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Sustainable Agriculture – A Panacea for Achieving Biodiversity Conservation and Rural Development in Sub-Saharan Africa?

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1. Introduction

There is inseparable link between agriculture and biodiversity (broadly referring to the variation and richness of wild species of plants, animals and micro-organisms existing and interacting within an ecosystem). Natural biodiversity provides the foundation for agricultural plants and domesticated animals, on which humans rely for food and livelihood sustenance. Biodiversity also performs many ecological services, including pollination of agricultural crops such as fruit trees and major staple crops, recycling of nutrients, controls local microclimate, regulates local hydrological processes, controls abundance of undesirable organisms, and detoxifies noxious chemicals (Altieri, 1999). Additionally, the vegetative cover of forests and grasslands prevents soil erosion, replenishes ground water and controls flooding by enhancing infiltration and reducing water runoff. Furthermore, biodiversity provides a wide variety of food (wild vegetables, game meat, fish, fruits, nuts etc.), fibre, herbal medicine, and fuelwood on which rural people depend.

Dependence on extractive use of biodiversity is more prominent in semi-arid areas, where due to erratic and insufficient rainfall ($\leq 400\text{mm/annum}$); yields from agricultural production are generally poor – impelling rural communities in these areas to largely rely on natural resources to satisfy their nutritional needs. This reliance is aggravated by limited and unexploited economic opportunities in most rural areas; hence poverty in all its manifestation, such as undeveloped human capital, and lack of physical, economic and social capital assets is entrenched in the rural SSA. Dependence on natural resources, coupled with shifting cultivation, which prevails in these areas, contributes to degradation of biodiversity due to encroachment of agricultural activities into wildlife habitats, leading to undesirable depredation of agricultural crops and livestock by wild animals. Consequently, rural communities often consider wildlife, an important component of the region's biodiversity, as a cost and not as an asset for enhancing their livelihoods through, for instance, ecotourism development.

To address these challenges, some conservation non-governmental organisations (NGOs) are developing and implementing strategies – focused at integrating sustainable agricultural practices into biodiversity conservation programmes, both at local and large landscape

scales - primarily to improve food security, reduce agriculture encroachment into wildlife habitats and minimise rural communities' over-use of biodiversity resources; and thus, contribute to biodiversity conservation.

In this chapter, we review the performance of conventional agriculture in sustaining food security and as a driver of rural development in Sub-Saharan Africa (SSA); examine the performance of current attempts to integrate sustainable agriculture and biodiversity conservation efforts; and discuss conditions under which sustainable agriculture could improve food security, and contribute to biodiversity conservation outcomes and rural development, especially in SSA.

2. Performance of conventional agriculture in SSA

Agriculture plays a pivotal role in sustaining economic growth and food security in the SSA countries, accounting for 30 per cent of the gross domestic product (GDP) and employs on average, 75 per cent of the population (Commission for Africa 2005). Total agricultural output in SSA consists primarily of food crops, with export crops accounting for only 8 per cent of the total agricultural production (Peacock, et.al 2007). A reflection on agricultural performance indicators however shows SSA falling well below other developing regions in the proportion of the area irrigated, value added per worker, fertilizer use levels, and productivity growth in both crops and livestock sectors. SSA currently lags behind all other regions in agriculture productivity. For example, in 2001, cereal yield in Africa averaged 1,230kg/ha compared to 3,090 kg/ha for Asia, 3040kg/ha for Latin America and 5470 kg/ha for European Union (NEPAD 2004). This is a reflection, amongst other constraints, of the degradation of the natural resource base and limited access to, and use of, improved technologies. These problems can be addressed through investment in soil fertility, greater use of fertilizers and cheaper organic inputs, as well as better management and use of improved seed varieties. The limited growth in agricultural production in SSA, accounting for about one per cent per annum has been achieved through expansion of cultivated area - resulting in declining labour productivity (Sanders *et al.*, 1996), and encroachment into valuable wildlife habitats, and destruction of biodiversity in some of the countries in the region (Munthali & Mkanda 2002).

Notwithstanding agriculture's prominence in the SSA socioeconomic discourse, its performance over the past 30 years has been marginal; with cereal yields of about 1,230kg/ha (Ruben & Piters 2005) being inadequate to cope with the region's ever-increasing human population, which is currently estimated at about 8000 million, and growing at about 2.2 per cent per annum (IEG 2007). This population doubled between 1975 and 2002, and is projected to increase to 902 million by 2015 and 1.56 billion by 2050 (FAO 2005).

One of the manifestation of poor agriculture production and increasing human population in SSA is food insecurity, with about 33 per cent of the region's population (approx. 200 million people) being undernourished. SSA is currently the only region of the world where hunger is projected to worsen unless some drastic measures are taken to improve food production (NEPAD 2005). In most countries, access to food by households has further been undermined by: (i) the inability of countries to generate the resources required to import food; (ii) a high and increasing level of poverty (50 per cent in 2003) resulting from

overdependence on subsistence agriculture; (iii) limited access to off-farm employment; and (iv) sluggish development in urban areas and skewed income distribution (IEG 2007). Furthermore, bilateral and multilateral donor aid for development of agriculture has declined from \$1,921 million in 1981 to \$997 million in 2001 (IEG 2007). Similarly, private commercial investment in agriculture has been largely limited to export crops and higher potential zones (IEG 2007).

Other factors that have constrained agriculture production include prevalence of poor soils, highly variable rainfall, frequent droughts, poor infrastructure, and limited access to irrigation resulting in chronic food insecurity for millions of small farmers (IEG 2007), and this situation is worst in the semi-arid areas. To survive in such harsh environments, most rural communities rely on consumption of biodiversity resources, such as game meat, tubers, etc., as demonstrated by an example from Banhine, Mozambique (Fig. 1).

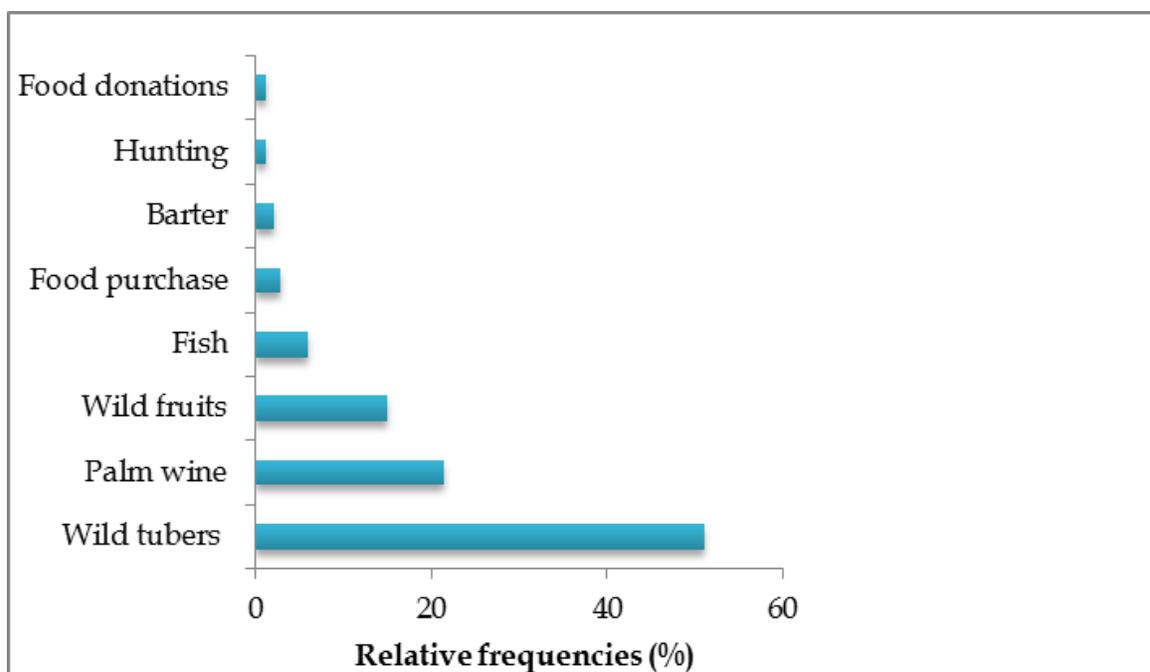


Fig. 1. Hunger coping strategies by the Banhine communities, Mozambique (Munthali, et.al 2010)

To address the underperformance of agriculture, the New Partnership for Africa Development (NEPAD) Secretariat prepared the Comprehensive Africa Agriculture Development Programme (CAADP) in 2002, “presenting broad themes of primary opportunity for investments to reverse the crisis situation facing Africa’s agriculture, which has made the continent import-dependent; vulnerable to even small variations of climate, and dependent to an inordinate degree on food aid” (NEPAD, 2002). In July 2003, the Heads of State and Government of the African Union (AU) considered the CAADP and resolved, *inter alia*, to “revitalize the agriculture sector by adopting sound policies for agricultural and rural development and committed themselves to allocating at least 10% of national budgetary resources to these critical endeavours within five years”. Translating this commitment into political action has however been a great challenge due to a number of factors, including: paucity of resources available to most SSA countries to revitalise their

agriculture sector against the needs of other priority sectors (especially health and education); the general perception that the performance of agriculture in SSA has been poor, particularly in the context of globalized markets and the dominance in the region of small-scale farming systems; lack of confidence in the potential of agriculture to reduce poverty; and the decline or disappearance of national development banks and the difficulties met with in establishing a well-performing financial sector (NEPAD, 2004; FAO 2005).

Against the backdrop of conventional agriculture's underperformance, and its general failure to sustain food security and meaningfully contribute to the socioeconomic development in SSA, would sustainable agricultural practices be a panacea to enhancing agriculture productivity and achieving improved food security, and contribution to biodiversity conservation and the ever-elusive rural development in SSA? In responding to this question we briefly review the performance of sustainable agriculture and discuss conditions under which it could contribute to food security, biodiversity conservation, and rural development.

3. Sustainable agriculture: A conceptual overview

Sustainable agricultural practices in SSA encompass a wide range of farming systems, including conservation agriculture, organic farming, eco-farming, permaculture, etc. Principally, these agricultural production systems involve designing and management procedures that work with natural processes to conserve all resources and minimise waste and environmental damage, while maintaining or improving farm profitability (MacRae 1997). They are designed to take maximum advantage of existing soil nutrients, water cycles, energy flows, beneficial soil organisms, and natural pest controls.

Sustainable agricultural production systems reduce or avoid the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives, and thus aim to produce food that is nutritious, and uncontaminated with products that might harm the environment and human health (MacRae 1997). These production systems rely more on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, appropriate mechanical cultivation and minimal tillage to optimize soil biological and natural pest control activity, and thereby maintain soil fertility and crop productivity (African Conservation Tillage Network, 2008; Stoorvogel and Smaling, 1998). In addition, resistant varieties, and biological and cultural controls are used to manage pests, weeds and diseases.

Sustainable agricultural production systems are also considered to have a biodiversity conservation utility, and have gained popularity among conservation organisations as tools for project managers to combat deforestation, and dependence on biodiversity assets to sustain subsistence needs of the rural communities. Promotion of these farming systems by conservation NGOs is driven by the concern that the present conventional agricultural practices are having negative impacts on biodiversity conservation, environmental quality and on resources availability and use. The general assumption in promoting sustainable agricultural practices is that these farming practices could lead to improved land husbandry and intensification of agriculture, which would lead to improved crop yields per unit area of land, and hence; decrease the likelihood of cutting down forested areas to plant new agriculture fields. Additionally, there would be reduced reliance on natural resources to

sustain subsistence livelihoods, as communities would produce sufficient food to sustain their nutritional needs. This assumption is applicable to areas that are located near valuable wildlife habitats or protected areas, where sustainable agriculture could be implemented as a tool to achieve biodiversity conservation goals (see Salafsky, et. al 2001).

Numerous studies have assessed the socioeconomic benefits of sustainable agriculture projects. These studies have looked primarily at variables such as changes in household agricultural productivity and yield, returns to labour, and income (Salafsky et. al 2001). One such study was carried out by Pretty et .al (2006) who reviewed 286 sustainable agriculture projects between 1999 and 2000 across eight categories of farming systems in 57 developing countries in Africa, Asia and Latin America. They confirmed that farmers increased yields by an average of 79% by adopting sustainable agricultural practices. These increases were attributed to efficient use of water both in dry-land and irrigated farming systems; improvement in organic matter accumulation in the soil, carbon sequestration; and pest, weed and disease control. Very few studies, however, have addressed the conservation benefits of sustainable agriculture projects. Even fewer studies have attempted to quantitatively measure the impacts of sustainable agriculture on biodiversity conservation goals (Salafsky, et.al 2001).

Our exposition on the application and performance of sustainable agriculture in SSA is based on group discussions we have had with smallholder farmers in the Democratic Republic of Congo, Malawi, Mozambique, Zambia and Zimbabwe. We have also reviewed literature on sustainable agricultural practices within and outside the African region.

4. Application and performance of sustainable agriculture in SSA

Sustainable agricultural practices in SSA are being promoted by a variety of agencies (NGOs & governments – mostly influenced by availability of donor funding), under a wide rubric of input and extension support. The primary objective of these initiatives is to increase agriculture production, and improve food security. Only those being promoted by conservation NGOs are latently linked to biodiversity conservation through promotion of agriculture intensification, improved food production, and by inference, reduce deforestation and encroachment into valuable wildlife habitats. Performance of sustainable farming practices in SSA differs widely, typified by:

4.1 Inadequate scale and level of adoption

Adoption of sustainable agricultural practices is characterised by inadequate scale, both spatially (on average <0.5ha, e.g., Banhine, Mozambique; Siavonga, Zambia & Kanyemba, Zimbabwe) and quantity, in terms of number of farmers (on average < 5%) at a village level. Furthermore, adoption is often limited to the middle age class (20-45 years). Older farmers are sceptical of these farming techniques, preferring conventional agricultural practices and use of unimproved crop varieties, which families have inherited and used for several past generations. At least 75% of the crop varieties grown by smallholder farmers who have embraced sustainable agricultural practices are local varieties – a preference that is influenced by the customary belief in the local crop varieties, which they consider taste and store better than genetically improved varieties. Preference for traditional unimproved and low yielding crop varieties is a universal phenomenon in SSA, which defeats the objective of improving yields and combating food insecurity.

4.2 Presence of multiple support agencies

There are multiple agencies supporting sustainable agricultural practices (African Wildlife Foundation, Wildlife Conservation Society, Golden Valley Agricultural Research, CIRAD, FAO, WWF, etc.) whose approach and techniques have not been harmonised, often confusing farmers, more especially as farmers have to navigate through various approaches to make choices on the best approach that suits their local environments. Provision of free inputs and extension services, which characterises these programmes, creates farmers' dependence on farm input subsidies, and therefore the sustainable agricultural practices being promoted cannot be sustained beyond the periods of free donations, and in the long-term, would not meet the objectives of improving food production and contributing to reduction of rural communities' dependence on natural resources use, and encroachment into wildlife habitats.

4.3 Nutrient recycling

One of the basic tenets of sustainable agriculture is nutrient recycling through fallowing to maintain soil productivity; use of crop residues which upon decomposition replace nutrients utilized by crops back into the soil; and intercropping with leguminous crops to enrich the soil with nitrogen. Additionally, there is a well-known linkage between livestock and soil productivity in the cycling of biomass (natural vegetation, crop residues) through animals (cattle, sheep, goats) into excreta (manure, urine) that fertilizes the soil (Powell & Williams, 1995). Manure application increases soil organic matter, improves nutrient exchange and water holding capacities, and increases crop and forage yields (Powell & Williams, 1995). In SSA this functional linkage is being challenged by the continuous removal of crop residues by grazing, degradation by termites, and removals for fuel - leaving soil surfaces unprotected during the dry seasons, resulting in high soil temperatures, and wind erosion; hence posing severe limitations to crop production in some of the SSA countries. The practice of fallowing has also decreased dramatically, or disappeared in many areas (Powell & Williams 1995). Consequently, nutrient balances for many cropping systems are negative, with off-take greater than input, demonstrating that farmers are over-mining the soils (Stoorvogel & Smaling, 1990).

The depletion of soil nutrients without adequate replacement has caused cereal yields to decline over time, and as more land is brought under cultivation in order to maintain production levels, farmers have had to cultivate more marginal areas, aggravating environmental degradation. Consequently, communal grazing lands have diminished and livestock have become more dependent on crop residues, especially during the six to eight months of the dry season (Powell & Williams 1995); hence limiting use of crop residues to enrich the soils.

Where farmers have opportunity to use crop residues, decomposition and release of nutrients usually takes long, particularly in arid and semi-arid areas. Farmers therefore tend to apply donated chemical fertilisers to boost crop yields.

4.4 Human-wildlife conflicts

Human-wildlife conflicts are profound problems, especially at the frontiers that divide land devoted to agriculture and land that remains as intact natural areas, causing massive crop

and livestock losses, and occasionally loss of human life due to wildlife depredation. A number of human-wildlife mitigation techniques are being implemented alongside sustainable agricultural practices, including use of chilli-pepper to repel the African elephant; and erection of two-wire strand solar electric fences to repel large mammals¹. These techniques though effective to some degree are ineffective in deterring crop predation by other wildlife species which raid crops, such as baboons, monkeys, bush pigs and birds. Besides these, crop disease and pests (e.g., stalk borer, aphids, crickets and termites) are major problems farmers face, and there are no locally adopted techniques to prevent these problems. There is, therefore, need for the development and adoption of multiple human-wildlife conflict mitigation techniques, as well as an integrated approach to pest and disease control. Failure to do so, any gain in the yields from the promoted sustainable farming practices will be lost and farmers will lose confidence in the NGOs that promote these farming practices. Throughout all the group discussions we had with farmers they wished all problem wild animals could be shot and eliminated from their areas, and this contradicts the expectation of conservation NGOs.

4.5 Economic viability

Farmers are generally unaware about performance of their farming enterprises, in terms of whether they are break-evening or making profitable gains. Most NGOs promoting sustainable farming activities are generally not assisting smallholder farmers in applying tools, such as “*Gross Margin*” analyses to measure each farming enterprise's economic viability and performance. Gross margin is defined as the enterprise's output minus the variable costs (e.g., labour, inputs, etc.) associated with it, expressed in money terms (Roberts 1973). The challenge to measure farming enterprises' viability and performance is aggravated by lack of linkages to markets. This was the case in Ituri and Epulu, D.R. Congo, where although the Wildlife Conservation Society is promoting goat farming, raising ducks, and growing of the high value Cocoa, by early 2011, farmers were not yet linked to markets; hence benefits from these farming activities were not yet understood and realised by the communities. Determining economic performance of the commercial agricultural activities is a must, and should be aligned with inculcating responsibility among the farmers to re-invest part of their profits back into their farming businesses, as a way of ensuring sustainability of their farming businesses.

4.6 Sustainability

Most sustainable farming practices being implemented in SSA are donor-funded and have limited time-span, and generally lack mechanisms for sustaining them beyond the projects' funded lives. Encouraging sustainability of these farming practices is also challenged by the limited scale at which sustainable farming systems are being adopted, and cultural aspects which influence their adoption and preference of traditional local crop varieties. Furthermore as the farming practices being promoted are predominantly focussed at meeting subsistence needs, there is limited opportunity to raise the required funds to procure the essential agriculture inputs. There is need, therefore for a good mix of cash and food crops so that part of profits from cash crops can assist to finance sustainable farming

¹ This technique is expensive; its adoption is mainly based on availability of donor funds.

practices. The Simamba Goat Producers Association, in Siavonga, Zambia, supported by the African Wildlife Foundation has formed a *Trust Account* into which members contribute part of profits they make from goat sales and these funds are used in various aspects of goat husbandry, including paying for veterinary services. This is one good example of ensuring sustainability that need to be encouraged by NGOs supporting sustainable farming practices in SSA.

4.7 Weak link between sustainable agricultural practices and biodiversity conservation

In promoting adoption of sustainable agricultural practices, conservation NGOs assume that these practices would lead to improved land husbandry and intensification of agriculture, which would lead to improved crop yields – resulting in reduced reliance on natural resources to sustain subsistence livelihoods and hence; decrease the likelihood of cutting down forested areas to plant new agriculture fields. This link is however poorly understood among the local farmers, more especially as there is limited concrete evidence of sustainable agricultures' conservation utility in SSA. Generally, farmers perceive the support associated with sustainable agricultural practices provided by conservation NGOs and others as free hand-outs of inputs and extension services to boost food production. With exception of the Wildlife Conservation Society's supported projects in Ituri and Epulu, Democratic Republic of Congo, where land has been zoned and physically demarcated into protected forest areas and agriculture land, the situation in other countries where we have reviewed sustainable agricultural practices, farmers can freely expand their agricultural activities as long as free land is available. Land in most SSA countries is a common pool resource, which can be acquired upon obtaining traditional leaders' consent. Hence, sustainable agricultural practices where land has not been clearly zoned and demarcated do not necessarily restrain deforestation and encroachment into valuable wildlife habitats. Lack of linkage to markets is also a disincentive for farmers to engage in intensive commercial farming.

4.8 Monitoring and evaluation of sustainable agricultural practices

The purpose of monitoring and evaluation is to provide comprehensive information on efficiency, relevance, sustainability, impact and effectiveness of sustainable farming practices. In most areas where these farming practices are being implemented in SSA, unless imposed by the donors funding them, there is generally lack of reliable baseline data to evaluate gains made in crop yields due to adoption of sustainable farming practices. Similarly indicators to guide assessment of sustainable agricultural practices' biodiversity conservation utility are either lacking or vaguely established, allowing only for conjecture on the link between sustainable farming practices and biodiversity conservation.

Although our prognosis of sustainable farming practices in some SSA countries shows that they have been mildly satisfactory, these farming practices have great potential to revamp the agricultural sector, by promoting land use intensification, and use of environmentally acceptable techniques to increase agriculture production, and meet the food demand, and restrain encroachment into protected wildlife areas. However to achieve these objectives, a number of conditions should be considered (see section 5 below).

5. Conditions under which sustainable agriculture could contribute to improved food production, biodiversity conservation and rural development

Much of the biodiversity loss in developing countries results from lack of advanced technologies, which in turn leads to expansion of farm areas to compensate for low yields. As earlier stated in this chapter, the overarching hypothesis in promoting sustainable agricultural practices is that these farming practices could lead to improved land husbandry, intensification of agriculture, improved crop yields per unit area of land, and hence; decrease the likelihood of cutting down forested areas to plant new agriculture fields. Additionally, there would be reduced reliance on natural resources to sustain subsistence livelihoods, as communities would produce sufficient food to sustain their nutritional needs. This assumption is however applicable to areas that are located near valuable wildlife habitats or protected areas, where sustainable agriculture could be implemented as a tool to achieve biodiversity conservation goals (see Salafsky et al. 2001), under the following interrelated principles:

5.1 Design

5.1.1 Clearly define the threats to conservation that sustainable agriculture is designed to address

Sustainable agriculture is effective as a conservation tool only if it is appropriately directed at addressing a particular threat, such as deforestation and encroachment into wildlife habitats, or protected area.

5.1.2 Land use planning and zoning

Promotion of sustainable agriculture should be guided by land use planning that incorporates agro-ecological attributes in zoning process of the land into various uses, such as: (i) settlements; (ii) agriculture; (iii) livestock production; and (iv) biodiversity conservation, where applicable. Such zoning should be legally binding and be able to help rural communities to develop optimal uses of their land, and reduce human wildlife conflict through better spatial planning and separation.

5.1.3 Land tenure security

Sustainable agriculture should be promoted where farmers have security to land, in the form of legally registered usufruct rights; as such farmers are more inclined to adopt intensive agriculture production systems than farmers who have open access to land. Free access to land encourages shifting cultivation, which contradicts the principles of sustainable agriculture.

5.2 Implementation

5.2.1 Scoping and due diligence

Many sustainable farming approaches (conservation farming, organic farming, permaculture, etc.) are being implemented under the umbrella of sustainable agriculture. A due diligence is required to assess the feasibility of these farming systems to select the best,

based on the agro-ecological conditions of the area where sustainable agriculture is intended to be implemented. Crop varieties should be carefully selected, primarily focusing on drought resistance early maturing, and high yielding.

5.2.2 Adopt appropriate systems and crop husbandry practices associated with sustainable farming, including:

- Crop rotations that mitigate weed, disease, and insect problems; increase available soil nitrogen and reduce the need for synthetic fertilisers; and in conjunction with conservation tillage practices, reduce soil erosion;
- Improved scale, both spatially (number hectares) and quantity (number of farmers at a village level, participating in sustainable agriculture);
- Harmonised sustainable farming approaches and techniques;
- Integrated pest management (IPM), which reduces the need for pesticides by crop rotations, scouting, timing of planting, and biological pest controls;
- Management systems to improve plant health and crops' abilities to resist pests and disease;
- Water conservation and water harvesting practices;
- Planting of leguminous crops and use of organic fertiliser or compost to improve soil fertility;
- Diversification of farming activities (food crops, agroforestry, cash crops, livestock mix);
- Adoption of multiple human-wildlife conflict mitigation techniques;
- Application of tools, such as "Gross Margin" in analysing and measuring farming enterprises' economic viability and performance.

5.2.3 Patience

The effects of sustainable agriculture take time to become apparent, as investments are often incremental over multiple years, so results might be slow in coming or difficult to discern (Salafsky, et.al 2001). Improvements in yields may require significant amounts of time, e.g., >15 years in arid and semi-arid areas (Mazvimavi, K. *Pers. Com*). Hence, contributions to biodiversity conservation take long before benefits are apparent.

5.2.4 Adapt to local conditions

Sustainable agriculture projects must be based on the needs of local farmers, such as promoting crop cultivars/ varieties that meet the local communities' expectations, in terms of taste and resistance to pests both during the growing and storage periods. These needs should form part of the plant breeding and research associated with sustainable agriculture in SSA.

5.2.5 Subcontract expert partners

Agriculture is not the core business of conservation NGOs; it is appropriate, therefore, that competent partners are identified and subcontracted by conservation NGOs to implement sustainable agriculture. Due to the multiplicity of institutions involved in supporting, promoting and implementing sustainable farming practices, it's important to analyse and

determine those involved in a particular area of interest, and categorise them according to their areas of competency, such as donors, agricultural extensionists, agronomists, researchers/crop breeders, brokers, humanitarian agencies and conservation NGOs. This analysis should assist in identifying competent partners to team up with in implementing sustainable farming practices, including assigning specific tasks that should be performed by the partners. This process should also help to identify specific capacity building needs at the service providers' level (e.g. research, agronomy, extension services). The role of conservation NGOs under these arrangements should be monitoring of compliance with agreed contracts, and ensuring that the link between sustainable agricultural practices and biodiversity conservation, including benefits to the farmers and local communities is well articulated and understood by the farmers.

5.2.6 Policy support

For sustainable agriculture to succeed, governments should develop enabling policies, infrastructure and support capacity building of the smallholder farmers to adequately tap into the opportunities associated with sustainable farming practices. Recent development in many parts of Africa, and the inclusion of sustainable farming practices in the agriculture policy formulation and dialogues, give reason for optimism and provides lessons for future strategies to reverse the negative agriculture production trends experienced in the seventies and eighties.

SSA's agriculture has begun a recovery process, with exports starting to grow again following a long period of decline and stagnation. On the production side, there have been positive policy reforms and some technological breakthroughs, including adoption of sustainable agricultural practices in many SSA countries.

5.2.7 Create the conditions for sustainable agriculture to contribute to conservation success

Promoters of sustainable agricultural practices should actively educate farmers about the link between these farming practices and biodiversity conservation, such as emphasising the need to prevent reliance on natural resources and encroachment into protected wildlife habitats. The benefits of conservation to farmers and the local communities should also be well articulated. For instance for the local communities at the frontiers - dividing land devoted to agriculture and protected areas (reserves & national parks), conservation NGOs should facilitate sales of food grown under sustainable farming practices to lodges in and around protected areas, which could give preferentially high prices, depending on quality of such supplies, and should broaden biodiversity conservation benefits, by providing employment, buying locally produced curios, cultural performances, etc. Tourists' lodges could also set up levies on bed occupancies, whose proceeds could be donated to farmers for advancing sustainable farming practices. Similarly protected area agencies could also charge levies on each tourist entering these areas, and the revenue earned through these levies could also contribute to funding sustainable agricultural practices. Such links could be appreciated by smallholder farmers who could reciprocate by supporting biodiversity conservation efforts, including restraining encroachment into protected areas.

5.2.8 Promote establishment of cooperatives

Agricultural cooperatives play important roles in mobilising smallholder farmers to work together towards collective goals. They act as farmers' governance institutions responsible for multiple tasks such as: establishing and administering *Trust Accounts* into which part of profits made from sales of agricultural produce could be deposited for re-investment in sustainable farming practices; accessing grants, credit and agricultural markets; negotiating partnership arrangements with the private sector; and promoting collectiveness in adoption of technological innovations in sustainable farming and harnessing equitable sharing of profits from farming businesses. Conservation NGOs should broker community-private partnership in the production and marketing of these farming enterprises – and in so doing, enhance the investment capacity of the smallholder farmers, who in most cases lack the productive assets, such as access to credit, capacity, and expertise to engage in profitable marketing of their agriculture produce. These partnerships could be beneficial to the poor farmers, and would create incentives for these farmers to be allies in nature conservation.

5.2.9 Harmonise approaches to sustainable farming practices, and data-collection instruments for monitoring and evaluation

As there are multiple promoters of sustainable agriculture in SSA, both at local and large landscape scales, application of these farming systems and data capture for monitoring and evaluating performance of these farming activities should be standardised. Similarly indicators to guide assessment of sustainable agricultural performance and impacts on rural livelihoods and biodiversity conservation should be harmonised to allow for effective monitoring and evaluation of these farming practices. Monitoring should be adopted as a systematic and continuous process of assessing progress and changes caused by implementing these farming practices – using predetermined and standardised indicators, while evaluation should aim at identifying the broader outcomes of sustainable farming activities, and determining whether their objectives have been met. M&E should be adaptive and process-based (Fig. 2), allowing for learning through locally generated processes and field experiences, guided by: (i) standardised instruments for gathering data; (ii) standardised indicators for assessing the impact of sustainable farming practices; (iii) annual targets/benchmarks for each indicator; (iv) required frequency of reporting on the performance of sustainable farming practices; (v) clear indication of the agencies/individuals responsible for monitoring and reporting for each indicator; (v); and (vi) levels/scale at which monitoring should be required (e.g., household, agro-ecosystem, etc.).

5.2.10 Learning framework

Dissemination of information on sustainable agricultural practices' performance, and their actual and potential impacts on food security and biodiversity conservation would improve public awareness about their values, and would be a necessary precursor to adoption of appropriate sustainable farming systems. NGOs promoting these farming practices should incorporate information dissemination and training as a medium for providing “proofs of concept” examples of sustainable agricultural practices that improve agricultural intensification, productivity and contribute to human well-being and biodiversity conservation outcomes. A web-based platform could be established to: (i) provide space where scientists, researchers, and agriculture practitioners could share their knowledge and

experiences on sustainable agriculture and engage in processes of mutual learning; (ii) store information, tools and methodologies for assessing the performance and impacts of sustainable agriculture; and (iii) store material from workshops, academic papers, policy briefs and information sheets – to be accessed by agricultural practitioners, researchers, etc.

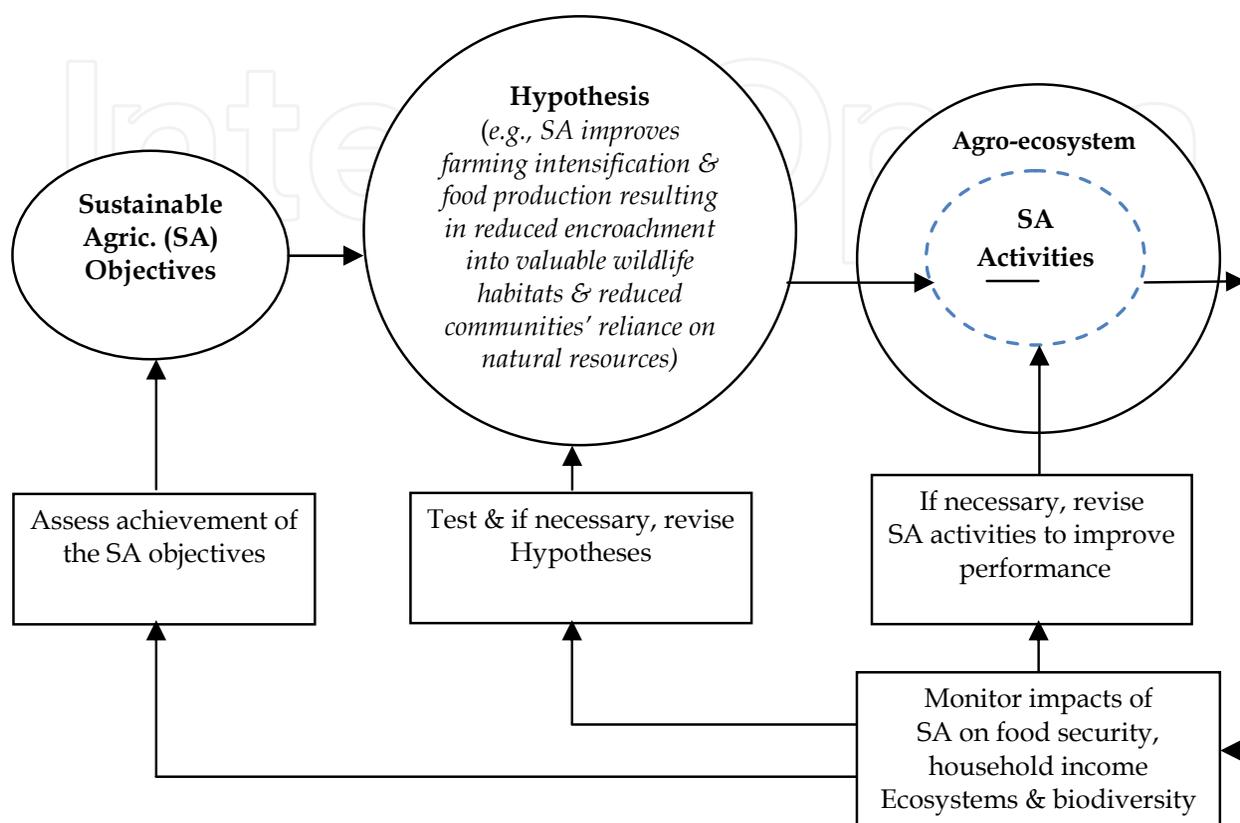


Fig. 2. An adaptive approach to monitoring and evaluating sustainable agricultural practices

6. Rural development

Rural development is an ever-elusive aspiration in the SSA, characterised by a continuous and dynamic evolution of development models and approaches over the past 50 years. These models have included: community development, small farm development, integrated rural development, market liberalisation, participatory development, human development, sustainable livelihoods, poverty reduction strategies, food security programmes, sustainable agriculture and rural development (SARD) and more recently, the Millennium Development Goals (MDGs) (for more detailed typology and analysis of rural development efforts, see Ellis & Biggs (2001). Neither of these has successfully achieved the sustainable rural development agenda, as poverty in all its manifestations (including denial of opportunities and choices most basic to human development to lead a healthy and creative life and enjoy a decent standard of living, freedom, dignity, self-esteem and the respect of others) is pervasive in SSA.

Although the proportion of the population in SSA living below the World Bank's new international poverty line of \$1.25 a day decreased from 55.7 per cent in 1990 to 50.3 per cent in 2005 (UN 2008), this marginal progress is far from the pace needed to reach the overarching Millennium Development Goal (MDG) of halving the rate of poverty by 2015 (UNEP 2003). Because of population growth, the number of people in the region living in

extreme poverty actually grew by 100 million over the same period. One person in two lives in extreme poverty in SSA. The prevalence of poverty in the region is due to the economic under-performance of most SSA – a situation which can be attributed to a number of interrelated factors. Notable among these are: the recurrence of natural episodic events (drought and floods), which lead to famine, malnourishment and under-performance of the human capital, especially in rural areas; armed conflicts in some countries (e.g., Democratic Republic of Congo, Somalia and Sudan), which besides killing innocent people, contribute to the destruction and loss of the valuable economic assets (forests, and wildlife); and external factors, such as the competition that results from the liberalization of international trade due to globalization and increases in agricultural subsidies in developed countries (Anon, 2005) which basically paralyse African agricultural economies.

With all these challenges, it would be naïve to expect sustainable agricultural practices on their own to drive rural development in SSA. Without doubt, these farming technologies have great potential to improve agriculture production and contribute to improving food security – an important ingredient of rural development, but for sustainable rural development, its time governments in SSA shift their rural development policies from rhetorical overtures to concrete actions, focused at transforming the rural areas by embracing a wide scope of processes and programmes, including:

- Development of institutions and their capacities in key areas, i.e. education and training, health, research and extension, marketing, savings and credit, environment, transport, etc.
- Development of rural infrastructure for roads, electricity, telecommunications, housing, water, sanitation, etc. Currently development in these sectors is restricted to cities and urban areas.
- Development of productive sectors: agriculture, non-agricultural industry, mining, tourism, natural resources, environmental management, etc.

Rural SSA is very rich in natural resources, such as minerals, petroleum, timber, wildlife, fish, water, etc., which are being extracted by the multi-national, private and state-owned extractive companies, but revenues from these natural resources extraction do not benefit rural development. The revenues being paid by the extractive industries (royalties, taxes, fees, etc.) to governments are not done in transparent manner and there is no accountability for such revenues to the local communities, who despite living in the midst of natural resources richness, are left in abject poverty. It is essential therefore that:

- Governments in SSA should enact legislation and procedures that enable transparency and accountability for the revenue earned from natural resources extraction, and set benchmarks for investments of these revenues in rural development. The enacted legislation should also enforce independent social and environmental certification of extractive industries to ensure that both renewable and non-renewable resources are exploited in a manner that ensures social and environmental safeguards, as well as contribute to social responsible rural development.
- Rural communities through their local governance institutions should participate in decision-making on resource revenue distribution and investments in rural development. This would require capacity building of the grassroots' governance institutions that are able to demand and advocate for broad-based economic and social development of their constituencies; and

- The civil society should hold the governments in SSA accountable for the management and expenditure of revenues received from extractive industries.

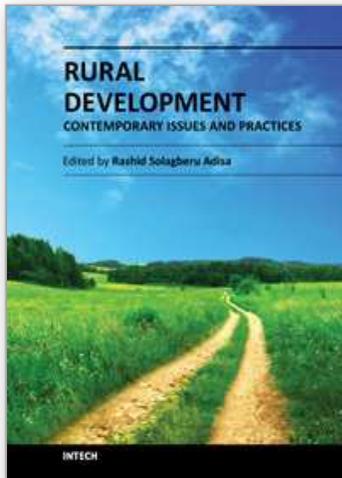
7. Conclusion

Although the performance of agriculture has experienced multiple turbulences over the past 50 years in SSA, the current efforts by national governments, supported by national and high level (African Union & NEPAD) agriculture policy reforms, gives reason for optimism and provides lessons for future strategies to reverse the negative production trends of the seventies and eighties. Africa's agriculture has begun a recovery process, with exports starting to gain positive momentum after a long period of decline and stagnation. Sustainable agricultural practices' potential to positively contribute to land use intensification, boosting crop yields and hence; meeting the ever-increasing food demands and meeting biodiversity conservation goals, depend on multiple conditions - requiring dedicated efforts to implement and achieve the expected results. Sustainable agricultural practices alone, will not sufficiently contribute to rural development. SSA should adopt an integrated approach to rural development that incorporates various economic sectors; including promotion of sustainable agricultural practices, and unlocking the potential to tap from revenues earned through royalties, taxes, etc. from extractive industries for investments in rural development. Doing so would unveil the most needed funds for developing various currently neglected socioeconomic sectors, such as education, infrastructure, health, agriculture, etc.

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Rural Development - Contemporary Issues and Practices

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Development of rural areas has witnessed increasing attention globally, especially over the past three to four decades. The highpoint in the renewed global interest in the development of rural people and their environment was reached with the setting of the Millennium Development Goals (MDGs) in the year 2000. All of the set goals are basically rural development goals. With less than four years to the deadline for the achievement of the MDGs, it is almost certain that the goals are far from being achieved in, especially, most developing countries for whom the MDGs were essentially set. The struggle thus continues for rural development. As long as problems of poverty, disease, illiteracy, unemployment, poor infrastructure, environmental degradation and others persist (or increase) in rural communities, better and more result-oriented solutions to perennial and emerging problems of rural communities would be required. But rural development, in spite of the variations in thresholds of rurality among nations, is not exclusively a Third World or “developing countries” process, owing to its multi-dimensionality. It is a global phenomenon that obviously requires global strategies. This book not only looks at rural development from its multi-dimensional perspectives, it is also a product of the experiences and expertise of distinguished scholars across the continents. Aiming to provide a comprehensive single volume that addresses salient issues and practices in rural development, the book covers themes ranging from sustainable agriculture, biodiversity conservation, strategic environmental assessment, renewable energy, rural financial resources, assessment of protected areas to statistics for rural development policy. Other subject matters covered by the book include social marginality, land use conflict, gender, cooperatives, animal health, rural marketing, information and communication technology, micro-business, and rural economic crisis. The book is thus an invaluable source of useful information on contemporary issues in rural development for researchers, policy makers, and students of rural development and other related fields.

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