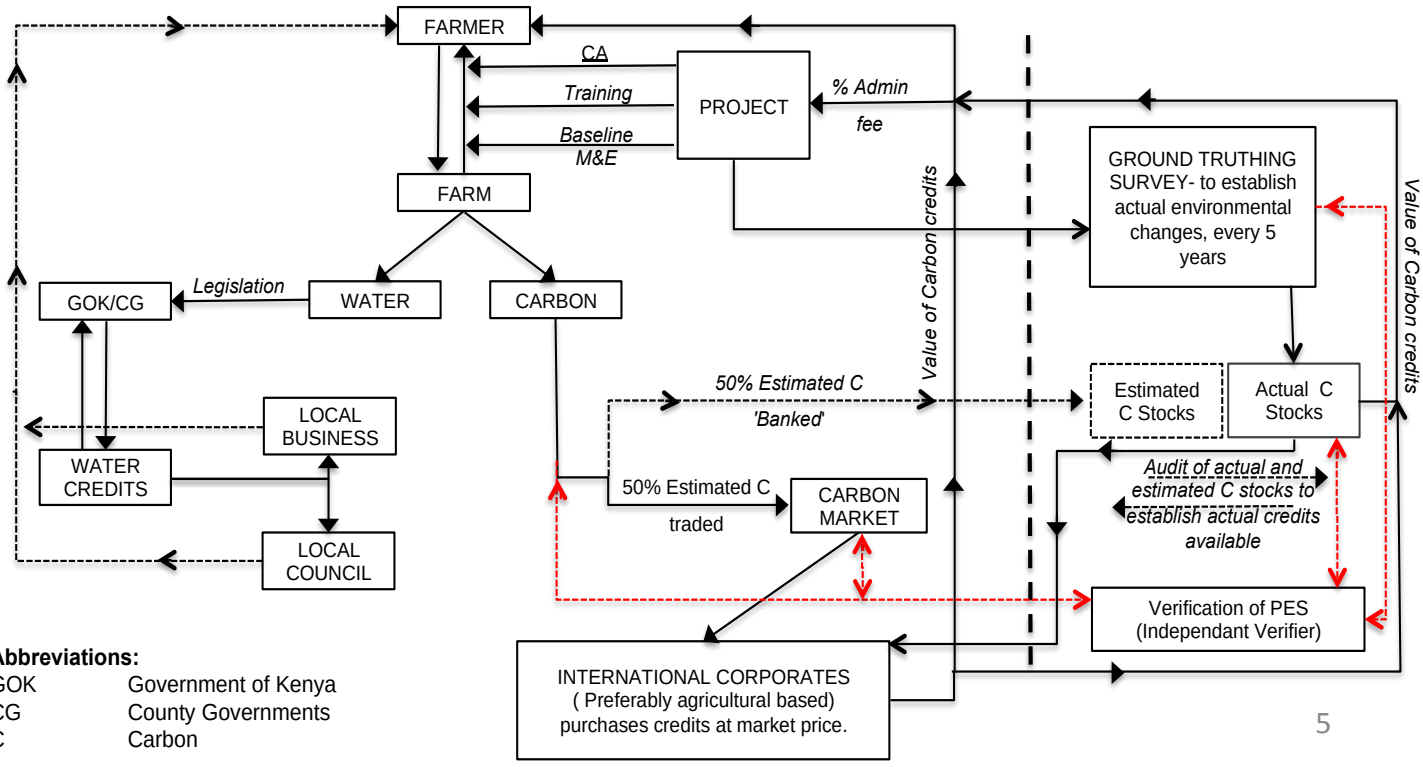
Stakeholders

The core stakeholders in the project are the individual smallholder farmers who adopt CA as an improved management practice and thus enhance household food security. Over time these will become the primary beneficiaries of any payments.
Donor/grants funds will be required in the first two years of the project to create the necessary infrastructure for the project and to establish credibility among the local stakeholders that the project is feasible . These funds will be used to increase the robustness of the GIS monitoring tools, implement and adapt an effective and recognized PES methodology across the project landscape and demonstrate the investment incentives to international agrochemical corporates.

The project will target these corporates offering them a two-tier investment opportunity. Initially by purchasing carbon credits these corporates can offset their international C emissions. Contractual agreements between the buyer (corporate), the seller (farmer) and the project administrator, will allow the buyer to trade any credits thus purchased for a defined period of time (i.e10 years).

Secondly as a portion of these funds will be used to develop extension services corporate buyers will be able to use this opportunity to market their products directly to farmers and thus increase sales. Thus the project's approach will offer financial incentives to both parties while increasing the sustainability of the project.
Initially the local administration and larger government involvement will be minimal, as the project will deal directly with farmers. Nevertheless it is anticipated that new policies and regulations will be implemented and the project will take account of these as they are introduced.

Figure 2. key stakeholders and their relationships



Abbreviations:

GOK	Government of Kenya
CG	County Governments
C	Carbon

Future outlook

Innovation

This project idea offers international corporate organisations, preferably those working in the agricultural sector, a means where they can add value to their CSR funds and provide incentives for improvements in agricultural practices resulting in improved food security. In addition to this they can offer farmers direct access to their products and through this improve efficiencies of labour and inputs at farm level and reducing land degradation. In sum this project offers the perfect opportunity for corporate funds to invest in third world development, offering a sustainable business development model linked to improvements in ecosystems.

Challenges

A primary challenge is to identify areas where there are existing CA programs and adding the PES MRV tools to this program. To do so, the project would need the seed capital required to implement the first stage of the project, namely the adaption and implementation of a recognized PES scheme across the selected landscapes.

Partnering with an existing CA project within the area will offer the developers an entry point into the farming community. Working with Lead Farmers who have already benefited from improved food security as a result of implementing CA, will ease the discussions over the financial incentives and benefits possible from the scheme. Identifying the 'true' landowner and ensuring the title of the land as valid is probably the greatest cost in the implementation of this project. The new Kenyan government (in campaign pledges) has promised to digitize the country's land registry, which will increase transparency and greatly reduce institutional obstacles, but whether 'promise' translates into 'action' remains to be seen.

With the development of the GIS tools and models, Monitoring, Reporting and Verification (MRV) of the project and individual farms will become less costly and more effective . Through IT systems buyers and other interested parties will be able to roughly check the situation on the ground at any time. Ground truthing at a rate of five years, undertaken by an independent party, will further enhance the robustness of these tools. Developing trust between the PES buyer (corporate) and the seller (farmer) will take time. Managing the negotiations between both will be crucial to the long term goals of all stakeholders. Keeping open lines of communication through the use of mobile phone platforms and IT systems, will enhance and cement this trust.

Contact
Finn Davey (fdavey.efti@gmail.com)
Director WAJIBU MS
Le Rustique
General Mathenge Avenue
Nairobi, Kenya

Contacts

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Food and Agriculture Organization
of the United Nations
Viale delle Terme di Caracalla
00153 Rome, Italy
www.fao.org

Dr. Philipp Aerni
FAO-NRD/ETH Zurich
Philipp.Aerni@fao.org

Bernardete Neves
FAO-NRD
Bernardete.Neves@fao.org

Stéphane Jost
FAO-NRD
Stephane.Jost@fao.org

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Eidgenössische Technische Hochschule Zürich
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