THE ROLE OF NATURAL RESOURCES

AGRICULTURAL TRANSFORMATION IN AFRICA
THE ROLE OF NATURAL RESOURCES
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Agricultural transformation in Africa
The role of natural resources

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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESSAGE TO READERS</td>
<td>Bukar Tijani</td>
<td>1</td>
</tr>
<tr>
<td>EDITORIAL</td>
<td>Cuthbert Kambanje and Tobias Takavarasha</td>
<td>2</td>
</tr>
<tr>
<td>SPECIAL FEATURE</td>
<td>Role of pulses and smallholders in the transformation of Africa's agriculture</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elizabeth Mpofu and Ndabezinhle Nyoni</td>
<td></td>
</tr>
<tr>
<td>OPINION PIECE</td>
<td>The quest for sustainable agricultural transformation in Africa under a changing climate</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Abebe Haile Gabriel</td>
<td></td>
</tr>
<tr>
<td>ARTICLES</td>
<td>Domesticating indigenous agro-biodiversity for improved food and nutrition in Africa</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Festus Akinnifesi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Building resilience through safe access to energy</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Andreas Thulstrup and Indira Joshi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stepping away from Earth and looking back at the vast African continent: A thought piece</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Ann H. Clarke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achieving food and wood security in the context of climate change: The role of urban forests and agroforestry in the NDCs in sub-Saharan Africa</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Jonas Bervoets, Fritjof Boerstler, Simone Borelli, Marc Duma-Johansen, Andreas Thulstrup and Zuizhang Xia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impact of foreign aid on integration of Musangu (Faidherbia albida) tree in Agricultural transformation in Africa: Lessons from Zambia</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Douty Chibamba, Progress H. Nyanga, Bridget B. Umar and Wilma S. Nchito</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Factors paralyzing agricultural development in Sub-Saharan Africa</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Michiel Laker</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reinventing governance and solidarity for agricultural transformation and sustainable development in Africa</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Mekolo Alphonse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The critical role of food systems development in the achievement of the SDGs in Africa</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Jamie Morrison</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fishers perceptions and adaptation to climate variability on Lake Kariba, Siavonga district, Zambia</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Mulako Kabisa and Douty Chibamba</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sylva model of commercialization of indigenous foods: Lessons for agricultural transformation in Africa.</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Progress Nyanga, Ireen Samboko and Douty Chibamba</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COUNTRY FOCUS: Republic of Zambia</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Betty Phiri, Progress Nyanga, Bridget Umar, Wilma Nchito and Douty Chibamba</td>
<td></td>
</tr>
</tbody>
</table>
## CONTENTS

### FAO ACTIVITIES AND RESULTS

**Ecosystem services for sustainable agriculture, forestry and fisheries**

_Damiano Luchetti, Clayton Campanhola, and Thomas Hofer_

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### LINKS

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### NEWS

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### ANNOUNCEMENT

---

### THEME AND DEADLINE FOR NEXT ISSUE

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### GUIDELINES FOR AUTHORS, SUBSCRIPTION AND CORRESPONDENCE

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Some pulses grown and consumed in Africa
Photo credit: ©Ndabezinhle Nyoni/Zimbabwe Smallholder Organic Farmers’ Forum (ZIMSOFF)
Bukar Tijani

The present edition of Nature & Faune journal emphasises the role of natural renewable resources within the framework of Africa's agricultural transformation. Central to the transformation agenda is achieving greater prosperity which can improve peoples' lives and livelihoods. These improvements of lives and livelihoods cover their economic well-being and way of life, their environment, socio-cultural and political sphere of influence, as well as room to exercise their freedom of choice. Given the need to modernise the entire value chain, the conditions for modernizing Africa's agriculture entail transforming not only production processes but also the products, adding value, remunerative marketing and utilisation – creating in all this more prosperous livelihoods for the dominant rural population and more jobs that are attractive to the youths. It also requires investment in infrastructure, technology, innovation and skills, which must include a paradigm shift from trading mostly in unprocessed agricultural products to processed products in both domestic and export markets.

This issue of the Journal highlights the unique features of Africa’s agriculture, including: (i) the urgent need for improving productivity; (ii) the importance of the agricultural sector in Africa’s economies in terms of employment; and (iii) the climate-resilient opportunities within agriculture to cope with climate change challenges. It draws attention to the fact that the agriculture sector offers possibilities for increased productivity while also adapting to and mitigating climate change thus safeguarding also future production. This is key to Africa's agricultural transformation as the majority of the population live and work within a highly climate sensitive agricultural system. The pathway to follow embraces a broader landscape approach to achieving sustainability of food production systems, and points to the fact that the use of an agro-ecological approach will help transform food systems towards sustainability, promoting a balance between ecological soundness, economic viability and social justice. As also noted by FAO (op. cit.), by building synergies, agroecology can increase food production and food and nutrition security while restoring the ecosystem services and biodiversity that are essential for sustainable agricultural production. To achieve this transformation, those who grow the food, those who eat it, and those who move the food between the two – must all be connected in a social movement that honours the deep relationship between culture and the environment that created agriculture.

The Country Focus in this issue of Nature & Fauna is on Zambia. Under the spotlight is the transformation from hitherto applied cultivation to "conservation agriculture" in the Chibombo District in central Zambia. This feature sheds light on Zambia’s smallholder farmers’ response to the pursuit of agricultural transformation.

The United Nations declared 2016 as the International Year of Pulses. As a contribution to recognising the global importance of this event and its particular application to Africa, the Special Feature article is dedicated to addressing the role of pulses in the transformation of Africa’s agriculture. The article describes how pulses could contribute towards agricultural transformation and the attainment of Sustainable Development Goals related to poverty reduction in Africa.

The fifteen short articles included in this edition address the above issues in the transformation of Africa’s agriculture from various perspectives. Join us to explore them and to discover the key forces that have shaped and that will continue to shape agricultural transformation in African countries, and the challenges associated with these developments. You are in good company!

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Bukar Tijani, Assistant Director-General/Regional Representative for Africa, Regional Office for Africa, Food and Agriculture Organization of the United Nations, P. O. Box GP 1628 Accra. Ghana. Tel: (233) 302/675000 ext. 2101/(233) 302/6101030; Fax 233 302 668 427. Email: ADG-RAF@fao.org
Drivers and actions required to accelerate African agricultural transformation

Cuthbert Kambanje and Tobias Takavarasha

Summary

The uniqueness of the African agricultural context implies that Agricultural Transformation in Africa may not be the same or may not follow the same pathways as in other parts of the world. In this article, the authors explore the issue of agricultural transformation in Africa focusing on what is already happening showing that a number of countries are already moving through the various stages of transformation. The authors also provide a short review of lessons that could be learnt from the continents which have experienced transformation showing that it takes a mix of actions and sustained long term catalytic investment for transformation to occur. The authors also argue that African governments should move away from overtaxing agriculture, but rather create incentives for small and informal businesses to play a bigger part in the agricultural value chain, with domestic resources eventually superseding financial contributions by development partners in funding African agricultural transformation.

Introduction and Context

The context for transformation of African agriculture is characterised by a mix of both challenges and opportunities. These salient mega trends include inter alia population growth and changing demographics, rapid urbanization and urban population growth, shifts in the labour force toward non farm employment, rising land prices, generally positive agricultural productivity growth rates and associated poverty reduction. In addition, Africa is witnessing increased land degradation and climate variability. The region is increasingly more dependent on imported staple foods with a huge import bill of an estimated 35 billion US dollars annually. There are many changes taking place, including gradually increasing access to markets by smallholder farmers as well as farmland ownership and farm size distributions with parts of SSA experiencing increasing importance of land rental markets and rising medium-scale farms (Deininger, K., & Byerlee, Det al, 2011)

Given this context, there is general consensus that Agricultural Transformation in Africa may not be the same or may not follow the same pathways as in other parts of the world. The African heads of state through the Malabo Declaration as well as the Agenda 2063 have however articulated the vision regarding what a transformed African agriculture should look like. The vision is premised on converting large numbers of household-oriented, subsistence type producers and their structures to commercial units that have highly efficient linkages to the urban markets. Transformation would then move Africa from the current situation of a low total factor productivity (TFP - measuring how efficiently and intensely inputs are utilized in production) status, to a high income industrial state where the role of agriculture in industrialized economies is little different from the role of the steel, housing, or insurance sectors. This will be the point where a dynamic growth process is in place, with the agricultural sector modernizing, continuing to produce food cheaply, and releasing labour to the non-agricultural economy. It is important to note that countries in Africa are at different stages of development, and indeed even the progress in the Comprehensive African Agriculture Development programme (CAADP) processes, is different across countries. It is therefore important to highlight that any efforts to transform African agriculture should pay attention to the various stages of transformation, as the interventions for countries will not be the same.

What is happening in Africa?

The agricultural transformation process in a country is generally associated with the following seven trends which have been accelerating since 2005 in countries such as Ghana, Kenya, Zambia, Ethiopia and Rwanda (summarized from Africa Agriculture Status Report, 2016):

(i) Some farmers (and farming households including youth) move out of farming to take advantage of better economic opportunities, while farmers remaining in production become more commercialized;
(ii) Farms transition from producing a diversity of goods motivated by self-sufficiency to becoming more specialized to take advantage of regional comparative advantage, and in the process they become more dependent on markets (market performance thus exerts a greater influence over the pace of agricultural transformation);
(iii) The ratio of agribusiness value added to farm value added rises over time as more economic activity takes place in upstream input manufacture and supply and downstream trading, processing, and retailing;
(iv) More medium to large farms begin to supply the agricultural sector to capture economies of scale in production and marketing, and mean farm size rises with the exit of rural people out of farming and consequent farm consolidation;
(v) The technologies of farm production evolve to respond to changes in factor prices (land, labour, and capital) as a country develops. (In most cases as non-farm wage rates rise with broader economy-wide development, farms become more capital-intensive as the cost of labour and land rise and the cost of sourcing capital declines);
(vi) There is a transition from shifting cultivation to a focus on more intensive, sustainable and management-intensive cultivation of specific fields; and
(vii) The agri-food system becomes more integrated into the wider economy.
What are the lessons from other continents?

Asian development benefited from (1) long-term perspectives and planning, (2) a commitment to economic growth despite political instabilities, (3) the presence of regional role models for success such as Japan, Taiwan, and South Korea, (4) an educated labour force and well-trained policy makers, (5) macroeconomic stability, which created a favourable environment for private investment, (6) a view of the private sector as government’s partner, not its rival, and as vital to economic growth, and (7) heavy investment in agricultural productivity through support for rural infrastructure, research and extension, and price-support systems (Seckler, 1993).

Key drivers for the transformation of African agriculture

A key driver for transformation which should be leveraged is the fact that optimum use of Africa’s limited natural resources must be promoted. Conditions conducive to sustainable agricultural development need to be identified and actively encouraged. These in accordance to the specific/peculiar requirements of these resources. However, this will depend on the political will by Africa Governments. There should be sufficient incentives and a well trained work force and adequate levels of public and private funding. Other factors include strengthening capacity for climate change mitigation and adaptation, resilience building, knowledge management, infrastructure development and youth involvement in agriculture. The high penetration of information and communication technology in Africa should also be treated as an important lever for Agricultural transformation. Investment in rural infrastructure, social protection and safety nets and improved and secure markets for farmers and making their organisations to run as businesses were noted to be critical areas.

How should African agricultural transformation be funded?

African governments should move away from overtaxing agriculture, but rather create incentives for small and informal businesses to play a bigger part in the agricultural value chain. In addition, the private sector should be incentivised to invest more not only in the ‘mainstream’ agricultural sector, but also in smallholder and informal value chains. Governments should therefore provide catalytic resources and an enabling environment for inclusive value chain development. In addition, domestic resources (provided by AU member states) should eventually supersede financial contributions by development partners (long-term approach) in funding African agricultural transformation. At country level, it is important to reorganise the whole budget architecture, so that resources are channelled towards catalytic investments which spur long term transformation. It is therefore important to demonstrate the return to agricultural investment in a broader sense, and to involve non-traditional agricultural ministries which have the levers of the economy and budget.

Conclusion

In conclusion, it is important to facilitate implementation of strategic food security commodities production to reduce Africa’s food imports. In the short run, it will be important to focus on grains (and other staples) and minimize Africa’s dependence on imports of these. Once the food problem is solved, many problems will also be solved. Investment in other crops other than the 4 strategic crops identified by the African heads of state (cassava, maize, rice and wheat) should be promoted once the food problem has been solved. Certain high value crops could be targeted which raise farm wages. Focus on strategic crops for Africa such as those with dual, triple or quad benefits (e.g. pumpkins: eat leaves and shoots, eat pumpkin, eat seeds, and get oil from seeds). Rapid assessment of global markets is required in order to map clear agenda for African acceleration of exports into those countries, basing it on Africa’s comparative advantages, facilitating ease of trade and exchange between the countries in line with the provisions of the Agenda 2063.

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Harvesting Sorrel leaves in Koutou, Chad ©FAO/Brya Grace Elysabeth
Transformation of Africa’s agriculture: The role of pulses
Elizabeth Mpofu and Ndabezinhle Nyoni1, 2

Summary
This article outlines how pulses could contribute towards agricultural transformation and the attainment of Sustainable Development Goals in Africa. A quarter of the African population, most of whom are smallholder farmers deriving their livelihoods from rain-fed agriculture, live in hunger and poverty. African governments should, among other measures, take advantage of the 2016 International Year of Pulses (IYP), declared by the United Nations’ Food and Agriculture Organization (FAO), to stimulate both domestic consumption and exports of pulses to address this challenge. This could be achieved, firstly, through deliberate public support towards participatory research and development of appropriate seed varieties, farming techniques and processing technologies of pulses for smallholder farmers. Secondly, they should engage in wider awareness raising campaigns that highlight the health and environmental benefits of pulses and promote their consumption.

Introduction
Africa is home to about a billion people, most of whom are smallholder farmers deriving their livelihood from rain-fed agriculture. Of these, over 200 million live in poverty and face malnutrition due to, among other factors, low dietary intake of nutrient-rich foods (WHES, 2016). According to IFPRI (2016) these include 58 million for children under 5 years. Pulses are nutrient-rich and could contribute towards reducing malnutrition (FAO, 2015). They improve the quality of people’s diets and their overall health, and diversify livelihood options. However, the consumption of pulses is relatively low in Africa compared to other continents. African governments should therefore put in place policies that will promote increased pulse consumption. Hence, the declaration of 2016 as the International Year of Pulses and its launch in late 2015 (United Nations, 2015) by the United Nations’ Food and Agriculture Organization (FAO) came at the most appropriate time. It also coincided with the adoption of Sustainable Development Goals (SDGs). If pulses are to contribute towards achieving the SDGs related to poverty reduction by 2030, public awareness campaigns to influence and promote their increased consumption and production are imperative.

This article outlines how pulses could contribute towards agricultural transformation and the attainment of Sustainable Development Goals related to poverty reduction in Africa. This could be achieved, by (i) deliberate public support towards increased pulse production by smallholder farmers, (ii) promoting in a participatory research and development of appropriate seed varieties, (iii) improving farming techniques and processing technologies, and launching wider awareness raising campaigns highlighting the health and environmental benefits of pulses in order to promote increased consumption.

Pulse crops’ contribution to transforming Africa’s agriculture: increased production, pulse trade and consumption

Africa accounts for about a quarter of total pulses produced globally (FAO 2016) and produces a variety of pulses (lentils, beans, peas and chickpeas, fava beans, cowpeas, and pigeon peas etc) for local consumption and export. Cowpea and dry beans are the most common pulses produced and consumed in Africa, accounting for 82% of the total area where pulses are planted. Niger, Nigeria, Tanzania, Ethiopia and Kenya are among the biggest pulse producers on the continent. According to Akikode and Maredia (2011) about 15% of global pulse production is traded, while the remainder is consumed locally.

Global demand for pulses is growing, driven by demographic and income trends and increased consumer consciousness of the nutritional value and other health benefits of pulses, especially in relation to celiac disease and gluten sensitivity.

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2Ndabezinhle Nyoni, Communications Officer, Zimbabwe Smallholder Organic Farmers’ Forum (ZIMSOFF), No. 197A Smuts Rd, Prospect, Waterfalls, Harare, Zimbabwe; ndaba74@icloud.com, +263 772 441 909. Pulses are annual leguminous crops yielding between 1 and 12 grains or seeds of variable size, shape and colour within a pod, used for both food and feed. The term “pulses” is limited to crops harvested solely for dry grain, thereby excluding crops harvested green for food, which are classified as vegetable crops, as well as those crops used mainly for oil extraction and leguminous crops that are used exclusively for sowing purposes (Source: http://www.fao.org/3/a-b213e.pdf (FAO, 2015)).

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Pulses grown and consumed in Africa.
Photocredit: @Ndabezinhle Nyoni, Zimbabwe.
South Asian markets drive the growing demand, with India’s share of global imports averaging 25%. Other regions such as the Middle East, North Africa and China are emerging markets for pulses. Internal trade of pulses within Africa is common, particularly among eastern and southern Africa countries such as South Africa, Kenya, Angola, Ethiopia and Zimbabwe. Pulse imports from outside Africa arrive largely in the form of food aid.

Countries such as Ghana, Kenya, Mozambique and Tanzania export large quantities of pigeon peas to India (Dragsdahl, 2016; Karanja, 2016; Reuters, 2012). Ethiopia produces the bulk of lentils which are exported to the Gulf states and other regions. Opportunities exist to transform the agriculture in these countries as they formulate strategies to diversify their traditional export crops to meet new demands. Tanzania is emerging as one of the top countries producing pulses, particularly dry beans, most of which is exported to India and within Africa. Value chains of pulses are developing in these countries to correspond to this growing demand. Foreign investment to support both up- and downstream industries is also growing. For instance, Tanzanian production and exports of pulses (cowpeas, pigeon peas, chickpeas and dried beans) have increased over the years with export revenues increasing from just under USD30 million in 2005 to about USD170 million in 2014. Besides developing a strategy to take advantage of this export market, Tanzania recently started to grow and export other pulses such as black mung beans and kidney beans. This has a potential to transform the country’s agricultural sector, broadening the livelihood options of many rural farmers. India is likely to continue being a major importer of pulses for some time to come, which might even out seasonal price fluctuations.

This upsurge in demand, both locally and globally, presents numerous opportunities to contribute towards transforming African agriculture, which is currently mainly based on staple cereal crops (maize, rice, small grains, etc.) and export-orientation, dominated by a few well endowed, large-scale farming enterprises. Cereal crops have been receiving more attention in policies, crop research and development (R&D) than pulses. This has resulted in relatively weaker agronomic and management practices and low access to inputs such as improved seeds, and to a lower average yield of pulses in Africa than on other continents.

Development of the pulse value chain through increased access to market information and finance will contribute towards transforming agriculture in Africa, allowing small holders to take advantage of increased global demand. In general, pulses are sold at higher prices than cereals (IFPRI, 2010), which means for the same amount of land, they can yield more income, thus contributing towards combatting poverty. Nevertheless, most smallholder farmers tend to sell at farm gate prices which are relatively low and do not stimulate increased cultivation either through investment (processing, storage etc.) or selection of better seed varieties. Given the existence of a wide variety of pulses grown by smallholder farmers and the greater return to effort than many of Africa’s prominent “cash” crops such as cotton or tea, governments should increase public support to agricultural research and development promoting this diversity for both domestic markets and exports.

As an example of such local investment, India, the biggest producer and consumer of pulses, seeks to introduce contract farming of a few select pulses (Dragsdahl, 2016; Vikram, 2016; The Indian Express, 2016) to meet deficits in India. Small holders in Tanzania, Mozambique and Malawi stand to benefit from such initiatives to increase their incomes as long as such investments follow the Responsible Agricultural Investments (RAI) principles. The economies of these countries will benefit through increased pulses value addition, the development of both up and downstream industries and job creation which could combat both rural and urban poverty.

Besides promoting pulse trade, African governments should put in place measures that promote internal consumption of pulses. A few countries, mostly in east Africa (Rwanda, Ethiopia, Kenya, Burundi etc.) have largest per capita pulse consumption in Africa, where 20% more of dietary protein comes from pulses. Opportunities exist to scale up consumption of pulses on the continent given the improved processing technologies. Pulses can now be consumed in various forms as processed dal (served with cereals such rice, chapatti etc.), flour in soups, other baked products among others. We highlight next the other benefits of consuming pulses which related addressing hunger and malnutrition in Africa.

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1. India’s increasing population, economic growth and urbanization drives import of pulses at US$2.7 billion in 2014 up from US$0.6 billion in 2002. Supplies 27% of imports.
Contribution of pulses in meeting climate change challenges

The contribution of pulses to the sustainability of cropping systems, soil fertility and ecosystem resilience are well documented. Under the current push for sustainable agriculture (ecological farming, agroecology, etc.) as alternatives to industrial agriculture in efforts to reduce the impact of climate change, the cultivation of pulses becomes imperative. Pulses reduce dependence on chemical fertilizers as they fix atmospheric nitrogen, so improving soil fertility and increasing crop yields. Since smallholder farmers, most of whom are poor, rely on low input rain-fed farming systems; pulses can be inter-cropped to promote increased on farm biodiversity and thus more reliable, diverse food production. Such diversity enables small holders better to adapt to changing climatic conditions, than homogenous industrial agriculture with its technological packages (agrochemicals, machinery etc.).

These packages also affect soil biodiversity and fertility required for carbon sequestration, further contributing to greenhouse gases which cause climate change. This fits well with the current efforts of civil society, social movements and policy makers who seek to curb agriculture’s contributions to climate change. They call for the development of alternative food systems based on food sovereignty and agroecological farming.

Pulses contribute to achieving SDGs related to hunger and malnutrition

According to the World Health Organisation (WHO), about 60% of the countries that account for 90% of the global burden of malnutrition are in Africa. The continent also has the highest deficiency of essential vitamins and minerals (40% for Vitamin A and iodine, 20% for zinc and iron) in children under 5. Pulses are rich in protein, iron and zinc, and could contribute towards the reduction of some forms of malnutrition. For instance, common bean that has been labelled as “near-perfect food” by CIAT (1995 as cited by Karanja 2016) and the “meat of the poor” by Sperling (1992 as cited by Karanja 2016) is a major staple crop in eastern and southern Africa which not only provides protein but is a third most important source of calories. Pulses can therefore play a major role in reducing hunger and poverty in Africa and contribute towards achieving the SDGs.

However, consumption of pulses is low in Africa, more so in urban areas as pulses are regarded as ‘poor man’s food’. The consumption of animal products, a critical source of protein, in Africa has also been declining in most countries. Milk, the most complete protein, in the form of sour milk, has traditionally been a very important part of the diet in Africa. This is because very large proportions of populations in Africa cannot consume fresh milk due to suffering from primary lactose intolerance and according to affected people pasteurized milk does not become sour, it “rots”. In one area in KwaZulu-Natal in South Africa it was found that 97% of the local population suffers from primary lactose intolerance (Fincham et al. 1986). With the introduction of legislation demanding the pasteurization of milk, the consumption of milk dropped to extremely low levels in some areas. Increased public awareness campaigns on the nutritional benefits of pulses as an alternative source of protein, are therefore required.

With increased awareness of coeliac disease and gluten sensitivity pulses provide alternative protein rich products to address such health conditions. For instance, pulses such as yellow peas, lentils and chickpeas are gluten-free and are being processed for various uses including as flour to make numerous recipes providing high protein (22 - 25%) and other essential minerals. These pulses are playing a key role for the growing population who prefer heart-healthy, vegetarian and gluten free packaged foods.

In Tanzania protein-energy malnutrition (PEM) was found to cause low birth weight because of high protein-energy malnutrition in pregnant and breastfeeding women. Thus Mkwa (2015) recommended that ‘sufficient intake level of pulses is clearly a solution to poor diet quality to both rural and urban consumers, it is also a cost-effective way to prevent protein energy malnutrition among children, pregnant and lactating mothers and a protective way against obesity and other chronic diseases.’

In view of the protein deficiencies in diets increased intake of pulses as protein source becomes critically important. What is needed is continuous efforts to support awareness events that bring together producers, processors and consumers to learn and exchange information on how best to improve pulses value chain to increase their consumption particularly in urban areas. The traditional and organic food festivals and fairs are one such way to stimulate the dialogue towards building more awareness reaching out to the urban consumers. Such events reconnect consumers at all levels and from all walks of life with traditional foods prepared using pulses, as they get to see and taste various recipes. Government support for local pulses promotes local food systems, thus ensures the right to food.

Further studies on consumers’ preferences regarding pulses – kind, colour, taste, texture, etc. – are urgently required to breed appropriate cultivars and grow preferred types of pulses. Again, such efforts should explore ways to incorporate three key recommendations made during the IYP closing ceremony to (i) strengthen national and international research on food composition and improved varieties (ii) promote and support policies in favour of pulses production by small farmers and training programs for school children, farmers and extension personnel on the value chain of pulses and (iii) institutionalize an International Day of pulses and other legumes.

IYP 2016 closing ceremony held in Ouagadougou, Burkina Faso, 9 - 13 February, 2017

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Conclusion

African governments should support the production of pulses by smallholder farmers through increased investment in physical infrastructure and research and development of appropriate pulses seed varieties and processing technologies. Such support should not be prescriptive but target proven local solutions that are beneficial to communities and the environment. There is need for governments to promote their consumption through increased awareness campaigns about the health benefits.

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The quest for sustainable agricultural transformation in Africa under a changing climate

Abebe Haile Gabriel

Summary
Transformation of African agriculture could be convoluted by climate change – a situation largely linked with heavy reliance of the majority of the population on a climate sensitive agriculture sector. Efforts in raising the profile of Agriculture must be anchored on innovations driving increased productivity and value-addition while contributing to climate solutions. Systemic innovations offer unique possibilities of converting the seemingly double-hurdles (of increasing productivity, while contributing to climate solutions) into opportunities through reducing trade-offs and promoting synergies between increased productivity and climate adaptation and mitigation actions. Climate Smart Agriculture approaches are suggested as examples demonstrating practices of integrating agriculture and climate change concerns in an innovative perspective.

Emerging opportunities can offer countries with options to innovate in the context of climate change. The Paris Climate Agreement highlights agriculture and introduces the Nationally Determined Contributions (NDCs) as key documents, providing the link between global commitments and local actions and therefore guiding partnerships and actions. The extent to which countries have identified agriculture sectors as integral part of climate actions within their respective NDCs would determine progresses towards transforming agriculture in the context of climate change. This also behoves a careful interrogation, refinement and integration of NDCs within national policies, strategies and plans, also in the context of localising SDGs so that they are not presented as a separate agenda.

The paper concludes by highlighting the inadequacies of technical and institutional capacities that may hamper design and implementation of systemic innovations at the country and local levels. It suggests for multi-sectoral engagement as well as institutional effectiveness (public, private, CSOs, etc.) to facilitate coordination, service delivery, and empowerment of stakeholders for ownership and accountability.

Introduction:
If transformation has long remained an elusive outcome for African agriculture, it could be further convoluted by climate change, set to disfavour Africa – a situation largely linked with heavy reliance of the majority of the population on a climate sensitive agriculture sector. Against this backdrop the agricultural transformation agenda must transcend the goal of raising productivity along the whole value-chain; it must also encompass the significance of achieving this goal while contributing to climate solutions.

Highlighting the unique features defining Africa’s agriculture, namely dependence of the majority of the population on a climate sensitive sector, this paper sets out to explore the agricultural transformation imperatives under a changing climate, and argues that agriculture sector offers possibilities for a concurrent achievement of increased productivity and contributing to climate adaptation and mitigation goals. The paper emphasises the utility of Nationally Determined Contributions (NDCs) as key documents in working with countries for policy and programmatic interventions to achieve both objectives. Multi-sectoral engagements and institutional effectiveness are suggested as key for implementation.

1. Africa’s Agriculture under a Changing Climate: the risk of vulnerability

FAO’s 2016 edition of the State of Food and Agriculture (FAO, 2016a) portrays a stark depiction of how climate change is affecting food and agriculture in Africa, and predicts glaring unfavourable possibilities. The messages are clear: first climate change is already impacting agriculture and food security in Africa. Rising temperatures, variability in precipitation, water stress and land degradation, etc., are already evident. Moreover, frequent occurrences of extreme weather events (e.g. El Niño) have the capacity of wiping out hard-earned gains registered in several years. This is despite the fact that occurrences of such extreme weather events are becoming increasingly predictable and that they had been preceded by several ‘normal’ seasons. What transpired in Ethiopia and in the Southern African region in 2015-2016 serves as a vivid example; in the latter case the 2015/16 harvest assessments indicated a regional shortfall of nearly 9.3 million tonnes of cereal production. Second, not withstanding sub-regional and country variabilities, the potential impact is expected to be much more intense and frequent in future for Africa (Table 1). This is owing to the particularly high vulnerability of Africa’s agriculture and food systems to climate change.

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Agriculture sectors comprise crops, livestock, forestry, fisheries and aquaculture.
The peculiar high risk of vulnerability of Africa’s agriculture and food systems stems from a number of factors. The first relates to the production systems: for example, irrigated farmlands account for less than 7% of the total, illustrating an almost complete dependence on rainfall availability and its distribution. As a result, agricultural yields are the most susceptible to climate variability—with impacts more deleterious in sub-Saharan Africa compared to other regions. The asymmetry of impacts of climate change among different regions of the world, and the comparison with Sub-Saharan Africa is particularly more revealing: in short, climate change impacts are set to disfavour Africa’s agriculture. Added to this, significant post-harvest losses and food waste characterise Africa’s agriculture and food systems, which is projected to exacerbate in the context of high risk of vulnerability to attacks by prevalence and newly emerging pests and diseases attributable to a changing climate.

The second peculiar feature of Africa’s high risk of vulnerability to climate change emanates from an evident reliance of the majority of the population on agriculture sectors. Thus under a changing climate, Africa runs the risk of witnessing the largest increase in the number of poor people, including those who are falling back into extreme poverty. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) makes projections that Africa (and Southern Asia) would be the most exposed among the developing regions to an increased risk to hunger and poverty even with a ‘no climate change’ scenario. Under the worst-case scenario, much of the increase in the number of the poor is forecast to occur in Africa (43 million) and South Asia (63 million).

The asymmetrical patterns of climate change impacts on yield levels between developing and developed countries suggest some striking features: most estimates for crop yield impacts forecast negative for the developing countries, with the trend tending to worsen further in the future. On the other hand, in some developed countries the forecasts suggest a much larger share of potential positive changes. For example, temperate and polar regions of Europe may benefit from increased crops and livestock production; many warm and cool water species of fisheries and aquaculture may move to higher latitudes in North America; higher temperatures and atmospheric CO2 levels may increase forest growth and wood production, etc. (see FAO 2016a). According to estimates by FAO, globally between 30 and 40 percent of total food production may be lost before it reaches the market. This varies with product type, nevertheless in absence of processing and preservation practices in Africa, these figures could even prove a conservative estimate.
2. The Imperatives of Agricultural Transformation in Africa Under a Changing Climate

The distinctive features that define agriculture-climate nexus call for demystifying the object of ‘agricultural transformation’ in the African context. Evidently, the conceptual dichotomy between agricultural transformation as an end in itself, versus as a means to overall economic development, is gradually losing its resonance to much more nuanced approaches that justify inter-sectoral linkages and interdependence. In this respect, the efforts exerted since 2003 to guide policies, strategies and actions, through rolling out the Comprehensive Africa Agriculture Development Programme (CAADP) by the African Union, has been instrumental. Among other things, it has helped raise the profile of agriculture within development policy domain as well as in advancing the narrative of a coordinated multi-sectoral and multi-stakeholders’ co-ownership of the agenda and constructive engagement. Worthy of note in this case is that this desired progress has resulted from a deserved recognition of the centrality of people’s lives and livelihoods - including their economic base and freedom of choices. In such a narrative, the transformation agenda could be justified in terms of its relevance in providing satisfactory answers to the vexing questions of: what is to be transformed?, why it ought to be transformed?, how it could be transformed?, and who is to benefit from such a transformation process? Such perspectives help discern the extent to which the desired transformation can contribute to the achievement of food security, poverty reduction and growth objectives.

The grim reality portrays Africa, particularly the sub-Saharan region, as the most food and nutrition insecure continent with about a quarter of its population undernourished. Quite paradoxically, the majority of these are the very producers of food, i.e., smallholder farmers, herders, fisher folks, etc. This however should not be surprising seen in the light of average yield levels in Africa being merely a quarter of the developing countries’ average. Africa continues to depend on mounting food imports to meet the yawning deficit – for example, between 2000 and 2010 food imports grew by 50 percent for crops and doubled for meat, claiming tens of billions of US dollars annually. The fact that West African countries import two-thirds of their cereals consumption (rice and wheat) vividly illustrates the magnitude of the problem as well as the challenges of sustaining it. The agricultural transformation agenda should therefore satisfactorily address this Africa’s paradox.

For another thing, much of the underpinnings for Africa’s agricultural transformation hinge on its potentials, both in terms of demand and supply prospects. Driven by rise of population and incomes, urban food markets in Africa are projected to increase by up to four-fold by the year 2050, signalling a significant rise in demand for processed foods and markets logistics and in the agribusiness development. This is expected to generate significant economic activities and opportunities for rural employment and incomes. Few doubt the plausibility of realising a substantial increase in productivity and production as well as enhance value-addition in view of the low starting point on both counts, provided the right enabling environment are put in place. The agricultural transformation imperatives must therefore espouse systemic innovations in agriculture as a lynchpin (to transform the production process) so that agriculture is organised as a viable and sustainable economic undertaking for it to become highly productive, competitive and economically rewarding to those who work on it. Secondly, the agenda of agricultural transformation should not stop at ‘modernising farming per se’ through innovation, but also must transcend into, and embrace, the realm of ‘agricultural products transformation’. This helps fix the broken value-chains in agriculture and facilitates the realisation of the huge potentials and opportunities for job expansion and incomes within a dynamic rural setting. Agricultural transformation can only be perceived in an environment of expanding market demand domestically and through exploiting regional and global markets, which can generate incentives for increased sustainable agricultural productivity.

It is significant that the African Union Malabo Declaration on Agriculture (African Union, 2014) sets a goal of at least doubling agricultural productivity (as part of the commitment to ending hunger by the year 2025) by focussing on intensification of inputs use, irrigation, mechanization and energy supplies as well as reducing post-harvest losses by half compared to 2014 levels. Similarly, the 2030 Agenda for Sustainable Development (United Nations, 2015) sets a goal of “…doubling of agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.”

Obviously, these commitments of a higher order could only be achieved in an environment of a major innovation drive propelling agricultural productivity and processing. The focus in the AU Malabo Declaration on irrigation and mechanisation infrastructure and services, as a sine qua non for modernising agricultural production process, is reasonable in view of the aging of current farmers in Africa – and with youth increasingly becoming apathetic to work in an occupation that is drudgery and non-rewarding, hence the imminence of agricultural labour shortage. Equally, product transformation necessitates expansion of agro-processing, agribusinesses and transportation logistics operations, a thrust which the AU Malabo Declaration pledges an explicit intent as regards facilitation of private investment in agriculture, agri-business and agro-industries.

However, one cannot overemphasize the inevitably huge energy demands of such a transformation process for example, and in absence of opportunities for effective and efficient use of alternative renewable sources of energy, this may unavoidably lead to a further increase in the emission of greenhouse gasses into the atmosphere, instead of reducing it. Incidentally, agriculture sectors are regarded among the highest emitters of GHGs in Africa (Table 2), notwithstanding the rather insignificant contribution of Africa to the overall global emissions.

The comparable estimate for 1990-92 was about a third. See FAO (2015) Regional Overview of Food Insecurity in Africa.
Needless to emphasise, agricultural transformation must address the challenges of high risk of vulnerability of production systems and livelihoods to climate change. The Malabo Declaration makes a commitment to enhance resilience of livelihoods and production systems to climate change and other related shocks through enhancing investments for resilience building initiatives and mainstreaming resilience and risk management in policies, strategies and investment plans (African Union, 2014). In the same vein, the 2030 Agenda for Sustainable Development sets a goal of ensuring “sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality” (United Nations, 2015).

Apparent, the challenge of transforming agriculture in Africa in the context of climate change may sound like leaping a double hurdle; that is achieving increased productivity and production while contributing to climate solutions through adaptation and mitigation actions. As we will see below the special feature of agriculture in addressing both adaptation and mitigation solutions renders Climate Smart Agriculture (CSA) approaches particularly appealing to the African context.

3. Agriculture in the Paris Climate Change Agreement: Working with Nationally Determined Contributions (NDCs)

The Paris Climate Change Agreement (UNFCCC, 2015), which entered into force on 4 November 2016, established clear aims with respect to mitigation and adaptation, grounded in sustainable development. It makes a couple of specific references to food security. In its preamble section, it recognizes “ the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse impacts of climate change. And, in its Art (2) it pronounces its”… aims to strengthen the global response to the threat of climate change, including by… increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.” Note that in both cases food production systems are considered mainly from their vulnerability angle (i.e., safeguard food security; not to threaten food production...) It is important that this must be understood in the broader context of SDG-13, which calls for promoting sustainable agriculture taking urgent action to combat climate change and its impacts.

It is also significant that in its Art (3), the Paris Agreement proclaims the Nationally Determined Contributions (NDCs) as representing countries efforts towards the global response to climate change. The NDCs essentially provide the link between global commitments and local actions. It clearly meant that the content of NDCs determine the extent to which countries have identified agriculture sectors as integral part of climate actions and solutions.

The analysis by FAO (2016b) indicates that agriculture sectors have been prominently captured in the NDCs submitted by most African countries, both on mitigation and adaptation counts. Practically all countries in Sub-Saharan Africa have included adaptation and/or adaptation actions as priority areas in their NDCs including in their agriculture sectors. Adaptation coverage of the agriculture sectors in the intended NDCs submitted by countries in Sub-Saharan Africa shows 98 percent for agriculture, 94 percent for forestry and 76 percent for fisheries and aquaculture. The breakdown by crop and livestock and pastoral systems were respectively 96 percent and 80 percent. Such a prominence of adaptation is not surprising however, in view of its articulation and relentless advocacy by the African Union through the African common position on climate change, among other things.

Note that the 2014 AU Malabo Declaration aims a more ambitious target to be achieved by 2025 (compared to the 2030 target set by the SDGs).

Including Algeria, Egypt, Libya, Morocco, Tunisia and Western Sahara.
To the extent that the NDCs have become key documents, their careful interrogation, refinement and mainstreaming within national policies, strategies and plans, efforts should therefore be geared towards supporting countries for them to be able to identify and integrate climate adaptation measures for the agriculture sectors into relevant national planning and budgeting processes, also in the context of localising SDGs so that they are not presented as a separate agenda.

As for proposed contribution in mitigation actions, 96 percent of NDCs submitted by countries in Sub-Saharan Africa mention mitigation targets and/or actions in agriculture, land use and land use change and forestry (FAO, ibid). It must be emphasised that agriculture is naturally endowed with the possibility to provide integrated climate solutions in terms of both adaptation and mitigation goals. For instance, photosynthetic capture and storing of carbon in soils (mitigation) will lead to enhanced soil fertility, which can contribute to increased productivity and therefore improved food security (contributing to adaptation). This way, what initially may have presented itself as a burden could actually be converted into opportunity. In this regard, FAO has been supporting and documenting a number of proven approaches that render the bifurcation of the climate action into the dichotomy of ‘adaptation’ and ‘mitigation’ rather superfluous. CSAs, for instance, by identifying and reducing trade-offs and promoting synergies between increased productivity, enhanced adaptation and generating mitigation co-benefits, demonstrate an innovative approach of integrating agriculture and climate change concerns in a transformational context.

4. Implementation issues: some practical considerations for a way forward

Legitimate concerns may arise when it comes to implementation of the agricultural components of the NDCs in a transformational context.

First, the technical and institutional capacities have generally been inadequate. In the African context, the agricultural operators who are likely to be impacted are the small-sized, large number and less organised farming, herding, fishing households with limited trade and market as well as risk-mitigating opportunities. For them to access to roads could be as important as improved crop varieties and animal species. Equally, for the youth and women farmers, herders, fishers and agri-entrepreneurs, access to credit and ICT services could be as crucial as access to land and water resources. In addition, in a context of changing climate, access to renewable energy sources or risk mitigating instruments could undermine any credible effort of modernising agriculture sectors. Effective support services could hardly be delivered through any sector-based compartmentalised, fragmented, and uncoordinated manner. It requires innovative approaches for multi-sectoral engagement as well as transformative and effective institutions (public, private, CSOs, etc.) that can facilitate this engagement and coordination, delivery of key inputs and resources to facilitate change and results, and empower small holders, communities for ownership and accountability. Strengthening the capacity of government and other actors for an innovative transformational process need to be pursued with the kind of vigour that it deserves.

Second, mobilising adequate investment finance for agricultural development has been difficult in Africa. Reports indicate that since the 2003 Maputo Declaration few countries have lived up to the CAADP commitments of allocating at least 10% of national budgets to agriculture. The agricultural sectors have also not been able to attract any meaningful private investment over the years. The 2014 Malabo Declaration upholds the commitment to raise public investment finance and to improve the enabling environment to overcome the barriers for private investment in agriculture. External financial resources, including the Green Climate Fund (GCF) can provide important windows of opportunity for countries to support their climate actions linked with agriculture sectors. However, these can only materialise when agricultural transformation is defined as a priority within the country’s development trajectories, including as part of the solutions to climate challenge (within the NDCs). Efforts directed at supporting countries for them to develop transformational projects would go far a distance in terms of meeting expectations. Obviously, these require transformational leadership at all levels that appreciates the agenda of agricultural transformation as not just a responsibility to be left exclusively for those in agricultural sectors to worry about, but most importantly one that can instil a sense of multi-sectoral co-ownership and mutual accountability as well as guide the alignment of development partnerships with nationally defined priorities.

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*Note that more than 30 countries, most prominently in Sub-Saharan Africa, specifically refer to CSA in their INDCs (FAO 2016b). It is significant to note that climate change has consistently been a standing item on the agenda of the AU Assembly of Heads of State and Government since July 2008, ensuring continuous political engagement and advocacy in favour of the African Common Position through the African Ministers Conference on Environment (AMCEN) and the Committee of African Heads of State and Government on Climate Change (CAHOSCC).*
Domesticating indigenous agro-biodiversity for improved food and nutrition in Africa

Festus K. Akinnifesi

Summary

Agrobiodiversity is the basis of human food and nutrition in Africa. The economic drive for a monoculture-led model of agriculture tends to undermine the potential of managing a wide range of biodiversity, including domesticated, semi-wild or wild species on farms, and in using an agroecological approach to produce more diverse, healthier and a more nutritious diet. Sustainability broadly aims to meet the present needs without compromising future needs. A transformation towards sustainable agriculture in Africa warrants integrating a wider range of biodiversity for more human nutrition. This article advocates domesticating agrobiodiversity as a pathway to improve food and nutrition in Africa.

Introduction

Sustainable agriculture, particularly the production of nutritious food, depends on biodiversity and the ecosystems services it provides. The role of genetic diversity of plants, fish and animals, including cultivated, domesticated, semi-domesticated, and wild species, varieties/breeds and land races, and their direct contribution to human nutrition, and indirect role in the entire food chain, are key to human survival on the planet. Despite the success of agriculture to meet the growing demands of the world population in the last half century, our food production system which has skewed towards monoculture, over-specialization of production systems and narrowing of the genetic diversity—crop, livestock, forest and fish, is undermining the potential for improving nutrition and health. Seventy-five percent of world food depends on only twelve plant species and five animal species.

Agrobiodiversity is the foundation of African agriculture, providing food, nutrition and health and livelihood needs. Domesticating a wider range of agrobiodiversity may contribute to improved Africa’s diet, nutrition and health, while reducing genetic erosion and extinction. This article presents agrobiodiversity as a vital element of sustainability in the context food and nutrition in Africa.

1. Sustainability and biodiversity

Nearly 25% of the plant species in the world—some 60,000 to 100,000 species—are considered threatened with extinction, and since the industrial revolution times, nearly 70% of crop diversity has been lost. Human consumption patterns can threaten biodiversity of endemic species unless there are measures to integrate them into the agriculture systems. For instance, one-third of biodiversity threat worldwide are reported to be linked to production for international trade (Moran and Kanemoto, 2017). Local farmers are custodians of the remaining genetic diversity on the planet. As climate change threatens staple food production, resource-poor farmers are inclined to diversify their sources of food and income as a coping strategy. Our nutrition security is closely linked to how we sustainably use and manage agrobiodiversity.

The pathways to achieving sustainable food and agriculture have been detailed elsewhere (see Campanhola et al, this volume), which should be an integral part of any strategy to achieve the 2030 challenge of food security, nutrition and sustainability. This requires better coordination, cross-sectoral integration and policy platforms that address social, economic and environmental dimensions of food security, nutrition and sustainability.

The sustainability of agrobiodiversity is vital in order to meet food and nutrition needs of both present and the future generations. For ecosystems to remain functional and healthy, they must have capacity to respond to unforeseen changes, both in the present and in the future. Given the rapid pace of change in recent times, and need to adapt to uncertainty, our agricultural production systems need to be positively responsive. This ability of the agroeco system to sustain, and quickly adapt and respond to (agility) current and future needs in new ways, is what agroecology scholars have coined, ‘sustainagility’ (Jackson et al, 2010). In achieving dietary diversity and nutrition, multiple options, as well as social-ecological and interdisciplinary approaches, are needed to increase the consumption, market access and value chain development of diverse food sources. This includes the cultivation of a wide range of nutritious plants, from both perennial and annuals—fruits, nuts, and vegetables, and where plausible, integrating biofortification into the value chain from production to consumption.

2. Changing trends in Africa’s food and nutrition

The African population is projected to double reaching to 2.4 billion by 2050, while 122 million young people will enter the labor market in the next five years. Therefore, our agriculture and food systems must continuously respond and adapt to challenges and demands of the changing African society, including issues of globalisation, demographic changes characterised by “youth-bulge,” economic and political migration, rural-urban drift, dietary shifts, health and diseases and impact of climate change, along the value chain.

With a gradual shift to “industrial diets” laden with excessive intake of fat, sugar and salts, animal sourced foods, characterised with prolonged storage and over-processing, Africa is increasingly confronted with the “triple burden” of malnutrition—hunger (inadequate calorific intake), undernutrition (undernourishment) and obesity (over-nourishment).

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Food production in Africa has generally focused on commercial crops, and most of the government policies, investment programmes, extension support and inputs delivery systems in the continent have over a long time, focused on a few staple or export crops and chemical fertilizer. Broadly speaking, this is linked to a policy bias from decades of a colonial legacy that is counter-productive to agroecology, biodiversity and good nutrition in the continent. In the post-colonial Africa, such policies and practices have unintentionally led to loss of important biodiversity of wild, semi-wild and less-known food sources. It is time to shift the emphasis of Africa’s agriculture from dietary energy provision and economic interest to more biodiverse and nutritious food.

Because of the inherent diversity of Africa in terms of its soil, topography, landscape, botany, and cultures, these indigenous undervalued crops can play a vital role in meeting the daily nutritional and health needs of the local people. Therefore, broadening the genetic diversity of crops, livestock and aquatic—genes, species and local varieties or breeds, in mixed, multiple or integrated systems at farm and landscape scales are key to addressing food and nutrition in Africa.

Nutritious food pathway: biofortification or biodiverse?
Although bio-fortification has been a major source of nutrients to combat nutrient deficiency or imbalance in the developed countries, access to bio-fortified food is a rarity in Africa (Kahane et al, 2013), and affordability poses a greater challenge. The natural source of nutrient from biodiversity is therefore pivotal, and as nutrition is concerned, perhaps it is a matter of life and death, for the most vulnerable rural populations. Several research evidence exists confirming the micronutrition superiority of some lesser known cultivars and wild varieties over conventional cultivars, sometimes multiple times over.

Recent studies involving more than 3,000 indigenous African fruit species show they are generally more nutritious, drought-tolerant and pest- and disease-resistant than their exotic counterparts (Cernansky 2014). For instance, marula fruit (Sclerocarya birea) contains 180 mg Vitamin C per 100 g—surpassing orange, grapefruit, mango and lemon. Likewise, the fruit pulp from baobab (Adansonia digitata) contains up to 500 mg of vitamin C - nearly 10 times as the vitamin C in equivalent amount of fresh oranges. It is also highly rich in Calcium, generally ranging from 300 to over 2000 mg/100 g dry weight. Its leaves are also very rich in Vitamin A and B2. Likewise, there are several hundreds of such wild species that are nutrition-rich in Africa.

For many indigenous species, high intra - and interspecific variation from tree-to-tree, between and within provenances and land races exists, which opens avenues for trait improvement. Nonetheless, the level of information is still largely anecdotal. There is need for more research on micronutritional diversity within and between species, origins and changes that may occur along the value chain, such as storage, processing and consumption. Heywood (2011) has argued that biodiversified food sources such as ecomunition model should be seen as part of an overall strategy that includes continued improvement of agricultural production, breeding new cultivars that are resistant to diseases and stress, nutritional enhancement of crops, industrial fortification, vitamin supplementation and other nutrition-agriculture linkages.

Balance between consumption and production in nutrition
The diversity of cereals in Africa is more researched than other food types. It is generally accepted that consumption of fruits and vegetables can improve nutrition and health, but their consumption in Africa is relatively low (Powell et al, 2013). Schippers (2002) provided a detailed overview of 126 African vegetables, emphasizing their nutrition and commercial potential. One particular aspect of agrobiodiversity in Africa that deserves increased attention is harnessing the potential of indigenous, wild and semi-wild crop species, especially fruits and nuts in order to address food and nutritional needs on the continent. The rest of this article will focus on domesticking agrobiodiversity with particular emphasis on indigenous fruit and nut trees, on which some progress has been made over the last few decades.

Ickowitz et al (2014) showed that a strong positive relationship exists between tree cover and dietary diversity: fruit and vegetable consumption increases with tree cover until a peak of 45% and then declines. In addition, the study showed that children in Africa who live in areas with more tree cover have more diverse and nutritious diets. It is suggested that off-farm income, market access and awareness education on nutrition can improve consumption. Efforts to promote an increase in consumption of nutritious food and systematic diet diversification should be an integral part of sustainable agriculture and food systems.

3. Recent progress in domesticking wild and semi-wild species as crops

Wild harvesting and domestication
The complex agricultural systems in Africa today have evolved from cultural imitation of natural systems and processes, in response to changes in population, ecological and climate conditions. It is evident that local farmers manage biodiversity on farms over several generations, and, in the process, they domesticate wild and semi-wild cultivars, land races and exotic species. These have resulted into morphologically recognizable improved varieties, through natural selection, intentional or unintentional breeding (Heywood, 2011, Akininfes et al, 2008).

For several thousands of years, African rural dwellers relied on the gathering of edible food, wild fruits, nuts, vegetables, herbs, honey, mushrooms, spices, game, medicine, insects, and aquatic animals, in addition to other uses such as fodder, medicine, fibres, shelter, cosmetic and other cultural uses. Figure 1 shows selected fruit trees that provide year-round supplies of important sources of nutrients and income to the rural people in Malawi and Zambia. These are particularly vital during periods of extreme food shortages (Dec to April) when human nutrition would be most at risk, such as those caused by El Nino droughts.
Nearly every country in Africa has a wide range of important locally important wild and semi-wild or domesticated species, which are valued for food, health and nutrition, and many are also locally traded. Each country depends on hundreds of local species for their daily livelihood needs. For instance, in West Africa important indigenous fruit and nut trees (IFTs) include: Artocarpus spp. (African breadfruit), Inga edulis, Treculia africana (African breadnut), Tamarindus indica (tamarind), Syzygium spp., Chrysophyllum cainito (star apple), Irvingia gabonensis (wild mango), Parkia biglobosa (wild locust bean), Castanopsis spp. (chestnut) etc are important IFTs; in Southern Africa, Uapaca kirkiana (wild loquat), Parinari curatellifolia, Strychnos cocculoides (monkey orange), Anisophylea boehmii, Azanza gackeana, Flacourtia indica, Syzygium guineense, Strychnos pungens, Physalis peruviana and Uapaca nitida, Anisophylea boehmii for Zambia and Vitex mombasae (Akinnifesi et al, 2008). Sclerocarya birrea, is also an important IFT in the region. The nutritional composition of several species have been documented, but there is need for systematic research on capturing putative cultivars based on high nutritional values.

There are four categories of indigenous fruit and nuts trees that can contribute to food security and nutrition:
- those that are consumed as fresh fruits (mostly with sweet non-toxic or astringent fruit pulp when ripe);
- those requiring cooking before being consumed (e.g. breadfruit, nuts, edible oils, spices);
- those requiring intensive processing into other forms before consumption (e.g. juice, wine, jam, chocolate, etc.); and;
- non-edible fruit and nut products (e.g. cosmetic oils or products, biodiesel, medicinal products).

The long neglect of indigenous fruits and nut trees and palms, and the failure to domesticate and develop them into crops, have been attributed to lack of awareness and inadequate understanding of the contribution to rural economy, livelihoods of communities and ecosystems services they provide; ii) policy bias in favor of export crops, exotics and plantation forestry, iii) poor development of the value chain and market; vi) pervasive stigma and general notion that indigenous fruits and products are poor people’s food.
Participatory tree domestication strategy

Of the 20,000 plant species producing edible products, only 0.5% has so far been domesticated as food crops, although the potential to develop new crops through participatory domestication has been a subject of intensive agroforestry research in the tropics, involving over 50 tree species (Leakey et al., 2012).

Participatory domestication is a farmer-led and market-driven iterative process of genetically and agronomically improving wild species with the end-user in mind. Tree domestication is needed to ensure that trees produce quality fruits in a shorter period of time, using proven strategies (Leakey and Akinnifesi, 2008). It is possible to obtain desirable fruit and nut traits such as high yielding cultivars, superior fruit size and other acceptability traits that enhance their market values, as well as food and nutritional values. Domestication aims at capitalizing on natural variation in the wild to obtain superior clones.

Akinnifesi et al (2006) demonstrated a participatory clonal selection strategy for indigenous fruit trees in southern Africa (Figure 2). It involved the following seven steps: (i) participatory priority-setting by multi-stakeholder approach, household and market surveys and product prioritization; (ii) identifying natural stands of priority of indigenous fruits through reconnaissance surveys; (iii) village workshops to define fruit traits (e.g. nutritional quality), and undertake joint selection of elite or superior cultivars with communities – farmers, marketers, village leaders and schoolchildren using ethnological approach; (iv) systematic naming of trees; (v) collection of seeds and vegetative propagules and nursery evaluation; (vi) establishing clonal field orchard—for continuous clonal selections with a view to obtain a few true-to-type and true-to-name cultivars; and (vii) release of superior cultivars for adoption, testing and scaling up.
Agroforestry and polyculture systems (e.g. agroforests, homegardens, trees on farms, etc.), provide excellent pathways for domesticking a wide range of wild, semi-wild and domesticated species, as well as boosting yield of staple crops and integrating livestock. Although Intellectual Property Right (IPR) has been advocated, it tends to be easier for plant breeders and institutions as innovators, and can therefore lead to a monopoly of local genetic resources by private transnational corporations. Africa needs rights on indigenous resources that benefit local communities and farmers, and recognize their innovative efforts as custodians of these genetic resources for the benefit of humankind.

4. Looking to the future

Innovative policy and governance mechanisms, backed by investment priorities, are needed to boost nutrition through development of agrobiodiversity. Kahane et al. (2013), in reviewing global agrobiodiversity of highly valuable but undervalued and underutilized crop species for food security and nutrition, concluded that only a change in policy is needed to influence behaviours and practices. However, the challenge for policy makers is that policy recommendations on biodiversity are easily stated but rarely adopted widely. This is partly because economic benefits are hard to estimate, and there is little incentive for deliberate biodiversity protection or conservation.

One robust pathway to biodiversity conservation is through participatory domestification involving local actors and smallholder farmers who are custodians of the resources. The domestication strategy for indigenous crop species—trees, crops and vegetables—can form an integral part of sustainable agriculture production and food systems, from production to consumption. Likewise, for nutrition strategies to be successful in Africa, it must deliberately harness, integrate and improve biodiversity of both staple and indigenous food crops across the entire value chain.

It must be mentioned that non-biodiverse crops—including commercial, staples and exotic horticultural crops, will always have important role in Africa’s Agriculture. However, their intensification must not compromise the development of the indigenous biodiversity and their value chain. A harmonious integration of biodiversity in the conventional production system is a win-win solution. This will not only boost food availability to reduce hunger but will also contribute to nutrition and income, while conserving biodiversity.

Lastly, Africa’s biodiversity and genetic resources must be safeguarded against privatization at the disadvantage of the farmers and local people.

5. References


Building resilience to protracted crises through safe access to energy

Andreas Thulstrup and Indira Joshi*

The importance of fuel and energy

Globally, an estimated 1.3 billion people currently lack access to modern energy services (Practical Action 2014) and almost three billion people rely on wood, coal, charcoal or animal waste as sources of fuel for cooking and heating (SE4ALL 2014). In emergency and protracted crisis settings even basic access to traditional biomass may be constrained. Protracted crises are characterised by “environments in which a significant proportion of the population is acutely vulnerable to death, disease and disruption of their livelihoods over a prolonged period of time. The governance of these environments is usually very weak, with the state having a limited capacity or willingness to respond to or mitigate the threats to the population, or provide adequate levels of protection” (Harmer & McCrae 2004). Protracted crises are becoming the norm, while short-lived acute emergencies are becoming the exception, not the rule (FAO 2012). Despite the realization that crisis-affected populations have significant fuel needs, the importance of providing fuel and appropriate cooking technologies in these settings is often overlooked or inadequately prioritized by humanitarian actors. While food may be provided, e.g. by the World Food Programme, the means to cook that food is not consistently provided and when aid agencies do provide cooking fuel they often do not provide enough to cover needs (WFP 2012). Lack of access to cooking fuel as well as appropriate technologies for cooking has far reaching consequences which may influence food assistance outcomes, food security, beneficiaries’ safety, dignity, health and livelihoods; women’s vulnerability to gender-based violence; and the ecosystems on which crisis-affected people depend. Women and children are often tasked with the collection of fuelwood and often spend several hours per day collecting wood in areas with degraded forests (Sepp 2014). Refugees and Internally Displaced People (IDPs) often face a severe lack of access and availability of fuelwood partly due to the fact that displacement camps are established in fragile, sparsely forested ecosystems in which displaced populations rely on the scarce natural resources found in surrounding areas. The time spent collecting fuelwood takes time away from school attendance, income-generating activities, child care and leisure. It can also reduce the effectiveness of other programs targeting women and children. The cross-cutting nature of the energy sector therefore poses a range of challenges but also a unique opportunity for building resilient livelihoods when context-specific and holistic approaches are used.

Building resilience

There is a growing consensus among donors, governments and humanitarian policy groups on the importance of building resilient livelihoods that can “efficiently anticipate, adapt to, and/or recover from the effects of potentially hazardous occurrences (natural disasters, economic instability, conflict) in a manner that protects livelihoods, accelerates and sustains recovery, and supports economic growth” (Frankenberger et al. 2012). While humanitarian responses have helped to save lives, they have not done enough to enable affected populations to withstand or absorb shocks and to avert future crises. Increasing the resilience of livelihoods to threats and crises is one of FAO’s five Strategic Programmes and is implemented through inter-disciplinary work that strengthens the linkages between humanitarian and development contexts. Ensuring energy access in emergencies is a core component of this work which can help foster the transition from vulnerable, crisis-prone livelihoods to sustainable and resilient livelihoods. Approaches that improve access, production and use of energy can help to diversify income sources, reduce environmental impacts and improve food and nutrition security, encompassing both immediate emergency response interventions and longer-term Disaster Risk Reduction activities that help to build resilient livelihoods.

A multi-sectoral challenge requires a multi-sectoral response

The collection, production, and use of biomass fueling emergency contexts create a myriad of risks for crisis-affected people and their environment. Displaced persons often rely on biomass fuel for cooking, heating and lighting. Risks include sexual and gender-based violence or assault during fuelwood collection, loss of livelihood and education opportunities, environmental degradation, and respiratory illnesses caused by household air pollution. The interventions to address these issues require greater attention, strong partnerships and a multi-sectoral approach from the humanitarian community. FAO is co-chairing the inter-agency Safe Access to Fuel and Energy (SAFE) Humanitarian Working Group along with key partners such as WFP, UNHCR and the Global Alliance for Clean Cookstoves. As a member, FAO contributes to achieving a more coordinated, predictable, timely, and effective response to the fuel and energy needs of crisis-affected populations. In order to design and implement effective SAFE activities, FAO is harnessing its full technical, programmatic and operational expertise in partnership with relevant stakeholders at headquarters, regional and country levels. In doing so, FAO is adopting a holistic and integrated approach, which addresses multiple sectors, including natural resources, nutrition, gender, protection, livelihoods and climate change. FAO has been using this approach in several locations (South Sudan, Kenya, Ethiopia, Somalia and Myanmar) in order to assess the multi-sectoral challenges and opportunities related to energy.

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Nature & Faune Volume 31, Issue No.1
Challenges and Opportunities

Across the board, FAO’s field work in different contexts has reconfirmed some key recurring challenges faced by communities. Women walk long distances in order to gather fuel wood which exposes them to protection risks and taking time away from other more productive activities. The depletion of forest resources in these settings is often also due to the reliance on woodfuel-related livelihood activities. When woodfuel is not available, women rely on unsustainable coping strategies such as using plastic jerry cans or small twigs as cooking fuel and bartering food for fuel. The use of a three-stone fire for cooking has a number of detrimental impacts on human health. The magnitude and nature of these challenges are also significantly affected by the existing relations between displaced populations and local communities. Economic and trade relations often exist between displaced populations and host communities. In Kenya for example, the host communities sell greens, cowpeas, meat, camel milk and cow milk to the refugees. At the same time, there is significant tension and conflict between these communities due to the collection and cutting of live wood for domestic energy use. The unchecked extraction of indigenous acacia trees for the production of charcoal has caused intra-communal conflict between pastoralists and charcoal producers. This is often because Acacia trees serve important functions e.g. as a source of medicinal products, shade for people and livestock, animal fodder, as landmarks/signboards and wind breaks. In terms of opportunities to address these issues, FAO see sample scope for planning a range of interventions. These include the provision and/or production of fuel-efficient stoves and alternative fuels, sustainable natural resource management for fuel and promotion of alternative livelihoods to counter environmental degradation resulting from activities such as traditional charcoal production. Livelihood activities, such as the local production of stoves, can help to diversify income and energy sources while reducing environmental impacts. The use of more efficient cooking technologies can also free up time for women that they would otherwise spend collecting fuelwood.

Final thoughts

There is an urgent need to address energy and fuel issues in a holistic and comprehensive manner, drawing upon the concerted efforts of UN agencies, partners and stakeholders. The involvement of regional organizations, partnerships and initiatives will greatly benefit efforts to scale up interventions to address fuel needs. One example is the Inter-Governmental Authority on Development (IGAD) whose mission is to increase cooperation on foodsecurity and environmental protection, promoting peace, security and a focus on humanitarian affairs as well as economic cooperation and integration. Furthermore, engaging with academia and research institutions should also be a priority for humanitarian actors, in order to capture the latest innovations and technology developments. At the global level, a number of recent initiatives provide strong justification for partnerships, inter-agency collaboration and greater overall engagement on the fuel issue in emergencies and protracted crises. A major stream of work for the Committee on World Food Security, the recently endorsed Framework for Action for Food Security and Nutrition in Protracted Crises includes a number of principles of direct relevance and significance to the challenges and risks associated with the collection, production and use of fuel. These include the protection of people affected or at risk from protracted crises, empowering women and girls, promoting gender equality, contributing to peace building, managing natural resources sustainably and reducing disaster risks. The Sustainable Development Goals also provide an important agenda for improving the well-being of the world’s most vulnerable people in an environmentally sustainable manner and a number of goals are of direct relevance to FAO’s work on SAFE. Goal 7 highlights the importance of improving energy access, Goal 12 highlights the need for sustainable management and use of natural resources and Goal 5 seeks to empower women and achieve gender equality.

This paper has highlighted the importance of energy access in building resilient livelihoods. In the coming period it will be crucial to forge meaningful partnerships with governments, donors and partners in order to capitalize on the significant momentum on initiatives such as SAFE. Lasting solutions which can address the fuel- and energy-related challenges faced by crisis-affected households should include a comprehensive package of context-specific interventions which include supply-side, demand-side and livelihood support activities. A particular focus should be on livelihood support activities which can ensure that there are income-generating activities which can provide an alternative to the selling of woodfuels. These alternatives may include the selling of locally produced fuel-efficient stoves, the management of tree nurseries and selling of tree seedlings, the establishment and management of Integrated Food Energy Systems (IFES) such as agro-forestry or biogas systems and value-added processing activities in the agricultural sector.

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Stepping away from Earth and looking back at the vast African continent: A thought piece

Ann H. Clarke

Africa, like other continents such as South America and Asia, faces many development challenges in the 21st Century. One of these is climate change. The Royal Geographical Society, for example, noted that the Intergovernmental Panel on Climate Change (IPCC):

“Identified Africa as one of the most vulnerable continents to climate variability and change. Africa faces an increased threat from extreme events such as storms, flooding in its coastal regions, sand dune mobilization and sustained droughts which impact on food and water security, ecosystems, health, infrastructure and migration. Mount Kilimanjaro’s glaciers are in retreat, over 5,000 African plant and animal species and the Karoo biomes are at risk.”

If for a moment, we step away from Earth and look back at the vast African continent, we would see that its lovely brown deserts and savannahs and green tropical forests and fields, and brightly lit cities are surrounded by Earth's beautiful white clouds and blue oceans and white clouds in the darkness of space. Whether this water resulted from seeding by comets or asteroids or not, the Earth's forests, farms, and cities, including and to an important degree those of Africa, currently provide us with a natural water, oxygen, and carbon recycling system that facilitates our habitable climate.

To engineer large scale substitutes within Africa, on Earth or even on other nearby planets would be cost prohibitive, if not impossible at least in the near future. Like Earth, Venus, may have had an ocean of water and been habitable, but Venus is now enshrouded by sulfuric acid clouds, and subject to heavy metal rain. On Jupiter, and possibly also on Uranus and Neptune, methane is cycled into graphite resulting in diamond precipitation. On Mars, carbon dioxide frost has been observed. In other words, we should not just think global and act local, but as the architect William McDonough said: “Think galactically, act molecularly.”

We, therefore, must pay attention and lend our support to Africa. How Africa balances its diverse sinks and sources of water and carbon in a rapidly changing society will not only affect the well being of its people, but also that of the planet.

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Achieving food and wood security in the context of climate change: The role of urban forests and agroforestry in the Nationally Determined Contributions in sub-Saharan Africa

Jonas Bervoets, Fritjof Boerstler, Simone Borelli, Marc Dumas-Johansen, Andreas Thulstrup and Zuzhang Xia

Summary

The demand for energy in urban areas of Sub-Saharan Africa (SSA) will increase in parallel to the growth of the urban population, with woodfuel continuing to be the most important energy source for cooking. SSA has the highest woodfuel consumption per capita in the world and it is estimated that demand will continue to increase. Charcoal is mainly consumed in urban centers with production taking place in the rural hinterland, adding layers of complexity to the urban-rural linkages of charcoal production and consumption. Urban and peri-urban forests and agroforestry systems offer a potential solution in meeting these challenges in the context of climate change. This article briefly examines how urban forest management and urban energy demand are reflected in the Intended Nationally Determined Contributions (INDCs) and the Nationally Determined Contributions (NDCs). A total of 46 reports were analyzed but only 8 highlighted urban forests specifically (Chad, Burkina Faso, Central African Republic, Cote D’Ivoire, Namibia, Senegal, Togo and Uganda). This article concludes that ensuring ‘wood security’ at present is a challenge, but a solution could be to promote urban forests and agroforestry systems and simultaneously integrate these in national policies and strategies.

Introduction

FAO (2009a) has projected that feeding a world population of 9.1 billion in 2050 will require a 70% increase in food production between 2005 and 2050. At the same time, migration from rural to urban areas will result in an estimated 70% of the world population living in urban areas by 2050. These trends will not only cause a significant change in diets and consumption patterns in urban areas, but will also require resources and efforts to ensure food security for an increasing urban population. Appropriate food utilization, one of the four pillars of food security, is crucial to ensuring an appropriate level of nutrition (FAO 2009). An often overlooked, yet crucial, aspect of food utilization is the need to have access to sufficient energy for cooking and processing food. Without access to a sustainable source of energy and appropriate cooking technologies, many types of food cannot be consumed. The demand for energy will follow population growth and ensuring access to widely available and affordable forms of cooking fuel and technologies will become an increasingly important challenge. It is estimated that the population of sub-Saharan Africa (SSA) will grow from around 770 million in 2005 to 1.5-2 billion in 2050 in both urban centers and rural areas (FAO, 2009b). Arnold et al. (2006) established that in Africa the increase in fuelwood and charcoal consumption is directly related to population growth and that we have not yet seen a decline in consumption of the two energy types. Hosier et al., 1993 found that 1 percent of urbanization in Dar es Salaam, Tanzania, led to a 14 percent increase in charcoal consumption.

Between 2015 and 2050, wood demand is projected to increase further (Iiyama et al., 2014). Hence, woodfuel will become even more important in 2050 than it is now.

At present approximately 300 million people in SSA reside in urban areas, a figure that is expected to grow to 500 million in 2025 (Mittin & Satterthwaite, 2011). Although data is somewhat limited, between 30-55% of the 300 million urban dwellers are considered to be poor (Mittin & Satterthwaite, 2011). There is a link between charcoal production and consumption, and poverty and per capita woodfuel consumption in SSA. The majority of the urban poor are highly dependent on charcoal for cooking, because it is often the cheapest and the only available source of fuel in cities, with few or no alternatives in place. Charcoal has several benefits which are of advantage especially in urban set-ups, such as a higher energy density in comparison to fuelwood, lower weight and easier transport/storage as well as low smoke levels during combustion (AFREPEN, 2005; Chidumayo & Gumbo, 2013; Iiyama et al., 2015). The urban poor thus remain heavily dependent on charcoal, which in turn increases the demand for production in rural areas. The energy ladder theory postulates that in response to higher income and other factors households will shift from solid fuels, such as woodfuel, to more modern cooking fuels and energy-efficient technologies, such as Liquefied Petroleum Gas (LPG) (Barnes and Qian, 1992). While in certain contexts, such as in parts of India, this may be the case (DeFries & Pandey, 2010), there is evidence that the use of solid fuels for cooking is rising in SSA (Roth, 2013). Socio-cultural aspects, such as cooking habits and preferences, likely play a significant role in this increase. An indication of the latter is that charcoal often remains a part of the energy mix even in wealthier urban households that have managed to switch to LPG, electricity or other forms of modern energy. Finally, it is also important to remember that in many countries, charcoal production is considered illegal and may be associated with social stigma (Gumbo et al., 2013).

Nature & Faune Volume 31, Issue No.1
Given the significant and increasing demand for woodfuel for cooking, and associated social and environmental challenges in SSA there will be a need to align efforts to achieve food security with strategies to ensure “wood security.” Iiyama et al. (2014) projected that SSA would need an area equivalent to 1.8 million ha of land to meet its charcoal demand for the year 2015 and 4.5 million ha in 2050. This increase will largely take place in smaller urban areas in SSA (with less than one million inhabitants), as they are the ones likely to house 75% of the future urban growth (UN-Habitat, 2014). However, it is currently unclear how the production of woodfuel will compete with agricultural production and other land use types. While charcoal is mainly consumed in urban centers, production most often takes place in the rural hinterland, sometimes hundreds of kilometers away. In places like South Sudan and Somalia, charcoal is even exported to other countries in the region or to the Middle East (Thulstrup & Henry, 2015; Oduori et al. 2011). These urban-rural linkages, in terms of charcoal production and consumption, put a lot of pressure on often already fragile rural environment. In fact, the production of charcoal relies heavily on hardwood tree species and the selective felling of trees from both forests and trees outside forests and results in a considerable loss of biodiversity. Furthermore, the use of highly inefficient traditional earth kilns results in a very low conversion efficiency of between 8-20% (Iiyama et al., 2015). Improved kilns, e.g. made from steel or bricks, have been designed to improve the efficiency of charcoal production. While they are less labour intensive than traditional earth mound kilns (EMK), they may be less accessible to small-scale traditional charcoal producers due to higher costs. In addition such kilns are often perceived as less practical by charcoal producers as they have to be moved from one charcoal production location to the next and require more preparatory wood work before the combustion can take place. Both of the factors may have a negative impact on the kiln’s social acceptance. Improving traditional small-scale methods, such as equipping earth kilns with chimneys made from oil drums, may offer a decent compromise (Stassen, 2002). A good example is the Casamance kiln, a traditional earth mound kiln modified with one chimney and four air letts which provides a better control of the carbonization process resulting in higher and better quality yields as the traditional EMK (Nturanabo et al., 2011).

This article seeks to analyze how urban forest management and urban energy demand, particularly in relation to charcoal, are reflected in what is currently one of the most important climate change policy platforms, the Intended Nationally Determined Contributions (INDCs) and the Nationally Determined Contributions (NDCs). The ongoing process of formulating and implementing Intended Nationally Determined Contributions (INDCs) and the Nationally Determined Contributions (NDCs) is led by the United Nations Framework Convention on Climate Change (UNFCCC). The INDCs and NDCs are the actions and targets that countries have stated they will undertake in order to contribute to keeping global temperatures from rising more than 2 degrees Celsius. Once a country ratifies the Paris Agreement, its INDC becomes its NDC unless a revised NDC is submitted. The NDCs are to be updated on a five year basis (UNFCCCb, 2016) and will highlight national climate change adaptation and mitigation targets. As of November 2016, a total of 117 parties to the UNFCCC had submitted their NDCs.

Materials and methods

All current 46 INDCs and NDCs from SSA countries were used for this analysis and were screened for the extent to which priorities relating to urban and peri-urban forestry and the role of the urban forestry sector in meeting urban energy demand were mentioned. The screening did in particular focus on keywords such as charcoal, woodfuels, urban forestry, and improved cook stoves.

Results

The majority of the 46 countries analyzed reported the need for introducing improved cook stoves. While these technologies are mentioned, there is very little focus on the supply of sustainable biomass. A few countries do highlight that a sustainable charcoal value chain is needed as a way forward (e.g. Rwanda and Cote D’Ivoire) and that improved charcoal kilns should be promoted and used (e.g. Burundi, Somalia, Zambia). In addition, a few countries highlight the need to promote woodlots for wood energy production (e.g. Benin, Cote D’Ivoire and Malawi).

With regards to urban forests and their potential role in supplying food and fuel to urban areas, only eight countries out of the total 46 countries mention urban forestry specifically (Chad, Togo, Burkina Faso, Central African Republic, Cote D’Ivoire, Namibia, Senegal and Uganda). Chad reported, in their INDC document, the need to develop green belts around urban centers at a cost of approximately 30 million USD. Togo, also in their INDC document, emphasizes the need to promote urban forestry at a cost of 80 million USD. Furthermore, Burkina Faso intends to restore the green belt in and around Ouagadougou, the Central African Republic states in its NDC an intention to promote urban forestry across the country and Cote D’Ivoire will promote community forestry at village level. Senegal states in their INDC that they will plan urban ecosystems integrating watersheds and Namibia highlights the need to promote urban and peri-urban agriculture. Finally, Uganda states in its NDC an intention to promote forest restoration in both urban and rural areas.

Wood security refers to the process of optimizing sustainable forest-and-farm production for wood, timber, pulp and bioenergy for domestic and industrial uses (Salbitano et al., 2016). At present only a number of the SSA countries had submitted their NDCs. The analysis was thus built on both INDC and NDCs.
Discussion

Possible reasons for the relative absence of urban forestry concerns in the INDCs and NDCs include lack of information, data and awareness of the importance of the woodfuel sector for addressing urban energy demand. However, if urban energy demands are not properly addressed, there may be dire consequences for millions of urban poor in terms of food security and nutrition. There is a clear need to explore opportunities for producing woodfuel closer to end users in urban and peri-urban landscapes. Urban forestry and its role in urban multifunctional landscapes is one of the most promising approaches. Affordable and sustainable energy can be made available through Sustainable Forest Management (SFM) and forestry planning in urban and peri-urban forests. This can provide not only woodfuel, but also other products such as timber and non-timber forest products as well as environmental services. Other systems that can be promoted include diversified farming systems, woodlots and agroforestry systems. Urban agriculture and charcoal production would also be located closer to markets, enabling farmers to reach markets nearby.

Urban and peri-urban forests are, however, in many cases degraded, deforested or nonexistent. Salbitano et al. (2016) highlight key actions for the successful use of urban forests for the provision of woodfuel such as i) mapping and monitoring of woodlots, ii) using fast growing species, iii) identifying coppice potentials and iv) developing efficient value chains. An initial step would be to carry out further studies of woodfuel mapping, such as the Woodfuel Integrated Supply-Demand Overview Mapping (WISDOM) and to advocate for policies which address the wood energy sector for urban areas (Drigo & Salbitano, 2008). There are many good examples of such multifunctional urban landscapes and farming systems. Agroforestry activities in proximity of urban areas could, for example, help to achieve wood security for growing urban populations. Trees outside forests offer numerous opportunities in this regard. Despite being present in rural areas, forests are not always easy for farmers to access; and trees outside forests thus become more important (FAO, 2013).

Trees can be integrated in crop and animal production systems, resulting in increased food security and the sustainable harvesting of woodfuel. Integrated Food Energy Systems (IFES), include systems in which the production of food and biomass for energy generation is combined on the same land (Bogdanski et al., 2010). In addition to multiple-cropping systems, agroforestry systems are some of the most common types of IFES. Furthermore, supporting the development of economically, socially and environmentally sustainable small and medium forest enterprises (SMFES) and increasing investment for sustainable forest management can be instrumental to meet urban energy demand. Associated activities, such as transporting and processing of woodfuel, could result in extra income for urban households. By improving market access and adding value to harvested forest products, access to fuel for urban populations can increase along with more sustainable urban livelihoods. A recent FAO study found that by establishing woodlots, agroforestry and improved fallows, women, who are usually responsible for fuelwood collection, would be saving labour (FAO, 2015) and thus be able to free up more time for other income-generating activities.

Conclusion

Wood security in urban areas is and will remain an enormous challenge in the coming decades. Despite the well-documented challenges of energy security and the potential role of sustainable woodfuel in addressing them, neither of these two aspects are sufficiently prioritized in the INDCs and NDCs of some of the most woodfuel-dependent countries in SSA. As mentioned above, the population of SSA is projected to reach 1.5-2.0 billion in 2050. This will pose numerous challenges to food and energy systems and the people who depend on them. Urban forestry and agro-forestry are an important tool for increasing food and energy security in urban centers and should be adequately promoted. There is an urgent need to further analyze how, in addition to maximizing their ecosystem services, urban and peri-urban forests can contribute to meeting the growing energy demand and to identify and upscale best practices. Finally, it is critical to ensure that the contribution of woodfuel to urban energy needs is better reflected in national energy policies and in particular in the INDCs and NDCs.

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Impact of foreign aid on integration of Faidherbia albida (Musangu tree) in agricultural transformation in Africa: Lessons from Zambia
Douty Chibamba, Progress H. Nyanga, Bridget B. Umar and Wilma S. Nchito

Summary
Agricultural transformation in Africa is inevitable if the sector is to reduce pressure placed on the environment, including land degradation, water depletion, greenhouse gas emissions and threats to biodiversity. Agroforestry, the cultivation of trees and agricultural crops in intimate combination, has been promoted in Zambia to mitigate agro-based land degradation, as part of the country's agricultural transformation efforts. This study employed panel data from 640 households from 2007 to 2010, and 509 households in 2015 to examine the impact of foreign aid on agroforestry among smallholders in Zambia. The study finds some variances between the claims of the donor agencies on the transformative power of conservation agriculture (CA) that incorporates Musanugu (Faidherbia albida) trees in agriculture and the realities and strategies of smallholder farmers on the ground. After almost a decade of promoting CA with several millions dollar budgets, adoption rates for Musanugu have registered a paltry 24% increase over the decade with survival rates of planted Musanugu trees at 33%. There is a clear need to interrogate the mismatch between the donor agencies' motivations of promoting CA and farmers' constraints to adopting the practice.

Introduction
Agroforestry is a form of land management aimed at reversing environmental degradation and improving sustainability (Sanchez, 1996). Some authors argue that adopting agroforestry practices can potentially help over one billion smallholder farmers around the world to reverse land degradation, improve the environment and enhance their livelihoods by replenishing soils, protecting water catchments, restoring water catchments and conserving biodiversity (Garty, 2004). Given the benefits of agroforestry highlighted in the foregoing, the Conservation Farming Unit (CFU) in Zambia, the organization that has been the most prominent in promoting conservation agriculture (CA) with funding from Norway, claims that Faidherbia albida is the “ultimate solution for small scale maize production” (Aagaard, N.D.: 1). Faidherbia albida (formerly known as Acacia albida) is native to Zambia and is distributed throughout the African continent. It is important in CA because it grows over a wide range of soils and climates. As a groundwater dependent species, it has a broad range of 50 to 1800 mm of average annual rainfall and grows well in deep sandy-clay soils, rocky, heavy and cracking clays (Koech et al., 2016). It is particularly preferred for combining with maize by CFU because it does not overshadow the crop since it remains leafless during the rainy season and in leaf during the dry season (reverse phenology). The tree provides several benefits for the maize crop. It improves the soil structure, stability and permeability through the falling leaf mulch that promotes higher microbial activities, and it increases the yields through nitrogen fixation, dung from livestock browsing and fallen leaves (Koech et al., 2016; Sileshi, 2016).

The aim of this paper therefore is to interrogate the CFUs claimed transformative power of CA on agriculture in Zambia. Thus, we pose two questions, namely (i) to what extent has the CA that incorporates Musanugu, as promoted by Conservation Farming Unit, transformed agriculture in Zambia? And (ii) to what extent does this claim hold when judged against the realities on the ground?

Research methodologies
This study used data from a Conservation Agriculture Project (CAP) that was funded by the Norwegian government and implemented by CFU from 2007 to 2015 in the Southern, Central and Eastern provinces of Zambia. Panel data, collected using a questionnaire, from a random sample of 640 smallholder households were used for the years 2007 to 2010. Supplementary data were collected in 2015 from a random sample of 509 Smallholder households in Eastern province only. Focus group discussions and discussions with individual farmers were also used.

Results and Discussion

Multi-functionality of the Musanugu tree
Musanugu has a huge potential role in agricultural transformation in Africa because of the multiple functions that the tree offers (Koech et al., 2016; Sileshi, 2016; Mokgolodi et al., 2011; Kho et al., 2001; Rhodeas, 1995; Kermse and Norton, 1984), most of which were similar to those that the authors documented in this study (Table 1).

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<td>Loeuville et al., 2010</td>
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<tr>
<td>Dung</td>
<td>Koech et al., 2016</td>
</tr>
<tr>
<td>Protection against livestock</td>
<td>Koech et al., 2016</td>
</tr>
<tr>
<td>Soil conservation</td>
<td>Koech et al., 2016</td>
</tr>
<tr>
<td>Water catchment restoration</td>
<td>Koech et al., 2016</td>
</tr>
<tr>
<td>Biodiversity restoration</td>
<td>Koech et al., 2016</td>
</tr>
<tr>
<td>Climate change resistance</td>
<td>Koech et al., 2016</td>
</tr>
</tbody>
</table>

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The abundance of Musangu trees in the areas where CA has been promoted in the Eastern region for almost a decade shows an overall increase of about 24%, from about 14% in 2007 to 38% in 2015. For all the CFU regions, each household had about 5 Musangu trees on average before the project started (Figure 1). This increased sharply to an overall average of about 11 trees during the first year of the project but the Eastern region had a particularly high increase of about 18 trees. The rapid increase in all the regions could be attributed to the effectiveness of the extension services provided by CFU, novelty of CA and farmer enthusiasm to adopt Musangu that was being promoted as the ultimate solution to soil fertility challenges. For the Eastern region, the exceptionally high numbers between 2007 and 2008 were because the region has high abundance of Musangu trees growing naturally while the sharp decrease after 2008 was because the CAP project pulled out from the valley areas which had naturally high abundance of Musangu trees. This trend was similar to that of the Southern region, except that the number of Musangu trees in the Southern region increased again after 2009 largely due to farmer enthusiasm. In addition, some parts of Zambia experienced a severe drought in 2008 that could have resulted in low survival rates for the planted Musangu trees in all the regions apart from the Central region which lies in a medium to high rainfall zone, and the CAP project did not pull out from parts of the region because there is no valley in the region. As for the Western region, the decline could largely be a result of the drought and termite attacks. For the Eastern and Western regions, the abundance of Musangu trees levelled off after 2009 because Phase I of the CAP project was nearing its end (2010), waning novelty of CA and reduced farmer response due to lack of immediate benefits from Musangu tree. The low survival rates of the young planted trees, which averaged about 32.8% (Umar and Nyanga, 2011) could also have contributed to the levelling off. The Central and Southern regions, however, continued to register increases in the number of Musangu trees, after 2008 and 2009 respectively, which could be attributed to sustained farmer enthusiasm in both regions, coupled with high rainfall in the case of the Central region.

**Figure 1 Abundance of Musangu trees among smallholder farmers**

**Association between Musangu trees and Conservation Agriculture**

The results show a significant association between CA and the presence of Musangu trees (Table 2). Thus the proportions of households that had Musangu trees were higher among farmers that had adopted CA than those that had not after the first year of implementing the Conservation Agriculture Program.

**Table 2 Association between growing of Musangu trees and Conservation Agriculture**

<table>
<thead>
<tr>
<th>Practising Conservation Agriculture</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fields with Musangu trees</td>
<td>Yes (n=16)</td>
<td>No (n=38)</td>
<td>Yes (n=25)</td>
<td>No (n=43)</td>
<td>Yes (n=31)</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Pearson Chi-square</td>
<td>0.290</td>
<td>13.37*</td>
<td>11.92*</td>
<td>4.67*</td>
<td>7.33*</td>
</tr>
</tbody>
</table>

*significant association at 0.05 level
After eight years, less than 40% of the CA households had Musang trees in their agricultural fields due to several factors that the authors have already discussed elsewhere in this paper. This was despite CA households having been incentivized to plant the tree through provision of free seed, and training on its management. One possible reason could be the casual and simplistic manner in which the donor agencies promote the practice. They equate it to the introduction of new agricultural production technology such as new seed or fertilizer and yet the practice has complex input-output mix and takes a long time to establish successfully. The other is ontological stratification (Jerneck and Olsson, 2012), where the motivations of the donor agencies for promoting agroforestry are at variance with everyday realities and strategies of the smallholder farmers, particularly how to realize immediate returns from their farming activities to meet their food and health needs, which are normally constrained by poverty in and of itself.

**Sustainability of the planting of Musang trees beyond donor funding**

The continued planting of Musang trees is less likely to be continued beyond the project period because of several challenges reported by the smallholder farmers, such as: (i) the tree does not provide any direct income or food, (ii) thorns on the tree pose harm to farmers, (iii) planting of the tree is incompatible with mechanization, (iv) the tree is unsuitable in some areas, (v) termite attacks at tender age, (vi) tender trees are easily destroyed by livestock, (vii) watering the trees increases labour, (viii) bush fires, (ix) lack of localized seed supply and (x) increasing fuel wood demands in rural areas. In Zambia, Garrity et al. (2010) observed that it takes up to 6 years before the farmers can realize notable benefits on nitrogen fixation and soil fertility from newly planted Musang trees. This is because the initial growth of the Musang tree is slow as it develops a deep root system, its characteristic of being one of the fastest-growing acacia species notwithstanding. This requires a lot of patience on the part of the farmer and donor agencies. This long wait could undoubtedly be one of the reasons for the low increase in the adoption thereof. Thus, other nitrogen-fixing plants that have a more immediate impact on soil fertility and crop yields could be planted in the same fields to reduce the waiting period.

**Conclusion and Recommendations**

The study has demonstrated that the adoption of Musang tree by smallholder farmers is low despite its perceived benefits and the millions of dollars that donor agencies have spent on promoting it over the decades. Thus, the claimed adoption and efficacy rates of agroforestry practices that incorporate Musang trees in Zambia by CA promoters appear to be overestimated. The transformative power of agroforestry on agricultural production in Zambia also appear to be overestimated given that farmers who adopt CA do not entirely abandon conventional agriculture. There is need for research to assess the kind of social and environmental conditions that are suitable for Musang tree rather than the universal approach that the donor agencies employ in promoting it. Further, there is need for research to assess the kind of crops that are suitable for intercropping with the tree rather than a universal approach. This study further recommends an integration of nitrogen fixing shrubs which grow fast and offer multiple benefits within a short period of time, such as Sesbania sesban. In addition to nitrogen fixation and soil fertility improvement, the fast growing nitrogen fixing shrubs have several other immediate benefits to the farmer including: (i) fuel - the plant grows fast, burns well, can be coppiced, (ii) food - flowers can be eaten, (iii) fodder - leaves are high quality forage, with lots of nitrogen and phosphorus, good for feeding to goats and cattle, (iv) fiber - used for making ropes and fishing nets, and (v) medicine - many traditional uses (Kwesiga et al., 1990). All these benefits provided by these shrubs could ameliorate against the lack of immediate benefits from Musang trees.

**References**


Rows of Faidherbia albida (Musangu tree) in maize fields in Zambia. Agriculture with Trees - a form of Evergreen Agriculture practiced in Zambia.

Photo credit: ©Conservation Farming Unit/Agriculture with Trees/Evergreen Agriculture Zambia

Source: http://evergreenagriculture.net/evergreen-nations/southern-africa/
Soil and climate factors paralysing agricultural development in Sub-Saharan Africa

Michiel C. Laker

Summary

Undernourishment is rife in Sub-Saharan Africa and in terms of numbers of undernourished persons it is worsening. The Central African region is in a crisis. Agricultural development, and especially increased food production is urgently required in the region. Unfortunately agricultural development and increased food production are paralysed by a number of soil and climate factors. A key factor is that Africa has a "unique" soil pattern, dominated by soils that are for various reasons difficult to manage, and difficult climate, with rainfall ranging from far too low to far too high in different areas.

Introduction

Undernourishment is a major problem in Africa, comparing very poorly with the rest of the developing world (Sanchez & Swaminathan, 2005; FAO, 2012), especially regarding trends over time (Table 1). The overall trend for Africa is largely influenced by the trend for Sub-Saharan Africa, where the percentage of undernourished people decreased only from 32.8% in 1990-92 to 26.8% in 2010-12, while during the same period the number of undernourished people increased from 170 million to 234 million, i.e. by nearly 40% (Table 1). This is in stark contrast to the Southeast Asian sub-region, where the percentage of undernourished people decreased from 29.6% in 1990-92 to only 10.9% in 2010-12 and the number of undernourished people decreased from 134 million to only 65 million, i.e. by more than 50% during the same period.

The critical area in Sub-Saharan Africa is the Central African sub-region, where the percentage of undernourished persons increased from 36% in 1990-92 to 55% in 2000-02 (AU, 2006). Combined with the population growth it means that the number of undernourished people in this sub-region doubled from 22.7 million in 1990-92 to 45.2 million in 2000-02 (AU, 2006). The main reason was that by 2000-02 about 71% of the population of the DRC were undernourished (AU, 2006), compared with 29% in 1990-92 (Laker, 2013).

Table 1 - Trends in undernourishment in different regions from 1990-92 to 2010-12

<table>
<thead>
<tr>
<th></th>
<th>1990-92</th>
<th>1999-2001</th>
<th>2010-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing regions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990-92</td>
<td>980</td>
<td>901</td>
<td>852</td>
</tr>
<tr>
<td>1999-2001</td>
<td>23.2%</td>
<td>18.3%</td>
<td>14.9%</td>
</tr>
<tr>
<td>2010-12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>170</td>
<td>200</td>
<td>234</td>
</tr>
<tr>
<td>1990-92</td>
<td>32.8%</td>
<td>30.0%</td>
<td>26.8%</td>
</tr>
<tr>
<td>1999-2001</td>
<td>134</td>
<td>104</td>
<td>66</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>1990-92</td>
<td>1999-2001</td>
<td>2010-12</td>
</tr>
<tr>
<td>1990-92</td>
<td>29.6%</td>
<td>20.0%</td>
<td>10.9%</td>
</tr>
<tr>
<td>1999-2001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: State of Food Insecurity in the World, 2012, FAO

This article aims to briefly list some soil and climate factors that seem to paralyze agricultural development, and especially increases in staple food production, in Sub-Saharan Africa. These factors have been elaborated on fully in an early paper presented in 2013 (Laker, 2013). Furthermore, in the editorial of the special issue of Nature & Faune journal on soil in 2015, some of these factors were touched on (Laker, 2015).

Soil and climate factors that are paralysing agricultural development in Sub-Saharan Africa

Misunderstanding of the realities regarding the quality of Africa’s physical-biological resources, such as climate and soil, for agricultural production, especially staple food production, is a key factor paralysing agricultural development in Africa. Unless agricultural development is adapted to Africa’s different climatic and soil conditions (and vegetation and water) there is no possibility that it can succeed. Africa generally has difficult soils to manage, described by Jones et al. (2013) as a “unique” soil pattern, and difficult climate. On page 36 of the “Soil Atlas of Africa” Jones et al. (2013) step-by-step block out areas that for different reasons have serious limitations for agriculture. In the end they have 8% of the continent left. The latter areas are almost exclusively in East Africa, with minor exceptions elsewhere.

There are two big solid areas that Jones et al. (2013) blocked out as unsuitable, namely (i) the Sahara desert and (ii) the Congo basin and surrounding areas in Central Africa. According to the GLASOD report for UNEP 25% of Africa is “non-used wasteland”, with which they mean desert (Oldeman, 1993). The Sahara alone has the same size as the contiguous states of the United States of America. The Congo basin is dominated by extremely infertile, highly weathered, highly leached soils, its soils and climate being like those of the Amazon basin in South America. Regarding the so-called Ferralsols that dominate the Congo basin ISSS Working Group RB (1998) state that virtually all plant nutrients are in the vegetation (and by implication not in the soil) and can be lost during deforestation.
Jones et al. (2013) point out that the inherently fertile soils of Europe and North America (and the author would add Argentina) are basically completely absent in Africa. A good perspective regarding the precarious situation of Africa compared with North America, Europe, Argentina, etc. can be obtained by comparing the global maps for inherently fertile soils, like Chernozems, Phaeozems, Kastanozems, Luvisols, etc. with the maps for the infertile Arenosols and Ferralsols (and shallow Leptosols) in ISSS Working Group RB (1998). An interesting comparison is for the fertile Vertisols, which are dominant in the Indian sub-continent and the productive eastern part of Australia and in Africa only in Sudan.

The impacts of resource quality cannot be explained better than Moormann (1978) did. “More numerically the extremely expensive development projects that failed because inherent limitations remained so severe that the sharply increased recurrent costs were not compensated by the improved productivity of the land. There is a general tendency to explain such total or partial failures in terms of socioeconomic constraints: lack of the farmer’s technological know-how, lack of sound infrastructure in the project area, lack of a credit structure, lack of marketing facilities, etc. It is my contention, however, that in most cases where land amelioration created category-1 land for the chosen land utilization type or types, the project was successful irrespective of the socioeconomic and technological difficulties encountered in the beginning. One of the most successful projects in the tropical and subtropical areas was and is the Gezirah project in Sudan, where a large surface of category-1 land was created for land utilization types including, among others, irrigated cotton. It should be pointed out that this project became a success against tremendous socioeconomic odds.”

“Crops, and certainly the annual food crops, produce well only in a well-defined range of land conditions. Beyond this range, constraints to productivity are such that common recurrent inputs such as fertilizers are no longer remunerative, hence, production remains at a low subsistence type level. Because of inherent land limitations, the “package deals” of the green revolution, which include improved seed, better plant nutrition, and improved production and cultural practices, do not work on this land.”

When considering the general quality of Africa’s soils (and climate) outlined earlier and the latter paragraph of Moormann (1978) it becomes clear why the “land surplus myth” and the “Asian technology myth”, with which is meant green revolution technology, are two of the “Four myths about African agriculture” listed by Nana-Sinkam (1995).

Successful farming systems and technologies that have been developed in continents with inherently fertile soils and temperate climates cannot by transferred blindly without adaptation (or at all) to the infertile soils and difficult climatic conditions that are dominant in Africa. This needs to be realised and accepted as a fact.

Of course, there are tropical and subtropical areas in Africa that are not suitable for staple food crop production that have high potential for special crops like coffee, tea, cacao, rubber, coconut, etc. These could be produced to generate income with which to purchase food. Only a few decades ago, the highlands of Angola was, for example, the third highest coffee producer in the world, producing some of the world’s best quality coffee on an area of about 600,000 ha.

**Final remark**

The author wishes to point out that a study of the papers in the special “Soil” edition of Nature &Faune Journal (Volume 30, Issue 1, 2015) will give the reader a good overview of the scientific realities of Africa’s soils and their management requirements and of policy issues that need attention. Looking at successes achieved in some countries could be used as guidelines.

**References**


Laker M C 2013. Soil fertility in Sub-Sharan Africa and the effect thereof on human nutrition. Paper presented at annual congress of the Fertiliser Society of South Africa, June 2013, Durban. Electronic copies available by e-mail from the author at mlaker@telkomsa.net


Reinventing governance and solidarity for agricultural transformation and sustainable development in Africa

Alphonse Mekolo

Moreover, the use by agricultural operators including ‘big investors’ and other so-called ‘business men’, of intensive methods practices and technologies aiming at maximizing yields and economic and financial returns, has eventually aggravated the adverse effects of development challenges. This is why, the author of this paper supports the positive agricultural transformation and suggests 10 areas related to inclusive governance for its success. These areas are mutually complementary in a spirit of solidarity while referring to the sustainable development model adopted by all United Nations Member States in September 2015 under the term “17 Sustainable Development Goals (SDGs).”

In their great wisdom, and on behalf of their nations, world leaders adopted in September 2015, after three years of careful consideration, a programme of action designed to ensure more peace and security and development to all including generations to come. This action programme actually defines the world’s “green” development vision and how to address the main challenges facing nations, drawing on the inclusive model of the 17 Sustainable Development Goals (SDGs). To achieve these SDGs the planned actions should be conducted in each country based on its own context and specificities, and should converge and be complementary in order to ward off the threats to the balance of ecosystems, biodiversity, and human life in all dignity. The wording of these goals says it all: 1. No poverty, 2. Zero Hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnerships for the goals.

While the first three goals that tackle (i) Poverty eradication, (ii) zero hunger, and (iii) good health for all, demonstrate the primary role of agriculture, a closer look shows that the vitality and positive impact of agriculture depend on the coherence and sound integration of measures to be taken in relation with the remaining 14 SDGs. Hence, the need for mainstreaming any development action within the wheel dynamics of the 17 SDGs so as to maintain its smooth turning and for the betterment of humankind is crucial (see below figure).

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This new way of thinking and even acting calls for a review and a thorough transformation of agricultural methods and approaches in Africa. Among the set of measures to be implemented to achieve the desired urgent and positive transformation, this article would like to highlight the relevance of two major success factors: governance and solidarity, which appear decisive regarding the specific context, place, time and individuals engaged in farming activities.

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Summary:

The objective of this article is to highlight the relevance of inclusive governance and solidarity as values promoting prosperity and happiness among communities and that have, in times past, been enforced by African people. Nowadays, in view of the realities of our changing world, especially in Africa, in terms of developmental challenges focussing on agriculture where practices in use increasingly aim at personal monetary gains without giving proper consideration to the adverse impact of these practices on the environment, on neighboring communities and on the other economic partners. This situation shows the importance of inclusive governance values that become much more stronger and topical.

In their great wisdom, and on behalf of their nations, world leaders adopted in September 2015, after three years of careful consideration, a programme of action designed to ensure more peace and security and development to all including generations to come. This action programme actually defines the world’s “green” development vision and how to address the main challenges facing nations, drawing on the inclusive model of the 17 Sustainable Development Goals (SDGs). To achieve these SDGs the planned actions should be conducted in each country based on its own context and specificities, and should converge and be complementary in order to ward off the threats to the balance of ecosystems, biodiversity, and human life in all dignity. The wording of these goals says it all: 1. No poverty, 2. Zero Hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth, 9. Industry, innovation and infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, justice and strong institutions, 17. Partnerships for the goals. While the first three goals that tackle (i) Poverty eradication, (ii) zero hunger, and (iii) good health for all, demonstrate the primary role of agriculture, a closer look shows that the vitality and positive impact of agriculture depend on the coherence and sound integration of measures to be taken in relation with the remaining 14 SDGs. Hence, the need for mainstreaming any development action within the wheel dynamics of the 17 SDGs so as to maintain its smooth turning and for the betterment of humankind is crucial (see below figure).

This new way of thinking and even acting calls for a review and a thorough transformation of agricultural methods and approaches in Africa. Among the set of measures to be implemented to achieve the desired urgent and positive transformation, this article would like to highlight the relevance of two major success factors: governance and solidarity, which appear decisive regarding the specific context, place, time and individuals engaged in farming activities.

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I. Keeping governance in context for agricultural transformation

If we consider governance as the mode of managing interrelations and interdependencies between multiple parameters, factors and actors to generate development based on the expected results or in relation to a global vision, or simply in relation to the effects and impacts on everyday life, it is then clear that in the agriculture field, no initiative is possible and viable without the effective interrelation and interdependence of several factors and a wide range of actors. It is therefore recognized that governance, in order to be efficient in achieving development, generally requires a leadership based on management principles, rules and systems, as well as on human resources-driven institutions. Governance is rooted in the realities on the ground, on practice and concrete initiatives, on innovation and mobilization of the resources needed for the targeted action. That said, for agricultural transformation to be a living and mobilizing reality for all in Africa, it therefore needs governance tailored to the context of each African country and each locality. How can this form of governance be put into practice in the face of the realities and challenges of today’s world and the mentality of populations, investors, agricultural operators and current leaders?

In the light of the 17 SDGs based on the cardinal principle of integrating development policies and including all driving forces for the well-being of all without exclusion, it is important to build a governance related to the context of areas where agricultural activities are carried out according to ecosystems and their biodiversity, and respective to local socio-economic realities. To achieve this and ensure success, an optimal interaction of 10 governance areas is proposed below.

1. Leadership and ‘Ownership’ or the art of leading and getting involved for the benefit of all

Agricultural transformation requires a new type of leaders and initiators of agricultural efforts, advocating the inclusion and commitment of all in decision-making processes, from farmers at the grassroots to the ministerial management level or beyond, through communities, administrations and agricultural technical staff and researchers. This enables to take clear measures that are friendly to the constraints of nature and the laws regulating any given country, as well as management systems and governance standards that are in harmony with the context of the country and locality including the quality of nature’s physical and biological resources (soils, climate, water, vegetation, fauna...) and socio-economic conditions (physical infrastructures and technical support provision).
2. Governance of Agricultural Development Institutions and Structures

It is important to set up and operationalize agricultural development institutions and structures that have the means to implement their policies and promote resources and capacity allocation based on the expectations of target groups on the ground. They must be complementary or convergent towards the orientations of agricultural processing.

3. Human Resources Governance and work methods

The competence of human resources on farms and their change mentality will contribute significantly to the success or failure of the ongoing agricultural transformation process. The same holds true for the abilities and mentality of those that endeavor to drive the agricultural transformation process by understanding the realities on the ground, and promoting the adaptation of the work methods and approaches needed. New agricultural fields of action need to be identified and new jobs created. New agricultural methods and techniques are also needed, along with appropriate work methodologies that ensure high yields at the lowest cost.

4. Natural resources and ecosystems governance

The challenge at this level is ascertaining how to manage the fundamental life-giving resources that maintain biodiversity, such as wind, water, sun and other sources of heat, and soil, wildlife and plant resources. They determine the best way to manage farms while preserving ecosystems balance and biodiversity.

5. Water governance

To achieve improved agriculture transformation, it is necessary to understand the different sources of water supply because water is essential to farms. It is necessary to know how to manage water from different sources (rainwater and other precipitations, groundwater, surface water, watersheds, etc.) based on the specific soil, climate and socio-economic conditions of each locality in order to support agricultural transformation.

6. Energy governance

It is necessary to know and master the various types and sources of energy in order to know what type of energy is best suited for the context of each country and locality, to make farms profitable, at the best cost for the environment while reducing the effects on global warming.

7. Infrastructure governance

Agricultural transformation depends on the realization and management of infrastructures that are essential for improved operation and increased farm yield, whether it involves electronic, marine or inland waterways (hydraulic and other dams) or communication, information and transport infrastructures (roads, bridges, railways, tunnels), etc.

8. Transport governance

Proper organization of transport modes to facilitate the trade, marketing and sale of agricultural products (provision/supply/delivery or shipping) is essential for agricultural transformation. However, it is important to remember that transport efficiency depends on the quality of physical infrastructures (roads, railways, bridges, etc.) on the availability and accessibility of vehicles and suitable equipments including spare parts as well as the efficacy of the technical support action (mechanics, welding, etc.) ensuring sustainability as time goes on.

9. Governance of agricultural lands beyond conventional traditional spaces

Arable areas should be well identified and managed in each country and locality based on the territorial management plan of each country and the current land policy. This would enable to increase the profitability of agricultural potential as compared to the population of potential farmers. Taking into consideration population growth, increased urbanization, and rural exodus, there is a need to devise new spaces conducive to farming within the agricultural transformation process, e.g. (a) the banks of streams, rivers and oceans so as to plant mangrove trees for example, in order to partly reduce coastal erosion and restore biodiversity, (b) public parks, (c) roadsides, (d) roofs, balconies and the walls of buildings, etc.

10. Research, innovation and governance of peoples’ knowledge and ingenuity

In its broader sense, research, as well as practical observation of physical phenomena deemed empirical, and innovation, should be necessary in the various ecological and agricultural zones. The age-old traditional knowledge and ingenuity of peoples which are part of the human capital, should be known and made available to farmers. In this context, the experiences of agricultural leaders who know the field well should be carefully maintained in the respect of African wisdom which considers the elderly as a library since they have seen and heard, have accomplished and have discernment. The use of research results and scientific advancement, as well as peoples’ knowledge and ingenuity that are part of the human capital, must be well managed for agricultural transformation to be a success for growth wealth and welfare of people and for sustainable development in Africa.

II. Rediscovering the wonders of solidarity for agricultural transformation

The 17 SDGs wheel model calls for an inclusive and integrated vision of development. This means that agricultural development or economic development alone cannot ensure sustainable development in a given country or locality. It is thus imperative to determine how to link any agricultural and economic development initiative with the other social and environmental development initiatives. This incites the promoters of development initiatives to act in synergy amongst themselves and with all the components of society, hence the importance of team spirit and solidarity.
Here, we discover one of the old values of African culture: ‘No to solitude and Yes to solidarity for working and for way of life’. While solitude is experienced as a marginalization (exclusion from society), in Africa, solidarity has always contributed to the happiness of families and societies. Thus, practicing solidarity today in Africa should be considered as a return to lively roots. Agricultural transformation takes on its full meaning here, since no farm, at the local or national level, is self-sufficient nowadays due to our world complexities and historical implications. There is therefore a need to promote the positive effects and benefits of agricultural transformation through the 17 aspects of sustainable development, in order to build the foundation of solidarity between the promoters of agricultural initiatives including solidarity with the actors in other areas, solidarity with the members of the community, solidarity with the leaders, etc. As a fusion of integration and inclusion, solidarity will provide the needed driving force to make turn the wheel of sustainable development in accordance with the vision adopted by the United Nations’ representatives for the 2015-2030 period.

**Conclusion and way forward: Gathering around the tree**

In conclusion, agricultural transformation in Africa requires the implementation of inclusive governance and solidarity between development partners and the various development initiatives around the 17 SDGs wheel. How can we then build this unity with the prevailing spirit of individualism, egotism and personal interest, and how to engage in general interest actions that provide the means needed to implement all the development initiatives in the agricultural sector while preserving ecological balance? How to establish the right links between the 10 governance areas mentioned above?

The easiest answer would be “change of mentality”, however how can we change mentalities at national or even local level? Herein lies the problem. The best way would be first to acknowledge the need to transform agriculture by questioning and reviewing the old and current operation modes. This collegial review of the work methods and approaches as well as mentalities by gathering the entire workforce of a given country through their traditional figures, representatives, opinion leaders of all the sectors and groupings, government staff and the development partners, will enable to select by exchanging more easily and efficiently, those that are the most advantageous on the one part, while ensuring the preservation of the natural and material environment including vital and strategic resources and infrastructures on the other part. Once this is done, it would be necessary to develop reference documentation to be for a common use such as, unique common vision, one development plan implemented by all, public policies that are well integrated and translated into well formulated development programmes that do not overlap. Stable, functional and efficient institutions will be established to ensure follow-up on decisions taken collectively. One of the main ways of achieving agricultural transformation goal will be to make good use of the communities’ ingenuity and accumulated knowledge with due consideration to the culture and specificities of each locality. All this will be possible only in a climate of constant dialogue and a sound mechanism for organizing practical meetings in order to devise solutions to clearly defined problems of common interest, using the time-tested African wisdom for problem solving around the solidarity formula based on the tree allegory commonly recognized as “Gathering under and around the tree; Training under tree; Tree speaks or Palaver Tree”.

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The critical role of food systems development in the achievement of the Sustainable Development Goals in Africa
Jamie Morrison

Summary

In determining the availability, accessibility, affordability, sustainability, diversity, quality and safety of food and agricultural products, developments in food systems will have a major influence on the extent to which several of the Sustainable Development Goals can be achieved. Developments in food systems are driven by rapidly changing consumer demands and are shaped by the actions of private sector enterprises in taking advantage of new market opportunities and of public sector institutions in attempting to ensure that societal objectives are met. While these developments have yielded many positive results, the complexity of food systems has contributed to a range of unintended consequences of food system development such as restricted access of more vulnerable groups, whether as producers or consumers, increased incidence of food safety incidences, poor dietary choices and increased pressure on the natural resource environment. Their complexity also requires a more coordinated approach by private sector actors on investments in food systems and across government ministries in order to avoid the disparate and poorly coordinated actions that have characterized food systems developments in many African countries, and which could prevent the achievement of several Sustainable Development Goals.

Introduction

This article sets out to explain the urgent need for a more coordinated approach to food systems development if several key Sustainable Development Goals (SDGs) are to be achieved. It first introduces the complex nature of food systems and the SDGs to which these developments will contribute. The article then outlines the forces that have, and will continue to, shape food systems development in African countries and the challenges associated with these developments. It concludes by arguing that in order to avoid the disparate and poorly coordinated actions that have characterized food systems developments in many African countries, a more coordinated approach, both by the private sector actors seeking to profit from food system development and by those government ministries whose actions affect food systems is urgently needed if several of the Sustainable Development Goals are to be achieved.

Defining food systems

FAO (2013) defines food systems as:

*“the entire range of activities involved in the production, processing, marketing, consumption and disposal of goods that originate from agriculture, forestry or fisheries, including the inputs needed and the outputs generated at each of these steps. Food systems also involve the people and institutions that initiate or inhibit change in the system as well as the socio-political, economic and technological environment in which these activities take place.”*

Food systems are therefore more complex than the linear set of relationships between production and consumption - often referred to as the value chain. Within this complex framework the actions of actors, involved in the value chain and in associated food industries, are influenced by the decisions of producers and consumers and by the set of policies and regulations that are designed and implemented at the national, regional and global levels.

In linking production to consumption, food systems therefore have a major influence on the availability, accessibility, affordability, sustainability, diversity, quality and safety of food and agricultural products. The multifaceted nature of food systems means that the way in which they evolve will be key in determining the extent to which food and nutrition insecurity, in all its dimensions, can be eliminated and more sustainable consumption promoted (Sustainable Development Goals (SDGs) 2, 3 and 12); in the provision of sources of employment and income, particularly for youth (SDGs 1 and 8); in the extent to which pressures on the use of the natural resource base can be reduced (SDGs 7, 13, 14 and 15); in the degree to which improvements in the equity and equality of resource use can be achieved (SDGs 5, 9 and 10); and in their contributions to the development of more sustainable cities (SDG 11).

Evolutions in food systems

Food systems are characterized by a coexistence of modern and traditional supply channels. These channels are shaped by the way in which actors respond to changes in consumer demand - private sector enterprises in taking advantage of new opportunities and public sector institutions in attempting to ensure that societal objectives are met.

In many African countries, emerging modern components of the food system are characterized by high levels of investment in more sophisticated infrastructure, private standards, and more sophisticated products and marketing strategies, a trend that is expected to continue. “According to McKinsey, African “consumer-facing” industries will grow by more than USD 400 billion by 2020 to tap into the aspirations of a new generation” (England, 2015).

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However, private sector investments have not been so forthcoming in many traditional, or local, food systems in Africa, including those characterized by predominantly subsistence agriculture. Where investments have taken place, they have concentrated more on the production of export crops (see, for example, the paper of Mpofu in this issue). Much needed public sector investments in upgrading infrastructure and in the provision of public goods required to stimulate development of both production and markets and improving linkages between them have often been lacking. About 30 million tonnes of grains and oilseeds are, for example, lost each year in Sub-Saharan Africa as a result of poor post-harvest infrastructure and practices (FAO, 2011).

**Challenges associated with food system development**

While developments in modern food systems have yielded positive results in making a greater variety of food available at lower cost, they have also given rise to several challenges which will need to be addressed if food system development is to contribute fully to the achievement of the national and global goals set out in Agenda 2030. These challenges include lowering of the present high barriers to the participation of those strata of society that traditionally have less access to education, resources and capital, including women, youth, urban and rural poor, indigenous peoples, small farms and firms. As producers, workers or entrepreneurs, these groups have limited access to more remunerative markets or employment opportunities, contributing to growing inequalities. Barriers also exist to the access of poor consumers to market outlets particularly in urban areas, with resulting inadequate access to safe, affordable and nutritious food. Even when they are not excluded from modern food systems, small farmers, small scale fishers, and small and medium agro-enterprises are increasingly dependent on dominant actors further downstream in value chains.

Other outcomes of food systems development which may limit the extent to which the SDGs can be met include their effect of growing malnutrition and related health costs due to the emergence of new preferences and energy dense diets. While access to sufficient quantities of nutritious food is still a critical problem in Sub-Saharan Africa, with an increase of 500,000 stunted children each year, non-communicable diseases are an increasingly visible issue. In Nigeria, for example, it is estimated that the number of people with diabetes will increase from 3.1 million in 2011 to 6.1 million in 2030 (Global Panel on Agriculture and Food Systems for Nutrition, 2016). Additionally, increased incidences of food borne diseases such as aflatoxins, produced by fungi in stored grains, have been observed. It is estimated that USD 450 million worth of African crops are unsaleable each year due to such contamination (Nowakowski, 2015). Significant levels of food loss and waste, as well as environmental degradation manifested by depleted soils, carbon emissions and loss of biodiversity are additional unintended outcomes of the way in which food systems have evolved, and which are increasingly visible in many African countries.

If such developments in food systems continue, it is likely that their evolution will hinder rather than contribute to countries’ achievement of the Sustainable Development Goals. Yet the development of food systems has generally been neglected by policy makers in African countries.

**Addressing the challenges of food system development**

Growing recognition of the unintended outcomes of food system development has resulted in two interrelated trends which can be used to provide a basis for intervention which ensures that food systems development contributes more positively to the achievement of the SDGs. The first, driven by increased consumer concerns, especially in the growing middle-income and high-end market segments, is the demand for more sustainable products, which in turn, generate new market opportunities. Actions to ensure that consumer concerns are well communicated to producers through, for example, consumer organizations, will be key in influencing the actions of food systems actors towards business decisions which result in improved outcomes.

The second trend sees the public sector, often working in tandem with civil society, responding more actively to the more visible negative outcomes of food systems development by making changes to policies, regulations, and to public procurement practices, in order to meet their objectives of securing access to safe, nutritious and healthful food and sustainably produced products and to ensuring that vulnerable population groups are not excluded from the benefits of food system development. Ghana, for example, has used food trading standards to limit the amount of fat in meat cuts (Global Panel on Agriculture and Food Systems for Nutrition, 2016).

A key challenge that has hindered the realization of more positive outcomes is the lack of coherent approaches to food system development. Reconciling the different objectives, interests and trade-offs of different groups (farmers, consumer groups with different preferences, private companies, government, etc.) requires coordinated action to ensure that food systems develop in a way that allows for efficiency gains to be made, but at the same time facilitates greater inclusiveness, better nutritional outcomes, greater resilience, and reduces the pressure on the natural resource base.

The complexity of food systems contributes to their significant coordination requirements. The development of the value chain component alone, which will be critical in ensuring that markets for increased agricultural production are attractive to producers, particularly for products produced in a more sustainable way, is a case in point. Markets provide the incentives that producers need.
if they are to invest in improved technologies and adopt new practices. Without viable markets, incentives for investment in increased production won't be sustained. At the same time, without a consistent marketable supply of product, investments in value chain development, including in efficient transport links between the producer and the market, without which there is restricted incentive for increased production or limited possibility that consumers can benefit from increased production, won't be made by private sector enterprises. The example of cassava, a crop that still has significant but unfulfilled commercialization potential in many African countries is illustrative. There has often been a reluctance of farmers to adopt new varieties which could increase production under certain conditions, but which may not give good yields under local conditions, have poor on farm storage qualities, and may not conform with the preferences of consumers. And because marketable production has not increased, investments in these new markets have not been made.

The need for greater coordination of actions

A key challenge therefore is how to support actors and enterprises throughout food systems to make coordinated investments - by producers in improved production technologies, by traders in logistics and post harvest facilities, by processors in improved processing facilities, and by retailers in marketing the end product. As well as ensuring that the business environment is strengthened through the implementation of consistent and coherent policy (see for example, Morrison and Sarris 2010, 2016), the managerial and technical capacities of actors along value chains need to be upgraded. For example by training young entrepreneurs or by designing and implementing contractual arrangements such as contract farming which link producers to buyers on better terms. Strengthening support services to increase the provision of inputs including seeds, fertilizers, spare parts, advisory services and credit, and help to governments and the private sector to mobilize resources for responsible investment in value chains will also be required.

But supporting inclusive food system development will also require the involvement of a wider range of stakeholders – consumer associations, industry associations, private sector enterprises. In particular it will require greater cross ministerial coordination – it is not only the Ministries of Agriculture, Forestry and Fisheries whose actions affect food systems but those of the Ministries of Trade, Planning, Finance, Labour and Health among others.

In many Sub-Saharan African countries, the actions of those in food systems tend to be disparate and poorly coordinated. The success of efforts to improve the coordination of the actions of these diverse sets of public and private sector actors will ultimately determine the extent to which food system developments in African countries contribute to, rather than hinder, these countries’ achievement of the SDGs.

References


Fishers’ perceptions and adaptation to climate variability on Lake Kariba, Siavonga district, Zambia

Mulako Kabisa and Douty Chibamba

Summary

The study aimed to investigate the perceptions of Kapenta fishers of climate variability and their adaptation to its impact. A total of 90 fishers were sampled for the study. The study showed that the majority of fishers are aware of climate variability (87.7%). Their perceptions were in line with actual climatic trends, thus providing an opportunity for stakeholder dissemination of climatic trends. Of the respondents, eighty-one (90%) were adapting to impacts of climate variability of which 64.3% have the potential to be climate-smart. The findings present an opportunity to coordinate and finance existing adaptation strategies with various stakeholders.

1. Introduction

Lake Kariba is a large man-made lake that was built in 1958 (Overa, 2003). It provides about 90 percent and 70-80 percent of the landed Kapenta (Limnothrissa miodon) on the Zimbabwean and Zambian sides of the Lake respectively (Ndebele-Murisa et al., 2013). On the Zambian side, Lake Kariba is in Siavonga district, which is currently experiencing climate variability and change (USAID, 2012). Ndebele-Murisa et al. (2013) show significant correlations between declining catches and the predictor variables: temperature increase, increased evapotranspiration and reduced rainfall around Lake Kariba and the Gwerimbe Valley, which ultimately affect Kapenta fish production (Ndebele-Murisa et al., 2011:106). Kinadjian (2012) reports a catch per unit of effort (CPUE) decline of 35 to 50 percent since 2005 with more than 1,000 rigs still operating on the Zambian side of the lake in 2012; far above the 500 rigs permissible to maintain the maximum sustainable yield of 25,000 tonnes (Paullet, 2014): Climate change is expected to exacerbate this problem of overfishing, which is already problematic on Lake Kariba, by interacting with existing drivers and trends such as stocks affected by pollution, alien species and habitat alteration (Daw et al., 2009).

Studies conducted on the Lake Kariba Kapenta fishery examine physical dimensions of the resource, ranging from the effects of climate change (Ndebele-Murisa et al., 2013; Ndebele-Murisa et al., 2011), the relationship between hydrology and fisheries (Karenge and Kolding, 1995; Chibamba, 2000) to the impact of fishing pressure on Kapenta production (Chali et al., 2014). Little has been done to investigate social dimensions amidst declining Kapenta catches. Yet, evidence shows that perceptions precede measures to adapt to climate variability and change (Swai et al., 2012) and fishers’ knowledge about their fishery can potentially be integrated into mainstream science to improve the management of fisheries (Gaspare et al., 2015). This study aimed to bridge this knowledge gap.

2. Materials and Methods

Primary data were collected using questionnaires administered on 90 fishers, of whom 89 were male and only 1 was female, over a three week period between 1st and 21st April 2014. Secondary data were obtained from articles, websites and books on climate variability and fisheries, peer reviewed journal articles and unpublished meteorological and fisheries data from the Lake Kariba Fisheries Research Institute (LKFRI) and Department of Fisheries (DoF) respectively. Multiple Regression Analysis, a Likert Scale and the Climate-Smart Agriculture Source book were used in analysis of the data.

3. Results and Discussion

Only one female fisher was found in this study out of a total of 90 fishers interviewed. A study by Chali et al. (2014) on Lake Kariba found that reasons for low participation of women include limited access to fishing permits and capital (rigs can cost US$13,500), cultural hindrances, gender stereotypes and security risks associated with fishing at night.

3.1 Perceptions of climate variability by the fishers

The majority of the fishers (87.7%) perceived a change in climate in terms of temperature and rainfall (See Figure 1). The fishers perceived a reduction in rainfall and an increase in temperature. The meteorological data on the Lake, as shown in Figures 2 and 3, show that there has been an increase in temperature and a reduction in rainfall. The fishers also perceived a decline in Kapenta catches and these perceptions can be validated by Kapenta catch trends on the Lake shown by Figure 4.

The perceptions of climate variability by the fishers and its effects on the Kapenta catches, provide important first steps toward stakeholder-inclusive, co-management styles of fishery management (Gaspare et al., 2015; Carr and Heyman, 2012). Examples of successes of using local knowledge include the Seri fisher folks of Mexico (Basurto et al. 2013) and the Pattinaver caste of the South Indian lagoon (Coulthard, 2008).

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3.2 Adaptation to Climate Variability

The study revealed that 90% of the fishers used one or more adaptation strategies. The majority of the fishers (84.4%) engaged in autonomous adaptation strategies i.e. strategies wholly implemented by the fisher without involvement of other stakeholders (Shelton, 2014). The strategies used by the fishers, as shown in Figure 5, when compared to interventions proposed by the FAO (2013) showed that 64.3% of the strategies have the potential to be climate-smart. These were: shifting of fishing times and location, using mechanized fishing rigs, stopping fishing activities and engaging in alternative livelihoods, such as clothes retailing and trading of other fish species. About 82% of the adapting fishers stated that they faced some difficulties in adapting. Of these, 60% cited a lack of money as being the main constraint to adaptation; 30% cited faulty fishing vessels and fishing time restrictions; and 10% stated lack of information on available adaptation options as a constraint. These findings can help in identifying the best application of risk management based on fishers knowledge, attitude, practices and belief systems (Aphunu and Nwabeze, 2012) that are locally appropriate and sustainable (Gaspare et al, 2015; Carr and Heyman, 2012).
4. Conclusion and Recommendations

The overall conclusion of the study based on these findings is that fishers perceive climate variability in terms of rainfall and temperature. The fishers are adapting to climate variability and the majority of their strategies have the potential to be climate-smart. Capacity can be built on already existing climate-smart adaptation responses through: coordination of adaptation activities between fishers and various stakeholders; providing finances and structural support for alternative livelihoods for the fishers by co-operating partners and local microfinance institutions; and strengthening extension services through a pluralistic model between the department of fisheries and the private sector to aid in dissemination of climate information and adaptation options.

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Sylva food solutions model of commercialization of indigenous foods: Lessons for agricultural transformation in Africa.

Progress H Nyanga, Ireen T. Samboko and Douty Chibamba

Summary

We assessed a Sylva Food Solutions (SFS) model of commercialization of indigenous foods in order to provide possible leverage points for agricultural transformation in Africa. Using in-depth interviews with key informants and farmers, results show that the SFS model is built on a triple linkage of extension, value addition and market access. The SFS model focuses on sensitizing farmers and consumers to the nutritional significance of indigenous foods and providing market opportunities for farmers for traditional foods. The model thus contributes to food systems’ robustness by bridging the gap between indigenous and commercial food systems through commercialization of indigenous foods. Thus, in agricultural transformation in Africa, a systems approach linking production, processing and marketing is essential for success. The study has also shown that private sector led initiatives should be encouraged in agricultural development for poverty reduction.

Introduction

The current wave of Africa’s agricultural transformations is characterized by a paradoxical increase in the use of agro-chemicals on one hand and increased promotion of a brand of sustainable agriculture called Climate Smart Agriculture (CSA). In Africa, the transition to CSA-led Conservation Agriculture (CA) is a major focus of the current wave of Agricultural development in Africa. CA is a farming system based on the three principles of minimum soil disturbance, diversified crop rotation and plant residue retention. This agricultural transformation towards CA has often paid less attention to indigenous food systems, especially edible insects, fruits and vegetables. This is against the background that this study documents a promising private sector led model of commercialization of indigenous foods (wild and cultivated vegetables and fruits in this case). Sylva Food Solutions (SFS) is a private institution in Zambia that is promoting indigenous foods through a business model. The study provides a succinct explanation of the model in order to raise some lessons for Africa’s agricultural transformation.

Research Methodology

Data for this study was collected between August and October 2016 using in-depth interviews with thirteen key informants at SFS and twelve smallholder farmers. The data was audio recorded and transcribed. A food system conceptual framework with production, processing and marketing as the main stages was used to organize the data. Thematic and Content analysis (Bryman 2008) was used to analyze data.

Results and Discussion

Model Structure

The SFS model structure has three main components corresponding to the three departments; extension, food processing and marketing. This structure embraces the major aspects needed for agricultural transformation in Africa and is consistent with food systems structure with production, processing and consumption as the main stages (Eriksen 2006).

Extension Approach

The SFS model uses a flexible market based approach to acquire various forest and farm products from farmers without giving farmers inputs, unlike the use of contract farming models (FAO 2016a). Women farmers in rural areas have formed groups for bulking the indigenous foods for SFS. This cuts down on the transportation costs, thus increasing the profitability in both time and income. The extension department uses a social engineering approach of talking with farmers to secure their trust and establish good rapport and sensitization of market opportunities for traditional foods as their starting point of interacting with farmers. This is contrary to the traditional extension approach that focuses on increasing production as a motivation for farmer engagement (Hussain et al., 1994). The extension department interacts with about 20,000 farmers across Zambia. The department is also responsible for linking farmers to other organizations, depending on the farmers’ needs, a task SFS considers to be a social corporate responsibility in addition to offering free training in hygiene and value addition for traditional foods to informal traders in urban markets.

Food Products

About half (47.8%) of the Zambian population, is undernourished (FAO 2016b). In addressing the nutritional problems, Wenhold et al. (2007) point out that indigenous foods provides a huge opportunity for addressing food and nutritional security through; their diverse and rich nutritional content compared to the often consumed staple foods such as Cassava; the high diversity of indigenous foods increases the dietary diversity that is needed for nutritional security; utilization of indigenous foods provides an opportunity for indigenous food system to complement the modern food system; and the promotion of under-exploited indigenous foods can expand the seasonal availability of food thus mitigating seasonal food insecurity.

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The SFS deals with foods, from both forest and cultivated land, including vegetables, edible insects and fruits. It also includes trees, such as Moringa (Moringa spp.) whose leaves form part of the Moringa and vegetable porridge, and Neem tree (Azadirachta spp) whose leaves are made into tea bags and sold for medicinal purposes. Wild vegetables include, Bondwe (Amaranthus spp.) kanunka (Bidens pilosa L.), Pupwe (Zanthoxylum chalybeum), Tindingoma (Corchorus spp.) while cultivated traditional vegetables include kachesha (Vigna unguiculata) and Chibwabwa- (Cucurbita spp.)

**Value Addition**

Traditional food preservation is part of value addition in the indigenous food systems. These methods of food preservation include blanching, salting for meat products; open sun drying; smoking and roasting e.g. for cassava; fermentation; underground storage with ashes e.g. for sweet potatoes; storage of dried vegetables in clay pots and also wrapped in dried woven tree leaves (Ayua & Omware 2013; Kamwendo & Kamwendo 2014).

For SFS the value addition is undertaken by the processing department. Three main aspects of value addition are done. The first aspect is vegetable and fruit preservation through drying; second aspect is formulation of food products through various combinations of traditional foods and thirdly packaging. The value addition is done at two spatial levels i.e. at farm level by farmers that have been trained (Figure 1) and also at the factory owned by Sylvia Food Solutions. At both levels improved indigenous food preservation methods that are environmentally friendly and economically sustainable such as a solar dryer (Figure 2) are used for drying fruits and vegetables. SFS also provide food solar dryers to some rural communities to minimize food loss and enhance quality in preservation of the foods before they buy the produce from the farmers.

**Marketing**

The marketing department for Silva Food Solutions (SFS) provides readily available markets to farmers. Dried vegetables are bought from farmers at between 40 to 50 US Dollars per 60 liter bag. Market targeting for the processed foods is based on segregated targeting based on the economic status and preferences of the potential customers. Thus both local and export markets are utilized. It is estimated that SFS has about 30% market share in Lusaka Province, with a population of about three million people (CSO 2016). There is more value addition on the food products targeted for export than those for the local markets, so as to make the products competitive for both local and export markets. Targeted outlets for the local markets are multinational companies such as Shoprite and Spar often located in shopping malls, thus minimizing competition with informal markets.

**Multiple Benefits of the SFS model**

The SFS model offers multiple benefits. Farmers benefit in terms of capacity building, stable markets, increased income, improved food storage, reduction in post-harvest loss and improved food security. The model also offers opportunity for increased resilience of the Zambian food systems by increasing the role of traditional foods in food and nutritional security. Environmental benefits include increased appreciation of the value of wild and traditional vegetables that could lead to enhanced conservation of such genetic resources. It enhances agro-forestry with trees with food value. The use of solar technologies provides mitigation and adaptation measures against climate change.
Sustainability Aspects of the SFS Model

This model has higher likelihood of sustainability than the often used development projects for reducing poverty that depends on donor funding because it is private sector driven. The model targets both forest and cultivated foods thus giving farmers incentive to conserve the wild indigenous foods in addition to income. The rapid urban restructuring and expansion characterized by increasing number of shopping malls housing multinational companies selling foods is increasing the market of SFS. The increasing demand for traditional foods in cities also adds to the likelihood of the model to stand the taste of time. The dual market targeting at both local and export markets increases the resilience of the business. Above all, the integration of the use of solar energy in processing foods adds value to environmental sustainability.

Possible Threats to Sustainability

Despite a high likelihood of sustainability, the model faces a risk of sudden collapse in the event of closure of multinational companies that are the main outlet points for the products for SFS in Zambia. With time, farmers are likely to increase the use of agrochemicals that may compromise the quality of foods. Due to increasing population and rapidly expanding urban areas, forests that are major sources of wild foods are likely to reduce in size in the long run.

Conclusions and Recommendations

The SFS model provides a unique private sector driven approach for reducing food insecurity through market integration and value addition. The study also shows that locally developed approaches and private sector driven initiatives are essential for enhanced agricultural transformation and food security. The study therefore recommends agricultural transformation based on enhanced linkages among extension, value addition and market access, promotion of both indigenous and commercial food systems; use of simple, locally accepted and economically sound technologies; and involvement of private sector.

References


CSO 2016. Projected Total Population and Number of Eligible Voters in the year 2016 CSO, Lusaka


Betty Phiri, Progress Nyanga, Bridget Uma, Wilma Nchito and Douty Chibamba

Summary
This study examined the sustainability of transformation from conventional agriculture to conservation agriculture (CA) and the impact on environmental conservation. Using interviews with smallholder farmers and key informants (donor funded CA promoters and government officials) the study found that there was only selective partial adoption of CA despite huge donor support for its adoption. The study showed various differences between CA promoters’ expectations on the one hand and actual responses to CA and farmers’ practical experiences on the other hand. Rather than promoting CA as a fixed package, practices that have shown positive impacts and thus high likelihood of continued practice by farmers beyond funded projects should be developed further and encouraged.

Introduction
One of the major foci of agricultural development in Africa is to promote a shift from conventional to conservation agricultural systems. Due to negative effects of conventional agriculture such as maximum soil disturbance, deterioration of soil health and low productivity (CFU, 2007), CA is being promoted as an alternative agricultural development pathway to address these challenges (International Resources Group, 2011).

CA is an approach to managing agro-ecosystems for improved and sustained productivity, thus increasing profits and food security while safeguarding the environment (FAO, 2014). Zambia is an example of a success story of Conservation Agriculture (CA) largely driven by international donors such as the Norwegian government.

This study builds on Whitefield et al. (2015)’s work on CA narratives by analyzing the sustainability of segregated CA practices based on interviews with key informants and smallholder farmers. The authors evaluated the CA against empirical evidence based on actual responses to CA technologies and farmers’ experiences and adoption patterns to determine the likelihood of sustainability of CA practices beyond donor support. The authors argue that some practices of CA were successful based upon empirical evidence and likely to continue beyond donor support. Others were not adequately adaptable and therefore not adopted by farmers.

Research Methodology
Data were collected in 2015 from Chibombo District in central Zambia. The district has a long history of CA activities. Data were obtained from three focus group discussions with farmers and eight in-depth interviews five with farmers and three with key informants from the Conservation Farming Unit (CFU) and forestry department. Data were analyzed by content and narrative analysis (Bell, 2003).

Results and Discussion

Expectations of Scientists from Introduction of Conservation Agriculture in a Small-holder Farmer Situation in Africa

The benefits that the scientists and donors involved in promoting CA in the study expected to achieve with CA are outlined in Table 1:

Table 1  Expected benefits from the introduction of Conservation Agriculture (CA) practices.

<table>
<thead>
<tr>
<th>CA system</th>
<th>Recommended practices</th>
<th>Expected CA impacts on the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Intensification of Crop Production</td>
<td>1. Minimum tillage 2. Efficient input use 3. Permanent fields</td>
<td>Reduces loss of forests to agriculture due to increased production per hectare.</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>Planting trees for various uses</td>
<td>Increases forest cover and ecosystem services</td>
</tr>
<tr>
<td>Climate change adaptation</td>
<td>1. Crop residue retention 2. Minimum tillage</td>
<td>Increases resilience of agricultural systems to extreme climate and extreme weather events</td>
</tr>
<tr>
<td>Weed control</td>
<td>1. Minimum tillage to keep most soil covered and suppress weed growth 2. Use herbicides (Less soil disturbance)</td>
<td>Reduces weed seed in the soil</td>
</tr>
<tr>
<td>Agrobiodiversity</td>
<td>Diversify annual crop rotations</td>
<td>Increases agro-biodiversity and improved soil health</td>
</tr>
</tbody>
</table>

Table 1: Expected benefits from the introduction of Conservation Agriculture (CA) practices.

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Responses to CA practices and small-holder farmers’ practical experiences

Small-holder farmers have not fully transformed from conventional agriculture to CA, but have selectively adopted some CA practices and rejected others. The result is that the outcomes of the introduction of CA as a whole is completely different to what the donors and scientists in support of CA expected (Table 2). The decisions of farmers whether to adopt or reject a practice were not ad hoc, but rational, based on their socio-economic and environmental (soil, climate) situation.

Table 2: Expected CA impacts on the environment and Small-holder farmers’ practical experiences

<table>
<thead>
<tr>
<th>Expected CA impacts on the environment</th>
<th>Small-holder farmers’ practical experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces loss of forests to agriculture due to increased production per hectare</td>
<td>Forests continue to be cut because of population increase and charcoal burning.</td>
</tr>
<tr>
<td>Agro-forestry increases forest cover and ecosystem services</td>
<td>Most farmers were not planting the trees recommended by CA promoters.</td>
</tr>
<tr>
<td>Increased resilience of crops to extreme climate and weather events</td>
<td>Farmers reported high crop resilience in CA in the face of droughts and dry spells.</td>
</tr>
<tr>
<td>Reduces weed seed in the soil</td>
<td>Weed pressure increased when herbicides were not used. Some farmers also reported an increase in weed resistance against herbicides.</td>
</tr>
<tr>
<td>Increased agro-biodiversity and improved soil health</td>
<td>Farmers reported a reduction in biodiversity with herbicides use. Most crop residues are used as fodder and some are burnt.</td>
</tr>
</tbody>
</table>

Although use of selected trees for soil fertility, food, fences, fodder and fuel wood was reported, environmental conservation was not among the prominent reasons for agroforestry (Table 2). This shows the need to take into account the local contexts and smallholder-farmers’ preferences.

Farmers’ reports agreed with CA narratives on its suitability as an adaptation to water deficit conditions but not in times of excess rainfall. These findings are similar to Thierfelder and Wall (2010). It was further reported that weed pressure was high in CA fields but reduced with herbicide use. Some farmers observed that weed pressure was increasing because of resistance of weeds to some herbicides. Farmers also complained of herbicides being expensive. On the agro-biodiversity, the CA expectations were that smallholder farmers will shift from a dominance of monocropping (heavily supported by government subsidies) to a diversified cropping. Farmers reported an increase in crop diversity and improved food security due to diversified cropping. Most farmers practiced crop rotation but not annually and not on evenly proportioned areas because of preferences for food crops, response to markets, and residual effect of selective herbicides that remain active in soils for more than a farming season.

Sustainability beyond Donor Support

The authors further analyzed sustainability in terms of the likelihood of continued use of agronomic practices supported by CA narratives beyond donor support (Table 3).

Table 3: CA practices likely to be sustained beyond donor support

<table>
<thead>
<tr>
<th>Practices promoted by CA narratives</th>
<th>Likelihood of Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent fields</td>
<td>Less likely</td>
</tr>
<tr>
<td>Efficient input use</td>
<td>More likely</td>
</tr>
<tr>
<td>Agro-forestry</td>
<td>Less likely</td>
</tr>
<tr>
<td>Minimum tillage</td>
<td>More likely</td>
</tr>
<tr>
<td>Plant residue cover</td>
<td>Less likely</td>
</tr>
<tr>
<td>Herbicide use</td>
<td>Least likely</td>
</tr>
<tr>
<td>Diversified cropping rotation</td>
<td>Most likely</td>
</tr>
</tbody>
</table>

Diversified cropping rotation is most likely. Diversified crop rotation has the highest likelihood of sustainability because of involving food crops that are part of the local food systems and cash crops with readily available local markets. Most smallholder farmers are also less likely to use chemical weeding as it is inimical to crop rotations.

Efficient use of inputs is likely to continue beyond donor support because of high appreciation of precision in input application in CA among smallholder farmers. Purchased inputs are highly valued among farmers.

Likelihood of continued use of minimum tillage alongside conventional tillage, without donor support, is quite high because the two farming systems reduce the risk of crop failure due to extreme weather events (Umar et al, 2012). Thus farmers that have adopted CA will most likely continue practicing some individual components of CA, and aspects of conventional agriculture that have proven to be helpful in the farmers’ context. These results underscore CIMMYT’s recommendation to all actors in agricultural development to be cognizant of the fact that farmers perceive agricultural technologies not as a package but as segregated components, thus make decisions based on individual components of the technology (CIMMYT Economics Program, 1993).

The use of herbicides is least likely to be sustainable because it attracts financial costs most farmers are unwilling to undertake. Thus farmers are most likely going to continue with conventional methods of weeding using hand hoes, oxen and burning.
Sustainability of practicing agro-forestry in CA is less likely because often, benefits take a long time to be realized; land tenure insecurity discourages farmers from such long-term investments; and farmers perceived agroforestry to be men’s domain but men often do not water and protect trees from damage by animals and fire especially when trees are young. Consequently, farmers are most likely to continue to rely more on chemical fertilizer application than natural fertilizers from agro-forestry.

Plant residue retention and maintaining of permanent fields (as opposed to bush fallowing) are less likely to be sustainable because land is still abundant in most parts of rural Zambia, plant residues are valuable fodder in most parts of Zambia, crops such as cotton and tobacco need the fields to be burnt for sanitary reasons and avoid the negative effect of nitrogen dynamics on crops such as tobacco due to incorporation of crop residues in the soil. Kumar and Goh (2000), caution that the crop residues can have both positive and negative effects on crop production. Thus when incorporating crop residues in CA both existing farming practices and scientific knowledge need to be taken into account as opposed to a universal recommendation to small-holder farmers.

Conclusions and Recommendations

This study concludes that agricultural transformation from conventional agriculture to Conservation Agriculture (CA) is selectively partial. The narratives linking agricultural transformation in Africa in the form of CA imply increased environmental conservation through CA. These are based on experience in other continents with completely different socio-economic and environmental conditions (soil, climate) from those in Africa. The evidence based on farmers’ experiences show variances from the narratives. This proves that the CA ideas and practices from elsewhere are not always applicable here and cannot be transferred blindly. It would be thus important for future policies and donor projects to allow flexibility in CA packaging because farmers make decisions to adopt or not based on individual components of CA and not CA as a package. Furthermore, policies, projects and programmes should avoid promoting CA as a universal system for all socio-economic and environmental conditions at all times; increase linkage of agricultural transformation to markets and allow mutual learning between small-holder farmers and scientists as they adapt the CA practices to local contexts.

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Ecosystem services for sustainable agriculture, forestry and fisheries
Damiano Luchetti, Clayton Campanhola, and Thomas Hofer

Summary

The paper presents FAO’s concept and principles of sustainable food and agriculture and calls for the consideration of ecosystem services as a key condition to achieve the Sustainable Development Goals (SDGs) and to address the Paris Climate Agreement. The paper also lists examples of ongoing FAO field projects which address sustainable production in agriculture, forestry and fishery through the consideration of ecosystem services and biodiversity. Ecosystem services are defined as the multitude of benefits that nature provides to society, including food, clean water, shelter and raw materials for our basic needs. Biodiversity is the diversity among living organisms and their habitats, which are essential to ecosystems functions and services delivery.

Introduction

The implementation of the SDGs calls for integration and synergies among sectors and between SDGs themselves, and no Goal will be achieved in isolation. Sustainability of agricultural production and of human consumption practices is a key condition to achieve several of the 17 SDGs. For instance, sustainable agriculture is instrumental to achieve biodiversity goals on land and sea, it strongly contributes to specific water, climate and health targets and is instrumental to achieving food security, nutrition, and several other social and economic related goals and targets.

From the food and agriculture perspective, it is increasingly recognized that the use of natural resources for production only without paying equal attention to the management of the ecosystems is unsustainable. Also, experience throughout the world has shown that working at the farm-scale alone without taking into consideration a broader landscape approach is not sufficient to achieve sustainability of food systems (see for instance UNEP, 2012). Competition is exacerbating pressure over natural resources and hence increasing degradation of ecosystems. At the same time, degradation and abandonment of natural resources can lead to increased competition over not yet degraded natural resources and to expansion of activities into fragile and degraded areas which then become further threatened.

Discussion

With the objectives of increasing production and productivity, addressing climate change and environmental degradation in agriculture, forestry and fisheries, FAO has adopted five principles for Sustainable Food and Agriculture (SFA) offering an integrated and multi-disciplinary view for sustainable production in these sectors (see figure 1). The SFA principles also facilitate a multi-stakeholder and cross-sectorial dialogue at policy level in countries. These principles are: 1) improving efficiency in the use of resources; 2) conserving, protecting and enhancing natural ecosystems; 3) protecting and improving rural livelihoods, equity and social well-being; 4) enhancing the resilience of people, communities and ecosystems; and 5) promoting good governance of both natural and human systems. The principles also consider the three dimensions of sustainability – economic, social and environmental – and support countries in defining their roadmaps, establishing priorities, identifying trade-offs, and defining implementation mechanisms that are aligned with their development strategies. Although the principle 2 refers exclusively to environmental issues, including ecosystem services, the management of ecosystem services is mainstreamed across the other principles (FAO, 2014).

Focusing on the production side of the vast and complex food system to achieve sustainability entails changing the way we produce food by integrating crops, forestry and fisheries and adopting a landscape or territorial approach, which also considers people and their activities as a main component. These concepts are increasingly being recognized at different levels, including within FAO’s rich and varied constituency of countries, donors, technical committees, partner organizations, experts groups, and stakeholders.

Consultant to FAO’s Major Area of Work on Ecosystem Services and Biodiversity.
FAO - Strategic Programme Leader, SP2 Increase and improve provision of goods and services from agriculture, forestry and fisheries in a sustainable manner.
FAO - Team Leader, Water and Mountains Team, Coordinator Major Area of Work on Ecosystem Services and Biodiversity.

The Sustainable Development Goals can be found here http://www.un.org/sustainabledevelopment/sustainable-development-goals/
The Paris Agreement can be found at http://unfccc.int/paris_agreement/items/9485.php
In many cases, intensive production systems with inadequate consideration of ecosystem services have come at a high price to society and the environment. Too often, the agricultural gains in the past fifty years have led to adverse impacts on the resource base. While such gains have been instrumental to address critical food security issues, it is not possible to intensify agriculture, forestry and fisheries using the same practices and approaches as in the near past. Chemical and nutrient pollution of watersheds, over-use of water and loss of wetlands, reduction of soil fertility, human and environmental health impacts of pesticides, bacterial resistance to antibiotics, loss of biodiversity and ecosystem services including pollinators, and greenhouse gas emissions from fertilizer and fossil fuel for mechanization, are some of the negative externalities caused by these practices. Also, heavy demand for fish, a key nutrition element for around 820 million people around the world, has led to over-exploitation of fish stocks, and intensive aquaculture, to satisfy a growing market but with increasing impacts on the environment (see also Secretariat of the Convention on Biological Diversity, 2014).

On the other hand we are increasingly learning how human beings depend in countless ways on healthy ecosystems and their products and services: (agro) biodiversity, food, clean water, shelter and raw materials are a few examples. Ecosystem functions regulate our environment and sustain production systems: pollination services from wild bees, pests and disease control through natural enemies, water purification through trees and forests, soil fertility maintenance through nitrogen-fixing plants are but a few of the ecosystem services that can be put at work in our agro-ecosystems in both terrestrial and aquatic environments. In order to ensure sustainability of agricultural production, ecosystem services need to become an integral part of our crop, livestock, forestry, fisheries and aquaculture practices. Directly or indirectly, ecosystem services underpin every aspect of our society. Landscapes – the environment at large which includes natural and anthropic systems – inspire our cultures and provide homes for wildlife and people alike (see also FAO, 2016 b).

Several and varied are the approaches and on-the-ground initiatives that are being promoted and tested in FAO to apply the five principles and promote sustainability in agriculture. Many of these initiatives are being implemented in Africa. Through these activities, FAO has started a learning process on how ecosystems and biodiversity could be better integrated in its work. The following list provides just a sample of the various programmes and projects which are ongoing in this regard:

- In Burundi, Rwanda, Tanzania, Uganda, through a GEF funded project, FAO supported smallholder farmers in the Kagera transboundary agro-ecosystem in testing and adapting integrated production systems that sustainably increase production, enhance the delivery of ecosystem services and contribute to both environmental and development goals (see figure 2).
- The GEF-funded Fouta Djallon Highlands Integrated Natural Resources Management Project works in eight West African countries (Gambia, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Senegal and Sierra Leone) and aims to mitigate the causes and negative impacts of land degradation in the highland ecosystem which is the water tower for West Africa (see figure 3).
- The FAO Blue Growth Initiative, which is presently active in ten countries in Africa and Asia, supports activities that will bring about transformational change in the management and utilization of marine and coastal resources and habitats, and help reconcile economic growth and needs for food security with ecosystem conservation and sustainable use (FAO, 2016 a).
- FAO hosts the Forest Landscape Restoration Mechanism which works in Rwanda and Uganda and soon will be operational in Niger, Burkina Faso, Kenya, Sao Tomé, Central African Republic and Democratic Republic of Congo. The Mechanism supports countries in regaining the functionality of degraded ecosystems not only through forest-based restoration options, but also by enhancing crop diversity, food production and the creation of value chains for the rural communities.
- In Burkina Faso and Mozambique, FAO is building capacity on the management of biodiversity and ecosystem services within and outside farming systems by organizing training courses on agroecology. The training courses, delivered to managers and practitioners, provide guidance on increasing the resilience of agro-ecosystems through diversification and integration of crops, trees and livestock. The agroecological practices that are being promoted aim to enhance the provision of a range of ecosystem services such as food and nutrition, efficient nutrient and water cycling, soil fertility, pest management, erosion prevention, and carbon sequestration.
Figure 2: Byumba, Rwanda - A panoramic view of a tea plantation in the marshlands. Kagera TAMP Project.

Figure 3: the West African water towers under threat: shifting cultivation in the Fouta Djallon Highlands, Guinea.
Conclusions

The 2030 Agenda recognizes the importance of developing sustainable agriculture and food systems and new ways to manage natural resources, including land, water, forests and genetic resources, to support the increasing demand for food. This demand is predicted to rise by 60 percent to feed the estimated more than nine billion people in 2050. This challenge will have to be addressed in a changing climate scenario where agriculture, forestry and fisheries will have to adapt and contribute to mitigate climate change.

Experiences gained so far from our activities in the field show that integration of natural processes such as ecosystem services within production systems represents a key element to cope with the challenges we have ahead.

Considering the growing pressure on natural resources, new and stronger governance mechanisms will be necessary to address the complex linkages and growing competition. Policies and governance mechanisms will need to consider the multiple social, economic, nutritional and environmental goals, address possible conflicts and adapt agricultural development programmes accordingly. More integrated, cross-sectoral and coherent approaches, including those based on landscapes, territories, ecosystems, and/or value chains are needed to change policies and practices and contribute to sustainability.

These integrated approaches must put farming communities at the centre of these changes and innovations. When implemented, such approaches help optimize the management of resources to ensure food security and nutrition in light of different and sometimes competing development goals as well as to meet societal demands in the short, medium and long term.

References


Inspiring the young generation to take action against climate change - in pictures

We are never too young to start protecting our planet. Climate change is what most of us perceive as the top global threat, and the dangers it poses affect present and future generations alike. How global warming is threatening the planet has been a theme in children’s books for all ages in recent years. How everyone, especially today’s youth, can make a difference to the future of the world by changing their everyday habits is the message of FAO’s latest Activity Book, released to celebrate this year’s World Food Day theme: Climate is changing. Food and agriculture must too. Take a look at seven different areas related to food and agriculture where change needs to happen (forestry, agriculture, livestock management, food waste, natural resources, fisheries and food systems). Visit the following website for tips on how you can inspire the young generation to take action against climate change:

Addressing root causes of rural youth distress migration*

An FAO infographic describes the root causes of rural youth distress migration and how out-migration and remittances can contribute to rural development, poverty reduction and food security.


IUU fishing is estimated to strip between $10 billion and $23 billion from the seafood industry

FAO is working on various fronts to combat IUU fishing through an integrated approach that includes the elaboration of national plans of action (Photo: @FAO http://www.fao.org/africa/news/detail-news/en/c/446700/)


The FAO-led Port State Measures Agreement is the first ever legally binding international treaty focused specifically on Illegal Unreported and Unregulated (IUU) fishing. Learn more at http://www.fao.org/port-state-measures/en/?utm_source=intranet&utm_medium=intranet-dyk&utm_campaign=dyk

*FAO-led Port State Measures Agreement is the first ever legally binding international treaty focused specifically on Illegal Unreported and Unregulated (IUU) fishing. Learn more at http://www.fao.org/port-state-measures/en/?utm_source=intranet&utm_medium=intranet-dyk&utm_campaign=dyk
Pulses contribute to food security

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Pulses can help contribute to food security in a number of ways. Learn more: http://www.fao.org/resources/infographics/infographics-details/en/c/414726/ http://www.fao.org/pulses-2016/news/news-detail/en/c/400604/

FAO's Zero Hunger podcast series is now available via iOS/Android

In 2018, FAO launched a new podcast series that sheds light on different parts of our food systems. The complete series is now on iTUNES (for Apple devices) and STITCHER (for android devices). Visit to learn more: http://www.fao.org/zhc/detail-events/en/c/418647/?utm_source=intranet&utm_medium=intranet-dyk&utm_campaign=dyk

International Day of Forests 2017 Uganda


The greatest loss of forests and gain in agricultural land was in tropical and low-income countries.

FAO’s e-learning centre offers more than 50 free courses on food and agriculture topics

The courses are suited to agricultural and food security professionals, students, and anyone interested in the broad range of topics offered by FAO. For more information visit: http://www.fao.org/zh/c/detai1/events/en/o/396243/?utm_source=intranet&utm_medium=intranet-ky&utm_campaign=ky
Forests and agriculture: land-use challenges and opportunities

Forests and trees support sustainable agriculture. They improve and sustain agricultural productivity by stabilizing soils and climate, regulating water flows, giving shade and shelter, and providing a habitat for pollinators and the natural predators of agricultural pests. They also contribute to the food security of hundreds of millions of people, for whom they are important sources of food, energy and income. Yet, agriculture remains the major driver of deforestation globally, and agricultural, forestry and land policies are often at odds.

State of the World’s Forests (SOFO) 2016 shows that it is possible to increase agricultural productivity and food security while halting or even reversing deforestation, highlighting the successful efforts of Costa Rica, Chile, the Gambia, Georgia, Ghana, Tunisia and Viet Nam. Integrated land-use planning is the key to balancing land uses, underpinned by the right policy instruments to promote both sustainable forests and agriculture.

The State of the World’s Forests reports on the status of forests, recent major policy and institutional developments and key issues concerning the forest sector. It makes current, reliable and policy-relevant information widely available to facilitate informed decision-making with regard to the world’s forests. For further information, contact FO-Publications@fao.org.


Plan to survey and monitor fishing stocks from Morocco to South Africa in 2017

A new research vessel "R/V Dr Fridtjof Nansen" equipped with the most up-to-date technologies will soon be ready to embark on its first survey to help developing countries improve fisheries management. Although its maiden voyage is not until the beginning of May 2017, an official naming ceremony was held in Oslo Norway on 24 March 2017.

Food and Agriculture Organization of the United Nations (FAO) has been collaborating with the Norwegian Agency for Development Cooperation (Norad) and the Institute of Marine Research (IMR) for more than 40 years to successfully implement the Nansen Programme. This initiative, dating back to 1974, has featured two Nansen research vessels. The programme aims to gather knowledge, data and information to strengthen fisheries management, and to enable fisheries administration to take appropriate actions and counter depletion of global fish stocks.

The long-standing FAO-Norway partnership operates in some of the least observed waters on the planet, particularly in Africa. Its goal is to provide a platform for countries with very limited capacity to assess their fisheries to do so properly and with support.

Thanks to its well-equipped dry and wet labs, dedicated library, and unlimited availability of fresh specimens from the catches, the R/V Dr Fridtjof Nansen is a great place to be for any taxonomist that wishes to improve his/her skills with respect to marine species identification. Nansen surveys offer a unique opportunity to observe colour patterns of species (especially fish) when they are still alive or fresh and to examine important anatomical parts featured only in specialized textbooks. The third R/V Dr Fridtjof Nansen will mainly be navigating the waters of Africa and Southeast Asia. The 2017 plan is to survey and monitor fishing stocks from Morocco to South Africa, whereas 2018 will mostly focus on research in Asia.

Learn more about the programme: http://www.fao.org/in-action/leaf-nansen/en


Sixth Tokyo International Conference on African Development (TICAD-VI) summit declaration on structural transformation, shared prosperity

Heads of State and Government and representatives of Japan and 54 African countries have adopted the Nairobi Declaration, a three-year plan to promote structural economic transformation, resilient health care systems and social stability for shared prosperity. The officials were gathered for the Sixth Tokyo International Conference on African Development (TICAD-VI) Summit, which focused on the theme, ‘Advancing Africa’s Sustainable Development Agenda: TICAD Partnership for Prosperity’. TICAD meets regularly to promote high-level policy dialogue among Japan, African leaders and development partners. Over 6,000 participants attended the 2016 Summit, which took place in Nairobi, Kenya, from 27-28 August 2016, the first time a TICAD Summit has been held in Africa since TICAD’s inception in 1993.

The Government of Kenya, the Government of Japan, the UN Development Programme (UNDP), the World Bank, the African Union Commission (AUC) and the UN Office of the Special Advisor on Africa (OSAA) organized the event. The Nairobi Declaration addresses opportunities for promoting economic diversification and industrialization through agriculture, innovation and information and communications technology (ICT) economy. It stresses the importance of quality infrastructure, the private sector, and skills development in Africa’s structural economic transformation. The Declaration stresses that addressing climate change, natural resource loss, desertification, wildlife poaching, illegal fishing, food, water and energy insecurity, and natural disasters is critical to achieve social stability in Africa. In advance of the Summit, Japan’s Ministry of Agriculture, Forestry and Fisheries, the World Agroforestry Centre (ICRAF) and other organizations organized a two-day event on the role of tackling deforestation and forest degradation and promoting sustainable forest management (SFM) and agroforestry in achieving the Sustainable Development Goals (SDGs) in Africa.


World is home to ‘60,000 tree species’

There are 60,065 species of trees in the world, according to a comprehensive study of the world’s plants. Botanical Gardens Conservation International (BGCI) compiled the tree list by using data gathered from its network of 600 member organisations. It hopes the list will be used as a tool to identify rare and threatened species in need of immediate action to prevent them becoming extinct. Details of the study appear in the Journal of Sustainable Forestry.

BGCI identified a species that was on the edge of extinction as a result of over harvesting. Karomia gigas is found in a remote part of Tanzania. At the end of 2016, a team of scientists found a single population of just six trees. They recruited local people to guard the trees and to notify them when the trees produced seeds. The plan is for the seeds to be propagated in Tanzanian botanical gardens, allowing the species to be re-introduced back into the wild at a later date. BGCI said that it did not expect the number of trees on its Global Tree Search list to remain static as about 2,000 plants were newly subscribed each year. It would be updating the list whenever a new species was named.

Source: Mark Kinver Environment reporter, BBC News

The 2017 International Day of Forests

The United Nations General Assembly proclaimed 21 March the International Day of Forests (IDF) in 2012. The Day celebrates and raises awareness of the importance of all types of forests. On each International Day of Forests, countries are encouraged to undertake local, national and international efforts to organize activities involving forests and trees, such as tree planting campaigns. The theme for each International Day of Forests is chosen by the Collaborative Partnership on Forests. The theme for 2017 is Forests and Energy. On 21 March 2017, many countries, communities and organizations across the globe celebrated the most important date in the forestry calendar: the International Day of Forests. Inspired by the 2017 theme of "Forests and Energy", awareness-raising and educational activities encouraged visionary thinking about forests as a source of renewable energy, now and in the future. Visit http://www.fao.org/international-day-of-forests/en/ for full information on the day's activities and events. Also visit the "Collaborative Partnership on Forests" website http://www.cpfweb.org/en/ to link to partners' celebrations and statements. IDF 2017 is a contribution to the UN Decade of Sustainable Energy for All (2014-2024) See: http://www.se4all.org/decade

Women association of Finkolo village, Mali, attending a field lesson in an onion growing garden ©FAO/Swiatoslaw Wojtkowiak

Community tree nursery close to Mombasa, Kenya ©FAO/Fritjof Boerstler
**ANNOUNCEMENT**

**Invitation to respond to 8 questions about threats to species, habitats, and ecosystems in Africa**

The Africa Section of the Society for Conservation Biology (SCB) is conducting a survey to understand the current threats to species, habitats, and ecosystems in Africa. The aim of the study is to understand the threats, challenges, actions, skills and research priorities for conservation. The results will inform the work of the Africa section of SCB and be published and made available to everyone who would like to prioritize research and policy efforts to address these threats. The survey consists of 8 questions and takes about 10-15 minutes to complete. Please take part in the survey at this link: [https://goo.gl/forms/KVScWbmJ5yWCEk9H3](https://goo.gl/forms/KVScWbmJ5yWCEk9H3) For any questions, kindly contact: Tuyeni Mwampamba (tmwampamba@gmail.com), Ruth Kansky (kanskyruth@gmail.com), or Israel Borokini (tbisrael@gmail.com)

**Free Book: “Participatory Planning for Climate Compatible Development in Maputo, Mozambique”**

Edited by: Vanesa Castán Broto, Jonathan Ensor, Emily Boyd, Charlotte Allen, Carlos Seventine and Domingos Augusto Macucule

Download free: [https://goo.gl/HCxac1](https://goo.gl/HCxac1)

University College London (UCL) Press is delighted to share an open access book that may be of interest to readers in Africa and beyond. Participatory Planning for Climate Compatible Development in Maputo, Mozambique is a practitioners’ handbook that builds upon the experience of a pilot project (4PCCD) that was awarded the United Nations ‘Lighthouse Activity’ Award. Building upon a long scholarly tradition of participatory planning, this dual-language (English/Portuguese) book addresses crucial questions about the relevance of citizen participation in planning for climate compatible development and argues that citizens have knowledge and access to resources that enable them to develop a sustainable vision for their community. In order to do so, the authors propose a Participatory Action Planning methodology to organize communities, and also advances mechanisms for institutional development through partnerships. It is available to download for free from [https://goo.gl/HCxac1](https://goo.gl/HCxac1)

**Promoting a “golden thread” of forests and energy**

A panoramic snapshot of the use and potential of forests for energy is supported by newly released FAO publications, including a major study on greening the charcoal chain and a policy brief to incentivize sustainable wood energy production and consumption in sub-Saharan Africa, where woodfuel is the main source of energy for two thirds of all households.

FAO's message is clear: The transformation of the wood-energy sector is possible but must start with long-term investment in sustainably managed forests for wood-energy production, clean and efficient stoves, and measures to support efficient and well-regulated trade. For millions of people, wood fuel production and trade is a major economic activity, providing an important means of income, particularly for rural women. New FAO wood-energy publications released on 21 March 2017 describe the prospective gains that long-term investment and policy and fiscal measures favouring the growth of a sustainable woodfuel industry can render. Read more in the FAO publications released on International Day of Forests 2017 (IDF 2017) and available at the following links:

- [The charcoal transition: greening the charcoal value chain to mitigate climate change and improve local livelihoods](https://www.fao.org/3/a-i6935e.pdf)
  - in English
- [The charcoal transition: executive summary](http://www.fao.org/3/a-i6934e.pdf)
  - in Arabic, Chinese, English, French, Russian and Spanish
- [Incentivizing sustainable wood energy in sub-Saharan Africa](http://www.fao.org/3/a-i6815e.pdf)
  - A way forward for policy-makers
- [Forests and Energy infographic](http://www.fao.org/3/a-i6928e.pdf)

**Abstract:**

Charcoal is widely used for cooking and heating in developing countries. The consumption of charcoal has been at high level and the demand may keep growing over the next decades, particularly in sub-Saharan Africa. Some preliminary studies indicate that among commonly used cooking fuels, unsustainably produced charcoal can be the most greenhouse gas intensive...
fuels and simple measures could deliver high GHG mitigation benefits. Through the Paris Agreement on climate change adopted in 2015, countries set themselves ambitious targets to curb climate change, and forest-related measures have an important role to play in climate change mitigation and adaptation. Over 70% of the countries who have submitted their (intended) nationally determined contributions (NDCs) mention forestry and land use mitigation measures. Despite the importance of woodfuel in many countries, few have explicitly included measures to reduce emissions from woodfuel production and consumption. Many of the NDCs that include forestry do not yet provide detailed information on how mitigation is to be achieved. The overall objective of the publication is to provide data and information to allow for informed decision-making on the contribution sustainable charcoal production and consumption can make to climate change mitigation. More specifically, the publication aims to answer the following questions: - What are the climate change impacts of the current practices on charcoal production and consumption worldwide and across regions? - What is the potential of sustainable charcoal production in GHG emission reductions and how such potential can be achieved? - What are the key barriers to sustainable charcoal production and what actions are required to develop a climate-smart charcoal sector?


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**Pages:** 184 p.  
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**Job Number:** I6935;  
**Author:** van Dam, J.;  
**Agrovoc:** sustainable development; charcoal; fuelwood; climate change mitigation; greenhouse gases; emission reduction; energy generation; greening; energy policies;

Incentives to promote sustainable wood energy in sub-Saharan Africa: Policy Brief

**Incentives to promote sustainable wood energy in sub-Saharan Africa: A way forward for policy-makers**

**Year of publication:** 2017  
**Publisher:** FAO  
**Pages:** 12 p.  
**Job Number:** I6815;  
**Agrovoc:** sustainable development; fuelwood; charcoal; wood energy; energy management; energy policies; Africa South of Sahara;

**Abstract:**

Woodfuel contributes to more than half of energy consumption in 22 countries of sub-Saharan Africa, and over two-thirds of the households in Africa use wood as their main fuel for cooking, heating and water boiling. While its use is expected to further increase due to population growth and urbanization, there is hardly any systematic approach to developing a sustainable wood energy sector in the region. Absence of effective policies governing wood fuel production, trade, conversion, and consumption and the resultant indiscriminate and inefficient woodfuel collection and use contributes to continued deforestation and forest degradation. In addition, this is also causing indoor air pollution with obvious adverse health impacts besides imposing disproportionate fuelwood collection burden on women and children. While there have been instances where some of these challenges were addressed through suitable regulatory and incentive mechanisms; currently, however, information on such mechanisms is scattered. The proposed work directly contributes to enabling inclusive and efficient agricultural and food systems and also to alleviating rural poverty.

Visit the FAO Forestry Wood Energy website for more information.
Sustainable pastoralism and rangelands in Africa

The next edition of Nature & Faune journal will explore the intricacies of sustainable pastoralism and rangeland management in Africa. This lends support to the initiative of encouraging the United Nations to designate 2020 the International Year of Rangelands and Pastoralists (IYRP).

One billion poor people, mostly pastoralists in sub-Saharan Africa and South Asia, depend on livestock for food and livelihoods. Globally, livestock provides 25 percent of protein intake; provides bio-available sources of vitamin A, iron and zinc and caters for 15 percent of dietary energy. Livestock which is broadly defined to include cattle, camels, goats, sheep and wildlife or any other animals that are part of pastoral livelihoods contributes up to 40 percent of agricultural gross domestic product across a significant portion of sub-Saharan Africa and South Asia (FAO, 2012). Between 1997/99 and 2030, annual meat consumption in developing countries is projected to increase from 25.5 to 37 kg per person, compared with an increase from 88 to 100 kg in industrial countries. Consumption of milk and dairy products will rise from 45 kg/person/p.a. to 66 kg in developing countries, and from 212 to 221 kg in industrial countries. For eggs, consumption will grow from 6.5 to 8.9 kg in developing countries and from 13.5 to 13.8 kg in industrial countries.

Pastoralism plays a critical role in the ecological, social and economic sustainability worldwide, and is especially important in semi-arid and arid areas where rainfall is too low to sustain dryland cropping. In Africa, drylands make up about 40% of the land area, with pastoralism representing the main livelihood option for approximately 200 million people (CELEP, 2017). Pastoralism makes full use of and derive benefit from the climatic variability that is characteristic of drylands. Carefully planned livestock mobility and the husbandry of animals to feed selectively on the best available pastures are two critical strategies in the production system that allow pastoralists to create economic value on a sustainable basis rather than merely to survive in difficult environments.

However, livestock production and the increasing demand for meat, egg, milk and dairy products to provide diversified nutrient dense foods of animal origin have led to several sustainable environmental challenges. Different forms of livestock production have different impacts on natural resources. (FAO 2017) As the livestock sector is a primary player in the agricultural economy, a major provider of livelihoods for the poor and a major determinant of human diet and health, it is especially important to view its environmental role in the context of its many different functions. The considerable expansion of the livestock sector required by expanding demand must be accomplished while substantially reducing livestock’s negative environmental impacts (FAO, 2006).

The editorial board invites articles on the realities of livestock production in extensive rangeland conditions, rangeland ecosystems and sustainability, wildlife benefits and conflicts in pastoral systems, forest feed for livestock, animal disease control, silvopastoralism, and impact of livestock on water and soil degradation. We would welcome contributions from a wide field of expertise. If potential authors have reports on findings of programs and projects, success stories, and announcements on livestock related matters please send them to the address below. We usually prefer articles some 3 pages long, and we welcome and encourage colour pictures.

Please send us your manuscript(s) by email to the following addresses: nature-faune@fao.org and Ada.NdesoAtanga@fao.org

Deadline for submitting manuscripts for the next issue is 1st June, 2017.

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