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Special Issue on inclusive agricultural and rural development in fragile situations and crises

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Contents

The Tropical Agriculture Association (TAA) is a professional association of individuals and corporate bodies concerned with the role of agriculture for development throughout the world. TAA brings together individuals and organisations from both developed and less-developed countries to enable them to contribute to international policies and actions aimed at reducing poverty and improving livelihoods. It grew out of the Imperial College of Tropical Agriculture (ICTA) Association, which was renamed the Tropical Agriculture Association (TAA) in 1979. Its mission is to encourage the efficient and sustainable use of local resources and technologies, to arrest and reverse the degradation of the natural resources base on which agriculture depends and, by raising the productivity of both agriculture and related enterprises, to increase family incomes and commercial investment in the rural sector. Particular emphasis is given to rural areas in the tropics and subtropics and to countries with less-developed economies in temperate areas. TAA recognises the interrelated roles of farmers and other stakeholders living in rural areas, scientists (agriculturists, economists, sociologists, *etc*), government and the private sector in achieving a convergent approach to rural development. This includes recognition of the importance of the role of women, the effect of AIDS and other social and cultural issues on the rural economy and livelihoods.

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Editorial

Inclusive agricultural development in fragile situations and crises

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Karim is an international development specialist with a particular interest in fostering inclusive and participatory rural transformation, focussing on agricultural and rural development, research, policies and programmes. After 10 years working in UK-based development research institutes he has spent more than 17 years working for international development organisations in advisory, policy, research and programme management roles, in Africa, Asia and Latin America. This has included work for the Organisation for Economic Co-operation and Development, the International Fund for Agricultural Development, the Food and Agriculture Organization of the United Nations, Technical Centre for Agricultural and Rural Cooperation (CTA), the Global Forum for Rural Advisory Services and UN-Habitat.

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In the context of the global implications and gravity of the coronavirus disease 2019 (COVID-19) pandemic and related shocks, the last TAA Executive Committee agreed that it would be propitious to focus *Ag4Dev41* (autumn 2020) on these topics of critical importance to humanity in general, and to agriculture and development in particular. This will enable us to draw out timely, evidence-based lessons and recommendations for policy and practice to support agriculture for development in fragile situations and crises.

This year has been dramatically different for everyone: changing priorities and undermining plans at the personal and professional levels, while introducing great degrees of uncertainty in our lives. As I write, I sit in an Organisation for Economic Co-operation and Development (OECD) country that is in a second phase of 'partial' lockdown and a curfew on all but essential movement outside from 10 pm to 5 am. This is a different world. As Peter Gardiner in his International agricultural research news section aptly observes, in 2020 the world can look like a fragile place almost irrespective of where one is located.

We all face the enormous impacts of COVID-19 on lives and livelihoods in all countries and regions, whether developed or developing, richer or poorer. All people, societies and professions have recognised the need to adapt, respond and transform the ways we relate to other people, work and build our economies. The personal and community difficulties and suffering, reversals (particularly in terms of progress towards achieving inclusive development goals) and risks (with the dramatic falls in economic growth and output, exacerbating inequalities between richer and poorer) have been – and continue to be – very real as second waves of the virus sweep across the world.

This crisis has fundamentally affected all areas of economies and trade, including, of course, agriculture and rural development. It has revealed the fragility of the global economy and health systems in the face of a real, but unpredictable, health risk. It has shown how easy it can be for us all to fall into so-called 'fragile situations' with their attendant risks of unemployment, marginalisation and poverty.

However, despite the clear suffering and hardship this crisis has generated and that many will continue to endure for some time to come, there are germs of hope for the future emerging. This crisis has brought people together across the divides of wealth, race, class and location in ways we may not have been able to imagine before. Many, from private and public sectors, developed and developing countries, rural or urban-based are now urgently seeking to transform our ways of living and societies, and seeking ways to 'build back better' from the COVID-19 pandemic. To shift from a consumption-oriented profit-centred economic development and production paradigm to one that reaffirms sustainability and balance.

This entails highlighting once again the priorities of sustainable and inclusive development and achieving the objectives and targets of the 2030 Agenda for Sustainable Development and applying them in relation to fragile situations and crises.

This journey towards social, economic and inclusive, sustainable rural transformation has begun and it is one that we will have to support our children and young people to take forward to transform futures

for all in a mutually beneficial development process. It is critically important that this transformation be 'better' than in the past and that it be developed and undertaken in inclusive and participatory ways where no one of any gender, race or class is left behind (see *Ag4Dev40*, with its emphasis on participation in policy and practice). It will be a transformation that affects all parts of the economy and our society, including, of course, agriculture. We must make it a good one that contributes to a better world! It is not by accident that Qu Dongyu, the Director-General of the Food and Agriculture Organization of the United Nations (FAO) has talked of the need to focus on achieving the 'Four Betters' in this changing global landscape – better production, better nutrition, a better environment and a better life.

TAA members and the friends of TAA that readily contribute their expertise and knowledge to produce this quality *Ag4Dev* journal have their own roles to play in this transformation. In this issue, Harding & Bennett (Article 3) conclude their expert analysis of the various calls to action issued by eminent experts since early 2020 on COVID-19 and agriculture and development by highlighting that TAA can go beyond observing as spectators and continuing to raise the importance of better farming practices and more sustainable food systems. They rightly affirm that the TAA community has important roles within their own spheres of influence, and at different levels, to emphasise the importance of improving agricultural practices and the livelihoods of farmers and rural communities. They remind us that many of us have lived through outbreaks of disease and pandemics and know that recovery and resilience will require a focus on food and farming. They also point out that, as most pandemics are zoonotic diseases with their origins in animals, to avoid disease outbreaks the development and adoption of sustainable farming and land-use systems and effective surveillance of potential sources of disease will be essential.

In Article 1, Radcliffe & Subsol draw our attention to one of the biggest issues of our time: supporting climate change adaptation. They draw on learning from the International Fund for Agricultural Development's (IFAD) Adaptation for Smallholder Agriculture Programme (ASAP) to show how smallholder farmers can adapt in fragile situations. ASAP-supported projects are targeted at poor communities in developing countries, and 29 percent are in countries defined as having fragile situations based on security and institutional capacity. Two case studies, based on projects in Sudan and Niger, provide key lessons on addressing drivers of fragility. The importance of nesting development approaches in local contexts and adopting participatory methods and capacity-building to engender local ownership, are stressed. Examples of good practice are also identified in the areas of sustainable natural resource management, natural resource governance, attention to the particular needs of women and youth, and addressing immediate needs for sustainable incomes and food security. On climate-related issues, the Newsflash item by Brammer is a useful complement, here, providing an update on global climate change drawing on data from the United States National Aeronautics and Space Administration (NASA). It helps us understand the latest global data on climate trends, which only make the need to support climate adaptation more urgent.

Alan Yates confirms the evidence that global warming is clearly under way in Article 6 on 'Carbon sequestration: the natural way' and outlines different approaches to carbon sequestration. He argues that soil organic matter can be increased using conservation agriculture technologies, which are now widely understood and simple to implement. This has the potential to simultaneously reduce the problem of global hunger through protecting soils and increasing yields of crops.

Article 2 by Montalbano & Nenci explores countries' participation in agricultural and food global value chains (GVCs) based on a rigorous econometric analysis of panel data to provide a global assessment and an exploration of the implications of the COVID-19 pandemic. A review of data from the 2020 edition of FAO's *The State of Agricultural Commodity Markets* shows that there is empirical evidence of a positive relationship between changes in both agriculture and food GVC participation and changes in agriculture value added per worker. This indicates that economic growth and structural transformation of GVCs is occurring and, contrary to conventional wisdom, they argue that GVCs can reduce countries' vulnerability from trade since they foster trade channels and help the world economy to speed up the global recovery.

Article 4 by El-Harizi reviews the experience of IFAD in introducing, adapting and scaling up village group revolving funds (GRFs) in Cambodia as it emerged from a period of crisis. These targeted the most vulnerable segments of the rural population. He argues that this model of rural finance should not be overlooked as GRFs have proved to be a means by which the most vulnerable can graduate to market-based rural financing services as well as access other development services.

The International agricultural research news feature, prepared for the first time by Peter Gardiner (formerly a senior staff member of CGIAR Montpellier), provides an overview of important research issues and initiatives in fragile and conflict-affected contexts,

such as the Sahel. He highlights the initiatives of the CGIAR Climate Change, Agriculture and Food Security (CCAFS) programme in this regard and provides an update on CGIAR reform. To bridge the gap between perspectives, the climate security team of CCAFS held a series of six webinars on climate security from June to October 2020. They are now organising a dialogue to catalyse action for more robust ecosystems of innovation in food and agriculture.

We are grateful for the contributions of news items from TAA members. Several provide timely, recent, field-based perspectives on the effects of COVID-19 on agriculture and food in different country contexts: effects on crop and livestock production globally (Ward); impacts on smallholder farmers in Zambia (Kapembwa & Joshi); responses of agribusinesses to COVID-19 and best practices, particularly from experience in Africa where, in many cases, they have responded by rapidly adapting their operations to retain their businesses and profitability, albeit not without serious challenges (Evans); and impacts on food production and food security in Bangladesh (Brammer).

Article 5 (Ligairi & Joshi) provides evidence on the impacts of COVID-19 lockdown on smallholders in Fiji and illustrates the strategies and programmes put in place by the Fiji Government to cushion its impacts. In his Opinion page contribution, James Biscoe also reflects on his experience of COVID-19 in Eswatini earlier in 2020 and provides a flavour of how developing countries are responding to the COVID-19 pandemic.

Another news item provides an overview of research on the impacts of viruses on the local taro plant in the Solomon Islands, South Pacific. The authors argue for continuing research into taro, given the importance of local crops to maintain a diverse range of food crop staples to protect nutritional and cultural sustainability (Gollifer & Jackson). In addition, Nigel Poole (TAA member) and Joanna Kane-Potaka of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) provide an update on its important work on diversifying staples for better nutrition, and argue for continued investment in research in this area: the 'Smart food triple bottom line'.

We also include in this issue the presentations made at a special seminar on soil management in a changing climate, organised in June by TAA East Anglia (Keith Virgo, David Dent, Ed Turner and Mariska Bartlett).

Finally, following on from the review that we published in *Ag4Dev40*, a second independent review of the two volumes of *Advances in Conservation Agriculture* edited by Amir Kassam has been provided by David Dent under the fitting title for our times: 'Changing the future'. Two other book reviews are included in this issue: Peter Thompson's autobiography, *One of a Thousand*, and Merlin Sheldrake's *Entangled Life: How fungi make our worlds, change our minds, and shape our futures.*

I would like to invite readers to contribute news items and other contributions on experience related to food systems for *Ag4Dev42*, a Special Issue on food systems designed to coincide with the United Nations Food Systems Summit 2021. *Ag4Dev42* will be the first issue of *Ag4Dev* to be in the new '*shorter but better*' format (please see my piece on this change towards the end of this issue). TAA business and news will in the future be made available electronically, via email and the website. We welcome reader feedback on this evolution and other aspects of the journal and its content.

Lastly, I would like to thank all the contributors and, once again, the dedicated editorial team for their work to ensure the quality and relevance of *Ag4Dev*. The experience and evidence shared by TAA members and non-members through the journal is well received by many and greatly valued – well beyond the TAA community. I look forward to continuing to develop and strengthen it in 2021.

Addressing climate change adaptation for smallholder farmers in fragile situations: learning from the Adaptation for smallholder agriculture programme

David Radcliffe and Sebastien Subsol

David Radcliffe (TAA Member) is a soil scientist by training and was a senior rural livelihoods adviser with the United Kingdom Department for International Development (DFID) up to 2015. He has previously worked for the Food and Agriculture Organization of the United Nations (FAO) and consulting companies, living for more than 10 years in Africa. Since 2016 he has worked as a consultant for DAI Global, advising DFID on lesson learning and scale-up potential of the Adaptation for Smallholder Agriculture Programme (ASAP), during which time he has visited nine ASAP projects in the field.

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Abstract

Vulnerability to climate change is a significant driver of fragility. The *Adaptation for smallholder agriculture programme* (ASAP), managed by the International Fund for Agricultural Development (IFAD), provides grant funding to enable agricultural development projects to build resilience and adapt to climate change. All ASAP-supported projects are targeted at poor communities in developing countries, and 29 percent are located in countries defined as having fragile situations on the basis of security and institutional capacity. Two case studies, based on projects in Sudan and Niger, are described and key lessons are identified in the context of addressing drivers of fragility. The importance of nesting development approaches in local contexts, and adopting participatory methods and capacity-building to engender local ownership is stressed. Examples of good practice are identified in the areas of sustainable natural resource management, natural resource governance, access to water, attention to the particular needs of women and youth, and addressing immediate needs for sustainable incomes and food security. Some of these are being scaled up in the case study countries and it is anticipated that they may have broader application in similar fragile situations.

Introduction

IFAD defines fragility as a condition of high vulnerability to natural and man-made shocks often associated with an elevated risk of violence and conflict (IFAD, 2016a). Vulnerability to climate change can be regarded as an aspect of fragility. This paper examines the experience of two projects designed to support adaptation to climate change. It presents some of their results and emerging lessons, and discusses their broader implications for addressing some of the drivers of fragility and boosting the resilience of poor rural communities in fragile situations. It builds on prior reviews of IFAD experience in fragile states (Hussein, 2017) and assessment of ASAP experience across other African countries (Radcliffe *et al*, 2017).

Rural people in developing countries are among those most vulnerable to climate change. The agricultural systems on which they depend are sensitive to many of the various effects of climate change, such as increased temperatures, less predictable precipitation patterns and increased frequency of extreme climatic events. These effects may result in increases in drought, floods and landslides, and in changes in pest and disease incidence in crops and livestock, with potential negative impacts on food security, incomes and livelihoods.

Adaptation to climate change is crucial if progress is to be made on reducing poverty, improving food security and building resilience, in line with the ambitions laid out in the United Nations Sustainable Development Goals. Notwithstanding the urbanisation that has taken place in recent decades, an estimated 3 billion people still reside

in rural areas in developing countries, and depend on the agricultural sector for their livelihoods. A productive agricultural sector is also needed to feed the cities. Strengthening the resilience of agricultural systems, and of the people who depend on them, is an essential part of the response to climate change. In addition, agriculture and land use change are often drivers of environmental degradation and biodiversity loss, and contribute an estimated 23 percent of greenhouse gas (GHG) emissions globally (IPCC, 2019).

In addition to physical stresses such as climate change, fragile situations are typified by weak capacity of institutions, including government and the private sector. Vulnerable communities suffer from poor availability of services and resources, and limited access to them. Literacy levels are typically low and community institutions are absent or poorly developed. Demographic pressures or competition for natural resources may exacerbate the situation, sometimes leading to insecurity and, in the worst cases, to protracted conflict.

The Adaptation for Smallholder Agriculture Programme

ASAP is IFAD's flagship on climate change adaption and the largest programme addressing adaption in the smallholder farming sector. ASAP has a total budget of USD 316 million and provides additional grant funding into the larger loan-based agriculture and rural development projects that are part of IFAD's regular portfolio, with the intention of making projects 'climate smart' with embedded objectives of resilience. The ASAP Trust Fund is supported by 11 donors, with the United Kingdom Department for International Development (DFID) providing 64 percent. ASAP funding has been committed to 42 projects, three of which have been completed.

ASAP is a global programme focussed on developing countries. ASAP-supported projects are typically targeted at areas with a high incidence of poverty within countries, and interventions are targeted towards the needs of particular groups, who may be defined by poverty or vulnerability status. Gender is integrated into the projects and, where relevant, results are reported separately for female and male beneficiaries. Work is currently under way to strengthen the integration of nutrition, and the particular concerns of youth, into project implementation and reporting. Results from individual projects are aggregated at programme level to give an overall assessment of performance, which is assessed according to indicators related to land, water, skills capacity, infrastructure and knowledge-sharing indicators.

In all, 29 percent of ASAP-supported projects are located in countries with fragile situations, as defined currently by the World Bank (World Bank, 2020). The case studies featured are based on ASAP-supported projects in such environments.

Case Study 1: Butana integrated rural development project (BIRDP), Sudan

Butana is a region identified by geography and culture, and comprises nine administrative localities in five states: Gedarif, Gezira, Kassala, Khartoum and River Nile. It is a vast, flat plain populated by 800,000 people who were traditionally nomadic but now comprise a mixture of migratory and settled communities. The area has a hot, dry climate with mean annual rainfall varying from less than 100 mm in the north to more than 500 mm in the extreme south, and an ongoing trend of higher temperatures, particularly in winter when daily minimums are predicted to increase by 3–5 percent by 2030. Future precipitation trends are less clear, although most respondents reported a tendency to drier conditions with increased frequency of drought (IFAD, 2016b). Butana is predominantly flat with a few gravelly hills and occasional rocky escarpments. Soils vary from black clay vertisols and vertic cambisols, which are dominant in the south, to sandy and gravelly soils.

An estimated 50 percent of people are classified as poor and levels of illiteracy are high. Livelihoods are dependent on extensive livestock rearing, in some cases supported by rainfed cropping of sorghum and millet, drawing on water from shallow *wadis* and depressions.

Apart from the harsh climate, competition for natural resources is a major driver of fragility in Butana. The area is particularly important for seasonal grazing, and livestock numbers reportedly reach around 12 million in the rainy season from June to September. The secession of South Sudan has restricted traditional grazing routes. Alienation of community land by large-scale commercial agri-business and mining interests has further increased pressure on Butana's range and agricultural land. The combination of climate change and mounting pressure on natural resources may stretch coping strategies to the limit. Some basic information on BIRDP is given in Box 1.

BIRDP has adopted a participatory community-led approach, building the capacity of community members to identify priorities, articulate needs and access support. The Community Development Committee is the focal planning body. Thematic interest groups address such issues as opportunities for women and youth, crop agriculture, livestock, forest and range development, and savings and

Box 1. BIRDP

Duration: 2009–2019 (ASAP supported 2016–2019)

Total budget: USD 46.7 million

ASAP contribution: USD 3 million

Goal: Sustainable improvement in livelihoods and drought-resilience

Target group: Pastoralists and settled farmers (192,000 targeted for resilience to climate change)

Areas of intervention: Natural resource governance; access to markets; capacity-building

Source: IFAD (2016c).

credit. ASAP support has been directed specifically to capacity-building for climate-resilient community village plans and the construction and maintenance of water infrastructure. A natural resource governance framework (NRGF) has been developed to guide planning and related capacity-building, and to provide the context within which priorities and plans can be discussed with local government and private sector stakeholders.

Lessons learned

1. Natural resource governance

The NRGF is seen as a major instrument in resolving conflicts over natural resources, which are a major driver of fragility. It has made communities aware of laws and regulations with respect to sustainable management of land, water and biomass resources, which are coming under increasing pressure through competition from seasonal herders and from outside investors in agri-business or mining. Through the NRGF's cluster forums, communities are able to negotiate with each other and with local authorities, and to develop local byelaws to regulate access to community forest and rangeland so that it is sustainably managed. Some formal registration of community forest land has taken place in order to secure community ownership and provide protection against outside acquisition.

2. Natural resource management

As well as being effectively governed, natural resources must also be conserved and managed sustainably. Since accessing ASAP support, BIRDP has brought around 100,000 hectares of land under climate-resilient practices, including species enrichment and protection of community forest, enclosure and controlled grazing of rangeland, and rainwater harvesting for rainfed cropping areas. This includes more than 4,000 hectares of Guar (*Cyamopsis tetragonoloba)*, a fodder crop that is new to Butana and is valued by pastoral communities. Calculations by IFAD and FAO indicate a net carbon balance of minus 4.8 million tons CO_2 equivalent, comprising sequestration and avoided emissions, due to the project (IFAD, 2020).

Figure 1. Typical rangeland in Butana (Photo: David Radcliffe)

3. Access to water

Water was identified as the most important constraint by more than 70 percent of communities in the project area. BIRDP has substantially improved access to water for multiple purposes to more than 50,000 beneficiaries through provision of wells and boreholes in parts of the project area underlain by the Nubian aquifer, and through fenced open reservoirs or *hafirs* in areas underlain by basement rocks where aquifers are absent. Water is used for domestic and livestock needs, and for micro-irrigation. Community water committees manage facilities in a way that is sustainable, recouping costs required for maintenance. In one village, resident households pay a monthly subscription charge of 50 Sudanese Pounds for water, and 10 of the poorest households are exempt. Different charges are applied to visiting pastoralists who do not pay this subscription (Radcliffe, 2018).

4. Women's empowerment

BIRDP has made a significant contribution to gender transformation in a conservative society. Training and mentoring activities have empowered women and strengthened their position in community organisations. One third of office bearers in community committees dealing with such issues as water management and procurement are women. BIRDP has also created opportunities for women to access resources (including land, water and microcredit) and to engage in activities to improve food security and incomes.

Figure 2. Climate-resilient village plan (Photo: David Radcliffe)

5. Opportunities for youth

A young professionals (YP) programme has proved effective in engaging young graduates to train and mentor poor households, a win-win scenario in which YPs gain valuable experience and recipients' skills are improved. The YPs have been effective in mobilising communities, raising awareness on gender inclusion and increasing women's participation, supporting formation of savings and credit groups, and contributing to monitoring by undertaking simple cost–benefit analyses of communal farms. In all, 87 percent of YPs are women.

6. Food security and nutrition

BIRDP has resulted in significant improvements in food availability and nutrition through a combination of training in nutrition, health, animal health, and crop and fodder storage targeted at women. Project support has been targeted at *jubrakas*, which are plots managed by women to cultivate vegetables in the backyards of their houses. Households reporting food shortages reportedly fell from 63 percent prior to the project to 14 percent after BIRDP interventions had been implemented (Partners in Development Services *et al*, 2019).

By the time of project closure in September 2019, BIRDP had directly supported around 165,000 people in coping with the impacts of climate change (85 percent of the target in Box 1). Furthermore, 92 percent of beneficiaries have improved their incomes, with 39 percent of these reporting increases of more than 50 percent from the pre-project baseline (Partners in Development Services *et al*, 2019). Some of the significant project outputs, such as the NRGF, are now being applied and scaled up in the *Livestock marketing and resilience programme* currently under implementation in Kordofan and in Blue Nile, Sennar and White Nile states. The BIRDP experience has informed the design of the *Sustainable natural resource management and livelihoods project*, also supported by IFAD, which is expected to start in 2020.

Case study 2: Programme de développement de l'agriculture familiale dans les régions de Maradi, Tahoua et Zinder (PRODAF), Niger

This project is implemented in the south of Niger where the vast majority of the rural population lives. The economy of Maradi, Tahoua and Zinder regions is based on rainfed agriculture (millet, sorghum, cowpea, groundnuts), irrigated agriculture near the *wadis* (onions and other vegetables), and the breeding of livestock in particular in the northern fringe near the Sahara desert. Active commercial exchanges with neighbouring Nigeria enable Niger to export agricultural products and livestock. Nonetheless, these commercial corridors are currently under pressure from attacks by Boko Haram and various other groups. The total amount of annual rainfall ranges from 200 to 500 mm and soils are mainly sandy, except in the Tahoua region, which has a mix of sandy soils, rocky areas and clay soils. The amount of soil organic carbon is low in the whole region, typically below 1 percent. Box 2 summarises some basic information for PRODAF.

Box 2. PRODAF

Duration: 2015–2023

Total budget: USD 208.9 million

ASAP contribution: USD 12.9 million

Goal: Food and nutrition security and resilience to crises

Target group: Family farms (240,000 households targeted)

Areas of intervention: Restoring landscapes and promoting sustainable agriculture techniques; linking smallholders to markets

Source: IFAD (2015).

These regions of Niger are experiencing temperature increases of greater severity in the dry season (December–February) due to changing climate patterns, and there is also a higher frequency of extreme weather events such as droughts, heat waves and floods. Dry spells of more than 10 days are now more frequent in the rainy season, with severe impacts on rainfed cereal crops, which are the basis of the diet. Since the 1970s, irrigated vegetables have been cultivated as a form of response to severe droughts and

to provide an additional source of income during the dry season. However, increasing temperatures during the dry season put this activity at risk, with increased evapotranspiration and lower yields. Finally, livestock suffer from the lack of pasture after rainy seasons with low rainfall and, in one year out of three, the deficit of pasture leads to high cattle losses during the following dry season. This phenomenon is exacerbated by the fact that nomadic routes toward greener Nigeria are disturbed by the security situation and temporary closures of the border (as happened during the first half of 2020 due to the COVID-19 pandemic).

The main drivers of fragility in the project area are climate change, insecurity and weak public services (access to water and health). Niger has one of the highest population growth rates in Africa, and this constrains access to farmland and exacerbates tensions between settled farmers and pastoralists. Sporadic incursions from Boko Haram disrupt markets and livestock corridors and add to overall insecurity. Levels of chronic food insecurity are high, affecting more than 20 percent of the population every year.

Lessons learned

In this context, PRODAF invested in three notable sets of activities, with substantial uptake by beneficiaries and potential for scaling up.

1. Soil restoration in cropland and rangeland

PRODAF invested substantially in sustainable land management techniques, enhancing soil fertility and improving resilience to climate change at household and community levels. These techniques apply to pastoral land and cropland. The main technique promoted is assisted natural regeneration of useful trees in cereal fields. From 20 to 100 trees are protected per hectare and an area of 138,000 hectares benefits from this practice with PRODAF support. This practice has been known for decades in Niger and *Faidherbia albida* is the leguminous tree that is commonly used. PRODAF also promoted the protection of other native trees such as *Piliostigma reticulatum*, *Guiera senegalensis*, *Hyphaene thebaica* and *Balanites aegyptiaca,* which provide a range of benefits. Some legumes are able to capture nitrogen from the atmosphere and enrich soils. *Piliostigma* leaves act as a natural insect repellent, protecting millet from attacks. *Hyphaene* palms are used to produce a range of domestic items such as baskets and fences. Yield increases of up to 200 kg of millet per hectare are noted from assisted natural regeneration alone. The trees also act as windbreaks, limiting evapotranspiration and the number of replantings required when dry spells occur early in the rainy season. Given the cereal consumption norm in Niger of 200 kg per person annually, assisted natural regeneration contributes significantly to food security.

PRODAF also restored more than 20,000 hectares of pastoral land, including by water harvesting through the half-moon technique and by reducing aggressive undesirable plant species along pastoral nomadic routes. The half–moon technique fosters the growth of trees and grass on degraded land. Tree seedlings are planted at the rear of the basin and benefit from the water harvested during the rainy season. Grass species already present in zones nearby colonize basins and banks. These techniques led to a significant improvement in biomass production, ranging from 500 to 2000 kg of dry matter per hectare. They also provide temporary jobs to the most vulnerable within the communities, such as single women and unemployed youth. These cash-for-work activities (offering USD 3 per day) contribute strongly to resilience and food security.

Figure 3. Pasture improvement with half-moon micro-basins
(Photo: Sebastien Subsol)

2. Farmer field schools for rainfed crops and irrigated crops

PRODAF supports the development of farmer field schools (FFS) of two kinds, focussing on rainfed agriculture and horticulture respectively. These extension systems are based on a partnership between government and non-governmental organisation (NGO) service providers, in which local NGOs deliver the training, and the Ministry of Agriculture checks the quality of the contents and facilitates contact with academies and the national agricultural research system. FFS promote a list of practices enabling adaptation to climate change and sustainability. The most common are the use of organic fertilisers, micro-dosing of synthetic fertilisers, the production of bio-pesticides, the use of adapted seeds, and compost production. Farmers report levels of adoption ranging from 50 to 85 percent, depending on the technique,

the most popular being adapted seeds (short-cycle seeds for millet and cowpea). These techniques also help to increase the level of soil organic carbon, which reduces water losses.

FFS are the first stage of the extension system, and farmers are empowered through FFS to promote knowledge and techniques more widely, for example through farmer-to-farmer advisory groups.

3. Women's empowerment

Women are at the heart of PRODAF's strategy and targeting. The project targets women as a priority for cash-for-work activities and they represent more than 50 percent of people employed for land restoration. They use the cash to invest in small livestock, mainly goats, improving their incomes and the nutrition status of their children.

The project supports other activities targeting women in particular. These include tree nurseries run by groups of women, literacy courses spreading messages on nutrition and environmental protection, and cereal granaries managed by groups of women to meet lean season needs. These granaries also give incentives to young people to stay, rather than migrate, and contribute to improved nutrition in the villages.

Figure 4. Tree nursery managed by a group of women in Maradi region (Photo: Sebastien Subsol)

All these activities are connected to interventions aiming at developing short and medium value chains. PRODAF invests in climate-smart market infrastructure (halls and storage places with solar lights and improved air circulation) and rehabilitation for rural roads. This effort led to increased prices paid to producers, given that a higher number of buyers are now in competition thanks to improved road access.

To date, PRODAF has reached 233,000 households of poor farmers (97 percent of the target), restored 20,000 hectares of pastoral land, and supported the improvement of 138,000 hectares with the assisted natural regeneration technique. Around 1,000 FFS are active to date, benefitting up to 24,000 small-scale farmers. These efforts have led to significant increases in cereal yields and biomass production on rangeland, with impacts on the food security status of the families. On average, millet and sorghum yields increased from 400 to 800 kg per hectare. This increase feeds two more people per family during one year, in a region where the average number of people living in poor rural households ranges from seven to 10 (Household Economy Approach Sahel, 2017).

On the policy side, PRODAF made a significant contribution to the implementation of two key policies related to agriculture, food security and climate change. The *Nigériens nourissent les nigériens* (I3N) initiative is the umbrella programme in Niger for food security. It includes key pillars on environment and climate change, and the High Commission for I3N and PRODAF work closely to monitor results at the national level. In the same vein, PRODAF contributes to the achievement of Niger's nationally determined contribution to the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement. The Food and Agriculture Organization of the United Nations (FAO) recently undertook an *ex ante* estimate of the project's potential in terms of carbon sequestration. With a balance of – 5.26 million tons of CO_2 equivalent for a 20-year period, PRODAF will contribute 16 percent of the national GHG reduction target (Government of Niger, 2015).

In 2019, IFAD and the Government of Niger agreed a new phase of PRODAF, scaling up the activities to Dosso region and the northern parts of Maradi, Tahoua and Zinder regions, which are highly fragile in terms of a harsh climate.

Conclusions

BIRDP and PRODAF are independent projects that have been designed to address the relevant priorities of the governments concerned. Recognising their vulnerability to climate change, both are supported by ASAP grants to build the resilience of beneficiaries and support adaptation strategies. Climate change is a contributory factor to the fragile situations within which these projects operate. Both Butana and southern Niger suffer from competition for natural resources, which potentially leads to conflict. In southern Niger, incursions by Boko Haram destabilise agro-pastoral systems and pose a very real security threat.

Both BIRDP and PRODAF are essentially locally adapted responses based on an understanding of the physical environment of the project areas, along

with their constraints and potentials, and the socio-economic context of beneficiaries. Beneficiaries are used to carving out their livelihoods in marginal environments and the projects adopt participatory approaches, taking account of indigenous knowledge in introducing or improving technologies. A focus on building capacity in key skills and improving access to resources and services, including agricultural extension, has built beneficiary ownership of the initiatives.

The projects have attempted to address some of the major drivers of fragility in their target areas through the following interventions:

- Conservation, sustainable improvement and management of natural resources. In PRODAF this takes the form of assisted natural regeneration to protect trees on farmland and to plant trees on rangeland. BIRDP adopts similar principles in improving rangeland and in protecting both range and community forests. The net result is an enriched and biodiverse natural resource that is used to support farmers and pastoralists.
- A governance framework through which rural communities can exercise their rights and responsibilities for access to and use of natural resources. This is an innovation responding to acute competition for such resources in Butana.
- Enhancing access to and efficient use of water, catering for domestic and livestock needs in Butana through water harvesting on cropland in Butana and on rangeland in Niger.
- A focus on women in both projects, recognising their vulnerability and disempowerment, and offering routes to livelihood improvement. Particular opportunities for youth are also promoted.
- Addressing needs for sustainable incomes, food security and nutrition through improved crop husbandry, enhanced vegetable production and small-scale irrigation.

BIRDP and PRODAF are substantial projects, reaching more than 150,000 beneficiaries in Butana and more than 1 million (taking account of family size) in Niger. Their critical mass and positive experience have strengthened linkages with relevant government departments. Relevant good practice is being scaled up and projects are aligned with major policies and programmes, such as the I3N initiative in Niger. It is anticipated that some of the lessons from BIRDP and PRODAF may be applicable in similar fragile situations in the Sahel and elsewhere.

Acknowledgements

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News from the field 1

Effects of COVID-19 on crop and livestock production

Andrew Ward

After 20 years working in agricultural research for development, including the Department for International Development (DFID) Crop Protection and Research into Use Programmes and CGIAR, Andy Ward (TAA Member) joined CropLife International in 2017. CropLife International is the global association of research and development companies working in the plant sciences industry. His role, as Stewardship Director, focusses on promoting best practice to farmers and intermediary organisations globally.

2020 has seen incredible efforts to ensure that the effect of coronavirus disease 2019 (COVID-19) on crop and livestock production has been minimised. I feel that the public has been so focussed on buying products from the shop shelves that how the products are made in the first place has been largely ignored. There has been a huge drive to ensure that farms can continue to produce – to supply the food chain. What I have experienced has been about the provision of farm inputs.

Production levels could not have been maintained if farm inputs had not been available to farmers in a timely manner. Ensuring this required clear responsibility from input industries, rapidly adjusting their working practices so that they could continue to manufacture while minimising risks to staff. It also needed governments to recognise the need for the industry and to support its ongoing functioning.

Further government support was required to ensure that raw materials and finished products were available to be traded. Inputs needed to be designated as priority goods so that their trade (internal and international) could continue and, in some cases, companies needed to present the government with evidence to justify this prioritisation. On the whole, this process proceeded well and farmers have been able to source inputs – this has not been an additional constraint to food production.

As Stewardship Director at CropLife International, the challenge was to continue to provide product stewardship support to farmers when face-to-face interaction could put both farmers and staff at risk. In 2018, CropLife International worked with its associations in Latin America, Asia and Africa to train half a million farmers face-to-face. Our challenge was to continue to provide stewardship information on best practice in the new COVID-19 world.

The industry had to rapidly switch to alternative tools for training. In Latin America, this started with webinars on key production topics, which attracted huge interest. Building on that, a number of 'virtual' training tools have been built, including e-learning, animations and short films. These are being collated into an app that farmers can download and will provide them with key reference information.

In Africa, many of the farmers that we are working with do not have smartphones, although they do have more traditional mobile phones. By using SMS for product stewardship messaging our Africa team are on course to reach half a million farmers, matching the 2018 total from three continents.

In Asia, we are conducting a pilot on the effectiveness of using a smartphone app which would provide a virtual- or augmentative-reality farmer training experience when played with a cardboard virtual reality headset. In other situations where this technology has been deployed, recall rates of 80 percent have been recorded a *year* after the training. If this pilot proves to be effective, it will be a major development in knowledge provision to farmers and will be of particular interest to the youth.

Years ago, while I was an undergraduate, Professor Piers Blackie at the University of East Anglia (UEA) described how there was often change following disasters. The disaster of COVID-19 is not over yet, but it has stimulated innovation that has changed our approach and will increase the scale and effectiveness with which we (and others) communicate with farmers.

Newsflash 1

Update on global climate change drawing on NASA data

Hugh Brammer

Hugh Brammer (TAA Member) spent 22 years working on soil surveys in the Gold Coast/Ghana, East Pakistan and Zambia followed by 13 years as Food and Agriculture Organization of the United Nations (FAO) Agricultural Development Adviser in Bangladesh (1974-1987). Since his retirement, he has written 11 books and several journal articles on the geography and agriculture of Bangladesh.

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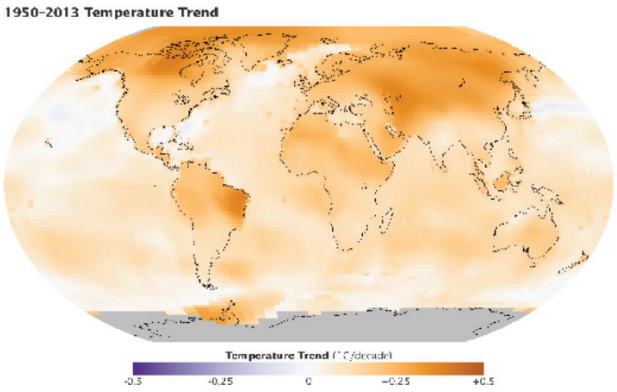

Figure 1. NASA map showing rates of global temperature change per decade, 1954–2013 (Source: NASA; reproduced with permission)

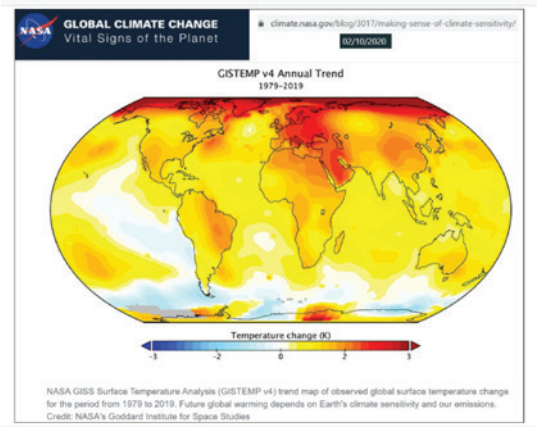

Figure 2. NASA map showing annual rates of global temperature change, 1979–2019 (Source: NASA; reproduced with permission)

Figures 1 and 2 show NASA global images of climate change across the world over the past 40–60 years. These maps have the advantage that temperatures in the most recent decades are based on satellite images of the whole land and ocean surfaces, unlike ground-based observations from meteorological stations that are mainly located in urban areas subject to a heat island effect. The two images are not strictly comparable because Figure 1 shows temperature trends per decade for the 1953–2013 period and Figure 2 shows the annual rate of change for 1979–2019. Nonetheless, they both show significant similarities and differences within tropical countries of interest to TAA members: the greatest temperature increases remain in eastern Brazil, and parts of North Africa and the Middle East; little change remains on the Indian subcontinent, and over much of south-east Asia and in northern Australia; but recent increases possibly occurred in Egypt and China. There are significant changes over some ocean areas. Another NASA site shows how irregularly regional annual temperatures changed over the past 135 years (https://climate.nasa.gov/interactives/climate-time-machine).

The participation of countries in agriculture and food value chains: a global assessment and the implications of the COVID-19 pandemic

Pierluigi Montalbano and Silvia Nenci

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Abstract

The 2020 edition of *The State of Agricultural Commodity Markets* (FAO, 2020) presents measures of global value chain (GVC) participation for the agriculture, and food and beverages sectors at the global level for a relatively long time span (1995–2015). The availability of these indicators represents an unprecedented opportunity to obtain a global assessment of the linkages between GVCs and economic performance worldwide. Thanks to these aggregate data, we report the empirical evidence of an increasing trend of agriculture and food value chains worldwide and also the presence, on average and *ceteris paribus*, of an established positive relationship between changes in both agriculture and food GVC participation and changes in agriculture value added per worker, net to the usual control. Although we acknowledge that it does not imply a parallel positive outcome in terms of social upgrading, we believe this overall picture should adequately inform policy making in the debate concerning economic growth and structural transformation of developing countries. As for the current pandemic emergence, contrary to conventional wisdom, we argue that GVCs can reduce countries' vulnerability from trade since they foster trade channels and help the world economy to speed up the global recovery.

Introduction

Over the last decades, GVC participation has shaped production and specialisation patterns worldwide in all sectors. Agricultural and food sectors have also changed their trade composition, from the dominance of traditional commodities to increasing trade in higher-value processed products (Taglioni & Winkler, 2016). According to the most recent literature, thanks to the 'GVC revolution', even small countries with limited capacities or resources have a chance to participate in GVCs and benefit from global trade (Minten *et al*, 2009; Cattaneo *et al*, 2013; Swinnen & Vandeplas, 2014; Swinnen, 2016).

The increasing importance of global agricultural trade as well as the importance of agriculture and food GVCs for the structural transformation and sustainable development of developing economies is the subject of the 2020 edition of *The State of Agricultural Commodity*

Markets (FAO, 2020). The emergence of agriculture and food GVCs comes with changes in the way these chains are organised, with increasing levels of vertical coordination, upgrading of the supply base, and the increased importance of large multinational food companies (McCullough *et al*, 2008). Notwithstanding considerable variation across sectors and countries, the empirical evidence shows that agricultural sectors participate in value chains mainly as suppliers of raw materials used in other production processes, whereas food sectors participate mainly in terms of sourcing inputs from around the globe (Greenville *et al*, 2017).

However, much empirical evidence on agriculture and food GVCs still relies on case studies at the product level and assesses their impact on specific national economies (Salvatici & Nenci, 2017). On the occasion of the publication of the 2020 edition of *The State of Agricultural Commodity Markets* (FAO, 2020), FAO released measures of GVC participation for the agricultural, and food and beverages sectors at the global level from the Eora global supply chain database panel data for a relatively long time span (1995–2015) (Nenci, 2020). This provides us with an unprecedented opportunity to obtain a global assessment of the linkages between GVCs and economic performance worldwide. It allows us to complement the existing micro and/or national studies and inform the debate on the pros and cons of countries' participation in the GVC. Since much of this debate deals with countries' performances in terms of value added, we will focus on this specific issue as our main reference variable. Although we acknowledge this is a quite restricted view that does not include important issues such as social upgrading and employment, we assume that investigating the relationship between GVCs and productivity has a pivotal role in the public debate about economic growth and structural transformation (Lim, 2019). Taking advantage of the timely publication, a parallel analysis of the validity of our conclusions is carried out in light of the spread of coronavirus disease 2019 (COVID-19). In this latter case, the lack of empirical evidence forces us to limit our analysis to some key conceptual issues.

The importance of agriculture and food chains: a review of the literature

The value chain analysis extends traditional supply chain analysis by identifying values at each stage of the chain. At each stage of the supply chain, value is being added to the product or service as it is being transformed. Value added equals the value paid to the factors of production in each stage. Value chains are labelled as global when they spread across different geographical locations (Gereffi & Fernandez-Stark, 2011). In the case of the agriculture and food value chain, because of the perishable nature of the products, a high degree of coordination across the involved actors is required along the chain. Typically, value chains feature two types of bargaining power relationships: buyer-driven and producer-driven. In developing countries, buyer-driven value chains are often characteristic of labour-intensive industries like agriculture, clothing and furniture. Producer-driven value chains are often characterised by knowledge intensity, relatively higher levels of technology or skills, high levels of marketing, or capital-intensive activities. The latter usually have barriers to entry, often requiring high research and development expenditures, or costly marketing. They are present in agricultural sectors when standards, product differentiation, packaging and logistics are important, or when research and development are critical. Examples from the agricultural sector include bananas produced by multinationals, organic products like cotton, branded products like processed and packaged agricultural products, quality-differentiated products like speciality coffees, or high-value processed products like essential oils (Webber & Labaste, 2010).

A common view is that the emergence of GVCs can represent a golden opportunity for supporting the ongoing transformations of developing countries, especially in agriculture and food markets, which could move from a subsistence-oriented and farm-centred system to a more commercialised, productive and off-farm centred one (Greenville *et al*, 2017; Del Prete *et al*, 2017; Montalbano *et al*, 2018a; Balié *et al*, 2019a). Furthermore, a significant share of the growth in value added in agriculture (or any other sector) comes from its linkages to other economic sectors. Thus, increased GVC participation in the sectors that demand agricultural inputs may boost agricultural GVC participation and agricultural value added generation (Dellink *et al*, 2020). GVC participation is indeed supposed to open access to unprecedented flows of knowledge, capital and, in particular, sophisticated inputs (IMF, 2015; Montalbano *et al*, 2018b), which can lead to an accelerated and widespread path of structural transformation and income growth. By generating higher incomes, and because of technology spillovers on food production, participation in the export chains is also supposed to improve income stability and the food security of smallholder households (Cattaneo & Miroudot, 2015; Swinnen, 2014; Swinnen & Kuijpers, 2017; Reardon *et al*, 2009; Barrett *et al*, 2017).

On the other hand, vertical coordination mechanisms and consolidation at the buyer end of export chains tend to amplify the bargaining power of large agro-industrial firms and food multinationals, displace decision-making authority from the farmers to these companies, and strengthen the capacity of these companies to extract rents from the chain to the disadvantage of contracted smallholder suppliers in

the chains (Warning & Key, 2002). Furthermore, in many developing countries, other obstacles add to resource constraints and menace competitiveness, such as weak regulatory institutions, poorly designed and implemented sanitary and phytosanitary regulations, inadequate transportation, power and water infrastructure, and the absence of important value chain actors (Hazell *et al*, 2010; Markelova *et al*, 2009). Consequently, small- and medium-sized producers are generally not well positioned to respond to changes in market structures and are thus marginalised (Dolan & Humphrey, 2004; Lee *et al*, 2012; Maertens & Swinnen, 2009). Some of the most discussed cases, namely the fruit and vegetable export sectors in Kenya and Senegal, are characterised by large shifts from smallholder to large-scale farming or, in the case of the Senegal tomato export sector, completely based on exporter-owned agro-industrial production (Maertens *et al*, 2012). Similar shifts, although mostly partial, are observed in other regions and countries, such as Latin America, other African countries, and the Russian Federation (Beghin *et al*, 2015).

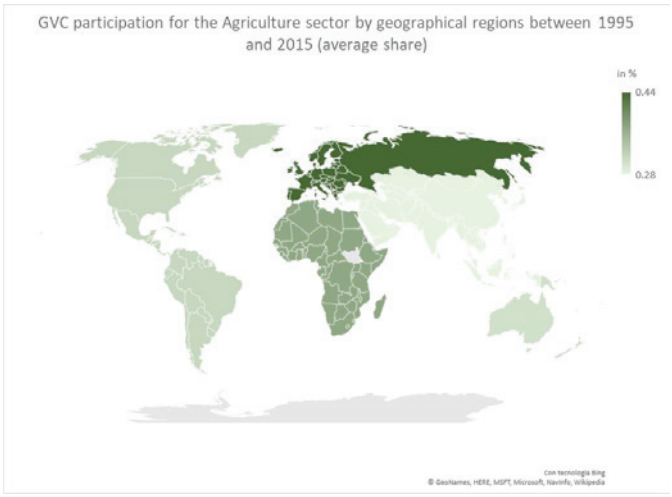
Furthermore, empirical analyses underline that getting access to, and involvement and participation in a GVC are not easy tasks. Increasing standards in international markets may exclude smallholders and family farms from value chains (Gibbon, 2003; Berdegué *et al*, 2005; Jaffee & Masakure, 2005; Belton *et al*, 2011). Small-scale farmers may be unable to comply with stringent requirements due to a lack of technical and financial capacity (Reardon *et al*, 2001). This may induce traders and processing firms to reduce sourcing from small suppliers. Also, transaction costs for monitoring compliance with standards may be very high in the case of sourcing from smallholders (Swinnen, 2016). Such requirements can represent significant barriers to market access, which make them prohibitive for many small- and medium-sized producers (Lee *et al*, 2012; Montalbano *et al*, 2018a). In summary, the empirical evidence yields a mixed picture on the capability of countries – and specifically small-scale farmers – to join agriculture and food value chains and exploit their economic benefits (Salvatici & Nenci, 2017).

The economic effects of agriculture and food GVC participation

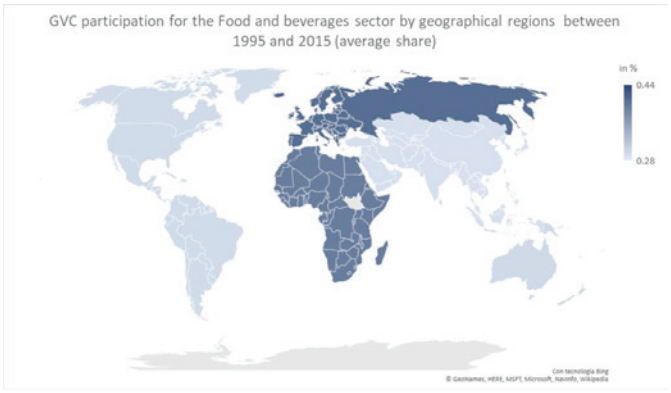
Empirical studies generally emphasise a positive impact of intermediate goods on total factor productivity (see, *inter alia*, Bas & Strauss-Kahn, 2014; Halpern *et al*, 2015). Empirical results also suggest that foreign sourcing in the production of exports is a complement to, rather than a substitute for, the creation of domestic value added in exports (Lopez-Gonzalez, 2016). Other studies confirming the positive relationship between the use of foreign imported inputs and an increase in firm productivity growth in developing countries include Amiti & Konings (2007) for Indonesia; Kasahara & Rodrigue (2008) for Chilean manufacturing plants; Halpern *et al* (2015) for Hungary; Topalova & Khandelwal (2011) for India; and Montalbano *et al* (2018b) for Latin America and the Caribbean. Kowalski *et al* (2015) highlight that the effect of GVC participation on domestic value added depends on both backward and forward linkages. In other words, either sourcing foreign inputs for export production or providing inputs to foreign partners for their export production tends to bring about economic benefits. Although *economic upgrading*, usually defined in terms of efficiency of the production process or characteristics of the product or activities performed (Humphrey & Schmitz, 2002) should be kept separated from *social upgrading*, generally referred to as outcomes related to employment and pay, gender and the environment (Milberg & Winkler, 2010), focussing on performances in terms of value added is generally seen as the preferred unifying characteristic for assessing the economic benefit of GVCs (Kowalski *et al*, 2015).

The availability of fresh measures of GVC participation for the agricultural, and food and beverages sectors at the global level from the EORA panel data (Nenci, 2020) for a relatively long time span (1995–2015) provides us with an unprecedented opportunity to obtain a global assessment of these value added performances. In line with observed trends for the integration of the global economy (Pahl & Timmer, 2019; World Bank, 2019), thanks to these fresh data we can see that agriculture and food GVC participation increased significantly between 1995 and 2008, from around 30 percent to above 35 percent globally. After 2008, further integration has roughly stalled (Dellink *et al*, 2020).[1] The trends are remarkably similar for both commodity groups, highlighting that there are common factors driving GVC participation that dominate sectoral and structural change effects. In fact, while the expansion of GVC participation has often been attributed to manufacturing sectors, the increase in the agricultural sectors has been of similar magnitude, even if, on average, GVC participation rates are 10–15 percentage points lower than the economy-wide average (Dellink *et al*, 2020). Participation is, however, still limited to upstream production stages of the chain and mainly driven by the European market (Foster-McGregor *et al*, 2015; Balié *et al*, 2019b). Complexity – in terms of diversity of sourcing from GVCs – has also increased over time. The distribution of labour returns from

[1] Evidence on trends after 2015 is scarce, but the *World Investment Report 2019* (UNCTAD, 2019) seems to suggest that foreign value added levels revert after 2015 to 2011–2013 levels, that is, the dip in 2015 is likely to be temporary, and the longer-term trend is roughly flat.

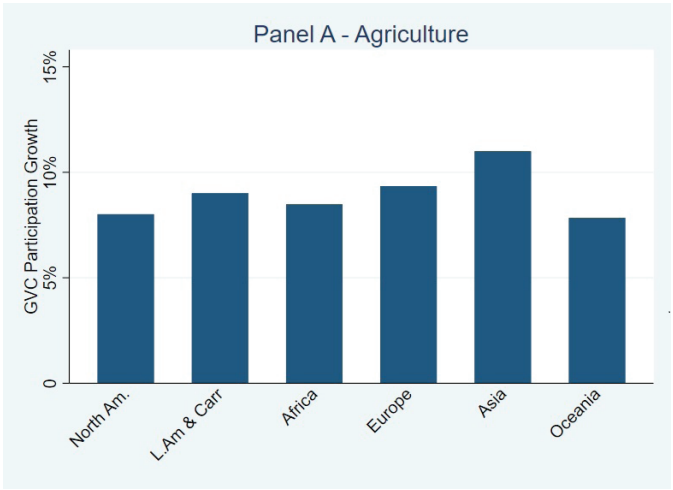


Panel A

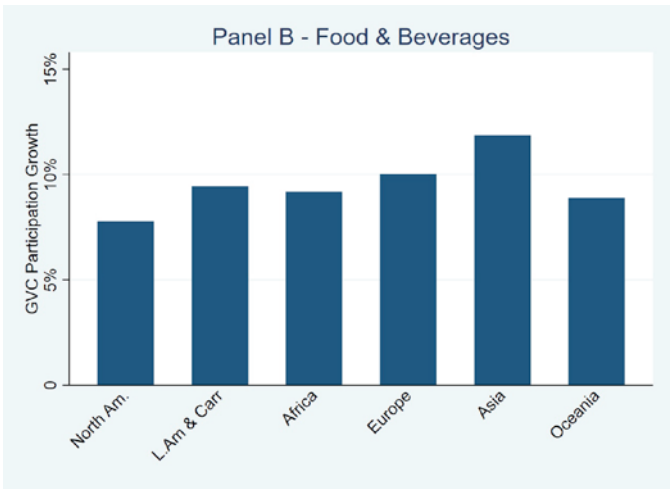


Panel B

Figure 1. GVC participation for the agricultural sector (Panel A) and food and beverages sector (Panel B) by geographical region (average share 1995–2015) (Source: Nenci, 2020; reproduced with permission from S Nenci)



Panel A



Panel B

Figure 2. GVC participation for the agricultural sector (Panel A) and food and beverages sector (Panel B) by geographical regions (growth rate 1995–2015) (Source: Authors' elaboration on data from Nenci, 2020)

Note: GVC participation growth reflects average annual growth between 1995 and 2015.

agriculture and food participation tends to be primarily captured by unskilled workers. This is due to a significant shift in trade from and towards developing and emerging countries that use higher amounts of labour in the production of their exports compared to developed regions (Greenville *et al*, 2019).

Figure 1 (panels A and B) reports indicators of GVC participation for the agricultural, and food and beverages sectors (namely, the value of exports that are part of a GVC[2]) by geographical area (average share for the period 1995–2015). These data show that Europe (including Eastern Europe) presents the highest rate of GVC participation in both sectors (about 40–45 percent of its total exports, on average, considering both the foreign value added and its domestic value added content embedded in third country exports). Despite low trade shares at the global level, we can see that the African region turns out to be deeply involved in GVC participation. This is consistent with the relative importance of the continent in the global agriculture and food value chains highlighted by the literature in the field. Note that we cannot detect strong heterogeneity by further disentangling the average values by sub-regions.

Figure 2 (panels A and B) reports the dynamics, showing the average annual growth of the same measure of GVC participation for the same period (1995–2015). From this figure, we can see that GVC participation dramatically increased in the last decade for all regions.

To establish causality, more fundamental econometric analysis is required. To this end, Montalbano & Nenci

[2] Specifically, the value of foreign inputs in exports plus the value of domestic inputs in third country exports.

(2020) tested the linkages between *changes* in GVC participation in the agricultural and food sectors and *changes* in value added in the agricultural sector per worker at the global level. Following Constantinescu *et al* (2019) and Gal & Witheridge (2019), they adopt a macro version of the reduced form of the standard constant returns to scale Cobb-Douglas production function with labour, land and capital, augmented with indicators of export performance. The full range of unobserved time-invariant determinants, such as absolute and relative convergence, labour market and other institutional differences, structural differences in trade policy, time-invariant technology differences across countries, and other possible time-invariant differences/confounders are all captured by the set of country fixed effects and thus are implicitly considered in the empirical analysis. Global changes such as global technology shocks as well as changes in the global business environment are also captured by time effects.

With all the above considered, Montalbano & Nenci (2020) confirm that in the investigated period (1995–2015), which can be carefully approximated to worldwide long-term elasticities, on average and *ceteris paribus*, there is a positive relationship between changes in agriculture value added per worker and changes in both agriculture and food GVC participation.[3] For example, in the case of the contemporaneous relationship, for each 1 percent increase in GVC participation, they estimated, *ceteris paribus*, about 0.1 percent increase of value added per worker. As expected, they detected a certain degree of heterogeneity by geographical areas but not by income levels. They also found that this relationship shows a kind of persistence over time since it proved to be statistically significant with lagged values of GVC participation. They also noted that backward and forward GVC participation are both positively and robustly associated with positive changes in agriculture value added per worker. Overall, these outcomes complement similar established empirical evidence on manufacturing and confirm the positive effect of GVC participation on domestic value added with reference to both backward and forward linkages.

The impact of COVID-19

The full impacts of COVID-19 on the developing world are yet to be seen and are still hard to predict in either scale or nature (Morton, 2020). GVCs have been in the spotlight during the lockdown phase of the COVID-19 pandemic. This is because of the conventional wisdom that GVCs could undermine the potential resilience of participating countries to the economic slowdown by fostering trade linkages that could act as potential disruptive chains of transmission for economic shocks across economies. As a result, during the health emergency, many nations applied export bans on medical supplies, and new calls for *reshoring* and *regionalisation* emerged in the post-pandemic political debate (UNCTAD, 2020). Trade economists argued, on the contrary, that trade linkages provide the most efficient avenues to better manage external risks and increase resilience (Bamber *et al*, 2020; Baldwin & Freeman, 2020).

As a result, trade economists warn that across the developing world, value chains should be protected and even fostered. They tend to be more fragile and susceptible to disruptions than in developed countries. Agriculture and food GVCs in developing regions rely less on foreign inputs, but labour-intensive value chains are under pressure because they are more exposed to movement restrictions. Since the main production factor/asset of poor people is physical labour (they have no land, no capital, no technical skills and so they have to go out to work), and both internal and international mobility is constrained, workers in low-wage and informal sectors are particularly vulnerable to income losses indirectly induced by movement restrictions. As a result, movement restrictions could result in labour shortages, and border closures further affect the availability of seasonal migrant workers. Hence, due to their perishable nature, agriculture and food GVCs are supposed to be particularly vulnerable to disruptions in the value chain (FAO, 2020). This implies income, nutrition and gender issues, but also global issues such as pressure on the global food system. Even if food demand is somehow inelastic, shortage of food leaves the poor more exposed to food and nutrition insecurity.

Local governments have actively strengthened food safety nets and social protection mechanisms to maintain access to food. Specific government measures also addressed the impact of income reductions through subsidies, tax breaks and transfers to those affected. These measures have been indispensable, but acted basically as coping strategies. The challenge is to stabilise global supply and consumption, heading the global food system towards a sustainable and resilient path. This revamps the important role of international trade in general, and GVC participation in particular, as the key tools for fostering resilience among the poor, and reducing their vulnerability to external shocks (Morton, 2020). The empirical evidence about vulnerability from trade shocks is mixed, scattered in separate fields of analysis and does not reach a common stance (Montalbano, 2011; Magrini *et al*, 2018) because of both the lack of suitable panel data and the complexity of the task of assessing *ex-ante* risks

[3] Possible short-term fluctuations are smoothed away and captured by the residuals.

(Klasen & Waibel, 2016). In principle, trade can magnify risks in two ways: by changing the riskiness of existing activities, for instance, by altering the weight of foreign relative to domestic shocks faced by the economy; or by changing the emphasis among the different activities households engage in, such as switching from subsistence food crops to cash crops (McCulloch *et al*, 2001) or to crops with less volatile yields (Allen & Atkin, 2016). Hence, trade openness could alter households' optimal portfolios so that their current ones become sub-optimal *ex-ante*. This is especially the case with the poor because of their limited ability to take advantage of the positive opportunities created by trade reforms, their weak capabilities to insure themselves against adverse impacts and, possibly, the lack of information about the risks associated with the new activities induced by openness (Winters *et al*, 2004).

However, none of the above effects depends on the magnitude or the nature of foreign risks and/or their channels of transmission to household welfare, nor on any correlations between domestic and foreign risks. Actually, 'risk-induced' vulnerability is relevant and significant in terms of its economic effects, even in the absence of *ex-post* shocks (Magrini & Montalbano, 2018). In this respect, trade vulnerability relates to how people actually manage risks, and the standard prescription is to foster the ability of poor people to manage risks and take full advantage of trade reforms (Magrini *et al*, 2018).

In the case of the COVID-19 pandemic, trade shocks have a different nature. They come as a side effect of trade policies meant to insulate domestic economies from global trade, as in the case of export bans. In this respect, they are not related to the inherent vulnerability induced by trade openness, but rather to trade policy *per se*. As for trade policy, however, the general prescription of trade economists is to keep trade channels open as much as possible (Baldwin & Freeman, 2020; Bamber *et al*, 2020). This allows participating countries to benefit from the gains from trade associated, theoretically and empirically, to production fragmentation, while at the same time helping the world economy to speed up the process of a global recovery.

Conclusions

The recent release of the 2020 edition of the FAO publication on *The State of Agricultural Commodity Markets* provides fresh measures of aggregate GVC participation. These allow scholars and policy makers to obtain a global picture of the linkages between GVC participation and economic performance worldwide. Thanks to these data, we can confirm the presence of an established positive relationship worldwide between changes in both agriculture and food GVC participation and changes in agriculture value added per worker, on average and *ceteris paribus*, and net to the usual control. We also carrried out a parallel analysis of the validity of this relationship in light of the spread of COVID-19. In this case, the lack of empirical evidence forces us to limit our analysis to some key conceptual issues. These confirm the importance of GVCs in reducing countries' vulnerability from trade and helping the world economy to speed up the global recovery.

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News from the field 2

The smart food triple bottom line – starting with diversifying staples

(including a summary of latest smart food studies)

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The Smart Food initiative engages in finding food-system solutions that, in unison, are good for consumers (nutritious and healthy), the planet (environmentally sustainable) and the producers, especially smallholder famers. This is the Smart Food triple bottom line. A key objective of Smart Food is to *diversify staples*. By focussing on staples across Africa and Asia, which typically comprise 70 percent of the plate and are often eaten three times a day, we can make a *big impact*.

For decades, huge investments as well as government support, private industry investment, product development and development aid have gone into the 'Big 3' – rice, wheat and maize – creating a '*Food System Divide*'. There are lessons to learn from the successes achieved by the Big 3.

Breaking into the Big 3 league and making inroads into the food system will involve *focussing on selected smart foods and dedicating efforts* to develop their value chains. The Smart Food initiative has chosen *millets and sorghum* as the first smart foods to focus on and to mainstream.

Millets and sorghum were chosen because they are highly nutritious and fulfil some major human health needs. For instance, many millets are very high in iron and zinc. Finger millet has three times the amount of calcium than milk and has a low glycaemic index (GI). They have a low carbon footprint, survive in high ambient temperatures and require very little water. They are often the last crop standing in times of drought, are climate-smart and a good risk management strategy against drought for farmers. They are multifaceted and versatile – serving purposes ranging from food, feed and fodder to brewing and biofuels, that are not yet fully tapped. Millets and sorghum were once the staples in many countries in Africa and parts of Asia. They also figure in some of the biggest global health food trends – of being a super food, ancient grain, are gluten-free, have high fibre and low GI, and are good for weight loss. Moreover, they can be consumed in multiple ways – cooked like rice, used as flour and for porridge, and used in desserts and as a drink. Critically, they are also tasty.

Figure 1. First scientific study of millets in a school feeding programme in India (Photo: Liam Wright, ICRISAT)

Figure 2. Millets are suitable as a staple and able to be consumed in multiple ways (Photo: Liam Wright, ICRISAT)

The Smart Food initiative started with the aim of helping smallholder farmers and communities across Africa and Asia. It also recognises that mainstreaming a couple of smart foods calls for thinking bigger and globally. The Government of India proposed a United Nations International Year of Millets that the Food and Agriculture Organization of the United Nations (FAO) has approved for 2023, with final approval awaited from the United Nations General Assembly. If successful, there will be just enough time to build momentum around the cause and ensure that the occasion marks a turning point in achieving major value chains of these smart foods globally, while at the same time positioning Africa and Asia to capitalise on this.

Meanwhile, it is critical to compile the scientific backing for millets and sorghum. Following are some of the Smart Food initiative studies that have tested the nutritional benefits and consumer acceptance of these crops in Asia and Africa.

- In **India**, the first school feeding study on millets, with 1,500 school children and 1,500 in a control group, showed that compared with iron-fortified rice-based meals, millet-based meals led to:
  - 50 percent more growth in the intervention group compared to those in the control group;
  - all millet-based meals being rated 4.5 or higher out of 5 for taste (Anita *et al*, 2019a; ICRISAT, 2019b).
- In **Tanzania**, over 2,800 students in four schools were introduced to finger millet and pigeon pea in their meals. All meals were significantly superior in protein, iron, zinc, calcium, magnesium, fat and energy. Fifteen months later, 681 students (26 percent) were surveyed, showing that:
  - 80 percent and 70 percent of the students had changed their negative perception of finger millet and pigeon pea, respectively;
  - more than 95 percent of the students wanted to eat the finger millet and pigeon pea dishes at school (Wangari *et al*, 2020; Smart Food Tanzania activities, 2020).
- A **protein study** highlighted that even though legumes are an important protein source (affordable proteins in developing countries and with rising plant-based diets globally), one must look deeper than just the total protein level. Legumes are low in one essential amino acid, methionine, which is found in millets. The analysis of a combination of millets and legumes found that they make a complete and highly digestible protein, while also providing a basket of micronutrients (Anitha *et al*, 2019b; ICRISAT, 2019a).
- In **Kenya**, parents of over 60,000 children under five years of age interacted with Smart Food Ambassadors who spread nutrition messages and

conducted fun activities and cook-offs. At the end of the first year, we found:

- almost 100 percent increase in diet diversity among the children; and
- 20 percent increase in diet diversity among the women (Wangari, 2018).

- In **Myanmar**, a small study undertaken with millets and pigeon pea meals:
  - had a positive impact on the extent of wasting and underweight children aged 2–14 months; and
  - showed an average score of 4 out of 5 in sensory evaluations of all the recipes and products among the community (Anitha *et al*, 2019c; Smart Food Myanmar activities, 2020).

These studies demonstrate the potential for significant consumer acceptance of millets and sorghum, as well as their very positive nutritional benefits. While there is a resurgence of these smart foods, which have been hailed as the next quinoa, we need biodiversity that caters not only to the health-conscious in high-end niche markets, but also reaches the masses, especially in less-privileged communities across Africa and Asia. This will create big impacts and contribute to the achievement of the United Nations' Sustainable Development Goals (SDGs).

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COVID-19 and agriculture for development – calls for action

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Introduction

As the global death toll passes one million, it is not surprising that the initial responses to the coronavirus disease 2019 (COVID-19) pandemic have focussed on saving lives, inhibiting the spread of the disease, protecting health services, finding effective treatments and developing vaccines. All the while trying to better understand the virus.

Some governments have struggled to develop strategies and implement measures to control the virus and mitigate the economic and social consequences of their actions. Their strategies appear to have been fragmented, dominated by perceived national self-interest and lacking in international collaboration and lesson-learning. Other governments have been more successful in coping with the pandemic. History has shown that successfully controlling pandemics such as smallpox, influenza, Ebola and severe acute respiratory syndrome (SARS) must involve global cooperation and access to information.

Calls for coordinated international efforts

An early (March 2020) open letter to G20 leaders, 'The COVID-19 pandemic: A letter to G20 leaders', coordinated by the London School of Economics (LSE), was signed by 20 healthcare professionals and 20 economists (LSE, 2020). This was quickly supported and signed by many presidents, prime ministers, ministers and other leaders. At the time, developed countries were just beginning to see the impact of the COVID-19 pandemic, but the authors foresaw that with fragile health systems and weak institutions *"emerging and developing countries are facing an unprecedented collective threat to human life, social cohesion and economic devastation … particularly among the 70 million globally displaced people."* It predicted that *"people will migrate out of fear as the epidemic takes hold leading to social disruption, violence and security issues … the virus could become endemic, producing new waves of destructive outbreaks regionally and around the world."* It called on the G20 to act *"now"* on two fronts – public health and economic policy – by:

- ensuring that the World Health Organization (WHO) has sufficient resources to lead the global response;
- shoring up domestic institutions managing the healthcare response, and to guarantee logistics and supply chains for health and other essential goods;
- accelerating the global effort to find vaccines and therapeutics, and manufacture and distribute them *fairly* across the world; and
- providing emergency resources to countries facing devastating fiscal outlays and massive capital outflows.

The scale of the necessary global response was illustrated by the Global Preparedness Monitoring Board request for *"at least $8 billion in emergency funding"*, but it was recognised that "to address the economic impact will require efforts of a completely different magnitude". Despite this, the letter warns that *"the required investment is minute compared to the social and economic costs of inaction."* It concludes that *"history will judge us harshly if we do not get this right."*

Several other open letters and calls for action appeared in quick succession, but perhaps the most widely read was coordinated by former UK Prime Minister Gordon Brown, and co-authored by Professor Erik Berglöf (Director of the LSE Institute of Global Affairs) and Sir Jeremy Farrar (Director of the Wellcome Trust) (Berglöf

et al, 2020). By 6 April, 'A Letter to G20 Governments' had been signed by more than 200 people, nearly half of them former presidents and prime ministers. Other signees included former ministers, heads of central banks, prominent scientists, heads of charities, and current and former United Nations, International Monetary Fund (IMF) and World Bank officials.

This letter called for *"urgent specific measures that can be agreed on with speed and at scale: emergency support for global health initiatives led by the WHO and emergency measures to restore the global economy."* It emphasised that this requires *"funding far beyond the current capacity of our existing international institutions."*

Global health measures included the following.

- Immediately agreeing to commit USD 8 billion, as set out by the Global Preparedness Monitoring Board, to fill the most urgent gaps in the global COVID-19 response: USD 1 billion this year for WHO; USD 3 billion for vaccines coordinated by the Coalition for Epidemic Preparedness Innovations (CEPI); USD 7.4 billion to replenish Gavi, the Vaccine Alliance, for procuring and equitably distributing vaccines to the poorest countries; and USD 2.25 billion for 100 million therapeutics treatments delivered by the COVID-19 Therapeutics Accelerator by the end of 2020.
- Rather than competing for a share of the existing capacity, with the risk of rapidly increasing prices, we should vastly increase capacity by supporting WHO in coordinating the global production and procurement of testing kits, personal protection equipment and intensive care unit (ICU) technology, to fully meet the worldwide demand.
- A further USD 35 billion to support countries with weaker health systems and especially vulnerable populations.
- A global pledging conference, its task supported by a G20 Executive Task Force, to commit resources to meeting these emergency global health needs.

To prevent a global recession becoming a global depression, economic measures proposed included the following.

- A wider group of central banks being given access to the arrangements for currency swaps and the IMF entering into swap arrangements with the major central banks, to provide emergency financial support to emerging and developing nations; with on-the-ground support for companies and individuals being provided by local banks.
- The IMF allocating USD 500–600 billion in special drawing rights (SDRs); and allowing lending quota limits to be exceeded in countries most in need.
- The World Bank and the regional development banks expanding their available resources.
- United Nations agencies being provided with USD 2 billion of additional resources.
- The international community waiving this year's poorer countries' debt repayments, including USD 44 billion due from Africa; and considering future debt relief to allow poor countries the fiscal space to tackle the health and economic impact of the COVID-19 pandemic.
- Providing developing countries with at least USD 150 billion of overall support for health, social safety nets, and other urgent help.
- Implementing a longer-term radical rethink of global public health, and a refashioning and resourcing of the global health and financial architecture.
- The United Nations, the governments of the G20 nations, and interested partners should work together to coordinate further action.

This open letter stimulated responses from a variety of institutions and organisations, and follow-up articles from its authors and signees. For example, Gordon Brown's article 'The deadly urgency of now' (Brown, 2020), and Oxfam International's open letter 'Uniting behind a people's vaccine against COVID-19' (Oxfam International, 2020).

The Oxfam International letter called on health ministers to rally behind a people's vaccine, and to *"unite around a global guarantee which ensures that, when a safe and effective vaccine is developed, it is produced rapidly at scale and made available for all people, in all countries, free of charge."* The same applies for all treatments, diagnostics and other COVID-19 technologies. The letter said bluntly that *"now is not the time to allow the interests of the wealthiest corporations and governments to be placed before the universal need to save lives, or to leave this massive and moral task to market forces."* Since vaccines and treatments are global public goods, *"we cannot afford for monopolies, crude competition and near-sighted nationalism to stand in the way."*

Recovering from the virus and building future resilience

COVID-19 is undoubtedly a virulent pandemic and there is clear evidence of a second wave emerging even in countries that had appeared to have weathered the first onslaught. It has generated a profound economic and social crisis, and even contributed to political instability. It is a new disease for which there is no ready cure and one that we must find ways to manage – not only the virus but its impact, its health, economic and social consequences, and recovery.

These consequences are as important for agriculture as other sectors of the economy.

The initial focus on the health aspects of the disease has been understandable, but it has taken attention away from other vital issues, such as availability of sufficient healthy and nutritious food, refugees, climate change, and poverty. These could undermine recovery and longer-term resilience. The WHO *2020 Global nutrition report* (*WHO, 2020*) presents growing evidence that nutrition and diet-related diseases can have an impact on people's vulnerability, the severity of the disease they experience, and the eventual outcomes of their illnesses.

In response to concerns over a lack of attention to agriculture, food and nutrition, a group of some 200 international scientists and development specialists, led by Ismail Serageldin (former Vice-President of the World Bank) and Dr Raj Paroda (former Director General of the Indian Centre of Agricultural Research [ICAR]) wrote an open letter in May to the United Nations, G20 and national governments entitled 'COVID-19 and agriculture for food and nutrition security' (Serageldin *et al*, 2020). The President of the TAA was a signatory to this letter.

The open letter recognises that the COVID-19 crisis has *"laid bare the need to address the inter-related challenges of hunger, malnutrition, climate change, and environmental degradation."* It calls for *"a set of internationally coordinated, locally relevant actions to address the medium- and longer-term impacts of COVID-19 on agriculture, food, and nutrition security."* As a result of the pandemic, food systems around the world are under great stress, resulting in the disruption of supply chains, higher prices for consumers, panic buying and empty supermarket shelves, children deprived of school feeding programmes, farmers losing their markets, and concerns about harvesting current crops and planting next season's ones.

In the short term, we need to:

- re-build resilient local and regional supply chains based on diversified local food systems and sustainable natural resource management;
- ensure crops can be harvested and planted in the coming months; and
- establish efficient food collection and distribution systems that can deliver nutritious food to hungry people, especially women and children.

In the medium and long term, we should:

- Reconsider how best to provide food and nutrition security in the event of long-term supply or demand-side disruptions due to public health effects, while still thinking about environmental and climatic factors.
- Support CGIAR to enhance the global research system to undertake more transdisciplinary research to develop more resilient agricultural and food security systems. The revolutions in information and communications technology (ICT) and biology can help re-imagine food and agricultural systems to provide food security to the poor, and to transform the sector by reducing its environmental and climate footprints. Research should bring new technologies to markets, such as meats from single-cell proteins, biofuels from algae, accelerated fish farming, and plant-based proteins.
- Consider a paradigm shift in national priorities to re-emphasize the importance of conserving natural resources, especially agro-biodiversity, increasing carbon sequestration, improving soil health and water quality, generation of renewable energy, scientific eco-regional planning, efficient water and nutrient use, diversification, greater dependence on locally available plant-based food systems, *etc*. Although the economic and social costs of the abrupt economic shutdown are not acceptable over the long term, COVID-19 has demonstrated the profound impact that human activities have on our environment.
- Ensure that the nutritional needs of all women, men and children are met, including those who are most marginalised – particularly rural women and youth.
- Ensure that adequate credit and agricultural inputs (seeds, fertilisers, pesticides) are available when and where needed; and enhance transportation, storage and distribution systems, including the capacity to change production systems to meet shifting demands.

The United Nations Food Systems Summit in 2021 will be a major opportunity to craft a well-organised global effort to address these challenges. The open letter concludes

> *"it is our firm belief that by acting collectively for the common good, motivated by our recognition of our common humanity, and driven by caring and compassion for the poorest and the weakest among us, we can help human society overcome the multi-faceted challenges to the agricultural and food security system brought on by the pandemic, and place society on a much stronger and more sustainable path of growth and balanced development. The time for action is now."*

Other calls for action related to COVID-19 followed, often focussing on particular aspects of agriculture for development. Three of these calls for action, focussing on food security, women, and livestock, are briefly considered below.

COVID-19 and food security and nutrition

The High-Level Panel of Experts on Food Security and Nutrition (HLPE) Issues Paper 'Impacts of COVID-19 on food security and nutrition: developing effective policy responses to address the hunger and malnutrition pandemic' (HLPE, 2020) is a key paper.

The purpose of this Issues Paper, requested by the Chairperson of the Committee on World Food Security (CFS), is to *"provide insights in addressing the food and nutrition security implications of the COVID-19 pandemic and to inform the preparations for the 2021 UN Food Systems Summit."*

The introduction emphasises that the COVID-19 pandemic has had profound implications for food security and nutrition, resulting in *"lower incomes and higher prices of some foods, putting food out of reach for many, and undermining the right to food and stalling efforts to meet Sustainable Development Goal (SDG) 2: Zero hunger."* Most health analysts predict that this virus will continue to circulate for a least one or two more years. The most recent estimates indicate that between 83 million and 132 million additional people will experience food insecurity as a direct result of the pandemic.

A number of overlapping and reinforcing 'dynamics' are identified that are affecting food systems and food security and nutrition thus far. These include: disruptions to food supply chains; loss of income and livelihoods; a widening of inequality (including gender inequities); disruptions to social protection programmes; altered food environments; uneven food prices in localised contexts; and potential for lower food productivity and production. These dynamics are affecting the six dimensions of food security – availability, access, utilisation, stability, agency, and sustainability – which are essential for ensuring the right to food. The paper outlines the initial (first 1–2 months), medium-term (next 2–5 months) and long-term (next 6–24 months) effects of these dynamics and their implications for the six dimensions of food security.

Four urgent *policy shifts* are considered necessary to achieve food security and nutrition, and to secure the right to food.

1. **A transformation of food systems as a whole**, which in practical terms means *"moving from a singular focus on increasing food supply through specialized production and export to making fundamental changes that diversify food systems, empower vulnerable and marginalized groups and promote sustainability across all aspects of food supply chains, from production to consumption."*
2. **To shape food policies in ways that recognise inter-system linkages**, ensuring, for example, *"that food systems, ecological systems, and economic systems create positive synergies, rather than working at cross-purposes."*
3. **To incorporate greater understanding of the complex interaction of different forms of malnutrition occurring simultaneously** within societies, including not just hunger and undernutrition, but also obesity and micronutrient deficiencies.
4. **Transformative food policies must also be flexible to allow for diverse approaches**, to fully take into account diversity and the specificity of each context, *"including the variable impact on food system workers, farmers in different countries and for different crops, gender-differentiated impacts and populations in crisis contexts."*

To support these broad policy shifts, the paper identifies the following six *specific recommendations* (with relevant priority actions for each listed in brackets).

1. **Implement more robust targeted social protection programmes** to improve access to healthy and nutritious foods (provide adequate emergency food aid; provide debt relief to governments; maintain robust social safety nets; design food assistance programmes that offer adequate access to healthy food, not just sufficient calories; provide alternatives to school lunch programmes when schools are closed; allow for adequate access to healthcare, including access to mental health services).
2. **Ensure better protections for vulnerable and marginalised food-system workers and farmers** (ensure food-system workers' rights; ensure food-system workers have access to full protection from hazards and risks; pay special attention to migrant workers in the food system; implement mechanisms to protect farmers from uncertainties and income losses).
3. **Provide better protections for countries that depend on food imports** (discourage food export restrictions; provide policy space and support to countries seeking to improve their domestic food production capacity; encourage countries to build better long-term grain storage capacity).
4. **Strengthen and coordinate policy responses to the COVID-19 pandemic impact on food systems and food security and nutrition** (create a task force led by the CFS to track the food security impacts of COVID-19; establish a reporting system for CFS Member States to share information; educate and

inform the public on nutrition-sensitive practices to prevent and manage COVID-19 infections; include food-system workers and agricultural producers' organisations in COVID-19 decision processes).

5. **Support more diverse and resilient distribution systems**, including shorter supply chains and 'territorial' (local) markets (invest in enhanced territorial market infrastructure; review policies that may unjustifiably privilege formal retail food outlets over more informal markets; adopt stronger regulation to empower small and medium-sized agri-food enterprises).
6. **Support more resilient food production systems based on agroecology** and other sustainable forms of food production, including home gardens and urban agriculture (more agroecological research-action projects; develop an agroecology curriculum in schools of agriculture; support more projects that encourage agroecology and other sustainable forms of agriculture; support individual and community responses, such as home and community gardens; ensure that sustainable fisheries and aquaculture, as well as animal production and forestry, are integrated in policy responses to COVID-19).

COVID-19 and women in agriculture

In its 'COVID-19 and women in agriculture call to action' (AGRA, 2020), the Alliance for a Green Revolution in Africa (AGRA) reported that *"as COVID-19 continues to spread in Africa, women in agriculture are struggling to cope not only with the restrictions to limit the spread of the disease but also with endemic inequalities, which undermine their capacity to respond and recover from the impact of this pandemic."* This is *"increasing the burden on women as they struggle to fulfil their multiple roles of managing their families, farms, and small businesses."*

Women constitute nearly 50 percent of the agricultural workforce and own one third of small and medium-sized enterprises (SMEs) in Africa. They are *"a key pillar of Africa's food systems."* As COVID-19 restrictions come into force, *"women's livelihoods and business activities are threatened, so is household food and nutrition, and family well-being."* Through this call to action, AGRA, in consultation with women's agripreneur networks, appealed to governments in Africa, the development community and the private sector, to *"assist women to access resources necessary to conduct agricultural activities, cushion their small businesses to avoid collapse and amplify their voices throughout this pandemic, to attract targeted support for recovery."* Six key action areas were identified:

- assist women to continue to access inputs, farm labour, mechanisation and advisory services;
- facilitate off-take activities by keeping local markets open, sanitising market infrastructure, providing protective attire for market operators, improving information flow to increase awareness, and recognising transportation and logistics of agricultural products as essential services;
- create a women's SME rescue fund with rapid disbursement;
- deploy gender-inclusive digital tools and services to assist women to access inputs, market products and financing;
- provide tailored training and capacity-building for women to respond to, recover from and build resilience to the pandemic; and
- increase gender disaggregated data to aid response and recovery decisions.

COVID-19 and livestock

Leading academics across four continents joined international organisations representing millions of farmers, producers and veterinarians to sign an open letter entitled 'How livestock is supporting global nutrition, high standards of food safety and public health during the COVID-19 pandemic' (Global Ag Media, 2020). The purpose of this open letter was to *"[push] back against misinformation around animal agriculture during the pandemic."*

Globally, 1.3 billion people depend on livestock for their employment, and billions more rely on livestock to provide food for their families, yet there are *"unfounded claims that livestock and modern agriculture were somehow the source of the COVID-19 pandemic."* In fact, *"ongoing research continues to confirm that domestic livestock production is safe and has not played a role in the spread of COVID-19"* and animal agriculture can *"offer lessons for wildlife zoonoses management as part of the long-term pandemic preparedness."*

The letter urges authorities, intergovernmental groups, and NGOs to:

- reaffirm the safety of livestock production and remind consumers of our robust food safety system;
- refute misinformation that tries to manufacture a link between livestock and the spread of COVID-19; and
- consult with livestock experts, including farmers and other stakeholders in the feed and food chains, to understand how to aid their efforts to feed communities.

Actions in response to these calls

The various calls for action and open letters have certainly provided world leaders with plenty of good advice and guidance, but did they make any difference? As far as the big picture is concerned, only time will tell; but from the agriculture for development perspective, it is encouraging to see that some positive immediate actions have been announced. We consider two such actions below, focussing on international research and a COVID-19 rural poor fund.

COVID-19 and agriculture for development research

CGIAR's paper 'Responding to COVID-19: CGIAR's contribution to global response, recovery and resilience' (CGIAR, 2020a) outlines its rapid response to the pandemic. It makes the important points that the pandemic was itself *"likely the result of unsustainable food, land and water systems"; that it is "exposing weaknesses in food systems, societies and economies around the world"*; and that it provides an unprecedented opportunity to 'build back better' food systems.

Representing about two thirds of the current CGIAR research portfolio, the work of most immediate relevance to the pandemic encompasses four research pillars: (i) food systems; (ii) 'One Health' (the human–animal–environment health interface)[3]; (iii) inclusive public programmes for food security and nutrition; and (iv) policies and investments for crisis response, economic recovery and improved future resilience. By *"immediately pivoting the current CGIAR programme of work, CGIAR can leverage its tools and evidence to help countries cope with the effects of the pandemic."*

In the short term (up to 12 months), CGIAR will *"deliver research across the four pillars to support crisis responses by providing evidence and tools for immediate decision-making and actions."* In the medium term (up to 18 months), *"innovations will target crisis recovery by contributing to a better understanding of the impacts and trade-offs of the crisis response."* For the long term (up to 24 months and beyond), CGIAR will *"widen its focus to build greater resilience into food, land and water systems."* The aim to 'build back better' and not return to business as usual following the COVID-19 crisis is a priority for a united CGIAR in its efforts to *"transform food systems to meet global goals on food security, sustainable development and climate change."*

Another CGIAR paper entitled **'**A 4-point CGIAR response plan on COVID-19' (CGIAR, 2020b) reiterates that the short-, medium- and long-term CGIAR reaction to the pandemic can be characterised as 'response', 'recovery' and 'resilience'. It acknowledges that *"the way this crisis will unfold in the medium- to longer-term is uncertain" but it provides an opportunity to "reset the world's food system…to finally implement … a sustainable food systems revolution."* It presents CGIAR's four-point response plan to the pandemic in the following terms:

- change existing CGIAR Research Programmes to support an immediate COVID-19 response;
- implement CGIAR programmes already highly relevant to COVID-19;
- re-orient CGIAR's longer-term research strategy to reflect the 'game-changing' scale of COVID-19; and
- strengthen CGIAR's immediate and longer-term response capability.

An important part of this plan is the establishment in June 2020 of the *CGIAR COVID-19 Hub* (CGIAR, 2020c). This Hub is *"bringing together agriculture and health research in collaboration with the London School of Hygiene & Tropical Medicine … to ensure that a research-informed response to COVID-19 effectively reaches the world's most vulnerable."* The Hub aims to *"maximize uptake of CGIAR innovations by countries most vulnerable to the impacts of the pandemic."* It will focus on high-priority research areas, including *"surveillance and modelling of secondary impacts of COVID-19, and on monitoring and preventing future zoonotic disease outbreaks."* It will also guide ongoing work, by identifying strategic opportunities for new research.

COVID-19 Rural Poor Stimulus Facility

The *COVID-19 Rural Poor Stimulus Facility* of the International Fund for Agricultural Development (IFAD, 2020) is a new multi-donor fund that aims to *"mitigate the effects of the pandemic on food production, market access and rural employment."* IFAD has already committed USD 40 million to the fund, which aims to raise *"at least $200 million more from Member States, foundations and the private sector"*. The fund will support smallholder farmers and rural communities to continue growing and selling food, by ensuring that *"farmers in the most vulnerable countries have timely access to inputs, information, markets and liquidity."* IFAD has received requests from governments in more than 65 countries to help respond to the impact of the pandemic.

Conclusions

The early open letters and calls for action naturally focussed on the health aspects of the pandemic. They

[3] Note that 'One Health' is also being promoted by the WHO/FAO/OIE (the World Organisation for Animal Health) and a growing number of donors (WHO, 2017).

needed to be written as a record of concern, to raise awareness and to provide general guidance around which governments could formulate their policies and responses to the developing pandemic. It is difficult to judge whether these letters had any impact, since the focus of attention is still on coping with, recovering from and living with COVID-19. Their effectiveness will be able to be assessed in due course.

The immediate reactions of governments to the pandemic have varied greatly. Some governments reacted swiftly, responsibly and successfully in bringing the virus under control. Others have denied, delayed and prevaricated, before eventually being forced to take the pandemic seriously. Some governments have supported coordinated international efforts – on protective equipment, treatments and vaccine development, for example – while others have been more concerned with the 'blame game', deliberately withdrawing from international efforts, and selfishly grabbing as much of the available resources as possible for themselves. Several governments have turned the development and testing of treatments and vaccines into a competitive rather than a collaborative effort, putting 'national pride' ahead of recognised safety protocols. Poor, malnourished and ageing people living in crowded urban environments have been most severely affected.

On the positive side, although a new deadly illness has appeared, the causal agent has been identified, its genes sequenced, its symptoms described, avoidance protocols and treatments agreed, and several vaccines are being developed and tested – all in less than 12 months. This is an extraordinary achievement, unlike any previous pandemic, and much of this success is due to governments and global organisations sharing information with each other.

It soon became clear that agriculture and food systems were being badly hit by the pandemic, which impacted on nutrition, health and livelihoods across developed and developing countries. Furthermore, agriculture and food systems would play a vital role in any recovery from the pandemic, and in future strategies to promote greater resilience. The various calls for action on agriculture, food security and food systems, in the light of COVID-19, were timely, competent and well received. They resulted in some immediate actions and funding initiatives to help countries cope with and recover from the pandemic. The need to work across multiple sectors has also been clearly demonstrated, as illustrated by the 'One Health' approach now being promoted by WHO, the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE), CGIAR and others. However, the longer-term goal of a complete re-design of global food systems, to achieve the required future resilience of food systems, while at the same time reducing negative impacts on the environment and climate, will be perhaps the greatest challenge we have faced. If successful, then the pandemic will have accelerated complex structural changes crucial to the future wellbeing of the planet and everything that lives on it.

Several general observations may be made. It is interesting that COVID-19 has given rise to greater interest in 'the science' and increased exchange of information and statistics. Constant references to "we are following the science" seem wise, but there is a danger that 'science' will become a scapegoat in the reviews that will follow once the storm has passed. We have seen that medical science, modelling, economics and politics are not always comfortable partners. The reliance on slogans and opinion polls are not necessarily the best tools when dealing with uncertainty and complexity.

The pandemic, and its restrictions, appear to have helped with some aspects of mitigating climate change and in reducing air pollution through reducing unnecessary travel, consumption of fossil fuels, and economic activity generally, particularly in more industrialised countries. It may also have slowed the loss of biodiversity in some locations. Local food sourcing appears to have prospered. However, panic buying and shortages of some foods have shown the vulnerability of our complex and transport-dependent food systems to disruption.

What can the TAA do beyond observing as spectators and continuing to raise the importance of better farming practices and more sustainable food systems? TAA is a charity and an Association for people whose livelihoods, past and present, have been built on a desire to improve agricultural practices and the livelihoods of farmers and rural communities. Many of us have lived through outbreaks of disease and pandemics, and know that recovery and resilience will require a focus on food and farming. However, most pandemics are zoonotic diseases with their origins in animals both wild and domesticated. Thus, to avoid future crippling outbreaks, the development and adoption of sustainable farming and land-use systems and effective surveillance of potential sources of disease outbreaks will be essential – and this is where the members of TAA might be well placed to contribute at different levels.

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Opinion

Eswatini and COVID-19: a personal view

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The following are the subjective impressions of one agricultural adviser working in Eswatini at the time coronavirus disease 2019 (COVID-19) was spreading worldwide. Living on the outskirts of Manzini, altitude 2,509 feet, working in Siphofaneni, the Lowveld, altitude 850 feet, distance by road between the two places about 45 kilometres. Once the lockdown ended, work resumed in rural areas daily.

Eswatini, which changed its name from Swaziland in 2018, is landlocked, mostly by South Africa and the remainder by Mozambique. Eswatini is a member of the Southern Africa Development Community (SADC) and the Southern Africa Customs Union (SACU), which provides free trade among its members. The currency, the Lilangeni, is at par with the Rand and the currencies can be used interchangeably.

Eswatini is a small country of about 1.3 million citizens, an absolute Monarchy but with a parliament and a functioning judiciary. Its COVID-19 management policies are similar to those of South Africa.

South Africa went for lockdown and Eswatini followed suit, albeit a little less stringently than its neighbour. The traffic of goods between Eswatini and its neighbours continued, although the travel of people between the countries was severely restricted. Alcohol and cigarettes were not available. Alcohol sales were allowed for about two weeks in Eswatini, but the government saw an upswing in cases and so sales were stopped for two months more.

To date, about 5,000 cases of COVID-19 have been identified of which more than four thousand have recovered. At the time of writing, there have been one hundred and twelve deaths ascribed to the virus. Out of a population of 1.3 million, 1 percent would be 13,000, so the number of cases and deaths are not high numbers. The density of population is 67 per square kilometre, with about 30 percent of people living in urban areas.

People are very anxious about the potential of catching the disease.

The previous pandemic, HIV/AIDS, hit Eswatini very hard. Many people are alive and productive as a result of a widespread programme of taking antiretrovirals. When COVID-19 restrictions arrived, people were anxious about the impact of disruption of supply lines for antiretrovirals.

Shops other than food shops were basically closed until the end of June when most reopened. Food supplies have been maintained and supplies of toilet paper did not falter.

Probably the most difficult issue was stopping the minibuses. Many people use them every day to go to and from work. For the owners of the minibuses, their investments have been literally parked for weeks at a time.

Markets are functioning as usual as the border to South Africa has remained open for trade throughout. Government services are constrained by a fuel shortage, but this is due to management issues at the government transport agency.

Second to the lack of minibuses, the arrival of roadblocks was a hazard. The police, always unfailingly polite, worked the longest hours. Originally you needed a letter saying you were travelling to X for the purpose of Y. The letters became generic. They were issued by village headmen at one stage and so were devalued. People were turned back by Police.

After that, temperature testing came in with handheld infrared thermometers. These are still in use, even though most roadblocks have now dissolved. However, walk into any shop and you get your hands washed with sanitiser (usually alcohol-based, some soap and/or Dettol and some, it is claimed, just water) and your temperature taken.

Sales of masks and sanitisers have boomed.

Masks came into vogue originally so that minibuses could function again. They did not last long when it became clear that because there were not enough masks people were often sharing them and their

germs. The numbers of people who could be carried in a minibus was halved. Then there was a dreadful accident where a runaway lorry ran into a police minibus, killing 11 of the 14 people onboard. This meant that the Police minibus was fully loaded not running at half capacity.

ESWADE, a parastatal that undertakes agricultural works, irrigation in particular, potable water supply and latrine development on behalf of the Government using Government and donor funding, issued me with two masks – one yellow and one black, embroidered with its logo. The only snag was that the elastic earpieces were a bit tight, but this has been overcome with some supplementary elastic. It also issued me with a bottle of alcohol-based sanitiser, which I subsequently learned is meant to be carried in the vehicle as the police have been known to ask to see it.

Social distancing has arrived and handshakes, normally a major part of African culture, have gone. I have seen some farmers undertaking training in the fields, where they remain two metres apart.

It was especially interesting to see His Majesty the King in photographs in the newspapers wearing a mask. There is even a huge billboard on the hill out of Mbabane with a picture of His Majesty wearing his mask and clearly smiling, even though of course you can only see part of his face.

Figure 1. Billboard showing His Majesty King Mswati III wearing a mask and urging others to follow his example (outside Mbabane, 1 July 2020) (Photo: James Biscoe)

In Damawenzi, the favourite local Shisha Nyama emporium, hands, utensils and tables are frequently cleansed, and of course the meat and pap (maize meal porridge) are cooked, as well as being dosed with chilli by most of the customers. Water and washing up liquid are provided and used. (Note that last bit: used!)

COVID-19 started here at the end of March, and the first lockdown occurred at that time. It is somehow still in force albeit mostly self-enforced.

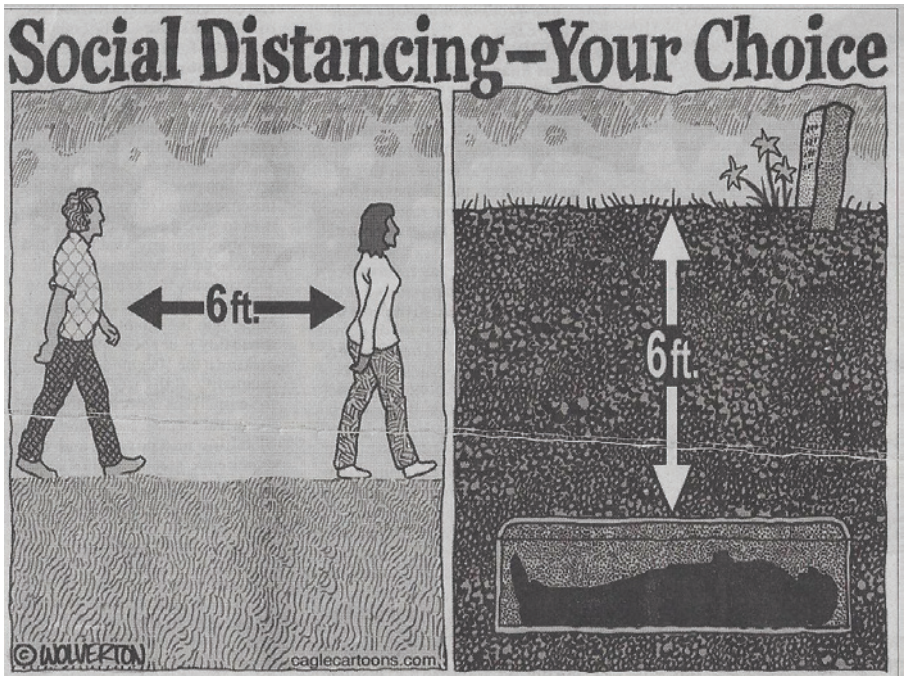

Figure 2. Cartoon from the *Times of Eswatini*, 12 May

Life must go on - King

BY SIBONGILE SUKATI

LUDZIDZINI – As much as Eswatini is fighting the coronavirus outbreak, other aspects of life, in particular the economy, must go on.

This was the message from His Majesty King Mswati III yesterday, who addressed the nation for the first time since he commanded the partial lockdown 41 days ago, on March 27, 2020.

The King said while the country continued to fight the pandemic, a balance should be struck, which was why government had introduced the eased partial lockdown.

He said while the health of the citizens was important, emaSwati needed to go back to work to try and fend for their families.

He said during the time when families were asked to stay at home, parents were still expected to make a living for their families and provide for their children.

Effects

"As we try to fight the virus by staying at home, there are other negative effects which came with it because this meant that there was no production, which also brought negative effects to the country," he said. He said as a result, that was why the country had decided to ease the partial lockdown in order to try and revive parts of the economy. He, however, emphasised that the eased partial lockdown was not a gateway for people to start operating in a 'business as usual' manner because that would have dire effects.

"It does not mean now that we have eased the partial lockdown people should start thinking that the virus is no more and they can go around conducting themselves as they please," he said.

His Majesty King Mswati III addressing the nation at Ludzidzini Royal Residence yesterday. (Pic: Sibongile Sukati)

wati adhered to the World Health Organisation and Ministry of Health guidelines by ensuring that they wore a mask, practised social distancing and washed their hands with soap and water.

He said these were the guidelines which all workers had to follow as the restrictions were relaxed. He said it was not just Eswatini alone which had started relaxing the rules in order for around the world were also ensuring that both the health of the people and the economies were revived at least to their previous standings.

"We want a healthy nation which will go out and restore the economy," he said.

The King stated that the country's economy in the recent past had not been one which had been doing well, however, just before the coronavirus struck there were indications that it was on its way to stability.

"*Ifhuwu yase iyochamuka le* outbreak *levele abona kutsi kuchamuka kwayo kuzibuyisele emuva kakhulu kunakucala*," he said in vernacular.

Loosley translated to "the coronavirus outbreak had set back the country to an even worse position than it was before'.

Revive

He said as emaSwati tried to revive the economy, this should be done in a very clever and strategic manner. "On one hand we are fighting the virus, but on the other we must ensure that the economy is also revived," he stated.

He emphasised on the importance of following all the health guidelines in order for emaSwati to be able to contain the virus.

He emphasised that people at work should ensure that there was social distancing in order for the cases not to spike.

On Wednesday, the Prime Minister, Ambrose Mandvulo Dlamini, announced that the country would ease the partial lockdown and seven more businesses, including the manufacturing sector, would be allowed to operate, but on strict WHO and Ministry of Health guidelines.

Government also said clothing shops would be allowed to operate three days a week, including furniture shops which would operate on a similar basis.

There is a negative aspect. The media and Government, along with many others, are talking of Manzini being the number one COVID-19 hotspot. What causes this is the fact that cases are reported on a Regional basis. Manzini is one of four Regions. The Manzini Region contains Manzini city, Matsapha, and many other settlements of varying dimensions. It is likely that 70 percent of the urban population live in Manzini Region. It is, therefore, not unreasonable that 75 percent of the cases in Eswatini might arise and are reported in Manzini Region. Manzini is not somehow more affected by COVID-19 than anywhere else. When the pandemic started and this statement first came to light one weekend, the whole city was closed off and the streets were fumigated with some form of sprayed-on chemistry. It was said to take the paint off cars. The same concern is possibly also driving the closure of drinking outlets. Hopefully, soon someone will work out the number of cases per thousand of population and more reasonableness will prevail.

Eswatini has, up to now, emerged from the COVID-19 pandemic relatively unscathed. One hundred and twelve people are recorded as having died from the disease. Of those diagnosed as positive, the majority recover quickly. The biggest complaint is that the alcohol and tobacco sales are still restricted.

My impression is that the Government decided on a course of action at one point and have by and large stuck to it. More so than some other governments around the world. The fact that Eswatini is a small country probably helps; however, the resources it can command match its size. Rural lives have gone on much as before, as far as can be ascertained from one person's observations.

His Majesty King Mswati III poses while wearing a mask at Ludzidzini Royal Residence yesterday. (Pic: Sibongile Sukati)

King worried about schools

LUDZIDZINI – Like many other parents, the King is worried about what will become of the 2020 school calendar.

He said in an unprecedented move, pupils were at home, a phenomenom which had never been witnessed. He said thanks to technology some of the pupils and students were using it to catch up on their schoolwork, but it was not everyone who had access to it.

"There are those in certain places who cannot access these lessons and all children must get an education," he said.

The King said it was unclear what this year's results for the various external classes would be like as the opportunity to learn has not been there.

Dilemma

He said they had engaged with other countries faced with the same dilemma but there was clearly no way forward thus far.

"When the year lapses what will be declared? Will they say the pupils be promoted *nje* to the next class?" he said.

The King said everyone was still pondering on what could be done about this and Eswatini was no different.

"Will it be right to promote children without going through the examination route? This situation was not anticipated by anyone to even plan for it because we never thought there would be such a moment," he said.

News from the field 3

COVID-19 impact on smallholder farmers of vegetables, fruits and meat production, processing and marketing in Zambia

Christopher P Kapembwa and Ravindra C Joshi

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This study was conducted to survey the impact of coronavirus disease 2019 (COVID-19) on smallholder farmers and marketers of vegetables, fruits, milk and meat. The survey was conducted in the Copperbelt provincial capital, Ndola, Zambia. The survey methods involved physical visits to smallholder farms, local open markets and small meat-selling outlets, as well as interviews with both farmers and marketers to compare production and sales margins between two periods, namely *before* and *during* COVID-19.

Smallholder farmers are key to production of local health foods: first, because they are closer to the consumers, and second, because marketers can access farm produce easily from them by either ordering for delivery or walking to the farms.

With the onslaught of the pandemic caused by COVID-19, both farmers and marketers have been severely affected, with production going down by half and sales also reduced by half since February 2020 (Jack *et al*, 2019).

This negative economic impact has been a result of the restriction of movements of people and loss of employment. Such factors have seen very little intervention from government and some of the mitigating measures put in place lack implementation expertise – for instance, the beneficiary selection for stimulus package which dismayingly lacks merits (ActionAid Zambia, 2020).

Vegetables

It has been noted that smallholder farmers in Ndola, particularly in areas like Minsundu, Munkulungwe and Kaloko, are facing challenges in selling their fresh farm produce, such as tomatoes, groundnuts, bananas and maize, primarily due to restrictions on movements of people. Most of the people in those areas depend on selling farm produce for their livelihoods. The restrictions on movements have negatively affected the economic activity of the people because their livelihoods depend largely on trading in various markets such as in Main Masala, Chifubu and Nkwazi.

Production of vegetables such as tomatoes, rape, spinach and cabbage has been reduced because prices of chemicals (fungicide, herbicide, insecticide, rodenticide and preservatives) have gone up. Most of these chemicals are not locally manufactured, but imported from countries such as South Africa, China and India. Border areas such Chilundu, Nakonde and Kasumbalesa were closed immediately after most countries in the Southern African Development Community (SADC) recorded a number of infections. Prices rose due to the border lockdowns.

Moreover, transporters (truck drivers) were being quarantined for 14 days, which negatively affected quick transportation of chemicals. Most of the farmers' fields were infested with pests due to the delay in delivery of these chemicals and other inputs (ActionAid Zambia, 2020; Gynch, 2020).

Even those farmers who managed to buy the chemicals found it difficult to sell products to their customers, because most would-be buyers have lost employment and are short of cash.

There were smallholder farmers who admitted that they resorted to cultivating 'Bondwe' (amaranths), which requires less chemical input.

Fruits

Fruit production, processing and marketing have likewise been impacted. Smallholder farmers who grow fruits, including oranges, bananas, guavas and lemons, have failed to sell their produce to customers. Women who buy fruits from farmers then sell them in the communities and along the streets by carrying fruits on their heads are complaining of lack of customers. They walk all day in the streets and around the communities to hawk boxes of fruits, but only a few are sold. They keep the unsold ones to sell

the next day, but most of the fruits soon go to waste for lack of buyers. Farmers' businesses have been seriously affected by the pandemic, such that they even fail to pay for their house rents or buy medicines for their children or relatives when they get sick.

Vegetable leaves devoured by insect herbivores

Unsold bananas wasted due to lack of buyers in local markets

Indigenous vegetable 'Bondwe' leaves free from insect damage

Meat and milk production

Meat and milk production and processing have not been spared either. Smallholder beef farmers have been complaining of high prices of feedstock. Previously, before the pandemic, feed for beef cattle was being sold at ZMW 250 per bell, but these days the price is pegged at ZMW 300–400 per bell, forcing some farmers to no longer buy feeds for their animals. With lack of feeds, most animals have lost weight and some died due to starvation. Some animals such as goats and sheep are now feeding on dangerous substances such as plastic, paper and sacks, which are health hazards. Mortality rate has also been increasing, for instance in Minsundu where one or two animals every 2 weeks die – this was claimed by three quarters of the beef farmers in the area.

Another reason beef production has been negatively affected is the increasing cost of drugs. For instance, some antibiotics – for example, potassium permanganate, which used to cost at ZMW 30–35, is now priced at ZMW 60–70 per 100 mg. Another drug, Terramycin, which used to be bought for only ZMW 125, is now sold at ZMW 225. This certainly has not gone down well with the farmers.

One small-scale dairy farmer from Minsundu reported that from his 20 cows, he used to collect 70–80 litres of

milk in the morning and 45–50 litres in the afternoon – a total of 115–130 litres per day (this was before the pandemic). Now he collects only about 45–50 litres in the morning and 20–35 litres in the afternoon – 65–85 litres per day. This is a result of the cattle being underfed or lacking the required nutrients. Some farmers have resorted to giving dairy animals feed made of maize meal and chicken manure mixture .

Some of the dairy farmers used to supply milk produce to Indians and Lebanese living in Zambia. They used to supply these customers either on a daily or weekly basis depending on the agreement. This business had been doing well before the pandemic, but now the farmers can no longer sell the milk products to these customers because most of the foreigners did not come back from their countries due to the lockdown.

As for meat, milk production has also been affected because of the increased cost of drugs, both for dipping and antibiotics. Dipping drugs were previously sold at ZMW 200 per litre, but now are priced at ZMW 300 per litre. Spraying and dipping used to be done at least once a week, but at present they can only be done once every two weeks or even once a month. The coats of some animals now have wasted appearance and show weight loss due to lack of proper nutrition and drugs that should keep their bodies healthy.

Most of the animals are infected with rabies, anthrax and other diseases, and given the limitations cannot be treated.

Beef traders in the markets have also confessed that the pandemic has affected them in such a way that they cannot even manage to pay rental fees to shop owners. Most of them are afraid of being evicted from the shops. Their meat sometimes goes to waste due to lack of customers. People, mostly youths, have also lost employment in these shops.

As shown, there is evidence showing the reduction of both production and marketing of agricultural products in this area in Zambia (The Kwacha Agritrageur, 2020). Reduced production is attributed to high cost of inputs, which smallholder farmers cannot afford (FEWS Net, 2020). Production has reduced by 50 percent compared with before the COVID-19 pandemic.

The Government has pronounced mitigating policy measures to help most of these smallholder farmers; these include providing subsidy on prices of feedstock, drugs for animals, and chemicals for vegetable and fruit production – all meant to keep farmers' businesses afloat both in production and marketing. Yet, since the COVID-19 outbreak and pronouncements made by the Government, very little has really been achieved. Farmer and marketer incomes have reduced by half. Many people in urban areas have also lost employment; consequently, sales margins have been affected since loss of employment of these city people led to their lack of capacity to buy the farm produce – the agricultural products lost these major buyers.

The pandemic's impact on Zambia's rural sector

Even before the advent of COVID-19 in Zambia, the rural sector had already been under severe stress, having registered poor harvests in recent years. It was further constrained by, among other things, lack of access to adequate marketing, storage, transportation and finance or capital.

The presence of COVID-19 therefore poses a severe challenge to food security and incomes, not only of the rural farmers but also the entire Zambian economy. There is no doubt that the scourge will put rural African farmers, particularly women-headed households, in extreme poverty.

Some of the negative effects of the COVID-19 pandemic on rural Zambia are itemised below.

Effects on production and productivity

Farm field operations depend mainly on affordable hired labour from local communities and villages. In rural villages, investments in resources by subsistence farmers depend on what their relatives living in urban areas can provide. Some of the small-scale farmers used to travel from urban and peri-urban areas to rural farm fields and back. But, because of the pandemic, the farmers in Zambia are staying at home, to avoid breaking the law.

Messages from the Zambian Ministry of Health on non-movements of people and lockdowns of some towns and cities have caused farmers to slow down or even abandon their work completely. One farmer said: *"We are not moving; we cannot travel into town to buy insecticides or fertilisers for our crops. My winter maize will be drastically affected."* The farmers' work can no longer be attended to; labour has been slowed down. There is very limited farm production, with the farms also running dry without water. These conditions have had a drastic impact on farm production levels and productivity among rural farms.

Slowed down or lack of transportation

The movement of farm products from rural to urban centres is severely affected by the crisis. Horticulture and seasonal maize (corn) farmers have relied mainly on private transporters to ferry their produce from their farms to urban markets. Because of the pandemic,

farmers are finding it difficult to take their produce to the markets. The transport system has been slowed down and at times transportation is unavailable because of travel restrictions. A number of transporters are afraid of taking risks and do not turn up to collect farm produce. Furthermore, as a result of the escalating cost of fuel, the cost of hiring transport has become unaffordable for many. The cost of fuel had already been comparatively high in Zambia even before the crisis.

Poor market prices

Farmers expect the theory of supply and demand to work in their favour, but unfortunately the price of farm products has not worked to their advantage. With the President having advised people to *"Stay Home, Stay Safe"*, only few are now turning up to open markets. Some towns continue to go through a lockdown on movements of people. The situation has caused a number of products, such as tomatoes, fruits and vegetables, to be destroyed, ultimately leading to loss of revenue.

Instability or changes in the COVID-19 approach

Via its Ministry of Health, the Zambian Government provides the population with daily briefings on the COVID-19 pandemic. While this is good in terms of information delivery to the people, it has not reflected well on the marketing of goods and services or on the rates of financial markets, and it has caused instability. The currency rates against the dollar have gone extremely high since the advent of the COVID-19. The rate of Kwacha to US dollar is pegged at almost 18:1 compared with 14:1 in May, a steep rise that stimulates price increases among consumer goods and farm inputs.

Farmer Input Support Programme

High poverty levels among rural farmers prompted the Government to introduce the Farmer Input Support Programme (FISP), whereby the Government subsidises the growing of Zambia's staple food to improve food security. However, the FISP measures have been ineffective in addressing high poverty levels in rural Zambia. Each year, rural farmers have recorded low yield per hectare.

The country's heavy reliance on FISP and output price support via the Food Reserve Agency (FRA) has created an agricultural growth paradox at the heart of Zambia. These two programmes have been costly and ineffective in addressing high rural poverty rates and low crop productivity. To make matters worse, they tend to disproportionately support farmers with larger land holdings and asset endowments. For agricultural spending to effectively address the challenges of entrenched rural poverty and low crop productivity, programmes must target poorer farmers and target crops that are better suited for the small land holdings that predominate rural Zambia. They must be less prone to appropriation by more wealthy and powerful individuals. The crops promoted by the Government should be those that are conducive to a given agroecological zone and should be economically profitable without requiring Government input subsidies or output price support (Mulozi, 2020; Barros & Rakotovololona, 2020).

Slowed down or absence of agricultural extension services

The current pandemic situation has government extension officers no longer conducting their functions owing to travel restrictions. This means that much of the agricultural information flow that normally reaches farmers has been curtailed. In the prevailing environment, farmers will have to either adjust to other income-generating activities or wait for the situation to cool down.

Recommendations for solutions

While it is hoped that the Government will continue to engage scientists to create the vaccines and cure for this deadly disease as quickly as possible, there is much to be desired in the agricultural sector in terms of stimulus packages. First, these stimulus packages should be non-selective – they must be a means to empowering smallholder farmers and marketers of farm products. This connotes that, in terms of mitigation measures, the Government should strive to minimise dependence on imports for Zambia's essential goods such as food. This is a great concern because it seems the power to decide what to grow is no longer in the hands of local people, but is rather controlled by external factors. Food sovereignty for local farmers has been taken away; they have no control over what to grow and how to grow it.

Continue demanding that Government prioritises investment in technology and research with regard to extension services provision. During this period, small-scale farmers will not have access to extension services due to restrictions on movements which have made the already weak extension services moribund. In situations such as this, farmers would hope to get technical support through virtual means such as radios, mobile apps and other digital platforms (Barros & Rakotovololona, 2020).

Parliament must also play its critical role of ensuring proper public resource management given the current condition of the agricultural sector.

All stakeholders should advocate for more farmer schools at the local level.

Proper management of the e-voucher system is required, such that intended beneficiaries receive proper benefits at the local levels (ActionAid Zambia, 2020).

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Village group revolving funds in fragile contexts: the case of Cambodia (1996–2015)

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Abstract

This paper reviews the experience of the International Fund for Agricultural Development (IFAD) in Cambodia in supporting key national policies of decentralisation, food security, poverty reduction and agriculture-led growth in successive projects between 1996 and 2015. The introduction, adaptation and scaling up of the village group revolving funds (GRFs) model, targeting the most vulnerable segments of the rural population, was at the core of IFAD strategy in Cambodia. With the remarkable development of microfinance institutions in modern Cambodia, GRFs are now generally seen as an obsolete solution by rural finance specialists, but this view somehow overlooks the fact that GRFs have represented much more than a mere channel for financing local initiatives. They have been a catalyst for the emergence of these very initiatives, a supporting mechanism for their implementation, and a means by which the most vulnerable can graduate to market-based rural financing services as well as other development services.

Introduction

Speaking of fragility in the case of Cambodia is a huge understatement. A particularly tragic and protracted period of war ended in Cambodia in the early 1990s. Years of conflict culminating in the horrors of the Khmer Rouge regime have left the country with a population deeply traumatised by the genocide, uprooted from their original land and displaced both in and out of the country, and massively poor and rural. The country suffered an enormous loss of knowledge and skills. The economy had collapsed totally, including agriculture. Yet, agriculture was clearly the sector to focus on to jump start the overall recovery of the country.

It is in this context, that the GRF mechanism was first introduced in 1996 to foster food security and income generation opportunities through a package of agricultural extension and farm inputs. In addition to this package, financial resources (typically USD 120 per person) were transferred directly to selected groups of poor rural families. After their first harvest, farmers were required to repay the value of the inputs provided to the group, hence establishing the start-up capital for a GRF.

In support of national policies of decentralisation (elected commune councils became a reality in 2002), poverty reduction and growth, IFAD-funded projects have subsequently attempted to scale up the GRF approach while adapting it to the evolving institutional context (decentralisation) and to a rapidly transforming economy (Kohl, 2012; IFAD, 2013a, 2013b). GRFs were first included in the *Agricultural development support to Seila project* (ADESS) in the Northwest provinces (see Figure 1). The project targeted 64,500 poor households who were food insecure, earned less than the national poverty line, and especially households with less than 1.2 hectares of land and those adversely affected by conflict. Of these, 12,940 households were members of 640 GRFs.

After a positive review in 2002, a revised GRF methodology was adopted for the *Rural poverty reduction project* (RPRP), which began in 2005 in Prey Veng and Svay Rieng provinces. Some 25,200 beneficiaries were to form 1,008 groups by the

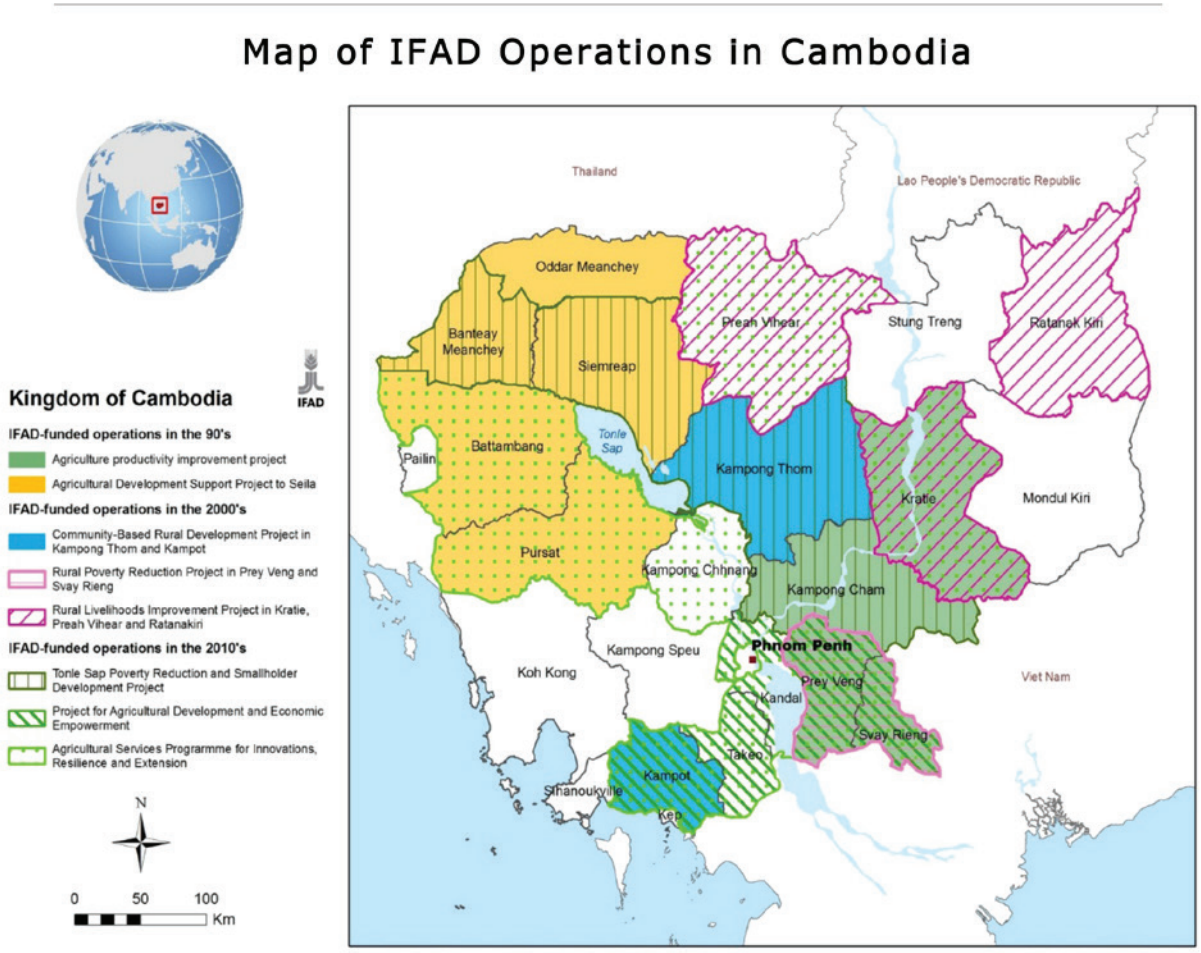

Figure 1. Map of IFAD operations in Cambodia

project closing date in 2011. Food security remained an important objective but diversifying households' sources of income and reducing poverty progressively became the prevailing objectives. In 2008, the *Rural livelihoods improvement project* (RULIP) in Kratie, Preah Vihear and Ratanakiri provinces began implementation, also using GRFs to deliver input packages to the poor (408 GRFs were formed with a total membership of 10,150 households). RULIP represents a first attempt at replicating the GRF model in a remote area out of the lowland rice-based agricultural systems with greater natural resources potential, but also characterised by weaker institutions, poor market infrastructure, low population density and isolated indigenous communities.

The 'Project for agricultural development and economic empowerment' (PADEE), approved in 2012, aims to tackle a number of GRF perceived weaknesses. Its improved GRFs (IGRFs) innovate by outsourcing critical functions to service providers, known as mobile field agents (MFAs), by placing more emphasis on the overall governance within the group, as well as on the post-project sustainability, the financial literacy of the members and the possibility of linkages with micro finance institutions (MFIs), while making capital transfers conditional on the group members' collective performance. With 980 IGRFs and a total membership of 49,000 households, PADEE represents the biggest attempt at scaling up of the GRF instrument.

This article examines three key challenges encountered by project teams, namely delivering decentralised credit services targeted to poverty reduction, supporting village groups and ensuring the sustainability of these services.

Delivering credit services for effective poverty reduction

Projects that pioneered a first level of scaling up of the GRF model were faced with first-generation-type challenges, mostly revolving around how to organise *decentralised credit delivery* and to improve the GRF instrument in the light of early implementation experience (IFAD, 2002). Challenges included, for example, the issue of fund ownership, the potential conflict of interest inherent in the fact that the same agents are in charge of extension and credit operations, how to link-up the groups to the MFI sector, and general group development.

The GRF unquestionably offered members access to affordable productive credit and the security of

knowing they can borrow in case of emergency. At the same time, some of the group members tended to become overly reliant on group credit, making little or no attempt to save sufficient cash to finance their own working capital. There were in fact *no real incentives to save and become self-reliant* in the GRF procedure, not least because members may fear that by saving to cater to their own financial needs, they would, in effect, lose the possibility to use the funds in case of emergency.

Coordination between credit and extension activities is essential to a good use of the funds and to the adoption of improved technical packages. When farmers are introduced to new technology, and like the idea, they may not be able to take advantage of such technology because of financial constraints. In the ADESS project, extension was delivered by the Provincial Department of Agriculture (PDAFF), while funds were channelled via the Rural Development Bank (RDB) with little coordination. The result was a significant breakdown in potential impact, both of extension and credit.

How best to deliver support to the groups?

The core GRF principles of group-owned assets being underpinned by peer pressure has remained constant throughout the ADESS, RPRP, RULIP and PADEE projects. There has however been a change in the way support to the groups has been provided (UNDP & IFAD, 2006).

Groups' evolving needs for support

In the early stages of a group's existence, the most important need is for technical support. This role is clearly well suited to the provincial departments of agriculture (PDAs) and their district teams, but could also be taken up in part by other sources such as the private sector and non-governmental organisations (NGOs). In any case, the challenge is to provide high-quality training to the extension staff, regardless of the source of funding. As the group matures, the needs change. Issues associated with GRF management, group leadership and group sustainability become the focus. This latter kind of support can be provided more efficiently by an NGO. Thus, future designs should look at an implementation partnership between PDAs and local NGOs that specialise in developing rural groups.

Technical support has changed from being provided by highly trained technical staff from PDAs to more enthusiastic, but less skilled support by commune extension workers (CEWs), hired at commune level, generally from among school leavers. This design change has been largely positive, particularly when the impact of the local government and associated local planning processes are taken into account. Nevertheless, commune- and village-level extension workers often express a desire for more training in technical subjects of importance to farmers, such as rice or vegetable and livestock production, as well as in extension methodologies.

Not all groups need the same amount of support. Some are able to manage by themselves because they are located closer to provincial towns, and hence also closer to market and employment opportunities. Other groups are remote, both in distance and access time. Others are able to manage better because they have more supportive commune leadership, better agricultural production resources and so on. Because there is a *wide range of capacity and performance across groups*, and because the number of groups is expanding, while PDA resources are scarce and capacity is limited, it is important to take a *strategic approach to making targeted allocations of a programme's financial and human resources.*

Group leadership

The challenge of inadequate leadership skills among very poor families was considerable in the immediate post-conflict period and is still significant today. To meet project poverty reduction goals, poverty targeting has been vigorously implemented. However, by definition, the very poor are frequently illiterate and innumerate, a combination that often results in low self-confidence and/or ability to take initiative. By definition, weak leadership capabilities also mean a weak sense of purpose and direction, and weak cohesion between members. There needs to be greater recognition of the effort required to develop and support leadership potential within a group.

Most groups had failed to implement a programme of regular elections for positions of group leadership. Reasons offered to explain this result included: "there is no one else capable"; "there was no demand for replacement"; "we didn't think it necessary"; and "the PDAFF staff didn't tell us to". The challenge for village and group leaders is to accept the rights of all group members to have a say and to do so on a regular basis. *Progressive leadership skills must be learned.*

Over time, knowledge has accumulated on how groups are expected to develop. This practice-based knowledge is captured in the following main *milestones in group development* (adapted from IFAD, 2010):

- a cohesive and functional group, where all members have an opportunity to participate in group governance and many have an interest to do so;
- members witness an improvement in their livelihoods outcomes that they associate with their

participation in the group;

- savings and capital build-up;
- linking to formal financial institutions;
- GRF members develop a vision beyond poverty reduction;
- well-planned small businesses funded by GRF capital;
- opening of membership and capital to newcomers;
- possibly merging into broader organisations or networks.

The search for sustainability

Several solutions have been considered and tested in order to encourage groups to become self-reliant. One such idea that has periodically been put forward but not implemented so far, is to create an *apex organisation for GRFs.* Such an organisation would provide a forum for the discussion of common issues and to engage with public and private partners in the search for workable solutions to planning and implementation challenges (IFAD, 2010).

A second solution has received much more official support: the merging of clusters of GRFs into agricultural cooperatives. However, most GRF members, CEWs and PDA staff, have limited understanding of what this graduation would mean for them. All too often, the cooperative concept remains a 'top-down' message from the Ministry of Agriculture, Forestry and Fisheries (MAFF) that has the potential to undermine and destabilise the GRFs unless the conditions of success outlined above are met.

Starting any business requires adherence to certain basic principles. Risk management is paramount and the most effective way to manage risk is to ensure a strong equity base. Starting a business, including a cooperative, with insufficient equity and too much debt is likely to undermine the cash flow, and hence prospects for sustainability.

Cooperative management will add considerable additional workload for group leadership, and many GRF leaders already struggle with the responsibilities of leading and managing GRFs. If cooperative leaders are paid in full for their management contributions, there is a danger that most of the benefits (and capital) of cooperative profitability will be captured by the leadership at the expense of members. This issue has led to the failure of rural cooperatives across much of the developing world.

If the goal of the cooperative is to promote commercially oriented and competitive agriculture, then it should be recognised at the programme design stage that the most effective target group would be the better-off farmers. As the RPRP completion report put it, the poorest are not always going to be able to accept business risk, and certainly not in the short term: *"GRF members must not be pushed to put their fund at risk to satisfy a MAFF Decree. All members must understand the risks. But any farmer group needs to approach cooperative and business development carefully. Confidence building is very important – in themselves, in each other, in the business venture. This will take time but is a vital step-by-step process"* (IFAD, 2010).

Impact and success factors

Increased rice production was the main benefit attributed by GRF households to their participation in the ADESS project, rice being a major source of income and the basis of their food security. Rice yields increased from around 1.2 t/ha to around 2.5 t/ha with a higher market value for improved varieties. For GRF membership, the income diversification promoted by the ADESS was tantamount to a safety net (UNDP & IFAD, 2006).

With regard to the RPRP groups, a survey conducted among 689 groups conducted about three years after project completion found that 66.8 percent of groups were classified as operating, whereas the remaining 33.2 percent were found to be inactive. Among the active groups, 74.8 percent were found to have good or satisfactory record-keeping in place, whereas the remaining 25.2 percent had either no or poor records. Assuming that groups with no or very poor records on capital, names of members and status of individual loans would soon cease to exist or are already quasi-extinct, the total number of surviving and properly functioning groups would be equivalent to 50 percent (Marx & Chhim, 2015). Considering the high failure rate of most new endeavours in any industry, let alone in hardship situations as in rural Cambodia, a longer-term success rate of 50 percent is in fact remarkable. The survey identified a number of success factors:

1. **Leadership:** good leadership and management is key to operating the group successfully; better performing groups were those where members reported that their leaders were actively working for their groups.
2. **Incentives for committee members:** the better performing groups paid higher amounts of financial rewards and recognition to their leaders.
3. **Common understanding of rules:** the study found that where bylaws and regulations were understood and accepted by members, loan arrears were fewer.
4. **Regular meetings:** there is a strong positive correlation between regular meetings and good

operation/strengths of the groups; this is because meetings provide a forum for the members to share experiences/information related to farming/business, facilitate saving and payments, and aid reporting on the group's capital and settling problems. In addition, meetings build trust and transparency through communication.

5. **Savings and collective fund:** there is a positive relationship between savings and good operation of GRFs. "Savings enable members and the group to increase their own capital and motivate them to come to meetings. By saving, they have more capital to invest in a business, thus generating more earnings. Members' savings also increase income for the group which will then be able to provide more incentives for committee members." (CEDAC, 2014.)
6. **Loan management:** most groups continued to follow the project-induced practice of meeting every six months and granting loans for six months to be repaid at the next meeting. Against this, groups that granted short loan terms (and thus met more frequently) achieved a higher level of capitalisation than those with bi-annual meetings.
7. **Record-keeping:** groups keeping good records have more trusted relations, and higher capital.

The importance of *programme facilitation* and support in establishing and developing the capabilities of these groups cannot be over-emphasised. According to the RULIP completion report: *"much of the progress towards sustainability (with the GRF group) or impacts (in adoption of new production technologies) has been achieved only in the last 2–3 years of the project, as significant problems in group mobilisation characterised the early years of project implementation"* (IFAD, 2014). After mid-term, a marked shift to results-oriented, farmer-driven and demand-responsive extension delivery and better support to GRF groups has mostly corrected the early problems and has been the main driver of the strong results achieved by the project, which closed with a real economic internal rate of return of 35 percent.

The 2014 project completion report (IFAD, 2014) assessed these changes as likely to have lasting value beyond the end of the project, stating: *"GRF Groups' capital growth (deducting bad debts) by June 2013, ie prior to many groups converting to Agricultural Cooperative (AC) status, was 38 percent in Preah Vihear and 27 percent in Kratie, and 26 percent for the project overall, excluding three problem districts in Ratanakiri (against a project target of 25 percent). This good growth in capital, in a large majority of groups, demonstrates the value of the GRFs to their members, with the additional benefit of most loans being used for improved farm production. Most groups have continued to grow their capital base in the intervening period, including during the process of conversion to agricultural cooperative status in which many groups sold additional shares"*.

The prospects of IGRF sustainability under the PADEE programme were assessed by the mid-term review (IFAD, 2015), as well as on a multi-stakeholder peer review of community-based financial institutions commissioned by PADEE and led by FAO (Marx and Chhim, 2015). According to the review, IGRF members liked the *financial literacy training* because they can now better manage the funds they borrow and utilise them for business; the training on how to think about income, expenses and saving, and how to distinguish necessary from unnecessary expenses, was much appreciated.

Members appear to have *confidence in the management of the funds* due to the *external support and checks* provided by a contracted external service provider for the monthly verification of records kept and the entry of data into an internet-based platform. For reasons of sustainability, the groups are requested to gradually increase their contributions to the costs of the service provider, until groups absorb these fully. While the income realised by the groups from interest on loans is largely sufficient to cover the expenses, there was little *willingness from group members to pay* and gradually take over the payments of the services of MFAs. Another issue noted by the review is that group members have neither saved much nor regularly. For group members to fully engage in IGRF, *capacity-building, mutual understanding and high levels of collaboration between group members* are required. These conditions necessarily take time to materialise and must be a constant focus of attention for programme staff.

Conclusions and lessons learned

In an attempt to extend the outreach of rural financial services to the poorer segments of the rural population and to help build their financial assets, IFAD and other agencies have often provided a group of people with a sum of money for the purpose of lending. In effect farmers are asked to perform the functions of a bank. This is particularly true if there is also a savings component in the project.

Experience gathered over two decades shows that GRFs can provide an effective and decentralised solution to food security and poverty issues, but they cannot be scaled up easily, due to inadequate human and financial resources in domestic institutions.

When a project establishes GRFs, it practically asks farmers to raise additional deposits and lend the funds out in a responsible and profitable way.

This involves a lot of decisions and operations. It doesn't matter whether the operation is big or small, a revolving fund is a banking operation and has to perform all the same functions as a regular bank, including product design, maintaining savings and loan ledgers, cash book, managing income and expense accounts, loan ageing, monitoring of overdue loans, making provisions for bad and doubtful loans, setting interest rates right, ensuring sufficient liquidity to meet withdrawals, *etc*.

The way that most donors go about this aggravates the situation. This is because management capacities are scarce and access to and knowledge of information technology is weak. In the banking business there are very significant economies of scale. But many projects, instead of establishing one big financial organisation, which can take advantage of these economies of scale, continue to set up hundreds or even thousands of little revolving funds where the economies of scale are nonexistent.

The solution for both sustainability and scaling up is to allow for multiple options and pathways in group development while tackling the difficult issues of weak capabilities and funding constraints in public budgets. A similar effort would be required to strengthen grassroots leadership skills and professional organisations' capabilities.

In rural and microfinance circles, GRFs have increasingly been seen as an outdated instrument that has by and large failed to create sustainability and thus long-term sustainable access to finance for its members. In addition, the narrative goes, there are no longer situations of mass poverty in Cambodia (World Bank, 2013). This view stands in sharp contrast to project designers' and national policy makers' perspectives, which can be summarised as follows: as GRF members repay the start-up capital into the GRF, with interest, the compounding effect will ensure steady capital growth. In effect, this is tantamount to a compulsory savings scheme able to raise adequate capital for the group to fund further on-farm and off-farm investments by the membership.

Conceived in the aftermath of the war as a quick fix in situations of mass poverty, GRFs proved to be much more resilient and sustainable than expected, contributing to local leadership development and inclusive growth. While financing services are better provided through more appropriate channels that are now available, the other functions performed by GRFs are still relevant in today's rural Cambodia and should be catered for.

Beyond Cambodia, GRF seems a valid option for tackling food security issues in fragile environments and mass-poverty situations. However, some realism is required as to the magnitude and pace of transformation that can be expected. While a project life cycle of about five or seven years is sufficient to meet limited poverty alleviation objectives, business growth will take longer and will entail different support needs and, most importantly, proper institutional capacity development at sector level.

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News from the field 4

Designing agribusiness responses to COVID-19: thoughts and best practices

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Agribusiness and risk in Africa in the COVID-19 context

All agribusinesses are familiar with risk and African agribusinesses already deal with a further complex range of social, economic and political risks. As a result, such companies have been well placed to cope with the unique, unforeseeable challenges manifested by the pandemic. However, the resulting adaptations differ significantly from previous shocks and have therefore required innovation to overcome them.

The coronavirus disease 2019 (COVID-19) pandemic has profound implications for how African value chains operate both now and in the future. Companies have been forced to adapt operating procedures at short notice to control the spread of the virus. Although the public health impact of the virus in many African countries has not been as severe as elsewhere in terms of restrictions on movement, reduced gatherings have major operational implications for agribusinesses, which involve large numbers of geographically dispersed farmers. In this short article, I share some observations drawn from my experience of supporting agribusinesses to develop ways to adapt their business activities as an immediate response to the restrictions and to identify longer-term strategies to strengthen their resilience.

Beyond operational realities and considerations, the commercial prospects for value chains have been influenced by COVID-19 in a broad range of ways. For export-oriented chains, the main priority has been to ensure operational integrity to fulfil contractual obligations even if this has meant operating on tighter margins. Export chains have greater concerns if demand is to be sustained within the context of a global economic downturn and if contracts contain new clauses that address COVID-19 risk (making financing more difficult). However, smaller, less capitalised, domestic market-oriented chains appear to have experienced a clearer and more immediate shock to operations and demand. These businesses have fewer financial resources at their disposal to effectively adapt and absorb costs. However, both large and small agribusinesses have recognised the key importance of maintaining the integrity of the supply base that feeds into their businesses and, where possible, enhancing the relationship by demonstrating mutual wellbeing and support through a challenging period.

Initial response: survival

The immediate priority for most agribusinesses is to ensure the safety of their employees. For most of them, this will involve both workers in the field as well as in offices and other infrastructure such as processing facilities. This poses vastly different workplace safety challenges to maintain appropriate social distancing and levels of cleanliness required. Food processing and handling sites are where value is added, and this is a key engine to generating revenue. Thus, the risk of a major disruption caused by a COVID-19 outbreak must be mitigated. Typical preventive measures incur additional costs, associated with operational changes, and often lead to shutdowns, forced inefficiencies and increased equipment needs – all of which can contribute to changes in the costs of production. As a result of these measures, companies have been forced to make major changes such as how workspaces are staffed, staggering shift starts to avoid issues with transport, and changing room facilities. This has led to smaller shifts and created clear bottlenecks in some processing facilities, which will have a significant influence on margins and profitability in 2020. The review of operational procedures, to include both taking account of the numbers of staff on site, as well as managing flow of staff and providing or acquiring personal protective equipment (PPE), is essential to formulate an effective operational response.

Off-site workers such as sourcing and extension officers interact with suppliers and value chain actors extensively, in many different contexts (officers, fields, meetings). They are also inherently more mobile and independent. Such mobile workers, meeting many people from different places, can pose a risk of contagion, being more exposed to community transmission given their need to travel between other company locations, suppliers, and others. The identification of work practices and risk events is essential; subsequently a decision has to be taken as to whether that activity can continue and, if so, how, with such protocols as social distancing and PPE, or alternatives, put in place. This approach should also be extended to suppliers via the provision of PPE and other hygiene products (soap or sanitiser) at meetings, buying events, and sometimes to communities or family members of suppliers.

Initially, companies were genuinely concerned about the impact of COVID-19 on sourcing raw materials. With the sourcing of raw materials under consideration, peak buying was anticipated during the period March–May, when uncertainty was greatest and time to adapt short. In particular, the ability to visit, coordinate buying and then manage the often-large numbers of people present at buying locations was constrained. Changes to established practices need to be communicated widely and in advance, given that many value chains are driven by meetings on an in-person basis. In addition to buying operations, other key field operations involve input supply and extension and advisory services. Much critical non-essential or non-business work has been delayed or cancelled. This has implications for the relationship between an agribusiness and its suppliers.

Considered response: mitigation of risk and strengthening operations

Agribusinesses are forced to think in seasonal cycles, and, realising in the middle of 2020 that COVID-19 was here to stay at least sufficiently to influence significantly the 2021 season, longer-term plans were required. Some of the initial responses put on hold important work that could not be delayed indefinitely. Operational changes were now more embedded, and managers started thinking on a more permanent rather than temporary basis. As there is little or no certainty over how long controls will be in place or in what form companies must address operational and commercial risks, assuming a worst-case scenario, companies have therefore entered an adaptive phase where the challenges of COVID-19 are better acknowledged and understood. The situation, although unexpected, has forced innovation and has provided an opportunity to not only address COVID-19 risks but also to address more inherent risks in value chains.

The challenges of securing raw material in Africa have not significantly evolved in the last century: knowing your suppliers, low productivity, climatic challenges and side-selling are key issues, to name just a few. COVID-19 has removed or hampered field-level effectiveness and capacities, while also squeezing profit margins by removing key elements of the toolbox used to interact effectively with agribusiness. In this context, a series of focus groups with suppliers identified their principle concerns regarding the continuation of the commercial relationship: serious concerns about possible disengagement from the buyer (due to reduced contact), collapse of demand and concerns about the following season dominated. This largely echoes the concerns expressed by agribusinesses and demonstrates the ability of a crisis to strengthen relations. Safety and new protocols were also seen positively, as demonstrated a duty of care to staff and communities.

There has been greater prioritisation of tools and approaches that enhance the ability to communicate and interact with suppliers and reduce the sole dependence on face-to-face meetings. This serves as an opportunity to redefine relationships and points of interaction with suppliers. There has been a general trend to try to conduct more one-to-one and small group work and to move to a more reactive, demand-driven approach to extension and advisory services, rather than a fixed calendar of meetings. This approach is preferred to group training by producers as it is more personalised and provides applied advice.

Companies that had already digitised part of their operations have been well placed to extend use of information and communications technology (ICT) both in terms of internal management and communication, and in strengthening technical support. Digital management of farms and crops has been approached with more seriousness and urgency and also in a more integrated multidisciplinary manner. The agriculture sector has lagged behind others in integrating technology, and the COVID-19 crisis has offered an opportunity to accelerate this process. There has also been a realisation that the chain can function better with more focussed person-to-person interactions augmented by better, more informed decision-making. This approach, if widely adopted, can catalyse other efficiencies and ultimately produce stronger value chains and more stable agribusinesses to drive them.

Conclusions

Given the uncertainty in Africa regarding the duration and severity of operational restrictions due to COVID-19, agribusinesses have been forced to move from a reactive to a more considered set of adaptations. These have cost implications, which have been almost exclusively been borne by the businesses. This will influence their profitability in 2020 and potentially generate considerable operational overheads moving into 2021. The commodity, country and scale of an enterprise have a major influence on the risk and scale challenges posed to it by COVID-19. Companies that had already implemented digitisation of some parts of the management of agricultural value chains have found it easier to mitigate some of the 'pressure points', particularly with regard to the ability to provide technical advice and to communicate and coordinate commercial activities.

In this way, COVID-19 could present a unique opportunity to re-examine and redefine the relationship with suppliers, with the aim of strengthening and not undermining value chains.

International agricultural research news

Developing research programmes relevant to fragile states and situations

In 2020, the world can look like a fragile place almost irrespective of where one is located. The social dislocation and sheer costs of responding to the current coronoavirus disease 2019 (COVID-19) pandemic and, for instance, frequent major hurricanes or forest fires, affect even larger, more wealthy nations. Climate change – higher temperatures, changed seasonality, erratic rainfall – threatens to introduce a fragility into formerly robust agricultural systems almost everywhere. How much more daunting therefore is the view of the future when this is seen as an overlay on already difficult circumstances. In development terms, the countries of the Sahel face an interlocking suite of challenges: national income is based to a large extent on dryland agriculture within which pastoralism and agro-pastoralism are essential contributors. With degradation of lands and plant cover already an issue, this requires natural resources, land management and policies to husband and modernise these systems appropriately. Fast-growing human populations pitch the balance of future need towards children and youth when agriculture is not sufficiently productive and rural poverty is already widespread. There is modest capacity in agricultural systems and institutions. There is the cruel expectation that countries that generate just 0.25 percent of the world's greenhouse gas emissions will likely suffer a 2.1° increase in temperatures by 2065, and potentially further increases and the strongest drying effects anywhere in the world by the end of the century. Productivity of current maize and sorghum crops would be diminished, amplifying the food security challenge. The populations at large have not generally prospered from transitory economic opportunities, and inequality, conflict and human displacement have heightened security and development concerns among governments of the region and internationally (Allen *et al*, 2018; Masson-Delmotte *et al*, 2018; Oxfam International, 2019).

In July 2017, France, Germany and the European Union together with the African Development Bank and the United Nations Development Programme (UNDP) founded the Sahel Alliance as an international cooperation platform, which Italy, Spain, the UK, Luxembourg, the Netherlands and Denmark have subsequently joined. With the objective of enhancing the stability and overall development of the region, the Alliance is currently financing and coordinating over 730 projects with the G5 Sahel countries[4] addressing current challenges across security, demographic, economic and social domains. A mapped listing of all anticipated projects through 2022 is available (Sahel Alliance, 2020a). Agriculture, Rural Development and Food Security is one of the six spheres of support, with a focus on enhancing agricultural productivity. An example is a major World Bank-led project, Regional Support Project for Sahel Pastoralism (Sahel Alliance, 2020b) involving an investment of around USD 200 million over four years.

During its presidency of the G7 in 2019, the French Government crystallised debate around the need for decent job creation for countries of the Sahelian region as the key entry point to support development.

[4] The G5 Sahel counties are Burkina Faso, Chad, Mali, Mauritania and Niger. In regional development terms they are sometimes grouped as G5+1, to include Senegal.

This emphasis on jobs is clearly not solely related to agriculture, needing to include other factors such as health and evolving social and economic opportunities for women within an overall framework for advancement. But, because such a large number of rural youth are exposed to, or already involved in, agriculture (Mabiso & Benfica, 2019), such a focus appropriately mixes (in prospect) agriculture and other aspects of development planning.

As part of their preparations, the G7 instigated a meeting in Paris among their agricultural advisors, and development and research agencies.[5] A meeting with regional stakeholders was held in Ougadougou. The recommendations from the G7 deliberations focussed on supporting opportunities for the entrance of the youth 'bulge' into the labour market, including secure land tenure, support to financial and advisory services, markets, and information and communications technology (ICT) for family farmers and 'agripreneurs' and small to medium-sized enterprises. It was noted that promotion of both on-farm and off-farm livelihoods was dependent on the capacity of youth to take part and to contribute, so that programmes of agricultural and rural training, ensuring adequate nutrition and diet, and women's empowerment and gender-responsive approaches to agriculture would be needed (G7 Food Security Working Group, 2019). The French research agency Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) is a party to the Ouagadougou declaration to develop a roadmap and mobilise anticipated research in the francophone countries of the region (see CIRAD, 2018, 2019).

It is striking how often funders supporting regional development are caught up in the immediacy of development (particularly emergency relief issues) and political time frames, and find it hard to envisage the utility of research programmes with long time frames. However, research agencies like CIRAD and CGIAR have a lot to offer within such frameworks from the fruits of current and past research. This can be either specifically from project engagement with partners in the region, or, potentially as powerfully, providing knowledge generated from other dryland agriculture research (from projecting future scenarios to successful adaptations to climate change from other dryland regions) and the seeding of knowledge hubs. The role could extend to methods to capture and analyse different sorts of relevant agricultural information at scale, to help adapt the latest knowledge and ICT for use through advisories and insurance schemes, and to assist with scenario development planning for use by government ministries. Scientific and technical review of agripreneur opportunities are as important as establishing a sound business case to take these opportunities forward.

To bridge the gap between perspectives, the climate security team of CGIAR's Climate Change, Agriculture and Food Security (CCAFS) research programme is currently (June–October 2020) holding a series of six webinars on climate security (see CCAFS, 2020). The intent is to capture key insights arising from climate and conflict research activities to help map the crucial narratives of important stakeholders and so connect the collective knowledge of food systems and natural resource management with conflict resolution and peace-building. The last webinar of the series (scheduled for 1 October 2020) will be directed towards a possible partnership agenda. The most recent event (at the time of writing – on 3 September) was also focussed on climate security for the Sahel.

The speakers represented different lines of policy, analysis and action (diplomatic, security, humanitarian and agricultural research). While sharing the same appreciation of the existing, difficult context for the region, the speakers provided insights into the temporal perspectives running between (and perhaps sometimes counter to) these action threads. Conflict brings disruption and loss of assets, and curtails migration and opportunities locally. New intergovernmental groupings for assistance to the region have been prompted by the actual security situation in countries, but also include funder country considerations of the potential for the rise of non-state actors, and the exportation of instability and refugees beyond the region. Security-related actions are very much in the here and now. They are predicated on trying to hold onto, or revert to, a previous normalised state – to buy time for the restoration of peace and order. Increasing climate variability on the other hand, is creating an evolving scenario that research needs to learn about in order to propose appropriate corrective actions for future food security. A humanitarian approach requires that we put people in the centre of our lens, both immediately and in the longer term. However, if climate change is a serious compounding element weighing on the fragile development status of the countries in question, the solutions we need for the underlying development challenges will require new socio-economic and natural resource paradigms for their solution. Planning for that changed future obliges us to think ahead in decadal time frames. Can the collaborating networks we build do all these things at once?

[5] The Rome-based agencies (IFAD, FAO, WFP) produced a working document for this meeting (unpublished) which drew on Allen *et al* (2018), IFAD (2019) and other UN statistics.

Speakers thought that while useful, the scope of the term 'climate security' was not commonly understood nor what is meant in terms of concerted action. For more immediate agricultural research, CCAFS believes that the nexus between climate and security still needs to be understood as practical interactions – what, for instance, are the dynamics of forced or limited human migration and what do they affect (pastoralism clearly, but also job opportunities and natural resource use, *eg* clustering of communities around water, *etc*)? We need also to make recommendations from climate models anchored in the specific resource contexts (in which there is a lot of variability across the Sahel). We will need to work with communities to test the proposed solutions at a local scale to make sure that they work and can be realistically extended. There needs to be a long-term focus on land and water issues. It will be important to keep these different temporal perspectives clearly in view as countries and collaborating parties prioritise future actions and investments. While we tend to focus on the agricultural research and capacity development dimensions, maintenance of a safe and dignified future for the populations of the region is a prerequisite for the transitions to be made. These perspectives were selected from a rich discussion which can be found as a podcast of the Global Dispatches podcasts (see CCAFS, 2020).

CGIAR in transition

Just as CGIAR is strengthening its climate programme to assist fragile states and climate-affected agriculture more generally, the organisation as a whole has embarked on a transition to a true 'One CGIAR' (CGIAR, 2020). The areas endorsed by the CGIAR System Council for primary attention during the transition are an integrated operational structure, One CGIAR policies and services, One CGIAR at the country level, a new research modality, and developing more and pooled funding. It is therefore both a strategic assessment – with the aim of making the organisation's research more agile in response to demands in a world where the rate of change seems only to accelerate – and a transition towards system efficiency.

The CGIAR Centres represent disciplinary hubs which have given CGIAR enormous research reach individually, and particularly when combined into specific programmes. However, having 15 sets of Boards and operating arrangements, particularly where CGIAR has several Centres operating in a single country, has not always been efficient from a whole-organisation perspective or from that of the focal countries. Descriptions of CGIAR often devolve to the roles of this or that Centre of CGIAR. Effectively, however, the programmes of CGIAR are composed of arrays of partnerships between Centres in combination with national partners in agriculture, forestry or fisheries, contributing international specialist research agencies or universities, NGOs, producer groups, *etc*. The aims, scope and timetable of the transition have been laid out (CGIAR, 2020). CGIAR has recently introduced its new Executive Management Team (EMT) and expects the new team to bring together areas recommended for change under the transition in September 2020. A new draft research strategy will be considered by funders for endorsement by the end of 2020.

It was an appropriate time for reflection and modernisation as the CGIAR system will be 50 years old in 2021. Before the transition, CGIAR underwent a MOPAN[6] review. This builds confidence among funders and provides a menu of structural priorities to enhance the organisation's performance in the future. The One CGIAR strategy will operate according to CGIAR strengths and aim to construct a future research portfolio by triangulation between identification of the evidence-based challenge, stakeholder demand and funder preferences. It will have to be selective, no one agency can do everything, and will build further partnerships around its goals. A strategy inevitably rests at the broad level, framed particularly by what is needed to accomplish the Sustainable Development Goals (SDGs) and written in a language accessible to global funders. Individual CGIAR *project* planning with stakeholders in any particular domain under the new strategy will be undertaken with the relevant stakeholders in the future.

As at the founding of CGIAR, and at critical moments in its history (*eg* the creation of the International Livestock Research Institute from its predecessors, or in the creation of the Center for International Forestry Research), the funders have played a critical role in the catalysis of change. Similarly, the CGIAR System Council has been on the front foot in the transition to streamline activities into a true One CGIAR, including the intent to balance long-term research with the agility of the organisation to address new challenges as they arise (CGIAR, 2019). However, in July this year, the IPES Food panel (an international expert panel on food systems) wrote an open letter (IPES Food, 2020) which was in part critical of the transition, largely on the grounds of the apparent diversity of the decision makers guiding the transition, the extent of

[6] MOPAN is the Multilateral Organisation Performance Assessment Network and is the third-party mechanism used by groups of funders to provide fit-for-purpose and performance quality assessments of multilateral agencies (mostly United Nations). The report established some weaknesses in organisational structure which the One CGIAR transition is seeking to rectify.

involvement of national partners and the apparent reduction in systems-type research. It is not the intent of this article to question the decision-making of the One CGIAR transition – and CGIAR has another hard taskmaster providing its perspective on the presentation and explanation of the new strategy (the Independent Science for Development Council; ISDC, 2020) which will be taken into account. However, two additional observations might be useful.

Firstly, from former experience, CGIAR works in partnerships moulded over many years of association – CGIAR (directors-general, scientists and funder representatives, and those who make up the decision-making bodies) engage with national agencies and individuals in the developing countries where they live and conduct their work so that project and programme development has always reflected this joint knowledge. The 'connectedness' and partnership arrangements of CGIAR generally scored highly in the MOPAN review report (MOPAN, 2020). The private sector should be added to that array of national programme, research and development partnerships to accelerate both research and dissemination of outputs at the scale required to have enhanced impact by 2030. Moving on, and in response to a particular recommendation (3c) of the transition, CGIAR is specifically developing country and regional engagement strategies, with all countries where it has a significant focus, to coordinate CGIAR input for streamlined interactions with national authorities and research entities. This theme is not a stand-alone element but a critical ingredient of the new strategy development, allowing a stronger regional focus within a shared agenda and geographical targeting of research. The plans and responses to the different transition recommendations that have been advanced separately by specialist groups in the first instance, will be brought together in the finalisation of a full CGIAR strategy under the EMT.

Secondly, CGIAR has a strong track record in crop improvement research: productivity research underpins food security, nutrition, health and safety, as well as income and business opportunities. Funders are pleased to foster this capacity in the future particularly applied to crops for the poor (CGIAR, 2018). But, as clearly, it is only a part of what CGIAR does in research terms or has to offer to agricultural research for development more broadly. The difficult problems of development are based on interlocking challenges and pathways. They are likely not solved on a technology-by-technology basis, or by a single research approach. It means that the various strands of research, present in CGIAR or provided by others, have to be appropriately woven into sequences of evidence gathering, discovery, application of knowledge and continuous system improvement according to country or subregional needs. The costs of research-for-development activities are likely to be substantial and planning research for maximum impact with development partners requires focus and time. As with the Sahel example, the entry point needs to be made clear, the intent and extent of the research and the responsibilities of players in systems improvement carefully formulated and carried through. A former CGIAR programme portfolio, as the IPES letter points out, included three so-called 'systems research' programmes (and before that there was the Sub-Saharan African Challenge Programme, which was a regional experiment in innovation platform research). Each made substantial inputs into agricultural innovation platform formation, research and learning with programme partners. Involvement also revealed that CGIAR's forte as a research entity is perhaps to offer context and trade-off analyses and injections of specific research or means of measurement and impact analysis, where requested by national players. But 'systems research' has not disappeared – trade-offs exist at almost all levels of agricultural undertakings from the biological system through to the socio-political management of landscapes and regions for wellbeing and environmental outcomes. The ISDC (2020) has urged a better description in the developing CGIAR strategy document of the differentiation of the environmental, land and water interface issues and approaches to trade-offs that new CGIAR projects will undertake. We look forward to that realistic demarcation between strategy and research project development, and to identifying the entry points for research of different types so that the collected evidence from all fields builds paths to better human development.

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Impacts of COVID-19 on smallholders in Fiji

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Abstract

The impact of the coronavirus disease 2019 (COVID-19) pandemic is well documented in international media, especially in mainland countries, but the Pacific islands have been neglected. This is partly because currently there are a small number of confirmed cases of COVID-19 across the Pacific Island countries and territories. However, the limited land mass and arable land, geographical isolation, vulnerability to extreme environmental shocks and small economies mean that these areas could easily be devasted by COVID-19. However, all islands swiftly put in place a state of emergency, closed borders and imposed a strict quarantine to limit the threat of the virus. Here, we share the impacts of COVID-19 lockdown on smallholders in Fiji, and illustrate the strategies and programmes put in place by the Fiji government to cushion its impacts.

Introduction

Fiji has over 330 islands with a total land area of 18,274 km^2 in an exclusive zone of 1.26 million km^2. The population of just less than 1 million includes indigenous Fijians, Indians, Chinese, Europeans, part-Europeans and other Pacific islanders. Fiji is a cosmopolitan mixture of culture, race and religion. Its two largest islands, Viti Levu and Vanua Levu, account for more than 85 percent of the total land area, and most of the businesses and urban centres are concentrated in these islands.

The country has a tropical climate with two main seasons, a mild dry season from May to October, with a warmer, wetter period from November to April. The majority of the islands are mountainous with high peaks and running streams and rivers, but there are also a number of low-lying atolls. In essence, the country has the potential to produce a wide range of tropical agricultural products. A few decades ago, agriculture was the largest contributor to the country's gross domestic product (GDP), and used to be referred to as the 'mainstay of the economy'. However, over the years this has slowly changed.

The global expansion of investment and trade have proceeded at such a rapid pace that transformations in Fiji have become inevitable due to increased contact and interdependence with the outside world. Fiji still sees itself as a small island state that faces a number of distinct obstacles that hinder its economic development.

Challenges

Physically, the country is geographically isolated from large metropolitan trading centres. The dispersed nature of the islands where people reside sometimes makes transportation and communications difficult within the country. Fiji has limited basic minerals and industrial raw materials. Its limited resources make it very fragile and vulnerable to natural disasters and climate change.

Economically, there is still a low level of incomes and low savings rate. Fiji is heavily dependent on tourism and other related industries, which makes the country vulnerable to fluctuations in world market prices, natural disasters and, equally, to the current global coronavirus disease 2019 (COVID-19) pandemic.

Effect of the COVID-19 pandemic on the nation

After the announcement of the country's lockdown, as we would all expect, the sector that was going to be the most affected was the tourism sector. This meant that there would be no tourists in the country, no flights and, more importantly, no work for all those reliant on the sector, especially those in the hotel industry. This had a domino effect on other related industries that support the tourism sector. With high unemployment and underemployment from the tourism industry and other related sectors of the economy, there was a need to have a temporary relief support for those that had become redundant due to the COVID-19 pandemic.

Relative to the tourism sector, the part of the agriculture sector that was going to be immediately affected was the agri-processors. A large proportion of the agri-processors that supplied the tourism sector were closed down and people working in the sector were laid off. It is recorded that five of these agri-processors were linked to farmers in the Sigatoka Valley. The farmers that supply vegetables and fruits directly to the hotels and the agri-processors were also affected. With the tourism markets closed, the farmers had no other option but to supply the local markets and supermarkets. The number of farmers classified under as part of this category was around 300 in the Sigatoka Valley alone, not to forget the many labourers who worked on the farms. Because of this, the local markets were oversupplied with vegetables and fruits, and the price was therefore affected.

There was a period where the two main cities, Suva and Lautoka, were completely locked down. This affected transportation into the cities from the rural areas, which in turn affected the normal supply of produce from the farms to the two biggest municipal markets. Smallholders who were contracted suppliers to vendors in these markets were not able to provide the goods for the vendors directly. As a consequence of the lockdown, limited supplies were available for the two municipal markets and the price of some of the produce increased by 50–100 percent during this period. While the Agricultural Marketing Authority was doing its best to buy from all suppliers and deliver to the vendors, market distortions could still be felt in some areas. This also gave rise to the emergence of de-centralised purchasing points and a number of new food stalls were erected along roadsides in areas where the density of the population was high. The government provided what support it could to link producers to vendors and consumers. At the same time, individual social media, online marketing and other initiatives (such as barter systems were being revived during this crisis period.

Government assistance

To mitigate the effects of the COVID-19 pandemic, the government provided a number of stimulus packages, especially for those that had been directly affected. These included measures to facilitate direct financial assistance through individuals or corporate bodies. There were also measures to assist businesses, either through the Ministry of Economy or other financial Institutions, such as banks, to businesses that were involved in trade.

The Ministry of Agriculture, apart from supporting the supply chain from smallholders to the market, also became involved in the important area of the provision of agricultural inputs with the following actions.

- Provision of seeds and planting materials to the heaviest hit rural farming communities in Fiji.
- Home gardening programme Under this initiative, the Ministry of Agriculture provided seed packages to all households in urban and peri-urban areas around Fiji, especially to households who met certain criteria; 11,602 households from all over the country were given seed packages. The purpose of the initiative was to provide access to nutritionally rich foods, help households save money on food bills, offer a fallback on food security due to the potential decrease in food production and food trade, and help maintain consistent home food supply.
- Seed packages. Based on the demand from the corporate sector, the Ministry of Agriculture started repackaging seed for further distribution to urban and peri-urban rural employees who had become redundant. This was called the corporate employee seed package, and was targeted at corporate employees.
- Farm support package. FJD 1 million (USD 470,800) was allocated for this initiative with the aim of boosting the production of short-cycle crops. The Ministry of Agriculture distributed planting materials and open-pollinated seeds to farmers around Fiji without charge.

Effect of the COVID-19 pandemic on families

In any disaster, such as the COVID-19 pandemic, food security cannot be ignored as it is a national responsibility to ensure that the population has access to enough food. Everything else is secondary; food is the only item that is important for all families. Where a significant amount of a country's food needs are produced in the country, agriculture plays a critical role in sustaining a country's socio-economic

sustainability. The people of Fiji are fortunate in terms of food security due to the government's policy on farm support. This is only a small part of the whole food supply chain, in which the subsistence sector is involved daily, and which is most often not recognised.

For the majority of people who have lost their jobs, their land – in the case of farmers - is the only asset for them to use to make a living from. Fisheries may also supply part of food needs For some, they may already have been involved in farming, but for others, this can be a good introduction, especially in ensuring that local nutritious foods continue to be included in the family diet.

Lessons learned from the COVID-19 pandemic in the agriculture sector

There are many lessons that can be learned and applied from the COVID-19 pandemic in Fiji. Agriculture has proven to be important for Fiji in two major ways: food security and income security. These are the two main areas that should be prioritised in the development of macro-economic policies for the socio-economic development of Fiji. Agricultural industries and investments are very important, especially for income and wealth distribution in developing countries. Primary producers should get the highest reward for their products, so that they are encouraged to sustainably provide the quality, diversity and the quantity of products that are required for the consumer market.

All other policies and regulations should support these two main macro-economic policies. Once these priorities are established, programmes and strategies can be further developed. The points below are some of the underlying themes that can be developed to ensure that the agriculture sector provides not only the basis for national food and nutrition security, but also a wide distribution of wealth through income generation from the sector and thus further mitigating the effects of the COVID-19 pandemic for all in Fiji.

1. Encourage more sustainable local food and agricultural production through improved production and marketing systems.
2. Make agriculture more nutrition-sensitive and disaster-resilient.
3. Improve technology on modern and traditional food handling practices by strengthening the capacity of the national food safety authority, supporting food vendors, and creating consumer awareness on traditional and customary food preservation techniques, which include drying foods and root crops, preserving breadfruit and storing coconuts.
4. Train young farmers and link them to organised markets.
5. Assist livestock farms and biosecurity authorities in efforts to prevent animal diseases.

Figure 1. Flower beds (left) converted to vegetable gardens with tomatoes (right) in the residential areas of Nausori, Viti Levu, Fiji (Photos: Ropate S Ligairi)

Newsflash 2

Impact of COVID-19 on food production and food security in Bangladesh

Hugh Brammer

Hugh Brammer (TAA Member) spent 22 years working on soil surveys in the Gold Coast/Ghana, East Pakistan and Zambia followed by 13 years as Food and Agriculture Organization of the United Nations (FAO) Agricultural Development Adviser in Bangladesh (1974–1987). Since his retirement, he has written 11 books and several journal articles on the geography and agriculture of Bangladesh.

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FAO has published a comprehensive *Second rapid assessment of food and nutrition security in the context of COVID-19 in Bangladesh: May–July 2020* (FAO, 2020). In 12 chapters, the report covers impacts of the lockdown on crop, fish, livestock and poultry production, employment and food security. Highlights are:

- domestic food reserves are considered adequate up to December;
- food prices generally increased, though prices of poultry, dairy products and meat fell;
- over 70 percent of surveyed farmers reported difficulties in obtaining agricultural inputs and over 90 percent reported scarcity of labour and machinery for harvesting the boro (winter) rice crop;
- over 90 percent of farmers reported a 20–30 percent increase in farmgate rice prices over last year's prices;
- meat sales fell by around 50 percent due to the closure of hotels and restaurants and the suspension of social events;
- there were drastic reductions in sales of fish due to transport restrictions, and in exports of fish, fruit and vegetables due to the suspension of air cargo flights; and
- dairy farmers suffered considerable losses due to transport disruption of both input supplies and urban market sales.

Short-, medium- and long-term recommendations are made for addressing the labour, transport and financial problems identified.

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Manual soil preparation for paddy rice (Photo: David O'Neill)

The two fundamental challenges for agriculture in the 21st Century

R Alan Yates

Alan Yates (TAA Member) started his 42-year career as a tropical agronomist in 1952, after gaining a BSc (Bangor Agricultural Botany) and MSc (Liverpool Veterinary School); his DSc was awarded in 1970 for published work on agrophysiology of sugarcane. He was a man who worked mostly in the field, working with large-scale and small-scale farmers, in more than 30 countries from Australia, South-East and South Asia through Africa (16 countries) to Central America. The early years were mainly sugarcane, but he has also been a rice breeder and has dealt with many other crops for both small- and large-scale farmers. He has been Economic Botanist (Guyana), Technical Director (Booker Agriculture International) and Senior Agriculturalist (World Bank). He retired in 1994, but has continued to write technical papers.

Abstract

It is clear that global warming is under way, much of which is attributed to anthropogenic CO_2 emissions. Photosynthesis has captured CO_2 in the atmosphere for millions of years; its capacity is fully adequate to transfer all excess CO_2 via plants to the soil and sea, where vast mobile reserves of C are already held. The soil reserves (as soil organic matter [SOM]) can be increased using conservation agriculture technologies, now widely understood, which are simple to implement. Increasing SOM will simultaneously reduce the problem of global hunger by protecting soils and increasing crop yields. Forests are relatively inefficient (per unit area) at sequestering carbon (C) and may compete for cropland. Peat and biochar have great potential per unit area but are of limited applicability. The potential for increasing marine sequestration is probably immense, but technologies suitable for large-scale use still need to be developed; recent histories of over-fishing and the damaging of coastal-lands for fish-farming suggest that caution is required.

The challenges

A basic objective of all agriculturalists is to ensure that people are adequately fed. This requires the production of sufficient food, and combatting or mitigating climate change. These two aims are linked through one mechanism: increasing carbon sequestration in the form of SOM.

The world population is now about 13 times greater than that in 1700, presumably because (according to the renowned historian Yuval Noah Hahari, 2016) humans have made vast strides in reducing conflict and reducing disease. The global rate of population increase remained modest until about 1920, after which the rate of increase tripled (Table 1). This unprecedented rate of population increase is expected to tail off in all continents except Africa later this century.

Table 1. World population growth

	1700	1803	1928	1950	1960	1987	2000	2021
World popln (billions)	0.6	1.0	2.0	2.5	3.0	5.0	6.1	8.0
Years taken to double			*125*			*37*	*40*	*44*

Source: Wilkipedia contributors (2020), based on European Environment Agency data.

This simple consideration of numbers is complicated by two things: the need to reduce, not exacerbate the already near-catastrophic effects of world hunger (Box 1); and the fact that urban populations (*ie* people having little or no capacity to grow their own food) have constituted the majority of the world population since about 2010, and are expected to account for virtually all future growth.

Separately, but undoubtedly linked to population growth, is climate change / global warming (Figure 1), which is associated with an immense increase in numbers of extreme weather episodes, increasing aridity in many major food-producing regions, rising sea levels caused by melting of polar icecaps leading to an average rise in sea level of 0.2 m since 1900 (Shukla *et al*, in press), which would exacerbate coastal flooding, and even lead to the disappearance of atoll countries such as Kiribati, the Maldives, the Seychelles and Tuvalu. Global warming is believed to be driven by accumulations of human-made (anthropogenic) emissions of greenhouse gases, notably CO_2. These anthropogenic emissions have increased immensely since about 1950, when they were about 5 Gt CO_2 per year, to about 35 Gt CO_2 in 2011; they came from burning fossil fuels, flaring and cement manufacture (Shukla *et al*, in press).

Accepting that the challenge is to offset the anthropogenic release of CO_2, it is essential to identify

Box 1. Nutrition: key facts and figures

Note: Some authorities are predicting that the Coronavirus pandemic is likely to double these figures.

- Number of hungry people in the world in 2018: 821.6 million (or 1 in 9 people)
  - Asia: 513.9 million
  - Africa: 256.1million
  - Latin America and the Caribbean: 42.5 million
- Number of moderately or severely food insecure: 2 billion (26.4 percent)
- Babies born with low birth weight: 20.5 million (1 in 7)
- Children under five affected by stunting (low height for age): 148.9 million (21.9 percent)
- Children under five affected by wasting (low weight for height): 49.5 million

Source: *Wikipedia, The Free Encyclopedia*, using WHO data.

the magnitude of the task. We need to capture 10 Gt C per year (or less, to the extent that we reduce our reliance on non-renewable sources of energy). This is a massive amount, but it needs to be put in context. It is less than 5 percent of the annual flux through photosynthesis and respiration (of more than 200 Gt C per year). This annual flux represents 40 percent of atmospheric C, or a modest 10 percent of soil C, or an even smaller 3 percent of marine storage.

Even assuming that the world, through a vast effort, renounces 90 percent of its fossil fuel use, offsetting the remaining 10 percent would still require a sink capable of soaking up about 1 billion tonnes (1 Gt) of carbon a year. There are industrial systems for taking CO_2 from the air, and for sequestering the gas underground, but those currently on the drawing board operate at barely one-thousandth of that scale, and would be astronomically expensive (estimated to be in the trillions of USD). Natural systems (photosynthesis to capture the CO_2 and sequestration in the soil as SOM) have plenty of capacity (see Box 2) to resolve the problem *at zero cost*. These systems have worked for 600 million years – since the Carboniferous period when they formed our present fuel deposits.

Box 2. The capacity of natural systems to capture CO_2 in the soil

The Food and Agriculture Organization of the United Nations (FAO) estimates that there are some 150 million ha of cropland in the world. Assuming that one third (50 million ha) is accessible for improvement, and assuming a 1 m root zone (the root zone of plants being the area of soil and oxygen surrounding the roots of a plant – typically from 50 cm to 1 m for wheat and barley). This equates to about 50,000 billion tonnes of soil; a modest 0.1 percent increment in soil C would absorb 50 Gt C, some five times the annual anthropogenic emissions.

To the extent that the SOM solution is adopted, it will relieve the already near-catastrophic effects of world hunger (Box 1). Sequestration of CO_2 in the form of SOM will increase soil fertility and yields (Box 3). Such fertility changes and yield improvements can be

A. Observed temperature change relative to 1850-1900
Since the pre-industrial period (1850-1900) the observed mean land surface air temperature has risen considerably more than the global mean surface (land and ocean) temperature (GMST).

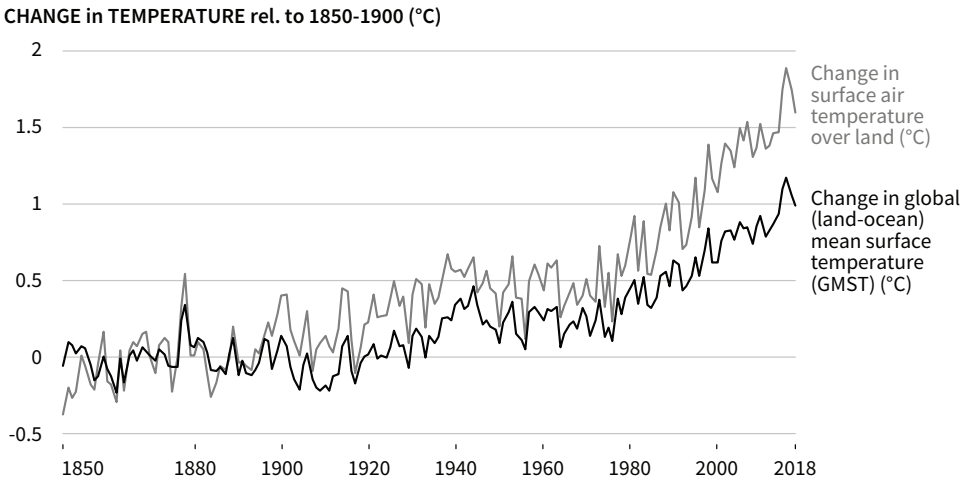

Figure 1. Global warming in recent decades (Source: IPCC, 2019)

permanent, given continued good management, as is illustrated by the 170-year-old winter wheat trial at Rothamsted (Figure 2; Rothamsted Research 2017); and the increase in SOM can be cumulative (Figure 3). The potential for normally cultivated tropical soils to sequester up to 5.0 percent C as SOM is confirmed by recent data from Malawi (Ormuto & Vargas, 2018): organic C contents examined in 2010 and 2017 ranged from virtually zero to over 5.0 percent C (see Table 2).

Table 2. Topsoil organic carbon content in Malawi between 2010 and 2017

	2010 topsoil organic carbon (%)				2017 topsoil organic carbon (%)				Change 2010–2017 (%)
	Mean	Std dev	Min	Max	Mean	Std dev	Min	Max	
Blantyre	0.876	1.523	0.060	17.100	0.99	0.45	0.31	2.44	13.50
Karonga	0.729	0.352	0.000	2.086	0.77	0.33	0.14	1.55	5.10
Kasungu	0.953	0.758	0.059	12.703	0.97	0.44	0.14	2.14	1.80
Lilongwe	1.006	0.612	0.055	5.139	0.93	0.41	0.14	2.41	–7.10
Machinga	1.278	0.751	0.000	4.046	0.69	0.41	0.08	2.49	–46.30
Mzuzu	0.834	0.424	0.176	2.456	1.04	0.73	0.20	5.07	25.40
Salima	0.685	0.443	0.029	2.426	0.93	0.43	0.34	2.45	35.60
Shire Valley	0.965	0.756	0.024	4.970	0.89	0.44	0.25	2.49	–7.30
Average	0.916	0.880	0.000	17.100	0.902	0.49	0.08	5.07	–1.40

Source: Ormuto & Vargas (2018).

Box 3. Yield response to increased soil organic matter of 1.0 tonnes carbon per hectare

(equivalent to 0.01 percent C assuming a 1 m root zone – a very low aim)

	From (low) response	To (high) response
	(Additional tonnes/ha per year)	
Wheat	0.2	0.7
Rice	0.1	0.5
Maize	0.3	3.0

Source: Lal (2008).

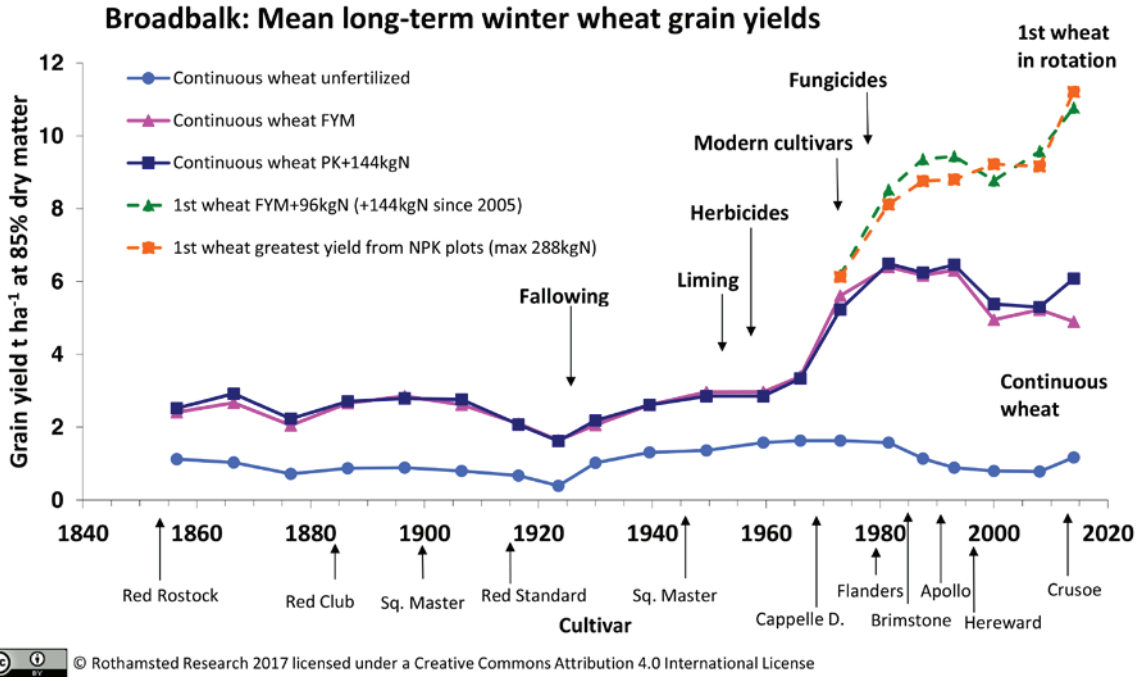

Figure 2. Very long-term winter wheat (170 year) trial at Rothamsted Experiment Station (Source: Rothamsted Research, 2017)

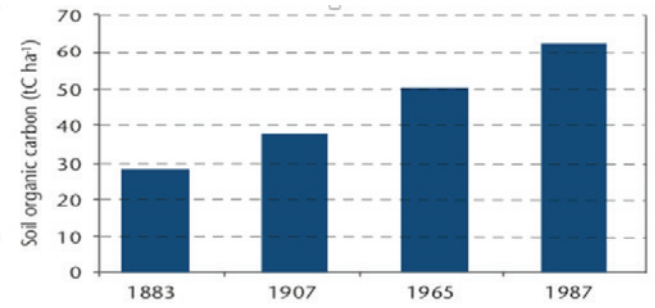

Figure 3. The accumulation of carbon stocks in a field at Rothamsted (Source: Author's own table redrawn from Poulton 1996)

Box 4 summarises the main options for sequestering C in an organic form; each option is then discussed separately.

Box 4. Methods available for natural C sequestration

Method	Notes	C sequestration (C/ha)
Peat restoration	Immense potential per unit area, but limited applicability	27 t per year
Tree planting	Heavily promoted but of limited value	250 t after 50 years
Improved farming methods	Almost universally applicable in most farming systems; increased SOM improves all soil characteristics and crop yields	Theoretical potential could reduce net CO_2 emissions in the atmosphere to zero
Special techniques (*eg* biochar)	As with peat, of limited applicability but relevant to industries with waste biomass	Stores up to 100 t
Marine storage	Research in early stages	Potentially immense

Peat restoration

Peat has immense potential per unit area for sequestering C; but a very high proportion of natural deposits have already been destroyed, and the opportunity for re-establishing peat bogs is very limited both in the UK and around the world. According to Friends of the Earth, the UK has lost 94 percent of its lowland peatlands, either for extraction of the peat, or for drainage for farmland; only about 10,000 ha remain (de Zylva, 2019). Drainage of the East Anglian fens and the Somerset levels was extensive in the post-war years, when soil levels were said to sink by up to 4 inches per year: the need for additional flood protection today is probably associated with that sinkage. I have experience of the destruction of peat soils in Rwanda. In this bimodal rainfall area, farmers are increasing production by growing a third (dry season) crop of sweet potatoes in the swampy valley bottoms (the '*marais*'). Near Butare (Nyanza Province), I passed through one such valley on three consecutive years: the first year, the land was only partially cleared and planted, the soil black, the crop healthy; by the third year, the humus had been lost, the soil was white sand, and the crop less healthy.

In spite of the very impressive C sequestration capacity of peat (reputed to be 27 t C/ha per year), it seems unrealistic to hope to do much more than retain as many as possible of the existing peat bogs: in recent years, the use of peat as fuel has declined, as has extraction to produce garden compost.

Tree planting

There are numerous very good reasons for planting trees and/or maintaining woodlands, including: protection of watersheds, moderation of dust storms, protection of biodiversity and provision of habitats for wildlife, for aesthetic reasons, and, of course, for the production of timber. Unfortunately, the potential for C sequestration by trees has been exaggerated: to quote an enlightening example in an Economist schools brief (*Economist*, 2020): assuming that the world reduces fossil fuel use by 90 percent, a forest roughly the size of Mexico would be required to sequester the remaining 1 Gt (every year). Clearly, such vast forests would compete with food production, with potentially catastrophic effects on world hunger (Box 1). The allocation of 'carbon credits' for re-planting cleared forests in countries such as Madagascar has been widely publicised, but not necessarily implemented effectively.

Humans have always destroyed trees, if only on a small insidious scale through collecting firewood; or using 'slash and burn' clearance for agricultural use on a small scale by peasant farmers (Figure 4); or similar techniques, mechanised on a much larger scale, for example in Amazonia and Sumatra. The whole of northern Europe below the tree line (except for peaty swamps) was once covered with forests; Linnard (1982) provides an informative description of how these were cleared by peasant farmers, by the Romans when building their roads, and by rich religious foundations. Small-scale 'slash and burn' is still widespread in Africa and South-East Asia. Figure 5 is an example of a practice encountered in Sumatra in the 1980s; I first witnessed this in Amazonia in the 1950s and was amazed to see that peasant farmers do so much work to make a fertile plot but move on to a new site after about four years when the fertility is lost. Not far from the Figure 5 site was a very much

larger mechanised clearance for an official Indonesian Government *'Transmigraci'* project. More recently, the Brazilian Government was severely criticised for allowing private farmers to do similar large-scale clearance in Amazonia.

Figure 4. Traditional 'slash and burn', South Sumatra, 1985
(Photo: R Alan Yates)

Even without such clearance, individual trees have a limited lifespan: before, say, 90 years of age, most individual trees die, fall and rot. In drier zones (*eg* California 2018–2020, South Australia 2019), forests are susceptible to devastating wildfires. The maximum C accumulation is usually quoted at about 250 t C per ha; this is the equivalent of only about 10 years of accumulation by peat, or the equivalent of increasing SOM in a 1 m root zone by a modest 0.25 percent C per ha.

One possible solution is to store the timber for a very long time: reverse open-cast mining has been discussed but not actioned. Reverting to timber houses would sequester C for many years: an exceptional example is the oldest dated timber house in Wales, built in 1436 in Ruthin, which has sequestered C for 600 years. More normal examples involve high proportions of the populations of North America and Scandinavia who live in well-insulated wooden houses; and the wooden houses (many on stilts) which were, and sometimes still are, dominant in moist tropical environments. Timber houses also greatly reduce the emission of CO_2 from the manufacture of cement and bricks.

Planting of other trees/bushes

Other than planting for timber, there are many trees and shrubs which are food crops, which often earn a cash income, and which also provide protection against soil erosion. Other crops which are not permanent tree crops but which fit the category include sugarcane: it is perennial, can protect soils, and is grown by small-scale farmers in most tropical countries either for 'jaggery' production, or to deliver to large factories.

Many of these crops are suited to smallholder ('out-grower') participation, especially when supplying relatively small local processing plants. One good example is oil palm, but unfortunately, there have been well-publicised crusades against some such developments. Other tree or bush crops that protect the soil with permanent cover, and which are well suited to smallholder participation include coconuts, coffee, tea and cocoa. Objections invoking 'monoculture' and 'no food crops' can be discounted or readily corrected through land allocation for 'garden' plots. Even in the early stages of such out-grower developments, increased wealth can be identified through the appearance of simple things such as bicycles. 'Orchard' trees such as mango, avocado, macadamia – and even rambutan – require access to more specialised markets, but are well suited to small-scale farmer participation.

Improved farming methods

SOM is already the largest *controllable* reserve of sequestered C. It is of the order of 2,000 Gt, four times the amount in the atmosphere, and 10 times the annual C photosynthesis–respiration cycle (Figure 2). It is *controllable* because it is susceptible to farming practices. The effect on C sequestration per unit increase of SOM can be readily estimated (Box 2).

Appropriate farming systems can greatly increase SOM and thus sequestration of C, and thus resolve the parallel objectives of mitigating global warming and increasing yields to feed the burgeoning world population. These farming systems are today called 'conservation agriculture' (CA) or (in the USA) 'regenerative agriculture' (RA, see Paustian *et al*, 2020). The definitions of the two systems differ in detail but are very similar in principle. The Food and Agriculture Organization of the United Nations (FAO) defines CA as an approach to managing agroecological systems for sustainably improved productivity, improved profitability and food security using three principles:

- continuous nil or minimal tillage;
- maintenance of permanent biomass cover;
- diversification of crop species (rotations).

Just as carbon fixation under appropriate management is not a short-term effect but cumulative over many years (Figure 4), there are numerous reports of disappointing yields in the first year or two of CA/RA, but C fixation will significantly increase yield in the longer term. Paustian *et al* (2020) provide many examples of yield responses.

The adoption of CA/RA was negligible until the 1990s, but has been very significant subsequently and accounted for about 200 million ha (12.5 percent of

global cropland) in 2015/16 – mostly in the Americas and Australia. Uptake in Europe is disappointing at less than 4 percent; in Africa, where the need is greatest, adoption is virtually nil. Lack of progress in Africa is of special concern, as current farming practices are often unacceptable, the population is growing rapidly, and nutritional levels are low. CA techniques are already available in Africa: manual jab planters were developed at the International Institute of Tropical Agriculture (IITA) (Ibadan, Nigeria) in the 1980s; mechanised versions are now available through the African Conservation Tillage Network; yet in the course of visiting many 'extension' plots in some 10 African countries, I encountered no on-farm demonstration of CA. However, the use of 'smother' green manure crops such as *Mucuna pruriens* has been widely demonstrated (Yates, 2016) though not adopted. The ubiquitous – and meticulous – cultivation of rice in South-East Asia is a distinct problem which releases other greenhouse gases (methane and nitrous oxide); it requires a different approach such as the dry/wet system I used to multiply foundation seed in the 1950s, now promoted by the International Rice Research Institute (IRRI).

Special techniques: biochar

One technique that attracted attention in the 1990s was the use of biochar as a soil amendment. The potential benefits of biochar were equated to the benefits of '*terra preta*': the patches of soil in Amazonia that were vastly improved by some poorly understood technology developed by pre-Colombian indigenous farmers some 1,000–1,500 years ago (see the following website for further information on *terra preta*: http://www.css.cornell.edu/faculty/lehmann/research/terra%20preta/terrapretamain.html). *Terra preta* is more than an activated charcoal, as it is nutrient rich, and that there is no evidence to show that biochar will have an equivalent extended life. The Israeli Volcani Center expressed, in 2014, very cautious optimism about the future for biochar because there were still many unknowns in how to use it, at what dosages, in what cropping systems and in what types of soil. Rawat *et al* (2019) published a paper which provided great detail about feedstocks and production methods; they described the very large improvements to soil properties; but they did not quantify application rates nor indicate yield responses. Biochar became readily available in UK garden centres some 20 years ago. It is still available online, but the cost is high and, after 20 years, there are still no recommendations on application rates, nor predictions on responses.

Nevertheless, the C sequestration in *terra preta* soils is enhanced to a remarkable extent (Table 3). For those enterprises that have the capacity to produce biochar – notably sugarcane factories that have an embarrassing excess of cellulose plus all of the nutrients carried into the factory in the crop (nutrients that can be incorporated in the biochar) plus the necessary technical and organisational capacity, there is every reason for immediate involvement. Box 5 provides an example of the potential of one sugar factory with which I was very familiar: the out-growers' food plots would be transformed if fertilised with (nutrient-rich) biochar at the potential rate. Similar opportunities exist at oil-palm factories, coffee de-pulping stations, rice mills and sawmills. Elsewhere, it might be desirable to delay implementation until more research is done.

Table 3. Carbon sequestration of *terra preta* soil

	***Terra preta* soil**	**Native soil**
Depth of humic horizon	1–2 metres	To 50 cm
C content (%)	15	2–3
C content (tonnes/ha)	1,500–3,000	100–150

Source: Cornell University (nd).

Box 5. Mumias Sugar Company, Kenya

Using the latest agricultural data published (Mumias Sugar, 2004):

- 27,735 out-growers growing about 2.4 million tonnes cane from 25,889 ha
- each with a house-garden plot of say 0.25 ha each
- **Total 6,500 ha garden plots**

Factory cut had over 100,000 tonnes (dry weight) per year of excess bagasse (cellulose) plus the waste products (filter mud and molasses/lees) which contain all the nutrients carried into the factory into the cane.

The factory also has the technical capacity to do low-temperature pyrolysis and the organisational skills to produce and deliver more than 100,000 t dry matter of nutrient-enriched biochar per year.

That is 2.5 t dry matter per year to each farmer, equivalent to 10 t dry matter per ha of garden plots.

Marine storage

The potential for marine C sequestration is possibly very much greater than for C sequestration on land, if only because oceans cover about 75 percent of the surface of the world (362 million km^2 against 127 million km^2 land area). Reactive sediments in the sea are supposed to store three times the amount of

C stored in the soil, and there is the mobile element of dissolved CO_2 which is released when currents take cold water from polar regions into the equatorial zone.

There are numerous statements on the web of the nature of: "One ha of seagrass can store twice the C captured by an average terrestrial forest" and "Forests of seaweed can sequester CO_2 with no risk of forest fires". However, while there are speciality uses, large-scale utilisation of seaweeds is in the future. Further, since the 1980s, when fishing quotas had to be imposed, special care is needed when exploiting marine resources. In particular, phytoplankton form the essential base of the marine food chain. In order to sustainably manage fish and invertebrate stocks, it is essential to protect the supporting habitats of targeted species.

In summary, exploiting the potential for C sequestration in the sea could resolve the anthropogenic CO_2 problem, but we need to define exactly how to do this. It seems improbable that seaweeds can substitute for the world demand for basic long established 'energy' food crops such as rice, maize, wheat, potatoes, sweet potatoes, cassava, yam, plantain and many others.

Conclusion

It is clear that there is one technology that is currently available, well understood and of very low cost, which can resolve the need to sequester excess C from the atmosphere and, concurrently, increase food production and so reduce global hunger. That is through increasing soil organic matter, using techniques which are today known as 'conservation agriculture' (CA) or 'regenerative agriculture' (RA). Neither of these variants can effect an immediate transformation, but getting the process under way is an urgent priority, especially in Africa, where adoption so far has been negligible – even though the need for increased food production is more urgent in Africa than in most of the rest of the world.

Forestry has limited value for C sequestration, but it can often be justified on other grounds, or used where soils can grow trees but nothing else. Actions to preserve peat-lands should also be implemented and the production of biochar should be encouraged at enterprises that have the capacity for this (notably sugarcane factories). Marine C sequestration developments should be considered with caution until more research is completed.

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News from the field 5

Viruses of taro (*Colocasia esculenta*) in the South Pacific

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Virus diseases

Research into the virus diseases of taro in Solomon Islands began in the late 1960s at Dala Research Station on the west coast of Malaita.

The diseases were not at first obvious as station workers removed infected plants from variety trials as they knew the risks from leaving the diseased plants. On Malaita, farmers grow two kinds of taro: 'male', a group of several hundred varieties that die from the disease, *alomae*, and 'female', a much smaller group that are resistant to *alomae*, but instead are susceptible to another disease called *bobone*.

We initially had the idea that 'male' taro were triploid and 'female' diploid, but this proved to be wrong: they are all diploid, so we still do not know the difference between these two categories of taro. What was obvious, however, was that the diseases of both these groups were serious. Plants with *alomae* often show yellow twisted young leaves, stop growing and succumb to a rapid necrosis; those with *bobone* fare better: they develop several stunted thickened leaves, often with galls, and then the leaves recover, and plants appear healthy.

Causes and research

What are the causes? Diseased leaf material was sent to Rothamsted, UK during 1971, where three virus particles were found: a flexuous rod, and two bacilliform particles (one large and one small). Both the bacilliform viruses were new to science.

Transmission tests followed at both Dala and Rothamsted, and these showed that aphid *Aphis gossypii* transmitted the flexuous rod, planthopper *Tarophagus proserpina* transmitted the large bacilliform particle, and mealybug *Planococcus minor* transmitted the smaller one. Our initial thoughts were that the *alomae* was caused by the presence of both large and small bacilliform particles, and *bobone* by the presence of the large particle alone.

Unfortunately for our theory, we could not produce *alomae* taking planthoppers fed on *bobone* (large particle), and mealybugs fed on *alomae* (small particle), but we could get *alomae* with planthoppers fed on *alomae* alone. Did that mean the planthoppers transmitted both particles, or was the small particle latent in the test plants? We did not know and had no time to find out because the government closed the station in 1976.

However, work started up again in 1998, associated with a subregional project known as TaroGen, funded by AusAID and the Australian Centre for International Agricultural Research (ACIAR); it was funded to breed taro tolerant to taro leaf blight, following an outbreak of this disease in Samoa which annihilated the crop. If countries were to share the results from the breeding programme, the new taro lines had to be free from virus. Hence, the need to know more about *alomae* and *bobone*.

Queensland University of Technology, Brisbane, took the lead and, by 2003, five viruses had been identified and diagnostic tests developed for each. Nevertheless, even though the work used more sensitive serological and molecular methods for virus detection, rather than just electron microscopy, and found hitherto unknown taro viruses – another bacilliform virus plus a spherical one – the cause of *alomae* was still unclear. Then in 2005, funding ceased, and the work stopped again.

We had to wait until 2010 for the research to begin again. A European Union-funded global taro project was established to create an international network for edible aroids as a model to improve clonally propagated root and tuber crops of tropical countries. This time, the German Collection of Microorganisms and Cell Cultures (DSMZ), Braunschweig, Germany, took the lead, using even more sophisticated methods to check previous protocols for international germplasm movement. Again, there were new discoveries, the most important of which was the likely presence of a new tenuivirus.

This was an interesting find. Some tenuiviruses are transmitted by planthoppers. We already knew that planthoppers spread the large bacilliform virus and that this was involved in *alomae* and *bobone*, so perhaps they spread the tenuivirus too. This might mean that the small bacilliform virus was not involved in *alomae*; instead, it was caused by the large bacilliform particle and the tenuivirus. But once more the project ended before answers could be provided.

The future

Since 2016, there has been no research on *alomae* and *bobone*, or any of the other taro viruses, but there is good evidence that the viruses are moving around the South Pacific.

The taro virus situation in Solomon Islands is complex, and answers have been slow to come by. Partly because of irregular funding, and partly due to the need for the development of appropriate technologies. We can see parallels with viruses and phytoplasmas of other tropical root crops – sweet potato, cassava, yam and also pineapples, where there are multiple viruses, strains and insect vectors. Taro, though, is unfortunate in that it is an 'orphan' crop, not supported by international agricultural research centres, so getting funds for research is a huge problem. So, it is inevitable that questions arise over whether it is timely to chase funds and continue the research.

Sometimes, the question is even wider: should we be bothering about taro at all! It is being overtaken by crops that originated from other parts of the world: African yam, cassava, sweet potato and *Xanthosoma*, so why bother? We believe that there are very good reasons for Pacific island countries to have a diverse range of food crop staples to protect nutritional and cultural sustainability. These include the following.

Why research should continue

1. Taro is a traditional crop in the Pacific and represents an expression of people's culture. Eating and exchanging it is a way of preserving their attachment to their communities. Apart from that, taro is one of the few crops where the entire plant is consumed in Pacific island countries, with the leaves making nutritious vegetable dishes. People do not find leaves of cassava or sweet potato to their liking as they do in other parts of the world.
2. Growing a garden of taro and having *alomae* come and quickly destroy the plants causes a great deal of concern. Farmers are asking for solutions.
3. To provide solutions to farmers, we need to know how *alomae* is spread and what viruses are involved, then we might be able to help with management. At present, we talk about 'tarophagus' planthoppers and mealybugs, and that both are involved, but we are not sure. Our latest results suggest that it is only planthoppers, but we need to do the work to prove it. And from experiences in the UK and Germany, transmission tests are best done where the diseases occur.
4. Biosecurity of countries is compromised by not knowing the aetiology of *alomae*. Countries beyond Papua New Guinea and Solomon Islands cannot make informed decisions on importing valuable accessions from these countries, as they do not know which viruses are involved.

For the reasons above, but also because there is more to be discovered, donors need to finish what was started. They should stay the course, given the complexity of the problems, such as the epidemiology of taro virus diseases. This requires reasonable timeframes and an understanding of the limitations faced by Pacific islands countries, such as in staff numbers, training and facilities. Further assistance is required to build the capacity in relevant government agencies and university faculties, to bring about sustainable change that is not possible with short-term support.

As always, we are hopeful that there will be change and that there will be new funding to bring it to fruition!

Bookstack

Changing the future

This second review of *Advances in Conservation Agriculture* is by TAA Member David Dent (see first review by John Wibberley, TAA member and Chairman published in *Ag4Dev40* – Summer 2020).

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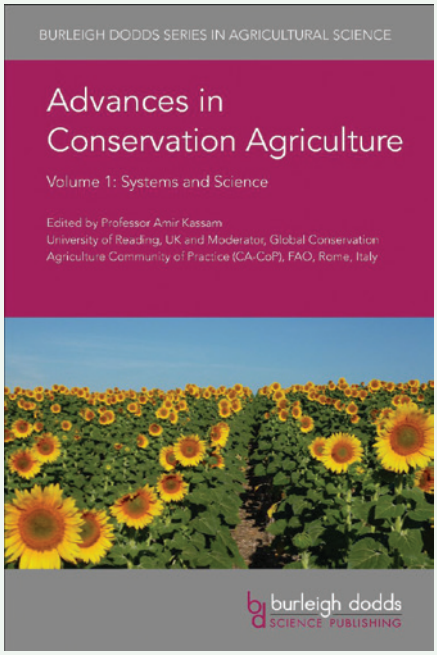
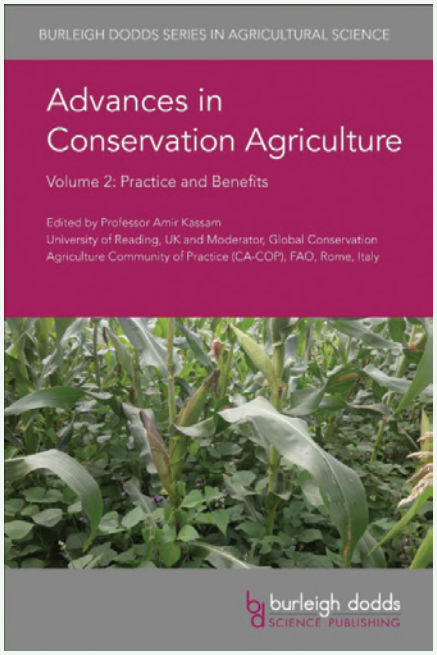




In a field bedevilled by vested interests, Amir Kassam has given leadership. He is eminently well qualified – but where are the world's schools of agriculture and the great research institutions? They have studiously avoided conservation agriculture (CA) and left farmers to their own devices, along with a few doughty champions of the new paradigm, who have carried the flag for half a century. More than a hundred of these champions have been enlisted to contribute 26 chapters, which have amounted to a 2-volume book which has over a thousand pages. The content is formidable (there are 211 pages of references).

Volume 1, *Systems and Science*, embraces: the need; global developments; soil health; the roles of minimum soil disturbance, mulch and cover crops; crops and cropping systems, vegetable systems, perennial systems; integration of cropping and livestock; mechanisation; certification; and institutional and policy support. Volume 2, *Practice and Benefits,* includes: management of crops and cropping systems, soil, weeds, insect pests and disease, nutrients, carbon, and biodiversity; climate change mitigation and adaptation; benefits to farmers and society; ecosystem services; and rehabilitation of degraded farmland. Each chapter is complete in itself so, inevitably, common ground is covered many times.

The advocacy goes back to Faulkner's *Plowman's Folly* of 1943. However, as a farmers' movement, CA took off in the USA, and then Brazil, in the 1960s when desiccant herbicides made zero tillage a viable proposition. It has now been adopted across 15 percent of the world's cropland: 35 percent in North America, 65 percent in South America (44 percent in Brazil but nearly all of Argentina) and 75 percent in Australia (but nearly all of Western Australia).

Faulkner reckoned that the plough had done more damage to society than all wars put together. The opening chapter by Amir and Laila Kassam doesn't argue with him. The spectacular increase in crop yields since the Second World War was achieved by application of more machinery (in terms of power and expense), more fertilisers (in amount and cost), more herbicides and pesticides, and more irrigation water – which was becoming ever more scarce

– to new crop varieties that could take advantage of these inputs. But the yields concealed an equally dramatic loss of the soil organic matter that fuels all inherent soil activity and fertility; it has been pumped into the atmosphere as greenhouse gases. In spite of greater inputs, yields have not risen since the early 1990s in the rich high-tech producing countries. At the same time, mass extinction of species and landraces, flight from the land, drawdown of water resources and abandonment of eroded land, were all accepted as the price of progress.

Conservation agriculture does things differently by combining zero tillage, continuous cover over the soil surface, and diversification of crops, and this combination controls weeds, pests and diseases. Fundamentally, it recognises that, in the words of VA Vernadsky, the soil is an alive thing. This theme is taken up by Don Reicosky in 'CA systems: soil health and landscape management'. With the ardour of St Paul, he illustrates the systems-based approach, the cardinal role of carbon, and quotes David Montgomery: *"Soil health is like human health; it's hard to define but you sure know when you don't have it."* CA drought-proofs the landscape and arrests erosion and flooding by increasing infiltration, allowing deeper penetration of rain and roots, and reduces evaporation. This is accomplished by a soil community allowed to get on with ecosystem engineering undisturbed. The emerging concept of continuous living cover – combinations of main crops, cover crops and perennials – is further mimicry of nature, and this brings benefits of food security, environmental services, carbon capture and adaptation to climate change.

All tillage is destructive and so tillage-based agriculture is unsustainable. Theodor Friedrich analyses the role of minimal mechanical soil disturbance, which should not be confused with *minimum tillage*. It is about avoiding soil disturbance in all its forms at all stages of agricultural production. Various options for achieving this are now widely available for manual, animal-traction and mechanised systems.

Ademir Calegari and colleagues provide a welter of information on mulch and cover crops. Their role in protecting the soil from the elements is well established, but a recent advance is the concept of mixed cover crops, where each species has a specific role: strong tap roots to break up pans, crumb structure from root exudates, nematode suppression, nitrogen fixation, solubilization of phosphate, nutrient retrieval from the subsoil, improved feed quality, tapping subsoil water, and weed suppression by allelopathy and smothering. Tabular data enable the reader to identify promising crops for particular situations. Cover crops also boost the production of biomass needed to maintain soil organic matter stocks.

Peter Hobbs and colleagues highlight local innovation and collaboration, coming to terms with innumerable problems and priorities in wheat–rice systems of the Indo-Gangetic Plains. Here, 135 million ha and 450 million people are running into heat stress and running out of water. Smallholders in sub-Saharan Africa face even more intractable problems. If food security means resorting to some tillage, herbicides and adoption of herbicide-resistant crop varieties, then so be it.

John Landers and colleagues describe the development of integrated cropping and livestock systems and sylvopastotralism in Brazil by innovative farmers, and inquisitive scientists. Together they are examining their unresolved problems – in particular, the need to close nutrient and energy cycles and, ultimately, make a profit. Soya is king, but the advent of short-season soya has enabled a second crop of maize to supplant fallow, or millet and sorghum as cover crops. Under-sowing pasture grasses has brought cattle into the system. The livestock feed on the pasture ley and, in doing so, greatly improve nutrient cycling and rebuilding of soil organic matter, soil structure and biodiversity. These, in turn, increase rainfall infiltration, and control pests and diseases. Pioneer farmer Ricardo Merdola lists the advantages as: less weed infestation, control of fungal pathogens and nematodes, soil decompaction (under grass), better erosion control, enterprise diversification, less consumption of water by irrigated crops, and better crop yields following the pasture phase. On the other hand, integration of crops, livestock and trees demands skilled management and labour.

Advances in CA have been accompanied by continual development of new equipment and adaptation to local differences in soil, climate and production system. Adoption of CA depends on the accessibility, performance and servicing of equipment. The chapter on mechanisation brings together 17 experts from four continents to furnish information on the particular requirements of CA for land preparation, seeding and planting, non-chemical weed control, and technical specification of machines for both small- and large-scale operations.

On policy, Tom Goddard and colleagues note that it has followed, rather than led, the adoption of CA. The beliefs, and biases, of decision makers are aligned with industrial farming systems; they are hard to shift and it should be no surprise that mainstream research and education are similarly hidebound. Farmers, adopting CA out of necessity, have even started their own companies

to make no-till equipment and, more recently, created internet directories so that new entrants can find coaching for their own circumstances. But the big guns could make a difference. We see this in the spectacular extension of CA in China since 2005. It is *government policy* supported by systematic research and subsidies for purchase of equipment. The chapter concludes with an analysis of how policies might be adapted to anticipated and unanticipated conditions. There is much to do. At the high noon of environmental ambition, three global threats were identified and United Nations Conventions on Climate Change, Biodiversity and Desertification were established for a better understanding, and response, to these threats. We now understand that these threats are existential and that agriculture is a driver of all three and yet, 30 years on, CA is not recognised in any Conference of the Parties (COP) process.

Volume 2 is about CA in practice, so it really should be written by farmers. Elsewhere, the writer has asserted that it is not the case, but now stands corrected. It is noted that several authors are, or have been, farmers, although they do other things as well.

The first chapter begins with hindsight: transformation to CA cannot happen overnight. Soil erosion is arrested and there are immediate savings in fuel and labour, but up to five years is needed to rebuild soil organic matter, soil structure and soil life. A further 5–10 years sees gradual improvement in soil health; mulch provides physical protection, supresses weeds and feeds soil microorganisms and mesofauna – including natural enemies of pests and pathogens; productivity, profitability and ecosystem services improve. Over the following 10–20 years, maintenance of continuous no-till, soil cover and diversified cropping continue the gains in productivity, water-, fertilizer- and energy-use efficiencies, and resilience against climate change – as well as mitigating climate change, through enhanced carbon capture and reduced greenhouse gas emissions. Adoption of CA across catchments can enhance socio-economic benefits and bring in further support from society, via payments for environmental services. The inclusion of CA in agricultural curricula and research is in everyone's interest.

The chapters on crop and cropping systems, and soil management go over the same ground as Volume 1, but in more detail. This brings no more clarity because of contradictions in the reviewed research. This has often confounded conservation tillage (oxymoron) with reduced tillage (disking instead of ploughing), minimum tillage and zero tillage; and very few researchers have looked beneath the top 30 cm of the soil. There is a telling contrast between big farming in Australia and smallholders in sub-Saharan Africa. In Australia, 80–90 percent of winter crops are grown under CA thanks to the combined efforts of farmers, grower organisations, agribusinesses and government. These combine with the logistic benefits of sowing large areas (sometimes tens of thousands of acres on a single farm), with the best equipment. But for all the efforts of champions and NGOs, CA has made less headway with smallholders: it takes 2–5 cropping seasons for yield benefits to materialise. And even then this is only the case if all the principles of CA are followed, and supported, including the use of drought-tolerant varieties, cover crops, green manures and grain legumes. That is a lot to get right in the face of technical, financial and social hurdles. Diverse crop rotations are also very difficult on very small farms.

Gottleib Basch and colleagues do take us beyond Volume 1, with an arsenal of physical, chemical and biological weed management practices and strategies. In the face of rising herbicide resistance and increasingly restrictive legislation, the future appears to lie with smarter farmers with better knowledge of the ecology of prevailing weeds, and optimum timing of interventions. The best story in the book, well told by Zeyaur Khan and his colleagues in Kenya, is the adoption of push–pull practice by farmers in East Africa. The initial concept was to: (1) drive out stem borers by interplanting the host cereal crops with tick trefoil (*Desmodium uncinatum*) that supports their natural enemies, and (2) attract the pests with a trap crop, such as Napier grass, where they can be controlled more easily. Desmodium also provides perennial ground cover, biological nitrogen, good forage and it happens to suppress the scourge of cereal crops in sub-Saharan Africa, the parasitic witchweed (*Striga*), by various mechanisms including allelopathy. Starting in 2000, farmer field days and farmer-teachers have proved the most effective ways of disseminating the push–pull practice. As well as controlling pests and weeds, it cuts soil erosion, increases grain yields, boosts milk production and thereby enables market participation and enhanced health and livelihoods, particularly for women.

In 'Nutrient management practices and benefits', Stéphane Boulakia and colleagues recognise the trade-offs between immediate production needs and ecosystem services. They include case studies of a Brazilian *fazenda* evolving from generic CA to multifunctional mixed-species cover, and a French dairy farm restoring stockfeed autonomy. Continual input of fresh biomass is beneficial on all counts, but microbiological mobilisation of nutrients has

to match crop demands and there is much to learn about the biological pathways that CA exploits to access nutrients that could not be assimilated under conventional fertility management. Certainly, CA expands the volume of soil penetrated by rainfall and snowmelt and that colonised by roots and associated mycorrhiza. It endows farming systems with their own nutrient supply from symbiotic and non-symbiotic nitrogen fixation, mineralisation of fresh biomass and soil organic matter, and increased accessibility, owing to extended microbial diversity and activity. As a corollary, it requires a specific crop breeding programme for creation, and selection, of varieties adapted to these new and different conditions.

Two chapters on carbon sequestration focus on two field experiments: one established in the sub-tropical south of Brazil in 1981, and the other established in the tropical *Cerrado* in 2001, both on strongly weathered, and strongly leached, clay soils. Soil carbon stocks were drastically reduced when the native vegetation was cleared and replaced by conventional agriculture; depletion under the plough ranged from 0.58 to 0.67 t C/ha per year from the 0–20 cm layer. This was reversed by CA, with carbon capture of 0.59 t C/ha per year in the sub-tropical region and 0.48–1.3 t C/ha per year in the *Cerrado*. These modest gains reflect the level of biomass inputs from the cropping systems under trial.

Scott Day, contributing to 'Biodiversity management practices and benefits', provides the authentic voice of a CA farmer. With the support of the Manitoba-Dakota No-Till Farmers Association, the family farm switched to no-till in the late 1980s and Scott has experienced the cessation of black dust storms, moderation of pest and disease outbreaks, dramatic increases in the populations of earthworms and other soil invertebrates, greater numbers of migratory waterfowl at the kettle holes that stud the prairies, and the return of ground-nesting birds and pronghorn antelope – along with the growing resilience of the cropping enterprise. Like CA champions everywhere, he wants to tell us about it. It is this enthusiasm that has spread CA across continents.

The concluding chapters deal with mitigating and adapting to climate change, and the benefits CA offers to farmers and society, linked to harnessing ecosystem services, and rehabilitating degraded land. CA transforms agriculture from a big source of greenhouse gases, to the only sink that we know how to manage. The benefits to farmers depend on farmers' circumstances. These are linked to the difficulties of re-equipping, weed issues, and the managerial capacity to operate a complex system, which needs information and inputs that might not be readily available. The drivers of adoption have been soil erosion, drought and commercial pressure to cut costs, so CA has been readily adopted by big, mechanised and rainfed farms. In South Asia, the initial driver was the saving in turnaround time between sequential rice and wheat crops. Most of the benefits carry through to society: less flooding and sedimentation of waterways and reservoirs, less air and water pollution; better aquifer recharge, conservation of biodiversity, reduction in greenhouse gas emissions, food security, and rural incomes.

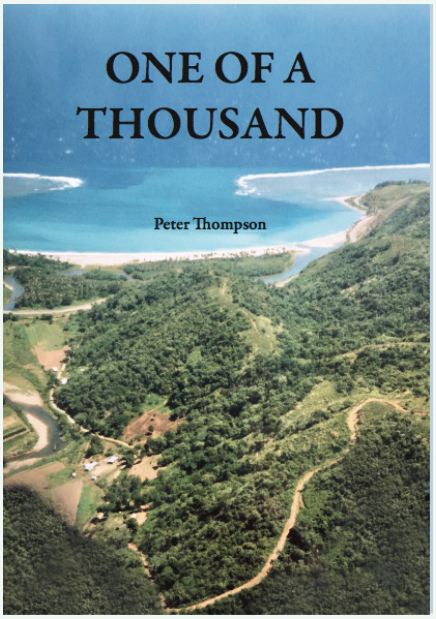
'Harnessing environmental services' includes case studies of the Alberta carbon offset payments, payment for watershed services in the Paraná basin in Brazil that services the huge Itaipú hydro-electric scheme, soil conservation in the drylands of north China, and soil cover in Spanish olive groves. The first demonstrates the substantial scientific, technical and administrative effort required for successful operation of payments for environmental services. The second describes a transformation of farming systems, transformation of water supply and quality that has quadrupled the life of the reservoir behind the Itaipú dam, and a transformation of values that follows from community adoption of the CA ethic. The other case studies make you wonder what took them so long.

The final chapter focusses on rehabilitation of degraded croplands and pastures in Brazil. Once cleared of native vegetation, the strongly weathered, strongly leached soils are soon compacted and exhausted. CA can reverse the process, but should only be established after remedying the compaction by subsoiling, and remedying aluminium toxicity and calcium deficiency by incorporation of lime or phosphogypsum. The ensuing no-till cropping systems should incorporate a variety of deep-rooting species and generate a lot of biomass in the annual cycle, which is not achieved by soya–maize duo-cultures.

These authoritative volumes will change the future. Forsaking the plough has been an agricultural revolution. We can look forward to further advances such as sylvopastoralism with *Leucaena* hedgerows that have transformed big cattle stations in tropical Australia and, maybe, another paradigm change, such as growing rice without puddling the soil and flooding. A third volume is in the pipeline...

David Dent

(TAA Member)



One of a thousand

Peter Thompson, 2019

Caroline Brannigan, Richmond, N Yorkshire (www.carolinebrannigan.com)

Soft cover, 343 pages

Available to download from TAA website: https://taa.org.uk/wp-content/uploads/2020/04/Peter_Thompson_One_of_a_thousand_text.pdf, or email the author if you wish to buy a hard copy (pgvmthompson@gmail.com)

In this autobiography, Peter Thompson (born in 1934 and a TAA member) traces his life and career as an agriculturalist, initially in the British Colonial Service, which was reputed to have recruited a total of 1,000 graduate agricultural scientists to the service (hence the title), then as an employee of Hunting Technical Services (HTS), and following that as a freelance consultant and finally involvement in a Yorkshire charity. The career involved him working across the Pacific, South Asia, Middle East, Caribbean, Eastern Europe and Africa (between 1959 and 2017).

The book is structured in an innovative way divided into the following parts: I. Starting out, II. Colonial service, III. Extra-curricula activities, IV. International consultant (HTS), V. Freelance consultant, and VI. Last lap. Within these parts, he presents bite-sized sections dealing with different aspects of life: projects, family, family pets, UK leave, *etc*. Consequently, the chronology is a bit confusing at times.

Peter was born and raised in south India before independence, where his father was employed in a manufacturing enterprise in Madras, after which the family moved to Yorkshire. After school and a BSc in agriculture at Leeds, he followed the Diploma in Tropical Agriculture (DTA) course through Cambridge and the Imperial College of Tropical Agriculture (ICTA) in Trinidad.

For pragmatic reasons, Peter had selected Fiji as his favoured posting, mainly because there was little risk of independence for a few years. Part II begins with him sailing to Fiji via the Panama Canal and New Zealand in 1959. He actually served 16 years in Fiji, at a permanent Colonial Agriculture Office post within the Agriculture Department. Initially, he was assigned to the Sigatoka Agricultural Station, then to the Karonivia Research Station and later he moved into rice projects and irrigation/drainage responsibilities, on projects supported by the Food and Agriculture Organization of the United Nations (FAO), marked by an influx of 'experts'. (In fact, I first met Peter in Suva in 1972, while I was returning to the UK from an HTS project in Thailand!).

Fiji evidently became his second home: it was where he married Valerie (whom he had met in Trinidad); their two children were born in Fiji; and their son married a Fijian and still lives in Nadi. Under his service contract, he was allowed a four-month home leave every three years (but the standard allowance of 6 weeks for sea travel each way had been replaced by 4 days air travel, just after he arrived). I liked his note on making mahogany packing cases for the return to the UK, which were then converted into furniture (I did the same with map cases from Côte d'Ivoire!). They have returned to Fiji regularly.

Part III describes the enterprises and farmers' cooperatives that Peter and Valerie set up with Fijian contacts, including handicrafts, brooms and fishing lures, and a home at the 38-acre Sovi farm.

In 1975 (Part IV), Peter joined HTS as Chief Agriculturalist, posted to the Lower Khalis Project in Iraq. HTS arranged to pay for the costs of driving from Borehamwood to Baghdad in his Volvo, which is not something to contemplate today. On his return in 1977, he was appointed Area Manager for Middle East and South Asia. These were hectic days, at the height of UK overseas development consultancy. Much of his time was spent on planes to negotiate and monitor projects in Saudi Arabia (Umm er Radhuma), Nepal, Burma, Bahrain, Kuwait, Pakistan. In Kuwait, Peter met colleagues of Ian Baillie (TAA member), who had been the HTS Team Leader of a huge soil survey project that was abandoned due to the Iraqi invasion: Ian avoided internment by showing the Iraqis his Swaziland driving licence – they thought he was from 'Switzerland' and he was allowed to go!

I joined Peter on an assignment to China as a member of the 'Gang of Eight' consultants. In the book he recounts our singing of 'Auld Lang Syne' on our departure from Yingchuan, but failed to mention that it was a week into the mission before we discovered that our Chinese hosts did not want an irrigation scheme but a mink project. As an ever-resourceful consultant, Peter said we could do this (he explained to us that he had prepared a rabbit project in Fiji: *"mink and rabbits have much in common!"*).

Peter was later promoted to Managing Director of HTS, but in the late 1980s the business prospects were deteriorating. Hunting went through rationalisation and a move to Hemel Hempstead. Ultimately he decided on early retirement.

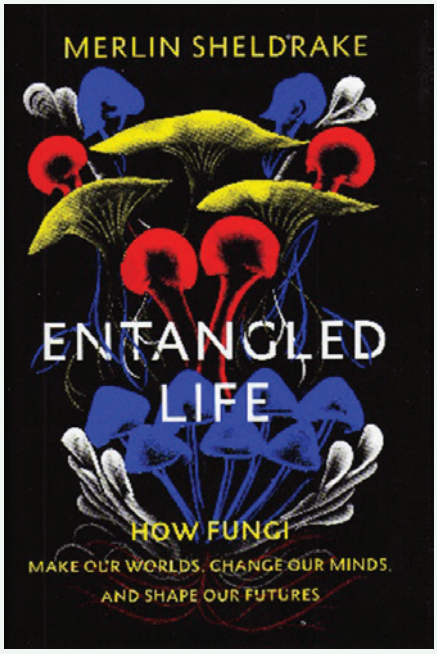
He made the ambitious decision to study for an MBA and get into institutional development consultancy. As he describes in Part V, he took a post at the Natural Resources Institute Greenwich during its privatisation, and assignments in the Pacific (multi-island development), Pakistan (water supply), Bangladesh (rural development review), St Lucia (watershed management), Guyana (Lands & Surveys Commission). He also made inputs in Moldova, Romania, Swaziland and Ethiopia, but some of the projects and clients were of rather uncertain quality.

In Part VI, Peter and Valerie became involved in a charity (PhysioNet) to provide physiotherapy equipment around the world, starting in Bosnia and culminating in winning the Queen's Award for Voluntary Service in 2017. He decided to retire from the charity that year and took this as the natural end of the book.

The book is a good read, especially for those of us who have a similar globe-trotting life. Personally, I found the insights into working with the colonial administration in Fiji enlightening, especially in the light of the current fashion of denigrating anything related to Empire. The Fiji service was a dedicated, professional body of officers who spent long periods in the field (16 years in Peter's case) and promoted new ideas from other parts of the world.

The text is well edited with very few typos. One I did like was a reference to an Eritrean who had a masters degree in 'afro-forestry' from S California! I would have appreciated a few maps in the text to guide me around the places mentioned. The photos at the end of each part add a personal touch. I was left bemused by how we ever managed to communicate in the early days, with no computers, mobiles, *etc*. Peter did mention the value of 'Tippex' (a white solution for painting on text errors, which could then be typed over and would appear unblemished when photocopied) to amend a typed contract that he was negotiating in Aden, but little of the advance in communication and travel over his 60 year career.

Keith Virgo (TAA Member)



Entangled life: how fungi make our worlds, change our minds, and shape our futures

Merlin Sheldrake, 2020

Random House, London

Hardback, 358 pages, £20

ISBN 978-0525510314

Merlin Sheldrake is a mycologist who has specialised in the study of a rainforest gentian called *Voyria*. *Voyria* is a mycoheterotroph receiving all its energy and nutrition from fungi in the wood-wide-web, and it pops up frequently in this fascinating exploration of the fungal world. Fungi are one of life's kingdoms, as broad and busy as plants and animals, but rather neglected in comparison. This neglect is puzzling as they have been around for at least 600 million years, allowed bacteria to emerge from the sea onto land to initiate the plant colonisation of Earth; and have survived all five of the planet's major extinction events which knocked out up to 95 percent of plant species.

The fungi that we see growing are fruiting bodies consisting entirely of felted hyphae, which absorb water and swell. The way that fungi make mushrooms and synchronise their emergence remains one of the central riddles of developmental biology. But our knowledge is growing rapidly, as this book informs us in riveting detail. The 'intelligence' of hyphal mycelium in detecting food sources, communicating across the network and exchanging (trading) nutrients for carbon in mycorrhizal associations with plants, are examples of how fungi actively sense and interpret their world. Fungal lives are a flood of sensory information: light, gravity and texture all make their mark on the behaviour of the mycelium, which is able to integrate the data and act accordingly – a brain-like concept.

Sheldrake delves into the concept of mycorrhizal fungi as a form of socialism – re-distributing the wealth of the forest. Supplying nitrogen and phosphorus to the neediest plant roots and receiving carbon from the photosynthesis of the strongest. In reality, there appears to be a mutualism-to-parasitism continuum in the fungal universe. Lichens are an example of symbiotic partnership (between fungi and algae, but also involving yeasts and algae as well). The fungal mycobiont enabled the algal photobiont to emerge from the water and live on the harsh environment of land – a place where neither could have survived alone.

The mind-altering effects of fungal chemicals is discussed in some detail. The hallucinogenic properties of psilocybin (from *Psilocybe* spp.) and LSD (from ergot, *Claviceps* spp.) are perhaps the best known, but other examples make for grim reading. There is the zombie fungus (*Ophiocordyceps unilateralis*) that invades carpenter ants, persuades them to climb high above the ant nest, and bite into a leaf nerve. This is the death grip, thereafter hyphae emerge and lock the ant's feet to the vegetation, then the fruiting body emerges from the ant's head and showers spores onto the nest below infecting the next generation of ants. The *Entomophthora* fungus infects flies and chemically obliges them to climb high when a gum exudes from the tongue to glue it to the vegetation before the body is consumed and the spore-producing fruiting body erupts from the dead insect.

There is so much more that the book will tell you, from myco-remediation of radioactive material at Chernobyl to mycelial furniture and modern medicines. Almost every page of this door-opening book has a similar revelation, but we are left in no doubt that there is so much more to learn and that we are standing at the entrance to one of the oldest of life's labyrinths.

Brian Sims (TAA Member)

Mailbox

Message from the Editor-in-Chief

We would like to inform members that Harry Matheson of St Andrews, who worked extensively in tropical agriculture in several countries including Malaysia and Lesotho, has sadly passed away. He was a tropical agricultural adviser and all-round sportsman known to longstanding TAA members.

A full obituary has been published in *The Courier* here: https://www.thecourier.co.uk/fp/news/local/fife/1662481/obituary-tropical-agricultural-adviser-and-all-round-sportsman-harry-matheson-of-st-andrews/?fbclid=IwAR3N-HdMTKchvh59_ah3d-kAUMj733earwwG0AHHUF6YEm7ng1Q1EgJJ3H0.

News from the regions

TAA East Anglia webinar: From the ground up: soil management in a changing climate

Keith Virgo

Keith is Convenor of the TAA East Anglia Branch.

Due to the COVID-19 pandemic, the proposed (7th) Annual TAA East Anglia seminar was postponed and held as a webinar on 29 June 2020. The event was hosted with Fauna & Flora International (FFI), in collaboration with the Cambridge Global Food Security (GFS) initiative and CambPlantsHub. Presentations were made by three speakers, who talked on ways in which soil management and cropping practices can influence climate change. They then joined a panel discussion.

Our speakers were: (i) **David Dent,** TAA and independent consultant, who presented 'An investable proposal: a plan for regenerative agriculture and carbon capture across the Eurasian steppes'; (ii) **Ed Turner** of the Cambridge University Department of Zoology, who spoke on his work to improve biodiversity in oil palm plantations: 'Good crop, bad crop …'; and (iii) **Mariska Bartlett,** a consultant with FFI, who spoke on 'Livestock and regenerative agricultural practices – taking a holistic management approach'. Each speaker was asked to provide a write-up of their talk: these follow. The entire event was recorded and can be viewed on YouTube (www.youtube.com/watch?v=dMMAU37Ujss&feature=youtu.be) or accessed via the TAA web pages (https://taa.org.uk/branches/uk-branch-reports/).

This was a novel approach for a TAA seminar, which worked extremely well. We were fortunate to have Michelle Villeneuve and her team from FFI to efficiently arrange the digital logistics of Zoom and to effectively stage manage the proceedings. The outcome and some lessons learned included the following.

- A total of 99 people registered, of which 53 actually participated (Zoom provides a complete list of registrants and attendees, including location and period logged-on).
- Participants were from a wide variety of countries (Cabo Verde, Chile, , India, Liberia, Pakistan, South Africa, Egypt, Uganda, UK and other countries in Europe, USA).
- Registrants included 18 TAA Individual Members and 21 employees of TAA Institutional Members, mostly from FFI and GFS.
- Many participants did chop and choose items to watch (as indicated by their frequent re-accessing of the webinar), but this may have reflected locally poor internet signals. Not many people seem to have stayed the whole course of 1 hour 20 minutes.
- Each non-member was duly invited to join TAA.

Feedback from TAA members who joined was very positive. Personally, I think I understood and retained more knowledge from this format than I would have at a live seminar, although in both cases, being the moderator, creates other distractions.

An investable proposal

David Dent

David Dent (TAA Member) works on the science and policy aspects of land resources for governments, international organisations, multinationals and private companies, working on every continent. He is former Director of ISRIC-World Soil information; and was awarded the Australia Day Centenary Medallion for the science behind the National Action Plan for Salinity and Water Quality.

The best soil in the world: is the Black Earth of the steppes, prairies and pampas (Figures 1 and 2). The topsoil is a metre thick with a unique, granular structure that can absorb all the rainfall and snow melt that comes its way and supplies crops with water through the long dry summer. When I took the photo, 50 years ago, this profile held more than 660 tonnes of organic matter per hectare – a bank of nutrients and energy that seemed inexhaustible. But it is not. And that is the focus of this proposal.

Figure 1. Typical chernozem (Photo: David Dent)

Agriculture and global heating

Black Earth is a special case of a big issue. Soil is the biggest brake on global heating. It holds more carbon than the atmosphere and all standing vegetation put together but, for 12,000 years, farmers have been burning off soil organic matter. The farmers are responsible for one third of greenhouse gas emissions. They have run up a carbon debt of at least 133 billion tonnes: the better the soil, the bigger the debt. The best thing they could do for the planet is to put it back again – and the best place to start is with the best soil in the world.

Thirty-five years of satellite measurements reveal dramatic change (Figure 3).

Half of the organic matter that makes the Black Earth what it is has been pumped into the air. The best soil in the world is the worst example of land degradation – not for the first time. In the 1930s, three quarters of the topsoil and 3.5 million Americans left the Dust Bowl. After that, soil conservation measures were developed (contour bunds, grassed waterways and the like) but they were never popular because of their cost and continual upkeep – and they do not deal with the root cause of soil erosion: bare soil. Annual crops give scant protection against the elements; ploughing trashes soil structure and accelerates humus loss, erosive runoff and topsoil loss in dust clouds.

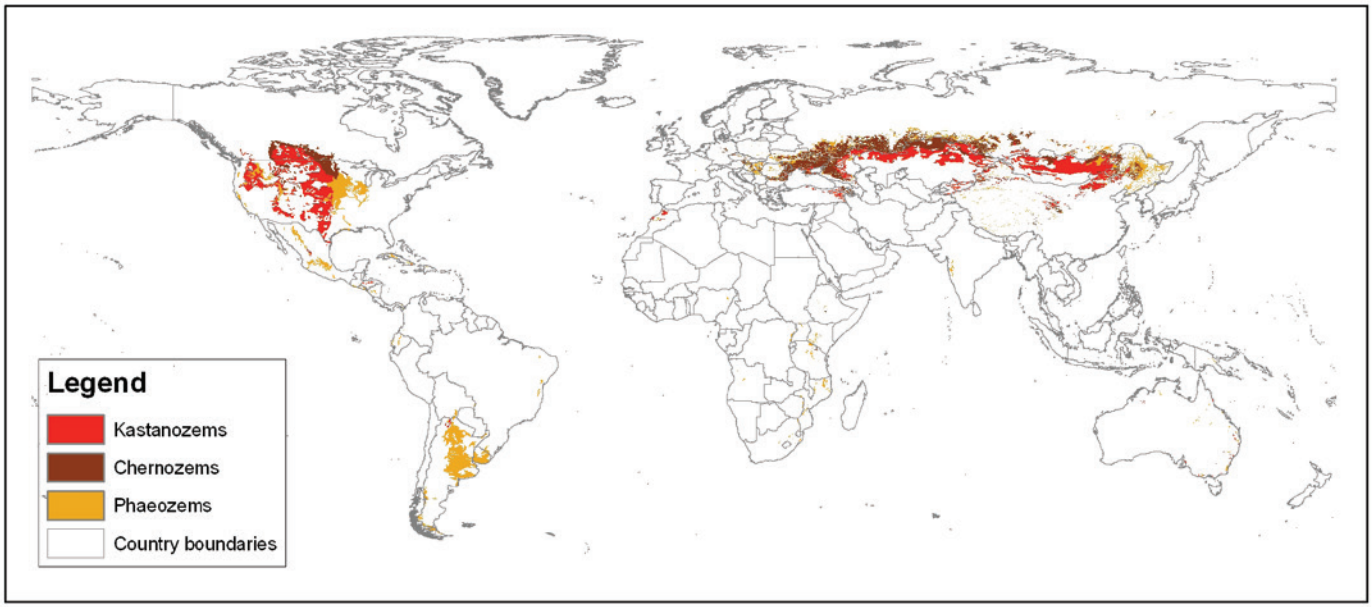


Figure 2. World map of Black Earths

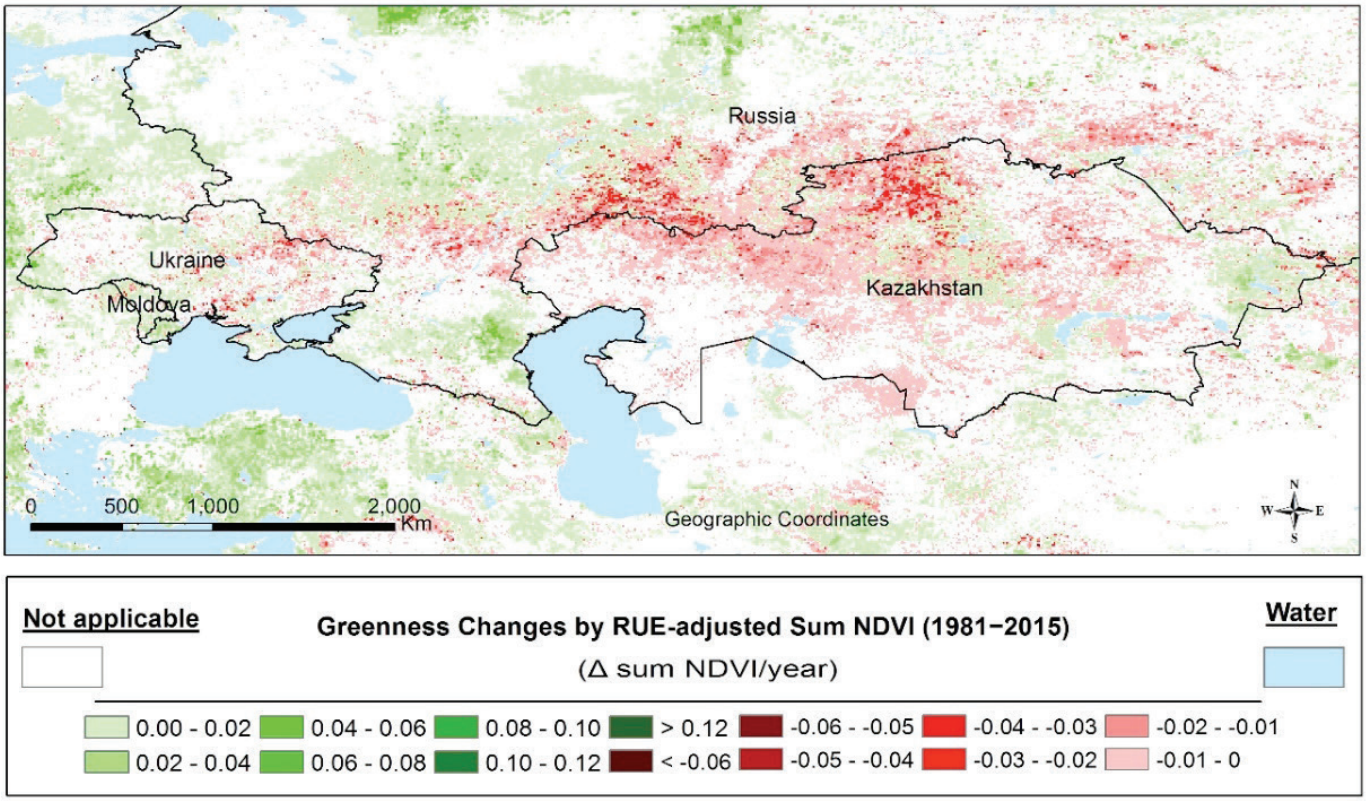


Figure 3. Trends of carbon-capture capacity across the steppes (Bai *et al*, 2015)

The pre-industrial concentration of CO_2 in the atmosphere was 280 ppm. It has been boosted beyond 400 ppm and is forcing global heating. To hold global temperature to 1.5°C above pre-industrial levels, emissions must be halved by 2030 and eliminated by 2050 (IPCC, 2018). Since 1970, soil organic carbon across the steppes has been run down by 165–192 t/ha – five times more when soil structure breaks down and the soil blows (Boincean and Dent, 2019). Taking the least of these figures, Liu's estimate of the area of Black Soils in Eurasia (3.23 million km^2, Liu *et al*, 2012) and assuming that two thirds of them are under the plough, mineralisation of soil carbon has emitted 195 Gt or 25 ppm of atmospheric CO_2 since 1970. Table 1 details the position in Russia, Ukraine, Kazakhstan and Moldova.

Table 1. Potential of conservation agriculture to cut atmospheric CO_2 and raise crop yields

Country	Total area (×1,000 km²)	Area of Black Earth (×1,000 km²)	Arable Black Earth (×1,000 km²)	Area of Chestnut Earth (×1,000 km²)	Arable Chestnut Earth (×1,000 km²)	CO_2 emissions 1970–2020 (Gt) (ppm)	Double cereal yield from 0.66 area (Mt)	Area under CA in 2015/16 (×1,000 km²)
Russia	17,098	1,348	1078	394	177	75.9 (9.7)	+27.3	50
Ukraine	603	265	233	13	11	14.8 (1.9)	+ 9.1	7
Kazakhstan	2,725	212	126	855	132	15.6 (2.0)	+4.2	27
Moldova	34	27	22	nil	nil	1.3 (0.2)	+0.6	0.6

CA = conservation agriculture; 1 Gt = 1,000 million tonnes; Mt = million tonnes; 1 ppm atmospheric CO_2 = 7.8 Gt.

Conservation agriculture does different. It embraces zero tillage, continuous ground cover by crops or crop residues, and diverse crop rotations that control weeds and pests. It arrests soil erosion by eliminating destructive tillage and the daily attacks of sun, wind and rain, and offers more planting days, less outlay on machinery, and 70 percent less fuel consumption and man hours. Wheat in rotation yields an extra tonne per hectare, so present production can be achieved from a smaller area, making room for the perennial grasses and legumes that we need to put the organic matter back into the soil. A farming system with one year in three under perennial legumes and grasses would transform annual emissions to annual carbon capture of 0.5–1.5 t/ha/year and produce all the nitrogen the crops can use – with enormous savings in the energy presently used to manufacture nitrogen fertiliser.

At present, there is no market for this green biomass. Coke of Norfolk's answer was to feed it to livestock that turn it into meat, milk and wool – and manure that doubles the benefit of crop rotation. Integrating crops and livestock would regenerate rural communities but the people and skills needed to run livestock are now hard to come by. The alternative is to turn the biomass into biogas. In the case of Ukraine, this could replace all the coal-fired power stations, leaving 22.1 million tonnes of coal in the ground every year. And the digestate is first-class organic fertiliser that will recycle all the plant nutrients and most of the organic matter.

Critical issues

Conservation agriculture has been adopted on more than 15 percent of the world's cropland: 35 percent in North America, 65 percent in South America, 75 percent in Australia, but on less than 10 million hectares across the steppes. Investment in know-how and infrastructure would help but there are two outstanding issues. The first is ownership of the problem. The people who farm the steppes do not own the land. This is surely the responsibility of the legislators of the country.

Secondly, finance is required. Corporate accounting for climate change reveals risks assessed in trillions and capital investment of USD120 trillion has been lined up to counter these risks. The cheapest finance is through Green Bonds issued by governments or municipalities that have the capacity to accomplish the work. Every bond offered has been oversubscribed. The shortfall is of credible action plans, so here is an investable proposal that will save 12 Gt of emissions a year, as much again from energy savings in the agriculture sector, and will draw down a further 0.5–1.5 Gt/year.

5-year action plan for the steppes

1. *Stop ploughing*.
2. *Do not fallow.* Instead, plant a cover crop like annual medic or a mixture of perennial legumes and grasses that can be under-sown with the summer crop.
3. *Adopt a diverse cropping system.* This is crucial. Crop rotations that include perennial legumes and grasses generate enough roots to replace the humus lost by mineralisation and control weeds and pests without resort to toxic chemicals.
4. *Integrate crops and livestock.* Alternatively, convert the biomass to biogas.
5. *Plant windbreaks against a drying climate.*

Re-equipment costs are manageable, given that the costs of replacing machinery come around all too often and less power will be needed. Given the market demand, infrastructure for a livestock industry should also be self-financing.

Biogas would be a strategic investment for Moldova and Ukraine, which presently depend on gas from Russia; and creation of a market for biomass would obviate the need for other incentives. The installed cost of a standard 500 KW biogas plant is about

USD2 million. For Moldova to replace its coal-fired power generating capacity it will need 3,200 plants (500 KW) at total cost of USD 6.4 billion; for Ukraine to phase out its coal-fired generating capacity of 21.8 GW it will need 4,000 (500 KW) plants, costing USD 87 billion at today's prices. As energy exporters, Russia and Kazakhstan face more nuanced decisions.

The finance needed is there for the asking.

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Investigating management options for more sustainable oil palm

Edgar C Turner

Edgar is a University Lecturer and Curator of Insects at the University Museum of Zoology in Cambridge. His research focusses on finding ways to manage human-modified environments more sustainably, to better support biodiversity and associated ecosystem processes. Working with industry partners, Sinar Mas Agro Resources and Technology Research Institute (SMARTRI) in Riau, Indonesia, he runs the Biodiversity and Ecosystem Function in Tropical Agriculture (BEFTA) Programme, a large-scale experiment that investigates more biodiversity-friendly management options within established oil palm plantations.

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Background

Oil palm cultivation has expanded dramatically in recent decades, with production increasing by 68 percent from 2005 from 2011 (Murphy, 2014) and palm oil now being the most widely used vegetable oil worldwide (Meijaard *et al*, 2018). The majority of production is focussed in South-East Asia, although oil palm cultivation is also increasing in Africa and Central and South America (Turner *et al*, 2011). Oil palm is the most productive vegetable oil crop per hectare (Corley, 2009; Wilcove & Koh, 2010), with highly cost-effective production (Woittiez *et al*, 2017). However, its increased area has come at a significant cost to biodiversity (Savilaakso *et al*, 2014), with a high proportion of new plantations replacing biodiverse tropical forest (Phalan *et al*, 2013; Meijaard *et al*, 2018). Compared to other vegetable oil crops, oil palm may have higher potential to support biodiversity, owing to its long life span and tree-like structure (Foster *et al*, 2011). In addition, the crop has several well-established certification schemes that are supported by companies and consumers, including the Roundtable on Sustainable Palm Oil (RSPO), which includes principles and criteria for more socially and environmentally sustainable production (RSPO, 2018). However, despite this potential, there is currently a dearth of research on the impacts of management practices within plantations, the impacts of cultivation on ecosystem processes, or direct tests of recommended management options from certification schemes (Dislich *et al*, 2017).

Methods

The Biodiversity and Ecosystem Function in Tropical Agriculture (BEFTA) Programme aims to fill some of these knowledge gaps. The Programme represents a full collaboration between researchers at the University of Cambridge and Sinar Mas Agro Resources and Technology Research Institute (SMARTRI) and is based in established industrial oil palm systems in Riau, Indonesia (Luke *et al*, 2020a; Figure 1).

The Programme currently has two key experimental projects under way. The first is investigating the effects of different understorey management treatments on biodiversity and ecosystem functioning (the BEFTA Understory Vegetation [BEFTA UV] Project). The second is investigating best management practices for the restoration of river margin areas in established oil palm plantations during replanting; a practice recommended under the principles and criteria of the RSPO (the Riparian Ecosystem Restoration in Tropical Agriculture [RERTA] Project) (Luke *et al*, 2020a). Owing to the complexity of tropical agricultural systems, both projects take an experimental approach (Fayle *et al*, 2015), allowing the interrelated impacts of different management options on biodiversity and ecosystem functioning to be assessed.

The BEFTA UV Project has established three different understorey management treatments replicated six times across the oil palm landscape, in which herbicides are: (1) applied across all areas; (2) applied

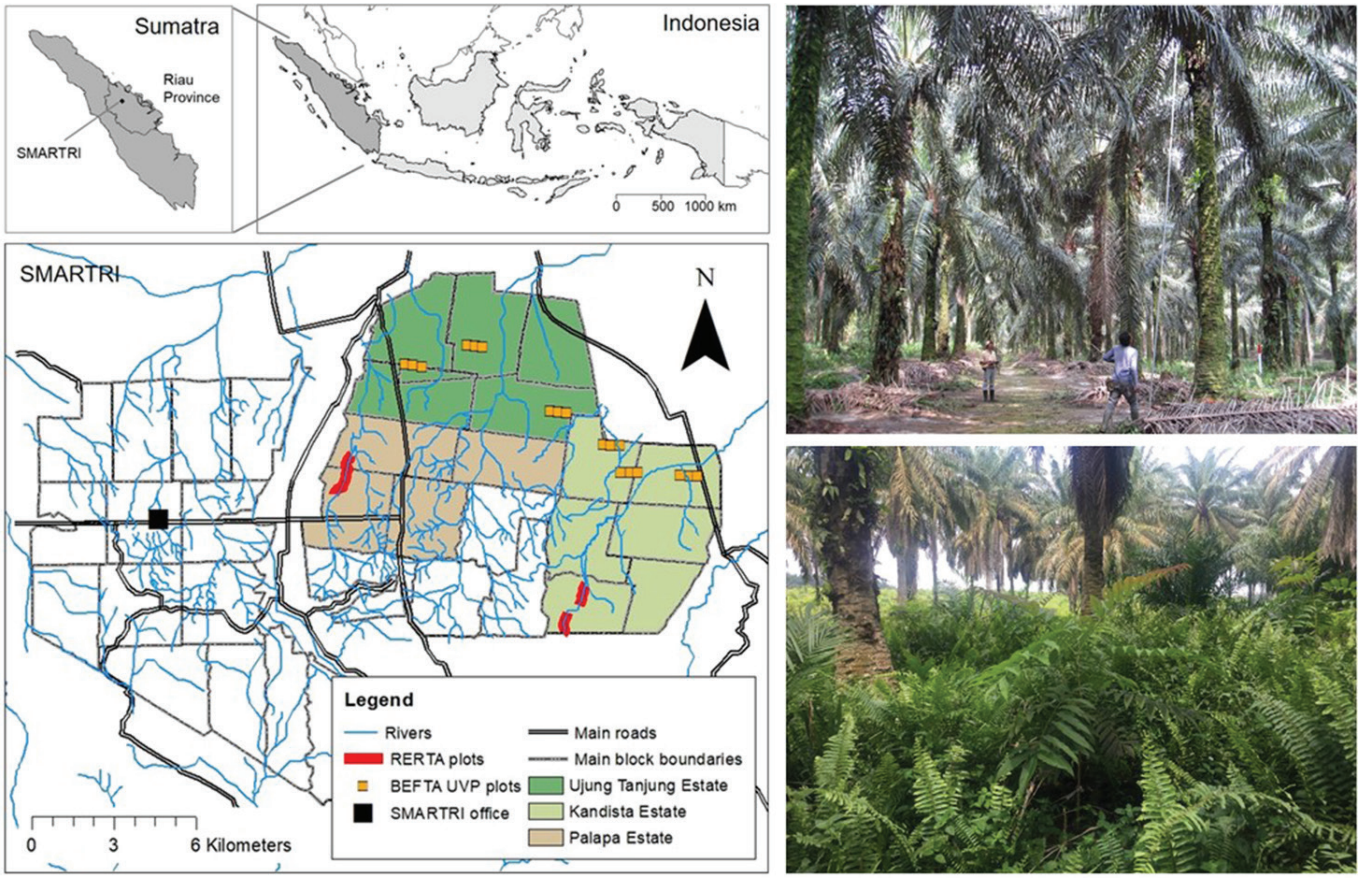

Figure 1. Location of the BEFTA Programme, with RERTA and BEFTA UV plots marked (source: Luke *et al*, 2020**). Photo top: ongoing yield monitoring at BEFTA UV. Photo bottom: a newly planted tree seedling in one of the RERTA plots** (Photos: Edgar Turner)

only along paths and around oil palm trees (current industry practice in the area); or (3) not applied, but understorey vegetation managed through manual cutting. These treatments reflect the range of practices currently used in plantations. Plots are 150 m × 150 m, allowing effects to be monitored across a range of taxa and processes.

The RERTA Project has established four different treatments across two experimental rivers. These were established during replanting of mature oil palm with young palms and consist of: (1) a control, where oil palm was replanted to the river edge; (2) a mature oil palm buffer, where mature oil palms were maintained along rivers; (3) an enrichment planting buffer, where mature oil palms were removed and the area was replanted with a mix of six native tree species; and (4) a mature oil palm and enrichment planting buffer, where mature palms were maintained and the same mix of six native tree species were planted. Each treatment is 400 m long and 50 m wide on both sides of the river.

In both BEFTA UV and RERTA, data collection followed a before-after-control-impact (BACI) design, where data were collected both before and after experimental manipulations, allowing the direct impact of the different treatments to be assessed. In both projects, we are collecting data on environmental conditions, the abundance and diversity of a range of taxa, and on levels of multiple ecosystem functions. These include: habitat structure; temperature; invertebrate groups in the canopy, understorey, soil surface and below ground; frogs; birds; rats (important pests of oil palm); (other) small mammals; plant cover and biomass; decomposition; soil physical and chemical characteristics; herbivory levels; predation rates; seed removal rates; and yield. In addition, in RERTA, we are collecting data on soil erosion, surface run-off, and within-stream conditions and communities. Taken together, these data allow a detailed assessment of the impacts of both sets of treatments on environmental conditions, biodiversity and associated ecosystem processes.

Results

The BEFTA UV Project was established in 2012 and has already yielded clear findings on the impact of changing management practices on biodiversity and ecosystem functioning (Luke *et al*, 2020a). Plots with higher herbicide application had lower levels of plant species richness, biomass and percentage cover (Luke *et al*, 2019); less habitat use by leopard cats (Hood *et al*, 2019); lower abundance of some species of spiders (Spear *et al*, 2018); lower abundance of ants (Hood *et al*, 2020a); and lower abundance and diversity of soil invertebrates

(Ashton-Butt *et al*, 2018). Several important ecosystem functions also differed between treatments, with rates of decomposition being lower in plots with less understorey vegetation (Ashton-Butt *et al*, 2018).

In other cases the differences between understorey vegetation management practices were less clear. For example, there were no differences in dragonfly abundance or diversity (Luke *et al*, 2020b), rat abundance (Hood *et al*, 2019), nest occupation by *Macrotermes gilvus* (an abundant and important termite in oil palm), or the abundance of snakes, ants and spiders inhabiting these nests between treatments (Hood *et al*, 2020b). Rat damage to palm fruits (Hood *et al*, 2019) and soil characteristics, including pH, organic carbon, water content, carbon/nitrogen ratio, and nitrogen, potassium and phosphorous content (Ashton-Butt *et al*, 2018), also did not differ between treatments. In some cases, small differences may have been masked by the impact of changing rainfall patterns across the study period and particularly the effect of the 2015–16 El Niño event (Santoso, McPhaden, & Cai, 2017). For example, we found that both decomposition and predation levels were affected by the interacting effects of rainfall levels at the time of recording and in the preceding months (Eycott *et al*, 2019). Analyses are still ongoing for other variables within the BEFTA UV Project. The RERTA Project was only established in 2017 and so findings are still in their early stages (Luke *et al*, 2020a).

Conclusion

The BEFTA Programme is founded on a strong and long-term collaboration between university and industry researchers. This has enabled us to experimentally assess the impacts of a range of industry-relevant management practices on biodiversity and ecosystem processes within the oil palm system. Although the projects are still ongoing, our findings demonstrate the wide-ranging impacts that management practices can have on biodiversity and processes within oil palm ecosystems. Although it is clear that oil palm contains much lower biodiversity than the forest it has replaced (Savilaakso *et al*, 2014), a developing body of evidence is demonstrating great potential for more biodiversity-friendly management practices within the oil palm system. With oil palm now covering 19.5 million hectares worldwide (Descals *et al*, 2020), the potential of such approaches to benefit wider biodiversity and ecosystem processes within tropical agricultural landscapes is substantial and growing.

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Livestock and regenerative agricultural practices – taking a holistic management approach

Mariska Bartlett

With a PGDip in Animal Science, and based in South Africa and Italy, Mariska is passionate to implement regenerative agricultural practices to improve soil health and biodiversity conservation. She is currently a consultant to Fauna & Flora International on regenerative agricultural solutions and possible livestock interventions for conservation. She is a member of TAA.

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When it comes to conservation, cattle are either at the bottom of the solution list or are made the culprits on the problem list. This is especially apparent where desertification or climate change is the topic. In recent years, however, the likes of Alan Savory, Gabe Brown, Allen Williams and others have advocated that cattle are the *only* solution to reverse desertification and climate change. I therefore want to emphasise that traditional perspectives of cattle being the culprits need to change.

Ruminants have been around for millennia. If we look at the history of North America, millions of bison were recorded over much of the west. These beasts roamed in massive herds, tightly bunched and constantly moving. Trampling the ground as they were grazing and in essence fertilising it with their dung and urine. This created the vast grasslands or prairies that were part of the landscape until industrial agriculture came along. Same thing in Africa, millions of springbuck were recorded by early settlers moving over an area called the Karoo, which is basically an arid to semi-arid area in South Africa today. This Karoo region was traditionally covered with grass, today people will only really farm with small ruminants as they understand the 'carrying capacity' to be very low. Those farmers that were brave enough to adopt the ultra-high-density grazing with cattle in this region in the last couple of decades have seen enormous recovery to its previous grassland glory.

This brings me to the solution; cattle are the most wonderful tool conservationists and farmers have. These infamous beasts, if managed correctly, have the ability to not only recover soils but actually regenerate whole ecosystems. Plants, as we know, have this wonderful thing that they do that sustains all life on earth – photosynthesis. However, it goes deeper than this, plants store carbon in the soil through their roots. This means plants can take carbon out of the atmosphere (yes from there, where it is currently in abundance and causing all the havoc that we know) and store it back in the soil. Dr Christine Jones, a globally recognised soil scientist explains how this works in much detail in her papers available on her website. One of the biggest contributors to atmospheric carbon is industrial agriculture and factory farming. This is where cattle got their bad name. When they are put in an unnatural environment overcrowded with no grazing and fed high-grain diets that have been transported thousands of kilometres, they are indeed part of the problem. However, it is not the cow it is the *how*, as beautifully put by the book *Sacred Cow* by Diana Rodgers. When we manage cattle in the way that herbivores naturally behaved over the past couple of millennia, *ie* tightly bunched, grazing quickly over an area and moving constantly, grasslands become regenerated and carbon gets sequestered back into the ground.

Desertification was created due to mismanagement of areas, which usually involved overgrazing. A common misconception is that overgrazing is a factor of too many animals; however, overgrazing is rather a factor of time. Overgrazing happens when a plant is grazed again before it has had time to recover from the previous grazing. Cattle, as most ruminants, are highly selective grazers and will only graze the most palatable species if allowed. Therefore, if animals are left in an area for too long they will go back to the most palatable species as soon as they shoot up again. That plant will not recover again and desertification is the result. It is thus essential to control the time. By this means the traditional 'carrying capacity' can often be quadrupled without damaging, but instead regenerating the rangeland if managed correctly.

Cattle cannot be removed from the food chain, alas they are essential to the food chain. Both for humans and the natural ecosystems. Therefore, in conclusion, cattle are essential to the solution to reverse desertification and climate change.

TAA news

The Zambian Institute of Agriculture (ZIA)

CP Kapembwa (ZIA President)

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Overview

The Zambian Institute of Agriculture (ZIA) was founded in 2007 by Dr Christopher Pannet Kapembwa, who is the TAA coordinator for Zambia and the Southern Africa region. The institute currently has 27 students studying for a diploma in agriculture. The ZIA has also been appointed as a key partner of the Ministry of General Education to implement agriculture production unit programmes nationally in secondary schools and primary schools.

Vision

The vision of the ZIA is to nurture leaders for the transformation of agriculture. The institute has two major programmes:

1. ***Empowerment through community agriculture:*** working with local farmers in rural areas, providing training in sustainable agriculture and supporting farmers to access start-up inputs; and
2. ***A two-year diploma in general agriculture:*** providing education towards a diploma in conjunction with the Monze College of Agriculture, a government college.

Benefits of membership of the TAA

The institute has recognised several benefits from the TAA, going back to the introduction of the academic programme in 2017. The ZIA advertised for volunteers to teach, but despite many expressing willingness, unfortunately the institute was unable to cover the travel costs of teachers at its inception. Since then, many of the volunteer teachers have continued their collaboration. The ZIA has continued to receive many technical books through TAA and the partnership with Afrinspire, of Cambridge, introduced by TAA, is a major benefit. We have received computers from Afrinspire and two students are currently being sponsored by the organisation. Ian Sanderson, the director of Afrinspire, is now the ZIA's UK contact. The institute's visiting adjunct professor is Dr Ravindra Joshi, the TAA convenor for the Pacific region, and he was linked to the ZIA through TAA. The institute has enjoyed numerous additional intangible benefits from its association with TAA since inception.

Looking ahead

The ZIA still rents a centre for its activities and operations. However, it has acquired land on which it aims to build using shipping containers. Drawings for the building have been completed and the ZIA is waiting to buy the used containers for construction. The institute is keen to continue engaging TAA members in various activities related to teaching and its other programmes, and also through Zoom meetings. The institute is embarking on a number of agricultural research programmes in the context of its academic programme (*eg* maize and tomato seed development). This would be a great venture in which to partner with interested TAA members, so many of whom are researchers.

ZIA students (Photo: C Kapembwa)

The local community (Photo: C Kapembwa)

New *Ag4Dev* format in 2021: smaller but better

Dear Readers,

From the 2021 Spring issue, as agreed with the TAA Executive Committee, *Ag4Dev* will have a new format. This is intended to continue to build on the process implemented over recent years to improve design, length and quality and be another step in the transition from a newsletter to a quality professional journal. This is with a view to making *Ag4Dev* more economical to produce while being more appealing to a wider set of partners and readers. It will seek to give TAA members a regular update on key issues and priorities in agriculture for development and will continue to be a space in which to publish their work, opinions and experience.

The journal will be shorter, at around 48 pages plus covers, and will include the following: Editorial; Opinions page; Mailbox; Bookstack; up to four items of News from the field and Newsflashes and 6–8 articles of 3,000–3,500 words. Upcoming events and TAA news will continue to be available online. Of course, there is flexibility depending on the number of Mailbox items or Opinions received, the number and length of articles received, and so on.

However, the overall aim is to make the shorter, focussed journal issue look more professional, with a wider reach that can well serve the membership and increase influence on agriculture for development research, policy, financing and programmes.

Reader feedback on this change to your Journal is very welcome to inform future issues! Please address your reactions to the Editor-in-Chief.

Karim Hussein

(*Ag4Dev* Editor-in-Chief)

Upcoming events

A full listing of current and future events of interest to readers of the journal can be viewed at the TAA Website: https://taa.org.uk/events-7

While the following events were indicated as confirmed at the time of going to press, in view of the uncertainty regarding COVID-19, several of the events may not take place. Please check on the event website for the latest information.

The Cash Crop Revolution, Colonialism and Legacies of Spatial Inequality: Evidence from Africa

Date: 1 December 2020

Details: A seminar organised by the Economics Section of Wageningen University, with Philip Roessler and Yannick Pengl presenting their findings on the long-term effects of colonial cash crop extraction in Africa. Their conceptual framework focusses on the dynamic, interactive effects of geography, trade and colonialism in the context of Africa's structural change from the slave trades to export agriculture.

Further information: www.wur.nl/en/Calendar-1/show/Philip-Roessler-Yannick-Pengl-The-Cash-Crop-Revolution-Colonialism-and-Legacies-of-Spatial-Inequality-Evidence-from-Africa.htm

Venue: Online platform to be confirmed.

TAA Annual General Meeting

Date: 3 December 2020

Details: The event (online) will be chaired by Andrew Bennett, our President. This will include the Chairman's Report, updates on the finances of the Association and the Tropical Agriculture Award Fund (TAAF), followed by the formal award of 2020 TAA Honours, including the 'Development Agriculturalist'. It is intended that there be a speech and a chance for members to share ideas informally online.

The Farmers Club: next year perhaps! (Photo: Farmers Club website)

We welcome members, spouses and friends to join the event. Dress will be informal!! For ZOOM links

and further details, contact the General Secretary as below.

[The AGM will be preceded by a separate ExCo ZOOM meeting 17.00 to 18.55 GMT].

Further information: TAA website – https://taa.org.uk/events/taa-2019-annual-general-meeting-honours-and-reunion

Venue: Online via Zoom.

World Soil Day

Date: 5 December 2020

Details: World Soil Day (WSD) is held annually on 5 December as a means to focus attention on the importance of healthy soil and advocating the sustainable management of soil resources. World Soil Day 2020 (#WorldSoilDay), and its campaign 'Keep soil alive, Protect soil biodiversity', aims to raise awareness of the importance of maintaining healthy ecosystems and human wellbeing by addressing the growing challenges in soil management, fighting soil biodiversity loss, increasing soil awareness and encouraging governments, organisations, communities and individuals around the world to commit to proactively improving soil health.

Further information: http://www.fao.org/world-soil-day

Venue: Online and dispersed events.

4th International Conference on Global Food Security

Date: 20 September to 29 December 2020

Details: The 4th International Conference on Global Food Security addresses the topic of food security at all spatial levels from local to global, and from an interdisciplinary and systemic food systems perspective. It aims to better understand environmental, nutritional, agricultural, demographic, socio-economic, political, technological and institutional drivers, costs and outcomes of current and future food security. Interactions with contextual factors, including climate change, urbanisation, greening the economy and data-driven technologies, will be central. The conference addresses the triple burden of malnutrition: hunger, micronutrient deficiencies and obesity. It explores the state of the art of interdisciplinary insight, addresses the trade-offs that occur – and synergies that can be sought – in transforming food systems.

Further information: www.icrisat.org/event/4th-international-conference-on-global-food-security-achieving-local-and-global-food-security-at-what-costs

Venue: Online webinars.

Oxford Real Farming Conference

Date: 7–13 January 2021

Details: The conference has developed over the last 11 years to become the unofficial gathering of the agroecological farming movement in the UK, including organic and regenerative farming, bringing together practising farmers and growers with scientists and economists, activists and policy makers in a two-day event every January. Working with partners, the conference offers a broad programme that delves deep into farming practices and techniques as well addressing the bigger questions relating to our food and farming system. In 2021, as a result of COVID-19, ORFC will host an online, global event with speakers and delegates from six continents.

Further information: https://orfc.org.uk/about

Venue: Online event.

Soil Erosion Research under a Changing Climate

Date: 10–15 January 2021

Details: This event is sponsored by the American Society of Agricultural and Biological Engineers (ASABE) and co-sponsors include the University of Puerto Rico – Mayaguez, the USDA-Agricultural Research Service, the USDA-Natural Resources Conservation Service, and the USDA-Forest Service. The meeting includes three days of plenary, oral and poster sessions, a day visit to the civil engineering and agricultural and biosystems engineering departments at the University of Puerto Rico – Mayaguez to learn of their related research projects, and a day's field tour of local areas with erosion and water quality concerns and/or research.

Further information: TAA website – https://taa.org.uk/events/soil-erosion-research-under-a-changing-climate-research-symposium

Venue: Punta Borinquén Resort, Aguadilla, Puerto Rico.

Intercropping for Sustainability

Date: 19–20 January 2021

Details: The conference will bring together the intercropping community to showcase the latest findings on intercropping research from the lab and

the field and encourage debate on uptake and best practice. Topics to be covered will range from basic research to the practical application of intercrops.

Further information: www.cvent.com/events/intercropping-for-sustainability/custom-18-d39d1013986047abaf1a13438000920f.aspx

Venue: Online via Zoom.

Power on Your Plate: All-Africa Summit on Diversifying Food Systems

Date: 25–28 January 2021

Details: The All-Africa Summit is organised by the World Vegetable Centre and will examine ways to diversify food systems, including incorporating African traditional vegetables, to increase health, nutrition, and wealth and to ensure a healthier Africa now and into the future. Power on Your Plate is a call for action: for increased investment, regional R&D programmes, and policies to promote traditional vegetables at national and regional levels and fully integrate traditional vegetables into Africa's food systems.

Further information: TAA website – https://taa.org.uk/events/power-on-your-plate-all-africa-summit-2

Venue: Gran Melia, Arusha, Tanzania.

Capacity-Building for Improving Agricultural Land Productivity and Water Quality

Date: 1–5 February 2021

Details: This is a training and education event hosted at the Institute of Environmental Sciences, Kazan Federal University, in collaboration with Rothamsted Research. The objectives are to:

1. To generate exchange of research experience, tools and ideas between British and Russian early career scientists;
2. To demonstrate, practically, Russian state-of-the-art erosion and sedimentation monitoring to UK participants;
3. To present and demonstrate UK state-of-the-art sediment source fingerprinting data processing procedures; and
4. To present UK state-of-the-art knowledge on the efficacy of water quality protection measures.

Further information: www.rothamsted.ac.uk/events/capacity-building-improving-agricultural-land-productivity-and-water-quality

Venue: Kazan Federal University, Kazan, Tartastan, Russia.

Plant Health Summit for Future Leaders

Date: 2–4 March 2021

Details: The summit is targeted at early career professionals in their first 10 years of work in any aspect of plant health, from all relevant sectors. The meeting will be addressed by keynote speakers, including Lord Gardiner, Minister for Rural Affairs and Biosecurity, and Professor Nicola Spence, chief plant health officer, Defra (Department for Environment and Rural Affairs).

Further information: https://planthealth.rsb.org.uk

Venue: Meeting to be held virtually.

All-Africa Horticulture Congress

Date: 29 March to 1 April 2021

Details: The main objectives of the 2021 AAHC are to: (i) provide horticulture professionals, researchers, young scientists, entrepreneurs and horticulture actors with a platform where they can share the results of research, innovations and actions; (ii) present and promote the potential of African horticulture to the world; and (iii) build a network of technical cooperation between professionals of African horticulture and strengthen the exchanges with the rest of the world.

Further information: www.aahc2020.org

Venue: Dakar, Senegal.

TAA Ralph Melville Memorial Lecture

Date: 23 March 2021

Details: The event will be hosted by the TAA and the All-Party Parliamentary Group on Agriculture and Food for Development, chaired by Lord Cameron of Dillington. The lecture will be presented by Prof John Morton, Professor of Development Anthropology in the livelihoods and institutions department of the Natural Resources Institute, University of Greenwich, who will speak on the subject of the 'Future of Developing-Country Livestock Producers as the Rich World Turns Away from Meat'. A buffet and refreshments will be served after the lecture.

Further information: TAA website – https://taa.org.uk/events/taa-ralph-melville-memorial-lecture

Venue: Attlee Suite at Portcullis House, Houses of Parliament, London.

Hortiexpo Africa 2021

Date: 9–11 April 2021

Details: The event is an international trade show on horticulture-floriculture and pre-harvesting. The exhibition, which attracts exhibitors from around 16 countries, will be held in conjunction with Agro-FoodPack.

Further information: www.mxmexhibitions.com/hortiexpoafrica/index.html

Venue: Sarit Expo Centre, Nairobi, Kenya.

Entosci20

Postponed: 29 April 2021

Details: Entosci20 is the entomological conference for schools and colleges, where the delegates are the pupils themselves, aged 14 to 18 years.

Further Information: www.royensoc.co.uk/event/entosci20

Venue: Harper Adams University, Shropshire, UK.

Shaping the Future for Pollinators: Innovations in Farmed Landscapes

Date: Currently planned for 29 June 2021

Details: A three-day conference from the Association of Applied Biologists, the British Ecological Society and the Royal Entomological Society. The conference aims to determine how we can shape farmed landscapes to make them resilient to future challenges such as climate change.

Further information: www.cvent.com/events/shaping-the-future-for-pollinators-innovations-in-farmed-landscapes/event-summary-7b5f5b6602194adc8286f8418521b3a5.aspx

Venue: Copthorne Hotel, Slough, UK.

8th World Congress on Conservation Agriculture – Field Day

Date: 2 July 2021, but subject to change, to coincide with the postponed 8WCCA, scheduled for mid-2021

Details: This is the Field Day of the 8th World Congress on Conservation Agriculture (8WCCA). The local Swiss No-Till organising committee has prepared a 'Save the date' initial flyer at https://taa.org.uk/wp-content/uploads/2019/07/Swiss_CA_FieldDay_2019.pdf.

Venue: Witzwil, Gampelen, Switzerland.

Summer School Green Genetics

Date: 23–27 August 2021

Details: Wageningen University offers this free Summer School to undergraduate students to provide a comprehensive insight into a Master's degree in plant science, biotechnology or bioinformatics. The programme consists of academic lectures and company visits.

Further information: Information flyer: www.wur.nl/upload_mm/4/d/0/cb0808c4-0a7c-4bf0-815d-2983a25101d4_Flyer%202020%20Summer%20School%20Green%20Genetics.pdf; website: www.wur.nl/en/show/Summer-School-Green-Genetics.htm

Venue: Wageningen Campus, Netherlands.

International Grassland and Rangeland Conference

Date: Postponed until 23–29 October 2021

Details: The theme of the congress is 'Sustainable use of Grassland and Rangeland Resources for Improved Livelihoods'. The aim of the congress will be to promote the interchange of scientific and technical information on all aspects of grasslands and rangelands, including grassland and rangeland ecology; forage production and utilisation; livestock production systems; wildlife, tourism and the multi-facets of grassland and rangeland; drought management and climate change in rangelands; and pastoralism, social, gender and policy issues and capacity-building, extension and governance.

Further information: http://2020kenya-igc-irc.rangelandcongress.org

Venue: Kenyatta International Convention Centre, Nairobi, Kenya.

Tropical Agriculture Association
Registered Charity No. 800663

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If you are reading someone else's copy of *Agriculture for Development* and would like to join, or would like to encourage or sponsor someone to join, then please visit our website at https://taa.org.uk

Step 1. Click on **<Become a member>** at top right of the webpage. This will take you to **<Membership: How to Join, Renew or Upgrade>** (https://taa.org.uk/membership-levels)

Then follow the instructions, taking note of the different membership categories and the benefits offered by each.

Membership categories, benefits and annual subscriptions			
Full Individual Member Receive printed copies of *Agriculture for Development* and access to all Members areas on the website	GBP 50	**Institutional Member** Two printed copies of *Agriculture for Development*, promotion on website and other benefits (https://taa.org.uk/benefits-of-institutional-membership)	GBP 120
Online Individual Member As for Full membership but with access only to the online version of *Agriculture for Development*	GBP 40	**Introductory Member** Available primarily to those aged under 35 years. Limited benefits and no access to members-only areas of the website	Free
Student Member Benefits as for Online Members, open to *bona fide* students	GBP 15	**Awardee Membership** Special one year's membership for people on TAAF assignments	Free

Step 2. Having selected the category that you wish to join under, at the bottom of the page click on the appropriate **SELECT** button. This will take you to the application form, which involves a three-stage process:

- **Payment method**. Decide on your preferred payment system. We recommend an annual bank standing order or a PayPal recurrent annual payment facility. Click the radio button next to your preferred option.
- **Billing address and personal data**. Please provide basic data about yourself, contact information, your experience and qualifications. We use this information according to our privacy policy (https://taa.org.uk/who-we-are/privacy-policy). Please add 'Gift Aid' if you are a UK taxpayer (you must include your Gift Aid donations on your UK tax returns).
- **Payment**. This appears at the foot of the page. A PayPal button will be visible if you selected PayPal at stage 1 above, or a bank standing order form if that was your preference.

Step 3. You will receive an email confirming your application. Our Membership Secretary will need to approve your membership application. You will then have access to all facilities of the membership category for which you applied. If you have any problems, please email the Membership Secretary: membership_secretary@taa.org.uk

Guidelines for Authors
Agriculture for Development

The editors welcome the submission of articles for publication that are directly related to the aims and objectives of the Association. These may be short communications relating to recent developments and other newsworthy items, letters to the editor, especially those relating to previous publications in the journal, and longer papers. It is also our policy to publish papers, or summaries, of the talks given at our meetings.

Only papers written in English are accepted. They must not have been submitted or accepted for publication elsewhere. Where there is more than one author, each author must have approved the final version of the submitted manuscript. Authors must have permission from colleagues to include their work as a personal communication.

Papers should be written in a concise, direct style and should not normally exceed 3,000 words. Please use Times New Roman font, 12-point size for the text body, with lines single spaced and justified, and pages numbered. Tables, graphs and photographs may take a further 1 page plus, but we try to keep the total length of each paper to 3–4 pages of the journal. Good-quality photographs are particularly welcomed, as they add considerably to the appearance of the contents of the journal. We prefer high-resolution digital images (*ie* separate from the Word file).

Format

- An informative title not exceeding 10 words.
- Authors listed, usually with first name and surname.
- A short biographical note about each author is included, preferably with a photograph. If still working, indicate your position and email address. If retired, your previous job (*eg* formerly Professor of Agriculture, ABC University).
- For papers longer than 1,500 words, a short abstract (summary) of 150–200 words.
- A short introductory paragraph is useful describing, succinctly, the current state of work in the relevant field.
- Système International (SI) units should be used. Others units should be related to SI units at the first mention.
- No full stops should be used with abbreviations such as Dr or Prof, or *eg*, *ie*, *status quo*, *viz* and *inter alia*. Acronyms and initialisms such as GFAR, FAO, IFPRI and GDP do not have full stops or spaces between the letters. Acronyms and initialisms should be spelled out in full at their first mention.
- Thousands should be indicated by a comma and no space, *eg* 12,400.
- Use 's' rather than 'z' (*eg* fertiliser, organisation, mechanisation).
- Commercial equipment and products referred to should name the product and company, but addresses should be omitted.
- State any statistical methods used, *eg* analysis of variance (ANOVA), and ensure that the analysis method chosen is appropriate for the data. Data tables presenting, for example, mean values should include the appropriate standard errors (SE) and degrees of freedom (DF).
- Results should be presented in an orderly fashion and make use of tables and figures where necessary.
- Discussion should focus on the work presented and its relationship with other relevant published work.
- Sources of funding should be listed in the acknowledgements.

References

- Please do not use footnotes in the text.
- Key references should be cited, but these should be kept to a minimum.
- Only papers accepted for publication or published may be cited.
- In the text, cite by author's surname and date – (Waller, 2009) or Waller (2009). Use '&' between names of two authors; use *'et al'* for three or more authors.
- At the end of the paper, give full details of references in alphabetical order and in the journal style as per the examples below.
- Personal communications in the text should be cited as: initials, name, affiliation and/or location, personal communication.

Journal (article): Bajželj B, Allwood JM, Cullen JM, 2013. Designing climate change mitigation plans that add up. *Environmental Science & Technology*, 47(14), 8062-9.

Journal (online): Osbourne K, Dolman AM, Burgess S, Johns KA, 2011. Disturbance and the dynamics of coral cover on the Great Barrier Reef (1995-2009). PLoS ONE. https://doi.org/10.1371/journal.pone.0017516

Book: Brammer H, 2012. *The physical geography of Bangladesh*. Dhaka, Bangladesh: University Press.

Book (edited): Fuglie KO, Sun Ling Wang, Ball E, eds, 2012. *Productivity growth in agriculture: an international perspective*. Wallingford, UK: CAB International.

Book (chapter): Warner K, 1997. Patterns of tree growing by farmers in eastern Africa. In: Arnold JEM, Dewees PA, eds. *Farms, trees & farmers: responses to agricultural intensification*. London: Earthscan Publications, 90–137.

Conference proceedings (published): McIntosh RA, 1992. Catalogues of gene symbols for wheat. In: Miller TE, Koebner RM, eds. *Proceedings of the Seventh International Wheat Genetics Symposium*, 1987. Cambridge, UK: IPSR, 1225–1323.

Agency publication: Grace D, Jones B, eds, 2011. *Zoonoses (Project 1) Wildlife/domestic livestock interactions*. A final report to the Department for International Development, UK.

Dissertation or thesis: Lenné JM, 1978. *Studies of the biology and taxonomy of* Colletotrichum *species*. Melbourne, Australia: University of Melbourne, PhD thesis.

Online material: Lu HJ, Kottke R, Martin J, Bai G, Haley S, Rudd J, 2011. Identification and validation of molecular markers for marker assisted selection of *Wsm2* in wheat. In: Plant and Animal Genomes XIX Conference, abstract W433. http://www.intl-pag.org/19/abstracts/W68_PAGXIX_433.html. Accessed 20 April 2012.

Tables

- Self-explanatory with an appropriate legend above the table, without abbreviations.
- Number with Arabic numerals, *eg* Table 2.
- Refer to tables in the sequence in which they are presented.
- Use superscript lower-case letters, *eg* a, b and c, for footnotes.

Figures

- Self-explanatory with an appropriate legend below the figure, without abbreviations.
- Number in a separate series from the tables.
- Use Arabic numerals, *eg* Figure 2.
- Subdivisions within figures should be labelled with lower-case letters, *eg* a, b and c.
- The author *must* obtain permission to reproduce illustrations (graphs, tables, images) that have already been published.
- Photo captions must include the photographer's name (and affiliation), and figure captions should include the source (unless original).

Submission

Your paper should be submitted ready for editing and publication.

Accepted text file types: Word (.doc or .docx), rich text format (.rtf) or postscript (.ps) only.

Accepted figure file types: .tif, .eps, .jpg or .pdf.

No lecture notes or PowerPoint presentations, please. If the paper is a presentation from a TAA meeting, please let us have it or as soon as possible afterwards so that there is no last-minute rush in trying to meet the next publication deadline.

Send submissions via email to editor_in_chief@taa.org.uk, preferably in an attached file.

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March 2020

Climate-resilient village plan (Photo: David Radcliffe)