Agriculture *for* Development

Tropical Agriculture Association

No. 25, Summer 2015

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 3000 words using 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.

Format

- An informative title not exceeding 10 words.
- Authors listed, usually with first name and surname.
- A short biographical note about the author(s) is included, preferably with a photograph of the author(s). 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 1500 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 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 such as GFAR, FAO, IFPRI, and GDP do not have full stops or spaces between the letters. Acronyms should be presented 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

- Key references should be quoted, 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) in chronological order. Use '&' between names of 2 authors; use '*et al*' for 3 or more authors.
- At the end of the paper, give full details of references in the journal style as per the examples below.
- Personal communications in the text should be cited as: initials, name, brief address, personal communication.

Journal (article): Uphoff N, Kassam AH, 2009. System of Rice Intensification. *Agriculture for Development* **6**, 10-14.

Journal (online): Osborne K, Dolman AM, Burgess S, Johns KA, 2011. Disturbance and the dynamics of coral cover on the Great Barrier Reef (1995–2009). *PLoS ONE* http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0017516

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

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, 1225–323.

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 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 in the text, *eg* Figure 2.
- Subdivisions within figures should be labelled with lower-case letters, *eg* a, b and c

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 or .PDF.
No lecture notes or PowerPoint presentations, please. If the paper is a presentation from a TAA meeting, please let us have this 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 e-mail to coordinator_ag4dev@taa.org.uk preferably in an attached file.

Copyright

Cover images

High quality colour images, suitable for the cover of *Agriculture for Development*, are welcomed and should be sent to the Coordinating Editor (coordinator_ag4dev@taa.org.uk)

Cover photograph: Chirtala Market, Ernakulam District, Kerala, India, with Elephant Foot Yams (Amorphophallus paeoniifolius) in the foreground (Photo: Keith Virgo)

Contents

The 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 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

Ag4Dev25, an Open Issue

A former Director of Lumle Agriculture Centre in Nepal, a senior research adviser at DFID and the EC, and Assistant Director General of Bioversity International (previously IPGRI) in Rome, Paul now divides his time between paid work as a consultant and unpaid work as the Coordinating Editor of Ag4Dev.

This is an 'open' issue of our journal, in which we aim to publish as many papers as possible by members of our Association. We are therefore pleased to include papers by Karim Hussein (*Implications of urbanisation for agricultural value chains and markets in sub-Saharan Africa: A review*), Rob Brook and colleagues at Bangor University (*Assessing agroforestry adoption in tribal areas of Maharashtra, India*), and Eilidh Forster, a student at Corporate Member Bangor University (*Enchanting entrepreneurs in the Philippines*). Elizabeth Warham and Jim Watson have researched the TAA's archives to compile a fascinating account of the formation and evolution of our Association entitled *Thirty five years of history for the Tropical Agriculture Association*. Also included is the 10th Hugh Bunting Memorial Lecture, *Going the extra mile: helping smallholder farmers obtain the knowledge they need to lose less and grow more*, which was presented by Trevor Nicholls, CEO of CABI.

This issue also contains several reports and papers from TAA Regional seminars, including two papers from the SW Group (*The population and demography dimension: an 'Elephant in the Room'?* by Brian Wood, and John Wibberley's keynote paper *Overview of trends and issues in dairying globally*); two papers from the East Anglia Group's seminar on Food Security (*Why we need to address food demand*, by Bojana Bajželj, and *Mobilising greater crop and land potentials: replacing the faltering production engine*, by Amir Kassam and Gottlieb Basch); and two papers from the London and SE Group's Curry Club meetings (*Linking African smallholder coffee farmers to international supply chains: a case study in Tanzania*, by Richard Bliault, and *Genes, Jeans and Bollworms - the changing world of cotton*, by Graham Matthews). There is a short report on a new TAA Regional Group for Scotland, which is currently being established under the leadership of John Ferguson.

We are pleased to welcome our latest Corporate Member, ECHO East Africa. ECHO is an American NGO with a global network of 10,000 members in 160 countries. A short note on ECHO is included under *Corporate Members' Page*.

A new feature, *Opinions Page*, is introduced in this issue. It comes with the warning that "the views expressed here by individual members do not necessarily reflect those of the editors or the Tropical Agriculture Association", so members are encouraged to submit their opinions on relevant issues, sensitive or otherwise. The first contribution is Charles Bevan's opinion on the FAO, *Fiat panis - quo vadis*?

Survey of readers of *Ag4Dev*

The questionnaires submitted during the recent survey of readers of *Ag4Dev* have been analysed by Bruce Lauckner, and the report on the survey is included under *TAA Forum*. Whilst most readers are very satisfied with our journal, several useful suggestions have been made for further improvement. These will be considered by the Publications and Communications (P&C) Committee. The question "should we aim to make *Ag4Dev* a peer-reviewed journal?" resulted in divided opinion, with about half of respondents more concerned about the disadvantages, and about half focussing on the advantages. The feedback from this survey is very helpful in planning the future evolution of your journal, and further comments or suggestions are always very welcome through letters or emails to the Coordinating Editor.

Contributing to the production of your journal

The journal is published three times each year, thanks to the voluntary efforts of a small editorial team, supported by the P&C Committee, a network of Occasional Editors, and of course the contributions of the authors of the many items comprising *Ag4Dev*. The further we can share this workload, the more sustainable it is, and the longer members are likely to continue volunteering in this way.

We are currently seeking a Proof Reader, and Coordinators of several regular features: *Obituaries*, *Mailbox*, *Opinions Page*, and *Reminiscences and Reflections*. Any member who would be willing to contribute as a Proof Reader, or as a Coordinator of any of these regular features, is encouraged to contact the Coordinating Editor. We are pleased to welcome Chris Garforth as the new Coordinator of *Bookstack*.

Increase in membership fees

Membership fees have not increased for seven years, but our costs have continued to rise. A proposal for a modest increase in fees, to take effect from August 2016, is therefore included under *TAA Forum*. This proposal is recommended by the Executive Committee, and will be considered by the 2015 AGM.

Paul Harding
Coordinating Editor, *Ag4Dev*

10th Hugh Bunting Memorial Lecture delivered at Reading University on 8 June 2015

Going the extra mile: helping smallholder farmers obtain the knowledge they need to lose less and grow more

Trevor Nicholls

Dr Trevor Nicholls is the Chief Executive Officer of CABI, a not-for-profit scientific research, publishing and international development organisation that improves people's lives worldwide by providing information and applying scientific expertise to solve problems in agriculture and the environment. He is a Steering Committee Member of the Association of International Research and Development Centres for Agriculture (AIRCA) and of the Tropical Agriculture Platform (TAP), an initiative of the G20 countries hosted by FAO.

Summary

The challenges to agriculture required to feed a growing world population have been widely analysed and documented. National Governments and the international donor community have responded by pledging large investments to support the breeding of new crop varieties. Whilst this is a vital part of the solution, it is not sufficient - nor will it yield rapid results given the time taken for widespread adoption of new varieties. With existing research findings and knowledge, we can make a major contribution to food security by losing less of what we already grow, if we can deliver this information in a way that reaches the large number of smallholder farmers in developing countries.

The last mile is a widely used phrase used in the telecommunications, internet and logistics industries to refer to the final, and often most challenging, leg of delivery to end users. The title of this paper reflects the need to use more creative ways to bridge that gap and deliver the right knowledge and information to smallholder farmers, so that they can reduce losses and improve the quality of what they are already growing. The paper reviews case studies of work by CABI in Africa and Asia, drawing conclusions for key success factors today and setting a direction for the future.

Background to CABI

Through knowledge sharing and scientific research, CABI an international not-for-profit organisation, helps address issues of global concern such as improving global food security and safeguarding the environment to improve people's lives. In particular, CABI focuses on helping farmers grow more and lose less of what they produce, combating threats to agriculture and the environment from pests and diseases, protecting biodiversity from invasive species, and improving access to agricultural and environmental scientific knowledge. The organisation has 48 member countries worldwide whose input guides and influences core areas of work spanning development and research projects, scientific publishing and microbial services. CABI runs the *Plantwise* programme, a worldwide alliance of partners promoting better systems of plant health at national, regional and global levels.

The challenge to agriculture over the next 30 years

A growing world population that is projected to reach over 9 billion by 2050 from the present level of 7.2 billion, combined with economic and social development, as well as climate change, will continue to lead to increased demand for the outputs of agriculture - food, fodder, fuel and fibre. By 2050, the Food and Agriculture Organization (FAO) of the United Nations (UN) estimates that the growing population will need 60 percent more food globally (FAO, 2012) - requiring an improvement in productivity that is almost equivalent to the gains that have been made over the last 2,000 years. Based on data from FAOStat 2011, Momagri has estimated that up to 40 percent of the working population worldwide are involved in agriculture (Momagri, 2015). The vast majority are smallholder family farmers predominantly producing food to eat themselves, as well as to sell (FAO, 2015). It is estimated that 75 percent of additional agricultural output will have to come from developing regions (OECD/FAO, 2014) so smallholders must play a central role in food security. Yet ironically, of the estimated 805 million people worldwide who are still chronically hungry, half of those are smallholder farmers (FAO, 2015).

Understandably, the family farm in developing countries is under threat as more and more people - especially the young - are attracted away from rural communities into cities by the promise of jobs, better housing and access to hospitals, shops, even entertainment. While a career in the city is embraced as a step forward, life in agriculture is often perceived as a step back. Fewer and fewer young people work in family run smallholder farms. The UN forecasts that by 2030, 60 percent of the global population will live in urban areas and up to 60 percent of these people will be under the age of 18 (UN, 2001). But this problem is also an opportunity, if we can help rural smallholders access the relevant value chains supplying food to these

growing urban populations.

This challenge means we need to think carefully about the way in which we use our resources. In the context of food security, simply increasing the amount of land dedicated to agriculture cannot be easily accomplished and could have significant impacts on biodiversity and ecosystems. A far better approach is to produce more food using the same, or less, land in a way that minimises negative impacts on resources such as soil and water.

Getting information to farmers

Too often, the response to the challenge of food security has been to pile investment into research to breed new varieties of traditional staple crops - maize, rice, wheat. But it is now widely accepted that we must go beyond calorie intake and look at the nutritional balance of the crops grown and consumed. Malnutrition - that is to say lack of nutrition or imbalanced nutrition - is a concern that is fast becoming the main threat to peoples' health in developed and developing countries alike. We need more focus on horticultural crops, fruit, legumes and vegetables: helping people achieve a well-balanced diet will address 'hidden hunger.'

In all aspects of agriculture, new varieties are only part of the solution. Whilst plant breeders promise (and deliver) many potential benefits in terms of resistance to drought, salinity, pests and diseases; it can take 10-20 years for a new variety to become widely available for smallholder farmers and even longer until there is widespread acceptance or uptake. Many attempts fail, because the new introductions are less well-suited to other aspects of the local environment, tastes and economy, than the traditional varieties that have been grown for years.

In addition to growing more, we must lose less if we are to meet the 2050 food security challenge. On average, as shown in Table 1, it is estimated that approximately 30-40 percent of crops are lost to pests and diseases (Oerke, 2006) before we even consider losses in the supply chain and wastage by consumers - where total wastage adds up to a massive 1.3 billion tonnes per year (FAO, 2015). That figure can go as high as 80 percent for some crops in some countries. Yet the knowledge and technology to significantly cut those losses is already available to us - the challenge is to put it into the hands of the farmers who need it, in ways that are practical, accessible and understandable.

It will be important to share scientific knowledge of sustainable agricultural intensification and the most practical and relevant innovations for smallholders with other countries that can benefit. Or, alternatively, further disseminate local best practices that are already being used effectively in the developing world.

Table 1. Pre-harvest crop losses due to pests

Crop	Average Actual Losses (%)	Range
Wheat	28.2	14 – 40
Rice	37.4	22 – 51
Maize	31.2	18 – 58
Potato	40.3	24 – 59
Soybean	26.3	11 – 49
Cotton	28.8	12 - 48

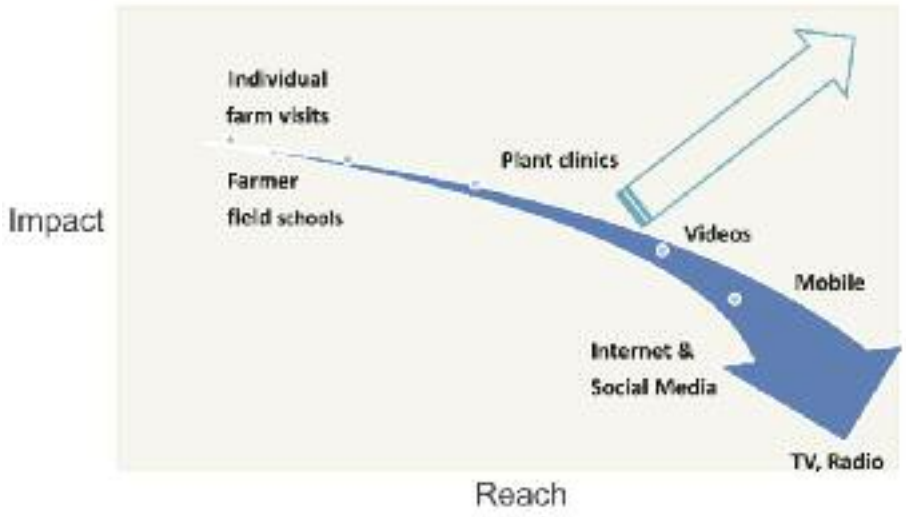

Figure 1. Communicating with farmers with greater reach, frequency and impact

Mass media communications can reach many farmers with low impact whereas the most effective communication is a face-to-face meeting between an extension worker and farmers on their farms. It is well-documented that there are not enough trained extension workers in tropical agriculture with ratios of one extensionist to every 1,000 farmers in India (Gowda, 2012) or 1:2,000 in Africa (Nyan Duo & Bruening, 2007) - rising as high as 1:3,250 in some countries (News Agency of Nigeria, 2013). We could make a step change in extension - which would make a major difference to the uptake of better varieties that we already have - by diverting some of the money that currently goes into plant breeding, but in reality that is not going to happen.

Therefore, we must find creative ways to leverage existing extension resources in reaching more farmers with greater frequency and impact. CABI is researching a variety of tools and techniques to assess their effectiveness (Figure 1). It is clear that there is no 'silver bullet' and that a combination of methods will usually be most appropriate, which will vary depending upon the local situation and the problem at hand. The explosion in modern technologies in developing countries brings an opportunity to reach more smallholder farmers than ever before, helping them to grow more and lose less. No or low literacy and language barriers can be overcome with the help of mobile agro-advisory services using, for example, voice messages. A recent report estimates that mobile services had the potential to boost agricultural income in 26 countries by an estimated $138 billion by 2020 - a prize too great to miss (Vodafone, 2015).

In addition to information flows, we need to help smallholder farmers to access markets for their better harvests, so as to translate yield improvements into higher incomes. For many rural communities, growing and selling high-value fruit, nuts, vegetables and medical herbs offer indirect health benefits, since the income gives farmers the choice to buy the nutritionally valuable produce they cannot grow. With increasing migration to cities, there are opportunities to supply urban populations that no longer have the desire, knowledge, space or time to grow their own food. Strengthening market linkages between producers and processors or buyers, can increase farm profits and supply more food resources to urban areas. Private companies engaged in this initiative are both local and multinational companies. Supportive government policies are also extremely important in adoption of best practices for food safety and quality.

Case Studies

The scale of change needed in most countries and regions is beyond both the scope and resources of any one organisation. Answering the question of how new farming approaches or produce varieties can be adopted by farmers at scale is essential. Creative partnerships are usually needed to bring together the requisite skills, knowledge, technology and local awareness. CABI has established a very successful 'Joint Laboratory' with the Institute of Plant Protection of the Chinese Academy of Agricultural Sciences (IPP-CAAS) in Beijing. Through this linkage, in work funded by the European Union's DEVCO Directorate General (EU Devco), we have been able to work with Chinese and European scientists in the Democratic People's Republic of Korea (DPRK)to transfer and implement technologies for integrated pest management based on mass production and application of beneficial entomopathogenic nematodes. The principles of this approach are now being extended into Rwanda as part of the DFID *Agri-TT* programme (one of the first trilateral cooperation programmes on agricultural technology transfer between DFID, the Chinese Government and countries in Africa). These programmes are predominantly delivered to large groups of farmers or technicians through face-to-face training since there needs to be significant 'show-and-tell' to help establish the mass production facilities needed. Creative partnerships are needed to effect change, comprising local, national and international actors to bring new technology but ensure it is implemented in a way that is sensitive to local conditions, regulations and practices in the target country (Figure 2).

Partnerships such as the *Africa Soil Health Consortium* (ASHC) accomplish knowledge transfer in different ways. ASHC works with knowledge and delivery partners to support the development and production of high quality communication materials to get techniques of integrated soil fertility management (ISFM) into use at scale by capacity building all along the

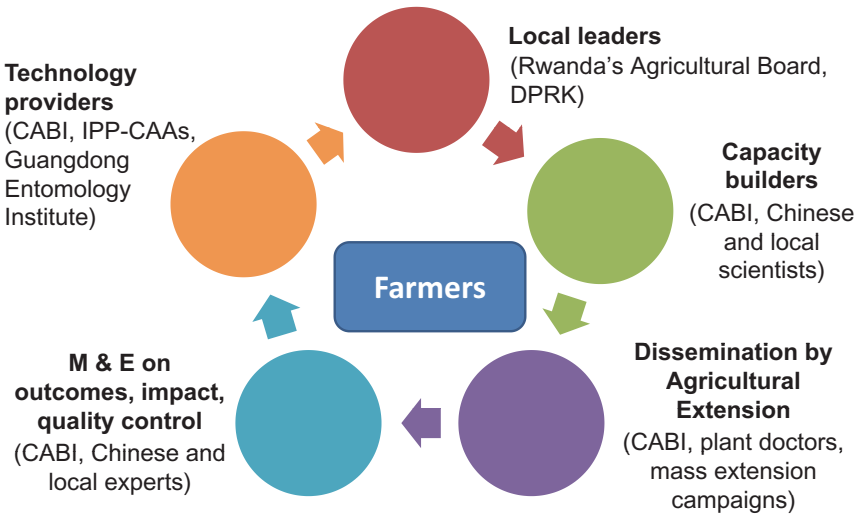

Figure 2. Creative partnerships for success

information supply chain from research to practitioners and policy makers. ASHC's online library of practical ISFM materials includes books, cartoons and posters. A related project, *Optimising Fertiliser Recommendations in Africa* (OFRA), aims to contribute to improved efficiency and profitability of fertiliser use within the context of ISFM practices. This helps collect and analyse data to develop practical decision-making tools, including fertiliser optimisation tools, providing advice on how much fertiliser a farmer should use to maximise their profits, tailored to their individual situation.

Women play a central role in feeding families and communities. According to the World Food Program (WFP), if women farmers have the same access to resources that male farmers do, the number of hungry people in the world may be reduced by up to 150 million (WFP, 2015). We also need to reduce, and ideally reverse, the migration of next-generation farmers into cities. Both ASHC and OFRA have experimented with different types of communication to overcome the challenge of how we best reach women and youth, to help them deliver their potential in agriculture.

Plantwise is a global programme, launched by CABI in 2011, to increase food security and improve rural livelihoods by sustainably reducing crop losses, with the goal of reaching 30 million farmers with plant health information by 2020. So far, the programme has reached nearly two million farmers across 34 implementation countries. *Plantwise's* motto is 'any crop, any problem,' including fruits and vegetables from home gardens, which can improve family nutrition but which are often neglected by traditional cash crop extension. *Plantwise* helps over 200 national partners to run plant clinics worldwide. Linkages are the hallmark of *Plantwise*: communications between farmers, extension services, research and regulatory bodies have substantially improved as they work together to run and backstop plant clinics.

The clinics work like those for human health where farmers bring in sick crop samples and trained plant doctors provide diagnosis and recommendations. Plant clinics, often run regularly in local marketplaces, attract more farmers than traditional door-to-door extension, increasing cost and resource efficiency for national partners. Countries see the value. Many have integrated permanent plant clinic departments and terms of references into government roles, and increase budget year-on-year to help ensure sustainability.

The networks of plant clinics are backed by the *Plantwise* knowledge bank: a database with over 20,000 fact sheets and resources covering diagnostic guides and science-based plant health advice on best practice in biological and chemical control. In addition, the prescription forms filled out at the clinic for each farmer visit provide a rich source for countries to data mine: they can track farmer needs and respond quickly to new or re-emerging pests (Figure 3). Over 110,000 records from plant clinic visits have been uploaded and analysed in a new *Plantwise* Online Management System. Already this is throwing up intriguing researchable questions about the spread of pests and diseases in response to soil type, climate change, trade and population movements.

The *Plantwise Factsheet Library* app, the *Serious* training game, and use of SMS and voicemail advisory services demonstrate how *Plantwise* can use information and communications technology (ICT) to expand the quality and reach of plant doctor advice, marking a new chapter of agricultural extension. Pilots in the use of tablets by plant doctors have shown a 75 percent increase in the speed of uploading data, as well as improvements in quality, capturing of pictures and promotion of networking among plant doctors and their customers.

As has been documented in many sources, access to mobile phones, and increasingly to smartphones, is growing at an incredible rate in the developing world. For the rural population they are not just a communication device but also, by giving wireless internet access, a source of information and entertainment. This combination makes the mobile phone a powerful tool for an increasing array of agricultural advisory services. Although the relative importance of and demand for different types of information varies in different situations,

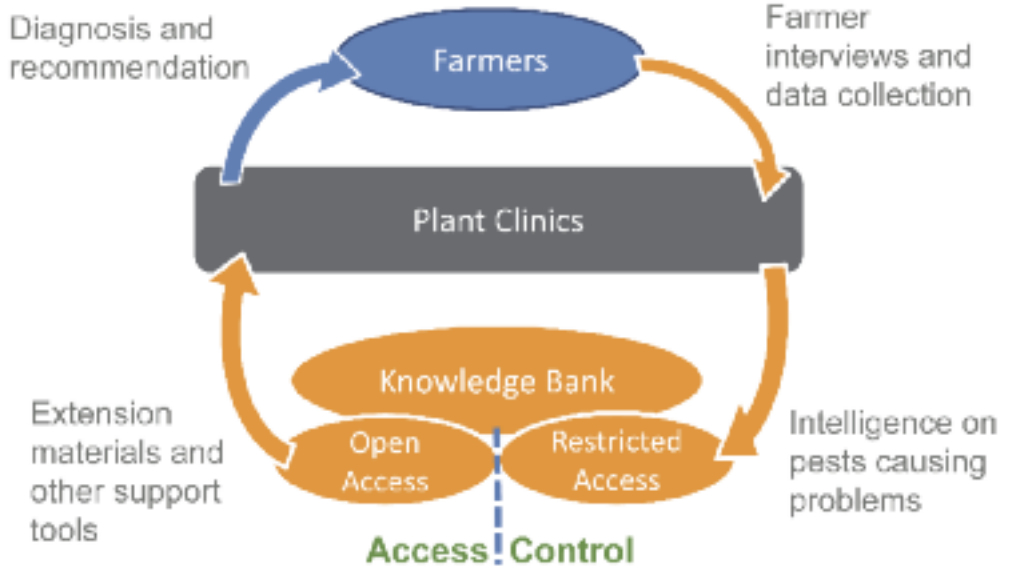

Figure 3. Information flows in *Plantwise*

there is a consistent demand for information on new varieties, pests and diseases, use of pesticides and fertiliser, as well as weather, credit and markets (Benard *et al*, 2014).

CABI has been involved in this revolution since 2009, beginning in India through a partnership with Airtel and the India Farmer's Fertilizer Cooperative, which reached over four million farming households. This stimulated our *Direct2Farm* initiative to build a database of short messages - deliverable via text or voice - which are specific to a location, the crops grown there and key points in time during the crop calendar. The information given via mobile services can include, for example, information on integrated approaches to manage soils, crop health, pests and diseases. It can also include information about nutrition. The Mobile for Development Foundation of the GSM Association (GSMA) recently appointed a CABI-led consortium to support the *mNutrition* initiative, which helps beneficiaries to access nutrition-based agricultural and health information using mobile technology. In all of our work with mobile services we have found the key factors for success to be:

- Multiple touch points with the farming family and the community within which they live;
- Easy adoption - accessibility over multiple media via robust standard technology offering plug-and-play capability;
- Hyper-localisation and synchronisation with the local agricultural system (economy and ecology); and
- Facilitation of peer-to-peer interaction and community building so as to build trust and viral adoption through word-of-mouth.

Conclusions

For impact, information and knowledge need to be put into use. Whichever mix of communication tools are used, the target information needs to be delivered to farmers in ways that are shown in Table 2. In particular, they must be:

- Appropriate, relevant and affordable;
- Timely and understandable;
- User-centric and pragmatic;
- Holistic - cover all farm activities, not just one or two crops; and
- Market related - to enable farmers to realise the value they create.

While these factors are necessary, they are not sufficient to ensure long term success. Donor funding is often essential to get projects off the ground but all too often interest and enthusiasm wanes just as the effort is at a critical point and about to deliver benefits. For long term sustainability, the original sponsor needs to think about bringing in private sector partners, investment and entrepreneurial skills to create a self-sustaining business to business (B2B) or business to consumer (B2C) activity.

Finally, when considering how to boost farming output, it is important to keep an eye on the bigger picture, understanding that agricultural production systems interact in many ways and at many levels of scale, from plot to farm, and from farm to landscape. Challenges can arise when trade-offs must be made between different land use objectives, for example, agricultural intensification versus environmental protection, and we need to think about the framework of the whole landscape. The members of the Association of International Research and Development Centers for Agriculture (AIRCA) are committed to tackling these problems at the landscape level. The 'landscape' approach to sustainable agriculture requires the creation of solutions that take into account the diversity of interactions among people and the environment, agricultural and non-agricultural systems, and other factors that represent the entire context of agriculture (Figure 4). This approach also takes into account the trans-national aspects of landscapes where they cross national boundaries, making concerted efforts to find solutions to sustainable agriculture more pressing (Nicholls *et al*, 2013).

For these efforts to be successful authoritative science-based information sources must be available, providing a true 'one health' coverage of human, animal, plant, soil, seed and environmental health - perhaps better termed an 'all health'

Table 2. Key success factors for ICT in agriculture

Engagement	Uptake	Scalability
Multiple Touch Points	Hyper-localisation	Robust technology standards
More benefit per cost	In sync with agrarian ecosystem	Plug-and-play modularity
Facilitating community building	Peer to peer interactivity	Easy adoption (viral)
Accessible over multiple media	User interactive	Trust & Word of mouth

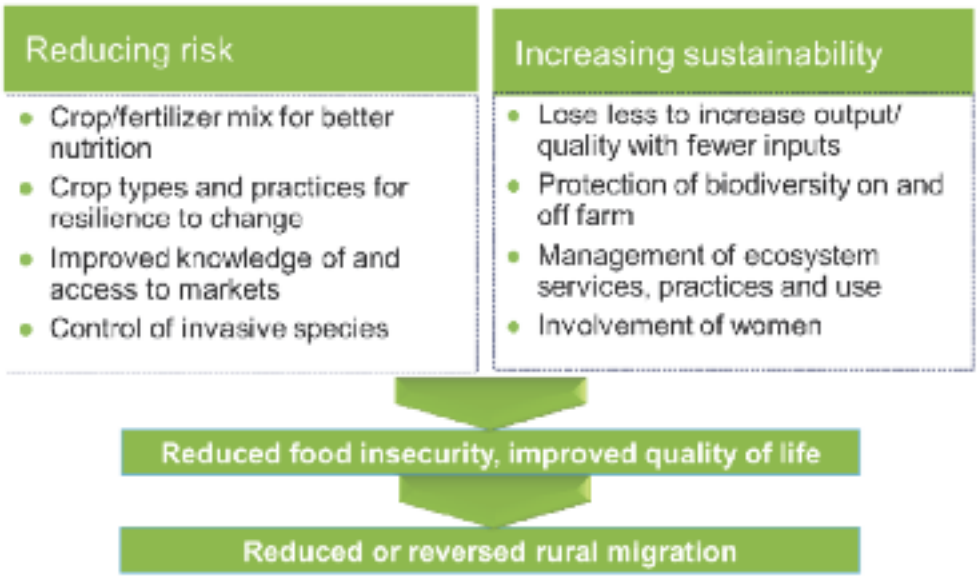

Figure 4. Healthy landscapes - making rural communities more viable

database. This needs to make information available in formats supporting a variety of end-users from academic research, through public and private organisations to extension workers and farmers. It also needs to be able to help users search, integrate and correlate findings from different disciplines and subject areas - particularly by drawing together the physical and social sciences - so as to promote approaches which are sustainable, climate-smart and gender sensitive. This is a very challenging objective but also an exciting one as the revolution in information technology makes it increasingly feasible.

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News from the Field

Conservation of the deepwater rice–upland vegetables system in Viet Nam[1]

Doan Thi My Hoa[2]

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Summary

Deepwater rice was formerly widely grown on the Mekong river floodplains in Viet Nam, but the area was greatly reduced following the building of dykes along the river and the introduction of high-yielding rice varieties from the mid-1970s. A small area remains on acid sulphate soils in An Giang province where pesticides are not used on the crop and the rice is grown in rotation with vegetables in the dry season. It is planned to expand the area under this rotation by developing niche markets for the rice grain in Vietnam and abroad, and by developing the area as an eco-tourism centre.

Introduction

Deepwater rice - so-called floating rice - is native in the Mekong River Delta (MRD). It has significant cultural, ecological, environmental and historic values in the region. This rice used to be a main source of high-quality nutrition for people living in the MRD. It comprised two species, *Oryza sativa L* and *Oryza prosative*, that were widely grown in both shallowly- and deeply-flooded areas, particularly in the Long Xuyen Quadrangle and the Plain of Reeds. Before 1975, there were estimated to be >500,000 ha, of which 50 percent was in An Giang province alone (Biggs *et al*, 2009; Nguy n H u Chi m, 1994; Võ Tòng Xuân & Matsui, 1998). However, the area was reduced by 80 percent between 1975 and 1994 due to the *Doi Moi* (economic reforms) policy (Karonen, 2008). By 2012, there were only 41.2 ha in Vinh Phuoc commune and 20 ha in Luong An Tra commune of Tri Ton district, An Giang province.

Originally, there were several different floating rice varieties such as *nang pha, nang tay dum, chet cuc, tau binh* and *bong sen*. Currently, only the *bong sen* variety is grown in Vinh Phuoc commune; the other varieties have disappeared. Traditionally, the floating rice is grown in seasonal rotation with vegetables. This unique ecosystem and its environmental services are at imminent risk of extinction unless there is conservation activity to maintain them.

The importance of preserving and developing the floating rice-vegetable farming system was recognised by the An Giang People's Committee in March 2012, to support, preserve and develop the system in Tri Ton district. The An Giang People's Committee and the Department of Agriculture and Rural Development (DARD) have requested assistance to conserve and expand the area to 100 ha in Tri Ton district by 2015, and to 500 ha in 2030. The preservation of floating rice is considered important for the reasons set out below.

The floating rice-vegetables system

The floating rice system is unique among other rice systems in Viet Nam because no pesticides are used. Farmers may apply a few kg of urea per 1,000 m^2, but this is only a small fraction of the amount applied to higher yielding modern rice varieties. Some Vinh Phuoc farmers have sold this rice in Ho Chi Minh (HCM) city. Farmers and consumers perceive that this rice is good for health because pesticides are not used. As consumers become richer, they become more concerned with their health and can afford to be critical about the quality of their food and the inputs being used to grow it, and they are willing to pay more for high-quality food. Farmers said that middlemen from An Giang and Tien Giang provinces, and monks in the Vinh Nghiem pagoda in HCM City, come seeking to buy the rice before the crop is harvested in late-December or early-January. As a result of this forward buying by outsiders, the supply is not sufficient to meet local demands as well. (Information based on in-depth interviews with farmers, 28/03/2013).

Floating rice is highly adapted to the acid sulphate soils in the area and to deep inundation. The crop is grown on rainwater until flooding occurs in mid-August. The flood water level usually rises gradually, and the rice plants follow the rising water upwards (Figure 1). When the water level recedes in November, the rice plants lie flat on the ground, flower and produce grain. Local farmers state that each rice plant can produce about four tillers, each with two or three panicles. The crop is harvested in December. The average rice yield is from

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Figure 1. Floating rice plant before harvest

Figure 2. Egg plants growing after harvesting floating rice

2.0 to 2.5 tonnes/ha. Farmers store some rice seeds in their homes for growing the next crop.

Following the rice harvest, farmers grow several upland crops such as cassava, Chinese onion, egg plants, pumpkin and chillies in the dry season (Figure 2). Cassava is the major cultivated upland crop because it requires less financial investment and is suitable for the acid sulphate soils. Chinese onion requires specialist knowledge, so few local farmers grow this crop: most farmers who grow Chinese onions come from other districts such as Cho Moi to hire land because they have the experience, specialist skills and working capital.

Economic benefits

A recent study on the costs and benefits of double and triple rice crop production systems in An Giang province, commissioned by GIZ (Binney & Fleming, 2014), demonstrated that growing floating rice and vegetables is a profitable alternative to double and triple rice crop production. Although the yield of floating rice is quite low, the net return is relatively high compared with the various rice crops in the two and three cropping systems (Table 1). The income from vegetable production provides the floating rice farmers with higher incomes compared with total revenue from rice-only production. These higher value vegetable crops are key to the profitability of the floating rice-vegetable cultivation system. The expansion of this cultivation system within the Long Xuyen Quadrangle may also provide societal benefits by providing larger flood-retention areas that reduce downstream flood risks. This is an area of research currently being supported by GIZ and others.

Environmental benefits

The floating rice-upland vegetables cultivation system provides several important environmental benefits:

- The cultivation of floating rice gives space for floods over a four-months period, which reduces the risk of dykes breaching elsewhere along the Mekong river. For local farmers, it reduces the risk of broken dykes and the cost to the commune of maintaining them.
- The floating rice-upland vegetables rotation uses much less water than is used for a winter rice crop.

Table 1. Economic benefits and costs of two and three rice crop rotations, floating rice and upland crops in An Giang province

Crop	Cost/return/profit in million VND per ha		
	Cost	Return	Profit
Rice			
Floating rice	5.0	15	10
Autumn-winter crop	28	29.60 to 38.9	1.6 to 10.9
Winter-spring crop	30.3	37.7 to 40.7	7.5 to 10.4
Summer-autumn crop	25.6	24.2 to 28.3	-1.4 to 2.7
Upland crops			
Cassava	12.5	30	17.5
Chinese onion	102.4	150	47.6
Pumpkin	20.1	50	29.9
Chilli	60	225	165
Soya bean	3.8	6.1	2.3

Source: An Giang Department of Agriculture and Rural Development.
Note: 21,200 Viet Nam dong (VND) = 1 US dollar.

- Floating rice creates large amounts of straw which is used as a mulch to cover soils on which vegetables are grown in the dry season. This conserves moisture in the soil for those crops. It also adds to soil organic matter and thereby returns nutrients to the soil.
- The system can both reduce greenhouse gas emissions and sequester carbon, because farmers do not burn the straw.
- Maintaining the floating rice keeps a unique soil and biodiversity system alive and maintains a valuable gene pool. As agriculture in the delta continues to develop, with high dykes and other forms of intensive agriculture, it is important for scientists to have a location against which they can make comparisons to identify the effect of high-intensity agriculture on the environment, particularly on the soils. This knowledge will be very important for policy makers and ultimately for farmers. This area in Tri Ton, where a very small number of fields have been farmed in a traditional way for more than one century, has not so far been subjected to chemical treatments, so it could be the baseline against which to measure changes to the soils of the province and beyond.
- The floating rice area provides an important habitat for freshwater fish and birds. Many agricultural areas are now surrounded by high dykes for intensive rice farming, thus destroying habitats for fish nurseries and growth. Farmers in Vinh Phuoc said that many fish species come to their fields because they offer shelter for fish. Some common fish found during the flood season are snake head fish, climbing perch, and *Cirrhinus caudimaculatus* (used to make a traditional fish sauce). These species attract carnivores to the area, such as kingfisher birds, water snakes and grass snakes. Experience shows that increased fish stocks occur in the floating rice area during big floods, providing a rich protein source for poor farmers. We also found several flocks of storks in the dry season and water birds in the wet season.

Looking to the future

Recently, through the support of GIZ, the Department of Agriculture and Rural Development in cooperation with Tri Ton district and Vinh Phuoc commune developed an Action Plan on Conservation of Floating rice to 2020. The action plan is included in the Provincial Agricultural Development Plan with the goal of expanding the areas of floating rice to 100 ha in 2015, 200 ha in 2020 and 500 ha in 2030. The plan focuses on quality improvements, trialling alternative crops and livelihood activities, developing national and international markets, regenerating other floating rice varieties which are now kept in the seed bank of Cuu Long Delta Rice Institute, and embedding floating rice into policy and planning instruments. GIZ has linked local farmers with an enterprise to support organic certification of floating rice and vegetables. The enterprise signed a contract with the commune to buy all of the floating rice produced in the 2014 harvest. In addition, GIZ in collaboration with the Dutch Embassy in Hanoi, is exploring export markets in Europe with samples of floating rice sent to the Netherlands for testing and market evaluation.

One year after the project was initiated, a floating rice harvest festival was organised in Vinh Phuoc commune. This was an opportunity to explore the possibility to develop eco-tourism to attract local and international visitors to this unique cultural system as an additional means to improve the livelihoods of poor farmers. The festival attracted more than 200 visitors from research institutions, universities, local governments in the Mekong Delta, local and international NGOs, media, and many ecotourism companies from HCM city and Hanoi. The quality of the floating rice was appreciated by consumers and they were willing to pay the higher price for it, three times higher than that for other rice.

Recently, floating rice has been classified as the top of eight agricultural products of An Giang province. Another district in An Giang province is now considering floating rice in their district agricultural development plan. In addition, the neighbouring flood-prone province of Dong Thap has decided to restore the floating rice-upland vegetables system in the Plain of Reeds.

Acknowledgements

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Assessing agroforestry adoption in tribal areas of Maharashtra, India

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Summary

In India, the *wadi* agroforestry system promoted by the NGO BAIF Development Research Foundation, has been by any measure outstandingly successful in terms of both rates of adoption, and retention after project cessation, with a significant impact upon the livelihoods of disadvantaged, poor farmers. Between 2001 and 2005, BAIF implemented a large scale *wadi* programme amongst hill tribe peoples in the Western Ghats of Maharashtra, together with accompanying social development actions. This article describes a study undertaken in 2014 to determine why some farmers did and others did not adopt *wadi* agroforestry systems. Sixty four percent of eligible farmers (those with 0.4 ha or more of land) did adopt, rates of retention were high, there was a great increase in tree cover on their farms and evidence that pressure on remaining local forests for fuel wood was decreasing. However, somewhat unexpectedly, none of the commonly used extrinsic variables such as size of farm, age and education, numbers in the household, capital assets, *etc*, were significantly different between adopters and non-adopters (and thus were not useful predictors of adoption). Although not studied in the same detail, it is suspected that less tangible intrinsic (socio-psychological) factors may have been better at explaining farmer behaviour. It is suggested that these factors should be taken into account in future adoption studies.

Introduction

The adoption of externally-facilitated agroforestry practices has been studied extensively by researchers in recent decades. This interest has largely been borne out of recognition that agroforestry development projects have a reputation for achieving limited success, with low and uneven adoption rates, and frequent abandonment occurring soon after cessation of implementing projects (Pattanayak *et al*, 2003). This is despite the fact that there are numerous examples of indigenously developed agroforestry practices in a wide range of agro-ecosystems around the world. In this article, we describe a development programme in India in which agroforestry is a central component and where adoption of a new practice has occurred on a very large scale. Known locally as *wadi* (meaning small orchard in Gujarati), this innovation has been co-developed by a non-governmental organization called BAIF Development Research Foundation (BAIF), working in partnership with Scheduled Tribes (commonly known as tribals or *adivasi*) for over three decades. *Wadi* agroforestry has proven to be very successful and is retained by the majority of participants for many years following initial adoption.

According to Mercer & Miller (1998), one of the common factors which contribute to the low uptake of externally-facilitated agroforestry practices systems is inadequate attention given to socio-economic factors in the development of agroforestry projects. Increased socio-economic research is therefore required in order to better understand the challenges that constrain agroforestry adoption processes (Current *et al*, 1995). Pattanayak *et al* (2003) pooled data from 32 empirical studies to identify the typical determinants of agroforestry adoption. These included: age, gender, education, wealth or social status, household assets (land, labour, livestock and savings) and biophysical factors such as soil quality and slope

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of farmland. Such household and farm characteristics together are referred to as 'extrinsic variables'. These potential explanatory variables were also used in the study described in this article.

The development approach of BAIF

BAIF (www.baif.org.in) is based in Pune, Maharashtra, and was established in 1967 with a mission to promote sustainable livelihoods and improve the quality of life and local environments of tribal people and other disadvantaged groups in rural parts of India. Programmes implemented by BAIF include artificial insemination, cattle and goat husbandry, watershed development, sustainable agriculture and agroforestry. The prototype *wadi* agroforestry model evolved initially in Gujarat in the 1980s and from 1995 was scaled-up under the KfW-NABARD (KfW Bankengruppe - supported) Adivasi Development Programme Gujarat (ADPG). The success of this programme led to its replication in Maharashtra from 2000 under the Adivasi Development Programme Maharashtra (ADPM). Subsequent scaling-up of the *wadi* approach has been supported by various national and international donors, and BAIF reported in 2012 that in excess of 180,000 families in nine states had participated in their *wadi* development programmes. In addition, since 2005, the *wadi* model has been institutionalised by NABARD through its Tribal Development Fund (TDF), which has supported a network of NGOs implementing *wadi* projects and is projected to benefit a further 320,000 families across 21 states of the country.

The *wadi* concept is a holistic approach that takes all aspects of rural life into account. The main objectives of the *wadi* programme are food security and poverty alleviation through development of wastelands. In the context of India, wastelands are defined as land capable of being, but not currently under, cultivation (Chaturvedi *et al*, 2014). As listed below, the *wadi* programme has a number of integrated components:

- Agro-horti-forestry (*wadi*);
- Soil and water conservation;
- Water resource development;
- Agri-business;
- Allied livelihoods; and
- Social mobilisation (farmer groups, cooperatives and federations).

Agro-horti-forestry is the core component of the *wadi* programme. This involves establishment of multipurpose trees around the field boundary - generally reinforcing soil and water conservation measures such as trenches and bunds - along with fruit and/or nut trees in the field, where wide spacing allows continued cultivation of annual crops (see Figures 1 and 2). A typical size is one acre (0.4 ha), but this is quite variable.

In May to July 2014, two of the authors (Pratik Doshi and James Brockington) conducted a study in Maharashtra to explore the determinants of adoption and retention of *wadi* by tribal households who had participated in the ADPM. The ADPM was implemented from 2000 to 2011 by Maharashtra Institute of Transfer of Technology in Rural Areas (MITTRA), a sister organisation operating under the umbrella of BAIF. Implementation was phased in five batches, one each year from 2001 to 2005, with each batch then receiving a further

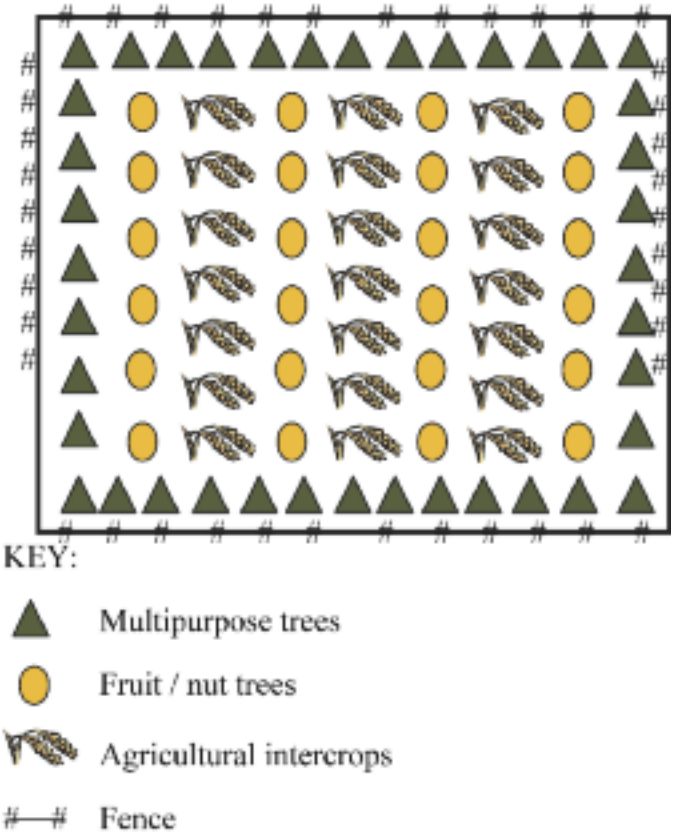

Figure 1. Schematic diagram of *wadi* layout (not to scale)

Figure 2. *Wadi* plot (~10 years old) in dry, pre-monsoon conditions. (Photo: James Brockington)

five years of technical inputs from MITTRA. A total of 13,848 families from Peint and Surgana blocks in Nashik District and Mokhada block in Thane District took part in the ADPM programme.

Methods

This study was carried out in three villages of Peint *taluka* (administrative block), which is approximately 60 km from the city of Nashik in western Maharashtra. Located in the Sahyadri (Western Ghats) range, the topography is hilly and intersected with deep ravines. Much of the dense teak forest that once covered the area has been cleared, leaving a mosaic of remnant forest, agricultural fields, human settlement and wastelands. For the predominantly tribal people who live here, rainfed

agriculture is the primary livelihood strategy. However, despite the region receiving 2,500+ mm of rain in a typical monsoon, lateritic soils and denuded slopes mean that little water is available for crop cultivation outside of the rainy season. In the absence of local employment opportunities, migration is common in the long dry season.

Eighty six farmers were selected for the study using stratified random sampling. Of these, 48 were *wadi* adopters and 38 were non-adopters. A mixed methods approach was employed with quantitative, qualitative and geo-spatial data collected. Households were interviewed using a structured questionnaire to elicit both quantitative data relating to socio-demographics, livelihoods and land-use, and narrative data on the reasons for adoption (or non-adoption) and retention (or abandonment) of the *wadi* innovation. Extrinsic variables were analysed using binary logistic regressions, as is common in such studies, to determine those factors influencing adoption or non-adoption.

The questionnaire was designed using Kobo software and entered directly in the field on to a handheld tablet computer using the Android operating system (Figure 3). This approach was used to eliminate the need to manually transcribe survey forms, thus saving time and improving data quality. Kobo software automatically integrates data from multiple questionnaires into a single database. Agroforestry plots belonging to those households interviewed were also surveyed using a handheld GPS unit to record their geospatial location and extent. An inventory of each plot was conducted to determine numbers and species of trees and agricultural intercrops.

Figure 3. Farmer interview using handheld tablet under mango tree. (Photo: James Brockington)

Results and Discussion

Landholdings in the sample of 48 adopting households ranged from 0.4 to 4.9 ha with a mean area of 1.9 ha (Figure 4). The 38 non-adopting farms were slightly larger, the mean area being 2.04 ha. Mean area per farm of agroforestry of all origins was 0.52 ha. Extensions of the BAIF mediated *wadi* agroforestry were observed in four households out of the 48 adopters, measuring 1.4 ha. Cases where farmers independently established agroforestry plots (*ie* without BAIF support) covered a further 1.8 ha. Figure 4 shows that two households converted all their land to BAIF's *wadi* agroforestry, but on average, agroforestry (all categories) covered 27 percent of adopters' farmland. In land-use change (adoption) studies this is a common finding, where farmers take a cautious approach to uptake of new technologies and typically only convert a small part of their farmland.

At a landscape scale, 64 percent of eligible households (those with 0.4 ha or more of farmland, which was 66 percent of all households) adopted BAIF mediated *wadi* systems. Assuming ours was a representative sample, across the three villages, agroforestry can be estimated to cover approximately 10 percent of farmed land (because we do not have data for the areas of < 0.4 ha non-eligible farms).

At the time of the survey, the mean number of surviving fruit trees per farm was 43 (57 percent survival rate up to 14 years after initial establishment). The majority (52 percent) were cashew (*Anacardium occidentale*), 36 percent were mango (*Mangifera indica*) and 12 percent were amla (*Phyllanthus emblica)*, plus a few tamarinds (*Tamarindus indica*). When extending their plots farmers also included other fruit species such as jackfruit (*Artocarpus heterophyllus*), custard apple (*Annona reticulata*) and guava (*Psidium guajava)*. In addition, there was an average of 157 (range zero to 1,000) surviving multi-purpose and forestry trees around the boundary of each *wadi* plot. Common species included *Acacia* spp, *Bambusa arundinacea*, *Casuarina equisetifolia*, *Dendrocalamus strictus*, *Madhuca indica*, *Pterocarpus indicus*, *Tectona grandis*, and *Terminalia arjuna*.

There were indications that about 70 percent of adopters were obtaining up to 20 percent of their fuelwood and another 20 percent obtained all their fuelwood needs from their *wadi* plots. On the other hand, 90 percent of non-adopters were still extracting all their fuelwood needs from the remnant forest that still remained in the locality. The species of preference for

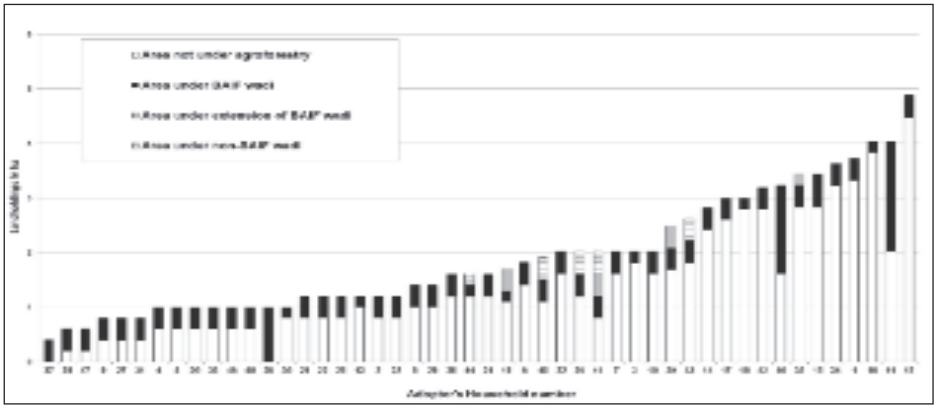

Figure 4. Agroforestry plot area for each of 48 households adopting *'wadi'*

Table 1. Principal reasons for adoption or non-adoption of *wadi* technology*

***Wadi* technology**			
Reasons for adoption	**% of adopters**	**Reasons for non-adoption**	**% of non-adopters**
Expectation of future income from the wadi	75	Land tenure issues	18
BAIF's development approach	35	Household migration	16
Fruit yields can enhance HH consumption	29	Lack of information	16

(* Multiple responses from each farmer were permitted)

fuelwood is *Terminalia arjuna* locally known as *sadada*. This species is also managed by pollarding to provide woody materials for *raab*, a traditional technique of ground preparation prior to the monsoon season involving burning to destroy weeds and weed seeds. Apart from *sadada*, teak (*Tectona grandis*) is also extracted for building purposes (see Figure 5) and for fuelwood.

One of the objectives of the *wadi* programme was to reduce distress migration in tribal communities, which is an imperative for many due to persistent food and financial insecurity but can lead to adverse impacts on social cohesion, family health, education of children, *etc*. Change in migration practice was not used as a variable to explain adoption in this study, but rather was hypothesised to be an important outcome of adoption of *wadi* and the attendant social development. However, there was no significant effect on migration habits as a consequence of the *wadi* programme, although in areas with longer established *wadi* plots in Gujarat, anecdotally there was a much reduced tendency for seasonal migration.

Rather to our surprise, none of the measured 'extrinsic' variables proved significant in predicting why some farmers adopted the *wadi* practice and others did not; this contrasts with our findings in an earlier study of *wadi* adoption conducted in the state of Karnataka (Brockington & Brook, 2014). Clearly there were (unmeasured) factors that did influence the adoption decision. We believe that these must be socio-psychological (or 'intrinsic') in nature, and relate to the aspirations, attitudes, perceptions and knowledge of individual farmers. Meijer *et al*, (2015) argue that uptake of any agricultural innovation (including agroforestry practices) is a complex process and farmer decision-making is influenced by both intrinsic and extrinsic variables. Although we did not attempt to measure intrinsic variables empirically in this study, we did collect narrative statements from farmers about their reasons for and against adoption of the *wadi* practice. Table 1 presents a summary of these.

The majority of the respondents who adopted (75 percent) cited anticipation of future income generated from fruit tree and crop yield as a primary factor in their decision to take up the *wadi* practice. Another common factor reported (35 percent) was BAIF's approach, which involved village planning meetings, exposure visits to other sites with established *wadi* plots, formation of farmer groups, provision of free planting materials and technical guidance. Household consumption of *wadi* produce was also important (29 percent). Other factors identified included: the influence of other villagers, the availability of suitable land for *wadi*, interest in cultivating forestry trees, and opportunities to control livestock.

Eighteen percent of non-adopters responded that there were land tenure issues (generally arising from unresolved inheritances, as most households had secure tenure). Sixteen percent reported that their household was heavily dependent on seasonal migration for employment and did not feel that adoption was possible or desirable given long periods away from the village. Another 16 percent of respondents reported that they had difficulty in getting information about the programme. Other less frequent responses included were health issues, perceived lack of water, poor financial condition, and no interest in planting trees.

Figure 5. Farmer building his house with *Tectona grandis* (teak) extracted from adjacent, remnant forest (probably illicitly). (Photo: James Brockington)

Adopting farmers also reported various challenges in managing their *wadi* plots once established. Common problems included infestation by pests (65 percent) such as rodents, termites, and the tea mosquito bug (probably *Telopelti santonii*) on cashew trees, lack of a water source for irrigation (48 percent), damage caused by livestock (39 percent) and damage to fruit crops caused by adverse weather events (19 percent).

Adoption of *wadi* was producing positive effects on farmers' livelihoods: 48 percent of adopters reported income generation from fruit yields; 35 percent reported household consumption of fruit; 20 percent reported using forestry trees to supply fuelwood and poles for house construction/renovation; and 13 percent reported using forestry trees to supply materials for *raab*.

Conclusions

It was clear that the *wadi* agroforestry practice as extended by BAIF, alongside their other development initiatives, was attractive to the majority of farmers, who retained their agroforestry plots long after the end of the five year post-establishment support period. This is often a crunch point when smallholder farmers abandon new technologies. Our experience of *wadi*-based programmes elsewhere in India (Karnataka, Gujarat) indicated that our observations here are typical. BAIF's own data show that, once established, fewer than 10 percent of farmers abandon *wadi* plots. However, the incidence of subsequent expansion and farmer to farmer diffusion of the technology was low, suggesting that external support was a critical factor in influencing adoption behaviour.

The inability of extrinsic variables to explain why some farmers did and others did not adopt *wadi* was unexpected, given the findings on adoption reported by other researchers. A possible explanation in our case is that the tribal communities are rather homogeneous compared to a typical, highly diverse Indian village, comprising a large proportion of landless households and farms ranging from small sub-economic to quite large tracts furnished with electricity and borewells. Another factor is that the binary logistic regression is a fairly crude instrument which treats adoption as being a simple 'yes' or 'no' decision, whereas reality indicates a much more nuanced response to promoted innovations. In this study there was evidence that intrinsic reasons were important, and our future studies will integrate socio-psychological variables into the analysis of adoption behaviour.

We have not yet been able to fully explain the acceptability of *wadi* to poor smallholder farmers, given the poor uptake of many other natural resource management innovations in India and elsewhere in the tropics. Theory suggests that the simpler a technology is the more likely it is to be adopted, whereas the *wadi* practice is relatively complex (integrating a number of components and the technical knowledge required to manage them in combination) and yet is still widely adopted. BAIF have avoided the temptation to go for an agroforestry approach based around fertility-building, nitrogen-fixing tree species (although they are incorporated along field boundaries to provide fuel wood and fodder for livestock). Instead they have chosen to focus on creating multi-purpose orchards with high future economic value.

The support package that *wadi* project participants receive, including (1) technical guidance over a five year period, (2) free planting and construction materials, (3) financial compensation for the opportunity costs incurred in establishment and aftercare in the first three years (before the fruit trees begin cropping), and (4) marketing assistance through farmer cooperatives and an overarching producer company (Vasundhara Agri-Horti Producers' Company Ltd), is doubtless an important factor in catalysing uptake. Some look askance at what is considered to be a subsidy; but then much of European and North American agriculture is heavily dependent upon subsidies. However one wishes to view the methods employed, there is no question that BAIF's holistic approach to agroforestry and rural development has been an outstanding success across large areas of India, and there is much we can learn from it.

Acknowledgements

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News from the Regions

SW seminar on *Agriculture and conflict: food and peace*, held at the Royal Agricultural University, Cirencester on 16 October, 2014

The population and demography dimension: an 'Elephant in the Room'?

Brian J Wood

Brian Wood is a zoology graduate who, in five years in citrus in Cyprus and a full career in oil palm in Malaysia, developed ecological approaches to pest control. This implied the understanding and maximisation of environmental limitations, coupled with minimum input of selective chemicals, which became part of the discipline known as Integrated Pest Management. His chief interests in present consultancy roles remain trying to understand what makes populations tick, and how this can be manipulated for practical advantage (to us!).

Introduction

My contribution to this TAA seminar arises out of some earlier meetings. In April 2012, we debated *The population food equation*, including a paper on *Population limits* (Wood, 2012). This was in part a follow up to a UK government sponsored meeting (Foresight, 2011). Then in March 2014, the branch held a seminar on *Technology and/or Ecology*, with an interesting exposition of environmental issues by Alastair McIntosh. I commented that the population explosion was "the elephant in the room". That meeting was inclined to concentrate on the technical aspects, but when today's topic was announced, it seemed to me that over-population was a key aspect of *Agriculture and conflict*, and that this merited further airing. My use of the elephant phrase was noted by TAA SW Chairman John Wibberley, who suggested the present title. An elephant in the room, presumably, is something very large and potentially intrusive, but that becomes too familiar to be noticed.

Population ecology

Experience from applied population ecology is that populations of organisms expand to the limit allowed by the resource available to them (Wood, 2012). 'Positive resource' includes nutrition and physical needs, whilst 'negative resource', working against increase in the population, includes such factors as competition from other organisms, depletion of resource, build-up of toxins, and so on. This is a universal rule of biology. It applies equally to human populations, which, although they clearly have a degree of control over resource available, ultimately must reach a limit. The work of Diamond (2006) provides historical evidence of how this has happened. Populations in separated environments, such as islands or others bounded against cross movement, might rise to a high density and then crash or disappear altogether, as the exploitable resource is exhausted. Some such populations have managed to achieve a degree of stability by rigidly controlling recruitment into the active population.

In recent decades, there has been overt emphasis in agriculture to provide food for a growing population. Media examples abound: for example, a newspaper supplement about Paraguay (Business Focus, 2014) which emphasises that country's agricultural potential to "feed a growing world population". Most days we see such sentiments and, as agriculturalists, we have been encouraged to produce more food over the years - as far back as the late 1950s (when I was new to agriculture), there were "2.9 billion mouths to feed, and 3.5 billion expected by 1970". The crucial point proposed here is that it is not a case of population growing by some innate inertia so we have to provide the resource (mainly food) - the fact is that, if we make the resource available, we shall have more billions. If we cannot, we will not. And if resource declines, whether occasioned by demand of increasing population or some other influence, subsequent population decline will be inevitable.

The history of human population growth

What actually is the story of the human population? From the time of some acceptably accurate numerical data, say around 1600, a world population of about 0.5 billion crept up to reach its first billion in 1804 (Figure 1). It reached its second billion in 123 years, the third in 33 years more, and so on. The rate of increase was 2.13 percent at the maximum, in 1963, and is

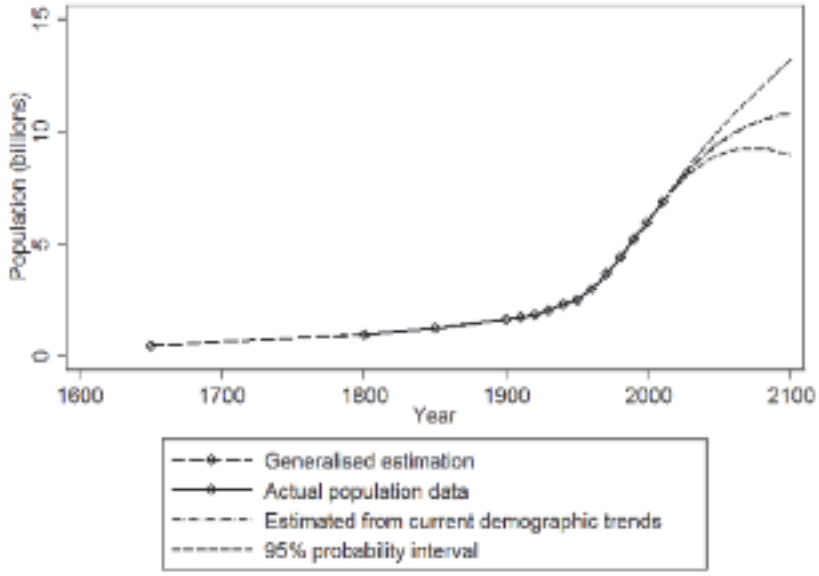

Figure 1. World population from about 1800 to the present, with assumptions earlier, and projections later (Sources: www.worldometers.info/worldpopulation and United Nations Secretariat, 2014)

currently 1.14 percent. From 1800 to the present, the graph is based on well-authenticated facts, but before that, and even more so afterwards, there is inevitably an element of guesswork. Why this increase occurred is also a matter for speculation, but is clearly a result of increasing control over resource limits. The key factors might be transport (fossil fuel use), communication, medicine, and even, perhaps, ever increasing agricultural efficiency.

Before 1600, numbers undoubtedly fluctuated. Populations were separated, and at various stages of change. Some populations would be increasing, until hitting a resource limit, then stabilising (which requires that loss is equal to recruitment gain), or more likely, declining. Mechanisms included starvation, pestilence, disease, or, particularly significant in the present context, conflict. Many populations were no doubt annihilated. Had anyone, at a given time and place, had access to prevailing demographics and knowledge of modern statistical method, they would surely have predicted outcomes different from what eventually transpired. Easter Island seems like a case in point (Diamond, 2006). It is unlikely that a forecast of future numbers made during the period with the flourishing population, around 1000 to 1600 AD, would have foreseen the crash to a total island population of 111 souls in 1700.

Future population predictions

Future population sizes can only be estimated from current demographic trends. Thus, in 2010, the United Nations Secretariat (2011), estimated that numbers would stabilise at around 9.5 billion by 2050, a figure accepted by the Foresight (2011) report. The calculation took into account a trend for affluent populations to show a declining birth rate, to replacement-only levels or even less. This is no doubt so, but recruitment is still likely through dispersal from other populations. Relevant perhaps is that populations in which fertility control might be expected to be among the highest, in the UK and USA, have increased respectively by 19 and 72 percent in the last 50 years. In a 2012 revision (United Nations Secretariat, 2014) using data from similar sources, with fertility data re-evaluated, the forecast was raised to 11 billion by 2100 and still rising. Useful popular reviews of this question may be found in Science (Gerland *et al*, 2014), and National Geographic (Kunzig, 2014).

Population projections have increasingly-wide mathematical confidence limits as they extend further into the future. Crucially, they cannot take into account the influence of ineluctable changes in resource, including those that arise inevitably from the population increase itself. What is certain is that populations cannot expand for ever. We may be confident of feeding a constrained number in a given circumstance, but there is no coping with the resulting expansion beyond resource limit. Even with a 1 percent annual rate of increase, the world population of 10 billion in 2062 would be 26.8 billion 100 years later - surely not realisable. What will be the mechanism of limitation? That is the question.

Limiting population growth

Annual population increases significantly greater than 1 percent still occur in many regions, and then reach an inevitable limit. Disease may strike, although modern medicine can restrain it. Starvation is common - we often hear that 2, 3 or 4 billion are near starving. A celebrated naturalist once said "starvation is nature's way of saying too many people". Quoting this, a somewhat whimsical commentator (Twitcher in the Swamp, 2013) said "when you are 87, you can say such things". Some such personal consideration might be why I venture to suggest that agricultural development to feed an increasing population will itself lead to conflict. The only way to avoid this is some conscious limitation to the increase of the benefiting population.

Issues of over-population and its environmental consequences are constantly exposed. There is a recent report that the number of animals in the world has halved in the last 50 years, with the clear implication that this is due to human population pressure. Radio programmes such as the BBC 4 series *Shared Planet* and *Costing the Earth* frequently relate to issues of over-population, sometimes overtly, but more often the link is not specifically mentioned, and is evident on reflection - that Elephant again. Conflict somewhere is ever-present. Usually it can be traced to pressure on land resource - *ie* the source of food - however much that may be rationalised as differences in ideology.

What then are the remedies? This is the difficult part! The first instinct of nearly all of us is humanitarian - to feed and shelter our fellows. Given the choice, everyone favours the good life, in a comfortable home, with adequate resource, rather than exposure to the uncertainties and adversities of the wild. The future, like that oft-quoted past, is a foreign country. We can be aware of the implications as we strive to increase agricultural efficiency and productivity. We can convey the message, and even in restricted projects with broad control, encourage the need to restrict reproduction and recruitment into the population.

Dangers, however, still abound, and they need monitoring. A recent radio programme from the sphere of big business (*Analysis*, 2014) quoted the expression 'wilful blindness'. This implies something that is or should be obvious, but is ignored. Generally it relates to circumventing responsibility, but perhaps there is another aspect - the feeling of being unable to do anything about it. The world might now be a global village, but it is unlikely that globally acceptable solutions will ever be possible - population consequences are likely to be regional, and the very process of over-population might well lead to fragmentation. It is unlikely that an international body could emulate, for example, the conferences on climate change (and even they have only had limited success). Contraception is put forward by the United Nations Secretariat (2011), but any specific suggestion is likely to be seen as from an 'interest group' and face opposition from others concerned only with that single issue - such as birth control or immigration.

Conclusion

As agriculturalists, we must still strive to improve agriculture, developing effective projects aimed at higher and more reliable production. Our contribution could perhaps be to keep the downside of any such development in mind, and to look at ways of promoting the need to limit the population growth that would tend to follow.

Acknowledgement

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SW seminar on *Dairying*, held at Burnham-on-Sea, Somerset on 19 March 2015

Keynote paper: Overview of trends and issues in dairying globally

John Wibberley

Professor John Wibberley, PhD, FRAgS, is an agriculturalist and resource management specialist who works in the UK and internationally, especially in Africa. He is a visiting Professor (Comparative Agriculture and Rural Extension) at the Royal Agricultural University, Cirencester, where he was until 1989 Head of Agriculture. He is a Secretary of State Appointee on Exmoor National Park Authority, serves on the National Trust Council, and coordinates the Council for Awards of Royal Agricultural Societies, which recognises outstanding contributions to UK agricultural progress. ejwibberley@btinternet.com

Global dairy production

Dairy farming data from many countries strongly illustrate the loss of family-worked farms (Wibberley, 2014). Of some 1.4 billion cattle in the world, around 260 million are dairy cows and around 150 million families are engaged in milk production worldwide (FAO, 2014). Overall, world milk production increased by 50 percent over the three decades between 1982-2012, from 482 million tonnes to 754 million tonnes. Though still a minority of this total, non-cattle milk production (from sheep, goats, buffalos, camels) is also increasing (Faye & Konuspayeva, 2012). This latter trend

may assist small producers in sub-Saharan Africa allowing them to satisfy the informal market sector in the face of growing concentration of formal cow's milk marketing in such countries as Kenya. India is the world's leading milk producer with 16 percent of the total from some 45 million dairy cows, followed by the USA, China, Pakistan and Brazil. While milk production has increased, the number of producers has rapidly declined, especially in North America and Europe. However, India has a National Milk Day (26 November) in honour of the late Dr Verghese Kurien, 'Father of The White Revolution', popularly known as 'the Milkman of India' (Anjana John *et al*, 2014).

Indian self-sufficiency in milk

India's self-sustaining dairy industry stems from Kurien's belief and practice, in nurturing the capabilities of farmers for socio-economic transformation. Kurien's innovative social entrepreneurship - driven by his integrity, fearlessness and perseverance - led to the establishment of the dairy cooperative movement, starting in Anand and replicated elsewhere as *Amul*. He also founded the Institute of Rural Management Anand (IRMA) to promote equitable and sustainable development. This successful collectivisation led to the formation of India's National Dairy Development Board (NDDB) to replicate the *Amul* model nationwide. *Operation Flood* in 1970 was the world's biggest dairy development project and made India a milk self-sufficient country. Kurien was passionate to ensure that farmers gained control of primary production, processing and marketing. He deplored the political hijacking of some cooperatives, believing in democratic control of autonomous cooperatives freed from government interference with farmer sovereignty over resources they managed.

USA decline in dairy farmers

USA trends are instructive. Dairy cow numbers declined from 17.5 million in 1960, via 10.2 million in 1990, to 9.1 million in 2010. Partially compensated by increasing annual yields per cow, dairy farmer numbers (producers) declined at a faster rate - from 369,210 in 1978, via 220,880 in 1988, to 60,000 in 2011 (Wibberley, 1990 and Table 1). This represents a loss of around one-third of a million dairy farmers in the USA during the past 30 years, a massive 84 percent loss. Adoption of Bovine Somatotrophin (rBST), which may increase milk yields by 15-25 percent, is greater the larger the herd size since fear precludes denial of use when competitors may adopt it.

EU decline in dairy farmers

EU dairy farmer numbers fell by 6.5 percent in the 27 countries in one year, 2011/12 to 2012/13 (www.dairyco.org.uk 2014) - with this fall greatest in the newest EU members: Bulgaria lost 21.7 percent (3,003) producers in that single year; and in Romania 9 percent (32,934) of farmers went out of dairying in that year, although still leaving one-third of a million dairy producers in Romania - 36.3 percent of the EU27 total! Table 2 shows the decline in dairying in five countries over 25 years from 1989-2014 (Wibberley, 1990; DairyCo, 2014). England and Wales lost 7,000 of 17,000 dairy farmers between 2003-2013.

Dairy agribusiness in China

China leads the nations with the highest milk deficits; yet it is actively seeking to dismantle its renowned energy-efficient agrarian structure of small farms in the name of supposed progress and political advancement, currently supplanting some 700,000 farming people with agribusinesses without regard to their alternative employment nor to the consequent loss of resilience of their national ecosystem security (Nie & Fang, 2013). Obsessive pursuit of 'least cost per kilogram of product' anywhere inevitably compromises sustainability criteria. Over-borrowing and failure to part-time farm and diversify threatens too.

Dairy farmers in Africa

In Africa, Ethiopia has the largest number of dairy cows (some 10.7 million in 2011), followed by Kenya where some 4.8

Table 1. Recent decline in USA dairy producer numbers with herd size increase

Herd size	Producers (k) 2010	Producers (k) 2011	% Production 2010	% Production 2011
1-29	20.0	19.4	1.1	1.0
30-99	26.6	24.9	14.1	12.6
100-499	12.5	12.3	23.9	23.5
500-999	1.67	1.65	12.7	12.6
1000+	1.68	1.75	48.2	50.3
	62.5	**60.0**	**100**	**100**

Source: USDA, 2014

Table 2. Decline in dairying - especially producer numbers - 1989-2014 in five EU countries

	UK	France	Spain	Portugal	Ireland
Cows 1989	3.0 million	5.6 million	1.7 million	400,000	1.4 million
Cows 2014	1.8 million	3.6 million	0.8 million	200,000	1.0 million
Farmers 1989	50,000	268,000	251,000	108,000	69,000
Farmers 2014	14,400	77,200	19,600	6,900	18,400
% Farmer loss	**71**	**71**	**92**	**93**	**73**

Source: Wibberley, 1990 and DairyCo, 2014

million tonnes of milk is produced per year (around 4.5 million tonnes from cows and the rest from goats and camels). Kenya has some 2.75 million farmers, around 650,000 of whom produce milk. Some 80 percent of Kenya's milk producers have fewer than five cows, and these small ventures (including those started by entrepreneurial youths) have been increasing since the 2003 restructuring of the Kenya Dairy Board and the revival of a new KCC (Kenya Co-operative Creamery) together with import/export adjustments. Post-election violence in 2008 disrupted dairying in the Rift Valley. The concentration of milk processing, as in other countries, has the potential to encourage larger herds leading to displacement of small ones, and this trend could soon outstrip the welcome expansion of dairying in Kenya during the past decade to meet growing population and rising consumer demand for dairy products. Loss of dairy farmers begs the question: what alternative productive activity can they engage in to contribute to Kenya's real economy rather than boosting unemployment and its community/geopolitical instability?

Summary of dilemmas and developments in dairying

- Yield/cow x cows/herd x no of herds → scale increase means yield/cow up, cows/herd up and number of herds and producers down substantially. To stay in dairying needs good succession planning.
- Processor concentration and power up.
- Supermarket concentration and power up.
- Milk price down (by 30 percent in UK from summer to autumn 2014) and relative to bottled water and other drinks worldwide.
- Bureaucracy increase post-Milk Marketing Board (UK since 1994) and quotas (UK since 1984).
- Robotic milking and precision farming.
- Cross-breeding to blend productivity with resilience for harsher climes and diets.
- AI - 'top of pops' bulls and 'Holsteinisation' as leading breed worldwide; genomics.
- MOET (Multiple Ovulation and Embryo Transfer) and 'top of pops' dams.
- Sexed semen - Cogent since 1995 (→ 93 percent reliability of female progeny).
- Adding value on farm to all dairying outputs (cream, yoghurt, cheese, ghee *etc*).

The pros and cons of these trends need to be addressed by producers, processors, sellers and policy-makers.

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Newsflash

Occupying the boundary between science and policy

Many TAA members spent their careers working on the boundary between science and policy - and we did not always sit on the fence! A series of three short articles in *Nature Climate Change* reviews the pros and cons of professional advocacy in relation to climate change, but the same arguments apply to ways in which, within our own expert fields, we can - or even should - seek to influence agricultural policy. There is scope for a lively debate on this subject in our columns! The articles are accessible on: www.nature.com/natureclimatechange.

The original article (Rose, 2014a) opened by stating that policy-making is rarely driven by scientific evidence alone, as evidenced by the slow and inadequate responses of governments to the evidence of global warming presented by scientists. He sets out five ways in which he thinks that scientists could better influence policy-makers. (i) Reject an evidence-based mindset: policy is not determined by scientific evidence alone (as is also reflected in local and national politicians' responses to the Somerset Levels floods in 2013-14 (see Thorne, 2014). (ii) Think 'evidence-informed': evidence must interact with other factors influencing policy, so scientists must understand and adjust to competing interests. (iii) Do not overrate certainty: especially in environment-related sciences, absolute certainty

is often impractical so, for example, a change from 90 percent to 95 percent certainty in the case of successive IPCC reports is unlikely to influence political decisions. (iv) Tell 'good news' stories: emphasise the positive (*eg* adaptation in the case of climate change) rather than focusing on dire predictions. (v) Be policy-relevant: package scientific evidence in policy-salient ways, *ie* that it is not necessarily alien to other political priorities. He concludes that "the battle may be won by firing a broadside shot at policy-makers, loaded with targeted information about how policy systems work and which issues are particularly prominent in holding up meaningful action, as well as containing astutely framed practical solutions."

A letter in a subsequent issue of the journal (Morecraft *et al*, 2014) challenged these views, stating that a clear distinction needs to be drawn between the presentation of evidence and advocacy of policy responses. The prime duty of scientists, they state, is to present their work clearly and effectively so as to inform not only policy-makers but also practical people in related policy-associated disciplines such as engineers, farmers, planners, *etc*.

Responding, Rose (2014b) pointed out that better communication alone is rarely influential. He recommended that more work needed to be done on the boundary between science and policy so as to help illuminate what the role of modern scientists should be in relation to policy formation (and, one might add, in agriculture, to policy implementation and monitoring).

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Hugh Brammer

News from the Field

New forest policy framework for India

Environment Ministry presents new document seeking to balance the Indian Government's bid to ease green clearance norms with the need for development

Over the years, forests in India have suffered serious depletion mainly due to relentless pressure from demand for fuel-wood, fodder and timber; and diversion of forest land to non-forest uses. Since 1980, a total of 1.21 million ha of forest land have been diverted for 23,784 proposals for non-forestry purposes - primarily mining and industrial projects. Nearly 400,000 ha have been diverted in Madhya Pradesh alone, followed by over 100,000 ha each in Maharashtra and Chhattisgarh.

The Ministry of Environment and Forests (MoEF) launched a basic framework in March 2015, aimed at presenting the nation with its third forest policy - an overarching document for forest management that will seek to balance the government's bid to ease green clearance norms with the need for development for the next 25 years.

The Ministry has entrusted the Indian Institute of Forest Management (IIFM), Bhopal, with the task of steering the process through working groups around key thematic areas to revise the national forest policy (NFP), only the third such after earlier ones in 1952 and 1988.

A key component of designing the policy will be a lengthy consultation process with all stakeholders such as state governments, key infrastructure ministries, civil society groups, non-governmental organisations (NGOs), scientists, forest-dwellers and others. The framework is now in the public domain for people's views for advanced consultation.

A recent report of the high-level committee headed by former cabinet secretary TSR Subramanian had criticised the Environment Ministry for not defining what constitutes a forest area. It had asked the Environment Ministry to not only define forests but also identify inviolate areas, *ie* regions that would be out-of-bounds for non-forestry activities like mining and industrial projects. The issue of go and no-go forest areas has pitted industry against the Environment Ministry amid serious objections from NGOs and tribal groups over allowing pristine forests to be cleared.

Prime Minister Narendra Modi, in the run-up to the 2014 general election, had assured industry that he would simplify and ease green clearance norms - a pledge he has carried through in government, with the Environment Ministry having made several policy changes in the face of criticism. The new forest policy is expected to take care of the concerns raised by the Subramanian report, and will also take into account related developments in recent decades, including the ambitious Green India Mission and the Forest Rights Act of 2006.

The new policy, therefore, will aim to evolve a new strategy for forest conservation that involves preservation, maintenance, sustainable utilisation, restoration, and enhancement of the natural environment. It will also address the important issue of climate change - a topic that the NDA government under Modi has tried to bring into the mainstream. Currently, 22 percent of India is under forest cover. India's target is to increase this to around 33 percent, which many, including former environment minister Jairam Ramesh, have described as unrealistic, given the pressures on resources from India's increasing population.

Read more at: http://www.livemint.com/Politics/PkLQKM81PRCgAHnzAaRP9O/Work-begins-on-forest-policy-basic-framework-by-March-2015.html?utm_source=copy

Keith Virgo

Implications of urbanisation for agricultural value chains and markets in sub-Saharan Africa: A review

Karim Hussein

Karim Hussein is Policy and Research Adviser, Global Engagement and Research Division, in IFAD's Strategy and Knowledge Department leading analytical and policy work on rural-urban linkages, increasing smallholder productivity and incomes, inclusive rural transformation in fragile situations, food security and nutrition in protracted crises.

Summary

This paper reviews selected evidence on national and regional smallholder agricultural value chains and urbanisation processes in sub-Saharan Africa (SSA). It begins by setting the context of rapid demographic change, urbanisation and implications for smallholder agriculture. Then it draws out five issues that emerge from the literature that need to be addressed in efforts to support smallholder agriculture in the context of urbanisation in SSA: the constraints and opportunities faced by smallholders in order to meet demand in urban markets; population and urbanisation trends shaping and driving change in agriculture value chains; flows of food and agricultural products within and between SSA subregions, including competition from food imports; shifts in consumption habits by urban populations; and the impact of demographic and consumption trends in urban areas on opportunities and constraints in rural agricultural systems and agricultural value chains. There is a wide literature that examines the significance of *global* agricultural value chains in Africa, but this is beyond the scope of this paper.

Introduction

Rapid urbanisation accompanied by dramatic population growth in the developing world in recent decades (with urban centres experiencing most of this population growth) are key factors shaping food production and consumption, factor markets and rural development around the world. Productivity growth in agriculture provides the food supply for urban growth and transformation, and frees the labour force for urban areas, while rural transformation is shaped by the growth and diversification of the demand for food and raw materials from the urban economy.

Urbanisation creates both opportunities and challenges for smallholder farmers around the world. Rural and urban areas, food consumers and producers, are linked by agricultural value chains, ecosystem services, urban consumption, labour and migration, commercial services, natural resources, infrastructure, energy and transport. Growing urban centres need fresh food and other agricultural products not only from international markets, but also from the rural areas close to them and from their rural hinterlands to ensure an economically, environmentally and socially sustainable urbanisation. In developing countries, most of this local food comes from small-scale food producers or smallholders.

Even though rural-based populations continue to constitute a majority in many areas of South Asia and sub-Saharan Africa, the growing numbers of people residing in urban centres (small and medium-sized towns as much as cities) is altering the patterns of demand for food and other agricultural commodities. However, the speed, extent and pattern of this structural change and its implications for smallholders differ greatly according to context.

Rapid demographic change, urbanisation and smallholder agriculture

According to the UN, continuing population growth and urbanisation are projected to add 2.5 billion people to the world's urban population by 2050 while the world's rural population is growing slowly and is expected to decline in the coming decades (UN-DESA, 2014). Africa remains mostly rural, with 40 percent of its population living in urban areas, but it is urbanising fast (UN-DESA, 2014). Africa's urban population is projected to increase from 414 million to over 1.2 billion by 2050, or from 40 percent of the population in 2014 to 45 percent in 2030 and 56 percent in 2050 (UN-DESA, 2012). In Ethiopia, for example, the number of people living in cities is expected to triple by 2040.

The growing urban population is altering the patterns of demand for food and other agricultural commodities. Urbanisation and income growth often drive increases in the demand for high-value foods, including meat, dairy, edible oils, and processed and packaged foods (CGIAR, 2012). Urban beverage markets alone are expected to reach USD 1 trillion by 2030.

Urbanisation in SSA is driving change in factor markets (*ie* land, labour and capital) and food markets, both upstream and downstream, in agricultural value chains (where agricultural value chains are key processes around a product from the provision of inputs, production itself, transportation, transformation, handling, processing, marketing, trading, and retailing, to final consumption). However, Masters *et al* (2013) point out that the demographic dynamism of cities in Africa seems only loosely associated with urban economic dynamism: it also reflects the fact that much of smallholder agriculture continues to provide low returns to labour while the availability of services in rural areas is also very low.

As noted by Höffler & Maingi (2006): *"Structural transformation of rural agriculture-based economies into more urbanised economies opens up new market opportunities to rural*

producers and their trading and processing partners in the value chain - provided they succeed in linking up rural production with urban markets and ensure that economic benefits (eg employment generation) are geared to both urban and rural areas". These urban markets, and the evolving preferences of consumers, shape the demand and price (as well as the profitability) of smallholder production.

Where markets work well and producers are effectively linked to them, consumers play a major role in determining what food systems produce (FAO, 2013). Rural production can in this context play a key role in providing growing urban populations with affordable, fresh, high-quality food. Yet this is only true to the extent that the food system and food producers are able to respond to consumer demand. This is not always the case for poor smallholders in rural hinterlands with weak connectivity to major consumer markets, and limited capacity to produce processed foods consumed in urban centres, as is the case in much of SSA. In order to seize opportunities, smallholders need to find avenues to increase their integration with markets, gain greater economies of scale and higher market share. This may involve forming farmers' organisations, either trading directly themselves or cooperating more with agribusiness and private operators in the processing and trading industry. While it is clear that urban and rural transitions will influence rural transformations, there is much diversity across Africa; the implications for smallholders need to be considered in relation to the change dynamics in each sub-regional context.

This paper will now examine five key issues that emerge from a review of the literature on urbanisation and value chains in SSA.

Key issues from the literature review

The diversity of urbanisation processes and agriculture needs to be better understood: differentiated responses are needed to engage diverse producers.

The specificities and diversity of urbanisation processes and agricultural markets in SSA need to be better understood. SSA will not necessarily follow the same types of urbanisation and integration into global food value chains as has been seen in Latin America and parts of Asia. In addition, sub-regional urbanisation and agricultural market development processes differ. Differentiated responses are needed to address the constraints and opportunities faced by distinct types of rural producers, specifically smallholders, in order to effectively meet demand in urban markets.

According to Losch (2013), some two-thirds of the population in SSA derive their livelihoods primarily from agriculture, and one-third primarily from urban and/or non-agricultural 'informal' activities. Off-farm diversification is high in SSA, and rural income diversification is linked to access to towns and cities. The nature of this diversification is linked to the type of urbanisation process: towns and cities must provide a sufficient level of public goods (infrastructure, public services, *etc,* to strengthen the diversification process and increase returns to off-farm labour.

SSA is a fast-growing consumer food market, with urban food markets set to quadruple and the food and beverage markets to reach USD 1 trillion by 2030 (Deutsche Bank, 2014). The transition from subsistence to commercial agriculture implies a diversification of production systems and improved market connections. In West Africa, OECD (2013) notes that the growth in the network of small and medium towns has been accompanied by the development of markets. This growth of small and medium-sized towns, along with increased population concentration in large cities, contributes to agricultural and rural transformations. Rural areas with the highest density and best connections to cities are also more diversified local economies. Farmers with better links to urban markets may benefit most from new technologies that allow them to sell higher-value outputs to urban consumers (*eg* meat, dairy, fruits and vegetables sold on domestic and regional markets). In addition, farmers may be able to supply non-traditional markets, such as selling agricultural outputs for industrial uses or commercial food processing where these have developed (*eg* fruit canning, brewing, industrial starch production).

Population and urbanisation trends in SSA are driving change in food and factor markets - but urbanisation rates vary widely across countries.

Population and urbanisation trends in SSA are shaping and driving change in factor markets (land, labour and capital) and food markets, both upstream and downstream in agricultural value chains. Changes in labour markets are particularly important, as returns to smallholder and rural labour compete with returns to labour in urban areas. Rural out-migration to urban centres will also reflect, or be affected by, trends in productivity in agriculture. However, rural-urban migration trends at country level are very heterogeneous, and there is emerging evidence that, in some countries, a 're-ruralisation' is occurring, with urban dwellers returning to agriculture.

Rural-urban migration is contributing to the structural transformation of SSA's economy and society, and the rapid urbanisation observed in SSA, as elsewhere, has largely been made possible by large-scale migration from the countryside to towns and cities. However, demographic transitions within Africa have generally proceeded more slowly than in other parts of the world: (see: http://www.newsecuritybeat.org/2013/06/population-projections-released-pockets-high-fertility-drive-increase/). There is also much diversity between countries (see, *eg*, Madsen, 2013), with urbanisation rates often highest in coastal countries (Table1).

There are almost 200 million young people aged between 15 and 24 in Africa and the continent has the youngest population in the world, projected to double by 2045. Youth unemployment is a particularly important challenge in Africa - *ie* as high as 23.7 percent in 2012 - the highest youth unemployment rate in the world. Most young people reside in urban areas (UN-Habitat, 2013), but the skills of this population often do not match evolving market demands. Addressing youth unemployment requires an integrated approach that creates new skills and takes advantage of economic opportunities in *both* urban and rural areas according to Awa Ndah (CIVICUS website, 2013: http://www.civicus.org/). A comprehensive model that caters for rural development, rural-urban migration, preparation of young people for the labour market and investments in agriculture might be the key (World Bank, 2008).

Table 1: Urban and rural populations in Africa – 2014

Region/country	Urban population 2014	Rural population 2014	% urban 2014
World	3,957,285,013	3,367,497,212	54.0
Asia	2,113,137,370	2,271,706,727	48.2
Africa	471,602,315	694,636,991	40.4
Eastern Africa	101,034,466	293,719,991	25.6
Middle Africa	63,060,945	80,231,666	44.0
Northern Africa	112,068,513	104,995,632	51.6
Southern Africa	37,813,255	23,532,453	61.6
Western Africa	157,625,136	192,157,888	45.1

Source: United Nations, Department of Economic and Social Affairs, Population Division (2014)

Average figures on rural-urban migration across SSA also mask significant heterogeneity at the country level and processes of people returning to the countryside in some countries. For example, compared to the regional average across West Africa of 32 percent in the year 2000, urbanisation rates in the region range from 16 percent in Niger to 46 percent in Senegal (Hitimana *et al*, 2011). According to de Brauw *et al* (2014), while the average rate of rural-urban migration in SSA between 1990-2000 was just above 1 percent, and a very small number experienced migration rates of over 2 percent in the 1990s, a few countries had very slow or even negative rural-urban migration rates during the same period. The authors argue that this negative rate of rural-urban migration implies that re-ruralisation is occurring (also see Losch, 2013). In fact, there are several SSA countries with low rural-urban migration rates and high population shares remaining in rural areas.

Smallholder farms with access to urban markets are increasingly relying on remittances from migrant household members as a source of capital, and on seasonal migrants for labour. Remittances from urban migrant relatives are often a key source of cash for investment in agricultural production, especially where smallholders have difficulties accessing credit. However, the escalating costs of urban living make it more difficult for migrants to save enough to send money home (IIED, 2013). These-processes are also embedded in context-specific social and economic relations. The capacity for different categories of rural people (grouped by gender, age, *etc*) to benefit from non-agricultural, off-farm, diversified employment and income opportunities that may service urban centres varies greatly.

Urban demand is an important driver of flows of food and agricultural products, but these value chains present both risks and opportunities for smallholder incomes and for nutrition.

Urban demand and markets are important determinants, although not the sole drivers, of flows of food and agricultural products within and between SSA sub-regions; African markets - principally linked to urban centres - affect production decisions and consumption behaviour. Domestic agricultural production in SSA is more geared to supplying local, national or, in some cases, regional markets than to supplying global value chains and international markets. Growing national and regional markets for agricultural products, food and starch products are becoming increasingly important in the commodity chains that link agricultural producers with urban consumers and other buyers of agricultural products in African urban centres. These agricultural value chains present both risks and opportunities for improving smallholder incomes and nutrition. Specifically, African agricultural producers face stiff competition from food imports, especially in coastal cities and highly urbanised sub-regions, such as coastal West Africa.

In much of SSA, the food economy, along the entire value chain from producer to consumer, is predominantly informal. Understanding and accompanying the dynamics of this informal economy are crucial for addressing current and future food challenges. Informal and formal, traditional and modern food systems coexist and evolve as economies grow and urbanisation increases (FAO, 2013). Modern supply chains entail vertical integration of storage, distribution and retailing, and they offer efficiency gains that can yield lower prices for consumers and higher incomes for farmers. Improved sanitation, food handling and storage technologies in traditional food systems, in which most rural and urban populations still acquire most of their food, could boost efficiency and improve the safety and nutritional quality of foods.

However, urban over- and under-nutrition are often caused by the presence of refined foods with little to no nutrition value. A key entry point for addressing the nutrition dimension in rural-urban linkages is in localising food systems and linking urban food systems and consumption with the fresh foods produced in the regions around towns and cities and in their more distant hinterlands. Appropriate policies and strategies are needed to enable small producers to offer their fresh products at lower cost in urban markets while increasing their access to processing facilities and transport networks to improve value addition.

Urbanisation shifts and consumption habits increase the importance of markets: understanding what foods urban consumers buy and eat is central to understanding where opportunities lie for smallholders in urban markets.

Urbanisation leads to shifts in consumption habits. Understanding what foods urban consumers buy and eat, and why, is central to understanding where opportunities lie for smallholders in SSA's urban markets. For fresh products, open-air markets, small shops, kiosks and informal hawkers remain key outlets. But for processed food items, increasingly important for urban consumers, formal traders and bigger shops/supermarkets are growing in importance. Urbanisation also increases the demand for starch products, both as staple foods and for use in food processing targeting

urban consumers. If smallholders are to benefit effectively from these markets and sell higher-value products to food processors and to urban consumers, they need to be able to access the facilities to condition, semi-process and package fresh products.

Agricultural value chains link urban consumption and rural production and marketing systems through demand for food and agricultural products, which is changing due to urbanisation, impacting on rural areas along value chains (Höffler & Maingi, 2006). Urban markets are the destination of more than one-third of starch products in SSA (grains such as maize and wheat, roots and tubers such as cassava) (AFD, 2013). Urbanisation has also boosted rice consumption across the continent. A baseline food security survey in 11 southern African cities by the African Food Security Urban Network (AFSUN) confirms this trend, finding that dietary diversity was very low in all cities, which heavily rely on starch staple crops (Battersby & Crush, 2014).

Understanding what foods urban consumers buy and eat, and why, is central to understanding where opportunities lie for smallholders in SSA's urban markets. Urban consumers are increasingly buying cooked or ready-to-eat, semi-processed and processed products (*eg* for wheat and maize: flour, bread, tortilla, semolina, couscous, malt, maizemeal, porridge, cornbread, corn starch, corn oil). There is also an emerging preference for longer lasting, packaged fruit and vegetables over loose, fresh local produce that is hard to store and spoils more quickly, and an increasing demand for livestock products (meat and dairy). Hence, processing and packaging are key for smallholders to maximise access to urban market opportunities in SSA.

Urbanisation also increases the demand for starch products, both as staple foods and to produce sugars for use in food processing targeting urban consumers. Globally, around 10 percent of starch comes from cassava roots, a staple food of millions of low-income rural people in Africa, Asia and Latin America (see FAO, 2006: http://www.fao.org/ag/magazine/0610sp1.htm). Despite the competitive price of cassava on the international market as compared to other sources of starch, the starch extraction industry is very small in Africa (with the exception of Nigeria and South Africa).

Demographic dynamics and consumption trends in urban areas increase dependency on food imports and are shaping opportunities and constraints in agricultural value chains.

Demographic dynamics, with increasing populations in urban centres, noted in sections 1 and 2, and consumption trends in urban areas shape opportunities and constraints in rural agricultural systems and agricultural value chains. There is evidence of high dependency on food imports in many African countries,particularly coastal ones. This may have the effect of squeezing out opportunities for smallholders to benefit from growing urban markets in SSA. For national food security and macro-economic stability, it can therefore make good economic sense to invest in the development of national and regional smallholder agricultural value chains, linking smallholder farmers and agricultural production to urban markets through agricultural value chains.

Of three main drivers of urbanisation identified in the literature, two clearly relate to demographic dynamics: natural population increase, and rural to urban migration. Reclassification of land into urban land also contributes significantly to increasing urbanisation. In West Africa, the population living in urban areas is projected to reach 400 million by 2050 (OECD, 2013). This continuing growth of urban populations can contribute to the integration of rural areas into the market economies at local, national and international levels. Urban market development and evolving consumption patterns may also involve a shift in the composition of local agricultural production away from traditional crops and agricultural products, requiring a transformation of agricultural production.

There is evidence of high dependency on food imports in many African countries - particularly coastal ones - seemingly related to urbanisation. Agricultural policies in Africa in the past two decades have emphasised cash crops for export, leading to growing dependence on imports of staple foods such as cereals and pulses. In 2012, SSA countries spent USD 37.7 billion on food imports (Montpellier Panel, 2014). An Africa-wide study by the FAO for the period 2000-2005 showed that the majority of Africa's low-income countries (mostly in SSA) were net food importers, importing food to the value of USD 17 per capita per year. These countries have had difficulty covering their food import bills, as their export revenues were limited. Furthermore, in many SSA countries, more than 50 percent of small-scale farmers (73 percent in Ethiopia) are net buyers of staple grains (IIED, 2013). Domestic food production has remained relatively low and increased by 2.7 percent per year, just barely above the population growth rate, implying that any increase in per capita consumption had to be met by an increase in imports (FAO, 2011).

Deutsche Bank figures show that SSA's share of global imports is around 20 percent for rice and 10 percent for wheat. SSA needs to import over 20 percent of its cereal requirements on average and this share is much higher for some countries. For instance, Angola currently produces only 30 percent of its needs in grains, according to the National Grains Institute. The value of food imports over total merchandise exports is relatively higher in SSA compared to the developing country average of 5 percent. This indicates a relative vulnerability to global prices through limited ability to generate foreign exchange through exports. During the 2007-08 food crisis when rice and wheat prices reached record highs, several African countries, including Nigeria and Senegal, experienced riots (Deutsche Bank, 2014).

For national food security and macro-economic stability, it can therefore make good economic sense to invest in the development of national and regional smallholder agricultural value chains, linking smallholder farmers and agricultural production to urban markets through agricultural value chains.

Conclusions

This paper has sought to provide an initial overview of national and regional smallholder agricultural value chains and urbanisation dynamics in SSA. Five key issues on urbanisation and agricultural value chains in SSA merit further attention and analysis in investment, policy and programming in the region.

In the context of rapid urbanisation and agricultural transformation in SSA, investment in smallholder production, rural businesses and food sector entrepreneurship - particularly in support of initiatives by smallholders, rural women and young people -

creates employment opportunities, increases incomes and improves food security and nutrition: see also the Montpellier Panel (2014), which highlights similar issues for action. Such investments will be critical to achieving inclusive and sustainable food and nutrition security in SSA in both urban and rural areas in the years ahead.

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News from the Regions

East Anglia Branch Seminar on *Assuring Food Security*, held in Hughes Hall, Cambridge on 14 May 2015

Overview

The Tropical Agriculture Association (TAA) East Anglia Branch and the Cambridge Humanitarian Centre arranged a seminar on the theme *Assuring food security to 2050, including implications for climate change and biodiversity loss*, in collaboration with CambPlants Hub, Cambridge Conservation Forum (CCF) and the University's Global Food Security strategic initiative (GFS). With some 50 people attending, the seminar proved to be a great success. It was opened by Keith Virgo (TAA Chairman) and Lara Allen (Director of Humanitarian Centre), with brief descriptions by Mariana Fazenda and Will Simonson of the work of our other partners.

Two speakers, who looked at the opposite sides of the food security issue, made presentations (presented in full over page):

Figure 1. The speakers (centre) and organisers

- Dr Bojana Bajželj (Cambridge University Engineering Department) looked at means to manage food demand, in her presentation *Why we need to address food demand*.
- Prof Amir Kassam (University of Reading and FAO) and Dr Gottlieb Basch (University of Evora, Portugal, and President of the European Conservation Agriculture Federation, ECAF) then presented their paper on ensuring the supply side of food production: *Mobilising greater crop and land potentials: replacing the faltering engine*.

Ample time was allowed for interactive questioning and discussion of each presentation. The range of interests of participants was illustrated by the diversity of issues discussed, from impacts of CA on birdlife to alternative uses of grass if not consumed by cattle and sheep.

Special thanks are due to Emily Brocklebank of the Humanitarian Centre for her efficient organisation and logistics management of the seminar. We were also grateful to Hughes Hall for provision of the Pavilion Room. We are pleased to report that £50 was donated to the TAAF and that ECAF joined the TAA as a corporate member, through Gottlieb Basch.

Keith Virgo

Why we need to address food demand

Bojana Bajželj

Bojana is a doctoral researcher in land-use, food security and climate change. She develops general methodology for the Land and GHG emissions issues in the Foreseer tool. Her latest paper examined the scenarios for global agriculture to 2050, and the importance of food-demand reduction strategies. Before joining the University of Cambridge, Bojana worked as spatial planner and later environmental consultant. She holds an MSc in Environmental Technology from Imperial College London and a BSc in Landscape Planning from the University of Ljubljana. bb415@cam.ac.uk

Summary

Global food demand is predicted to increase with population growth, and increasing *per capita* consumption. As countries and individuals become more affluent, they tend to consume more and different foods: some of this increase is beneficial to their health, but some of it can be detrimental. Sadly we live in a world of two extremes where two billion people are struggling with the effects of over-consumption of food, while about the same number of people suffer from hunger or nutrient deficiency. Regardless of what the effects of increasing *per capita* consumption are on well-being, they will have some very serious environmental consequences (including significant contribution to climate change) unless the problems of food over-consumption and waste are addressed.

Food demand projections

There are two widespread projections for global food demand by 2050: one by a UN Food and Agricultural Organisation (FAO) panel of experts (Alexandratos & Bruinsma, 2012) which predicts a 60 percent increase, and one based on a regression between *per capita* GDP and crop calories (Tilman *et al,* 2011) which predicts that, in order to support increasing food and particularly meat demand, crop production will have to increase by 100 percent by 2050. FAO uses expert judgement to give *per capita* consumption for main food groups in 2050. The projection by Tilman *et al* (2011) uses a relationship between *per capita* GDP and domestic crop supply for economic groups of countries to derive a convincing regression following a square-root curve. Based on this relationship and projections for global GDP in 2050, the demand for crop products is predicted to increase by 100 percent for protein crops such as soya, and less for others. This projection covers crops from cropland, including livestock feed, but does not cover pasture-based livestock production or specify how livestock production will evolve in the future. It does not differentiate between different commodities in any way.

Neither of the two projections therefore differentiates between the main livestock products such as poultry, pork, dairy and beef. Yet different livestock products are associated with very different land-use and GHG emission outcomes. An analysis of the available FAOSTAT Food Balance data (2013) reveals that world regions have very different patterns of consumption of different animal products over time and/or *per capita* GDP. Universally, the livestock consumption per capita has been increasing, except in the lowest-income countries that for various geo-political reasons have experienced no economic development in recent decades, but at different rates: more for poultry and less for beef. The demand for livestock has also slowed down or halted in some of the highest-income countries.

Food production is increasingly recognised as an important contributor to GHG emissions. Bajželj *et al* (2013) show that 30 percent of current global greenhouse gas emissions are related, in one way or another, to food. Food is a driver for other environmental damage such as groundwater depletion, nitrate pollution and biodiversity losses, all considered to be critical planetary boundaries (Rockström *et al,* 2009).

There is therefore a need to further improve our understanding of food demand in the future, particularly that for meat products. In this way, we could better understand how to target action so that people in high- and middle-income countries eat healthier diets, people in low-income countries and segments of society eat adequately, all while reducing the impacts of food production on the environment.

Consequences of projected food demand

In a recent paper (Bajželj *et al*, 2014), we calculated the consequences of the demand as projected according to FAO and Tilman *et al*. In the business-as-usual scenario, we assumed that crop yields progress linearly according to current trends, as reported in a study by Ray *et al* (2014), and livestock systems intensify to a small degree, without including improvements in the emission intensities of either crop or livestock products. Under these assumptions, projected food demand will not be met by increases in yields alone, resulting in additional cropland expansion, so that overall cropland area would expand by about 40 percent. The results are markedly different for different regions: greatest increases are calculated for the sub-Saharan and South Asian region. Due to livestock intensification and assumed pasture yield increases, the projected increase in pasture area is somewhat smaller - about 15 percent - compared to its current area (which is highly uncertain in itself). GHG emissions are predicted to increase by about 80 percent under these conditions, mostly due to increased livestock numbers and further deforestation in the tropics.

The second scenario is more optimistic about the supply-side mitigation. It assumes we will be able to achieve yield gap closures - current optimum agro-climatic yields worldwide (their quantification is taken from GAEZ v3.0 project, IIASA & FAO, 2013) - by employing optimum fertiliser use and other sustainable intensification techniques. Such more dramatic yield increases almost (but not entirely) reduce the requirement for further cropland expansion. However, while this supply-side optimistic scenario reduces the GHG emissions by about 4.5 Gt CO_2eq, this still presents a 40 percent increase over 2009 levels.

Due to the complexity of the system, many additional factors could be included in the analysis. Inclusion of some of these factors - for example, the inclusion of the already changing dietary preference for poultry compared to red meat, or more intensive improvements in the livestock sector - would make the results more positive. On the other hand, inclusion of some of the other considerations, such as the limitations to crop yields from limited water availability, increased soil erosion, and full consideration of climate change impacts, would make results more alarming.

Benefits of reduced food waste and healthy, sustainable diets

Both of the above scenarios paint quite a bleak picture for the future. Under them the number of malnourished people is reduced, but not entirely removed. What if we instead imagined a world, where the 9.6 billion people in 2050 (United Nations Population Division, 2013) transition to universally healthy diets so that, even in the poorest regions, the diets are on average adequate, while in the West we reduce the amount of over-consumed calories, particularly those in the form of red meat, sugar and saturated fats? Indeed, our calculations showed that, with such healthier diets and reduced food and agricultural wastage, we could feed the world in 2050 on the same or a smaller area of land than we are using today, as well as reduce GHG emissions and water and fertiliser use.

In scenarios where food and agricultural waste were halved, the main benefit came from a smaller area required to satisfy the food demand and reduced use of resources such as fertilisers and water, leading to lower GHG emissions. The benefits of reducing the burden of food waste in landfills and other forms of waste management were not included, but would add additional savings in terms of environmental costs. Just avoidance of producing the food which is otherwise wasted could save 20 million ha of tropical forest by 2050, and about 4.5 Gt CO_2eq yearly emissions in 2050.

The other large difference comes from the amount of meat people will eat. The healthy scenarios assume people in the US would, for example, reduce their consumption of beef to a third, so that it would be equal to two 85g portions per week (while the average consumption of poultry and dairy could remain at today's levels). Reduction of meat consumption leads to double benefits from the environmental point of view: reduction of large areas required to provide both grass and grain feed for the animals, and reductions in methane emissions from enteric fermentation and manure management. The overall food-related yearly GHG emissions could therefore be reduced by about 6 Gt CO_2eq in 2050. If necessary, the amount of protein can be replaced with higher consumption of pulses, which have relatively low environmental impacts.

By combining both food waste reduction and a transition to universally healthier diets, the GHG emissions from food could be reduced compared with today's level. In order to avoid dangerous climate change beyond 2°C warming, this might indeed be necessary, as a number of other studies have also pointed out (Hedenus *et al,* 2014; DECC, 2015). Today's agricultural and land-use change emissions already represent about half of the yearly emission's budget predicted for 2050 (Rogelj *et al,* 2011), so any further increases in agricultural emissions (which are highly likely without demand-side interventions) would make it very difficult to achieve climate mitigation goals by actions in other sectors, such as industry, energy and transport.

Health and environmental costs and benefits of different livestock products are very different across different settings, societies and production systems. In low-income settings, eating more meat and dairy can be beneficial to supplement poor diets with essential nutrients, such as protein, iron and calcium. However, in western diets, we consume on average 2-3 times more meat than is required to fulfil these needs, and to levels that can be negative for our health, for example due to links to colon cancer (Rohrmann *et al,* 2013). Similarly, on the environmental side, some livestock production systems can be in tune with their surroundings and provide nutrition from land, not otherwise appropriate for food production. But again, such systems cannot scale out to provide enough meat to satisfy current demand, let alone for the demand as projected for 2050.

Not all low-impact foods are healthy, and not all healthy foods are low-impact: for example, unhealthy sugar can be produced with relatively low GHG emissions (Garnett, 2014). However, our and other scenario studies (for example those done by Tilman & Clark, 2014) show that a move towards healthier diets would bring environmental co-benefits. Reducing over-consumption alone would bring large reduction of resource-use and emissions, with further benefits arising if this

reduction is mostly in high-impact foods such as red and processed meat.

Perhaps one of the reasons why we are so wasteful with our food is that its price is too low for high and middle-income consumers, as MacMillan & Beeden (2014) suggested in *Ag4Dev23*. Because the price is too low, we over-consume, waste and consume more livestock products than our environment can sustainably support. Not only are environmental externalities, such as impact on climate change, not included in the price of the food that we pay, but also the widespread subsidy systems and the culture of paying farmers a low price, make food much cheaper than it should be under free market conditions. Two great hurdles in rectifying this are the general economic inequality (or as MacMillan & Beeden put it, lack of social security) and the vested interests in the current system. As the awareness of detrimental consequences of food wastage and over-consumption rises, well-thought policies and interventions will hopefully be put into place so that the future food demand does not follow the current business-as-usual projections.

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Mobilising greater crop and land potentials: replacing the faltering production engine

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Summary

Latest estimates from FAO suggest that the world needs to produce some 60 percent more food to meet the demand of the expected global population of 9.2 billion in 2050. A recent FAO forecast indicates that this can be achieved if we can maintain an annual increase in food production globally at an average rate of 0.9 percent, with a variation in regional rates from 0.3 percent in Europe to 1.6 percent in Africa. In terms of the actual output of food, this corresponds to an increase in cereal production from 2.52 billion tonnes in 2014 to 3.28 billion

tonnes in 2050 from an area of some 736 million hectares. This equates to an average yield of 4.33 t/ha to meet food, feed and biofuel demands as well as losses of some 40 percent. If wastage was halved, the yield required would be 3.46 t/ha, and the total output required would drop to 2.64 billion tonnes, not much more than what the world agriculture is producing now. Reducing wastage is not going to be a simple matter because the issues involved are to do with our food habits as we become more affluent and urbanised, and the way the modern food system operates to store, process, package and deliver food to meet demands. However, we can presume that there will be increasing pressure in the future from the consumers and governments to minimise wastage of food as costs of production and consumer prices rise.

To characterise the nature of the supply side, we have used cereal output required, and the corresponding net land area and average yield, to set the quantities involved. This is because two-thirds of our calorie needs are met by cereals. Also, the proportion of net land area under cereals to non-cereal crops is about 50:50, and as cereal production increases, so does the non-cereal production. Thus the total agricultural land area required to meet global agricultural needs from annual cropping in 2050 will be some 1.53 billion hectares. There is additional need for land for permanent crops of various kinds which would suggest a total net land area needed for annual and perennial crops of around 2 billion hectares.

Currently, the total agricultural cropped area is 1.6 billion hectares. According to FAO, actual and potentially suitable agricultural land area globally is some 4.5 billion hectares. Thus, the current net cropped land area corresponds to some 36 percent of the total global available suitable land area. In addition to the suitable agricultural land, there is some 2.7 billion hectares of marginal lands. We believe that this includes some 0.5 billion hectares of land area that was once suitable agricultural land but has been abandoned over the years due to severe land degradation and erosion.

For the expected plateau population of 10 billion around 2100 and beyond, the total cereals required could be some 5 billion tonnes, if everyone were to demand some 500 kg per capita of cereals, which is the current level in Europe to meet food, feed and biofuel demands and the amount that is wasted. This equates to a yield of some 6.55 t/ha assuming no more area expansion in the net cropped area beyond 2050 (*ie* 763 million hectares) and no decrease in wastage, or 5.24 t/ha assuming 50 percent decrease in wastage. Alternatively, if we assumed an expansion of net land area for cereal cropping to 1 billion ha, then the corresponding yields would be 5.0 t/ha assuming current levels of food wastage, or 4.0 t/ha assuming a 50 percent decrease in food wastage. Whichever way the future unfolds, it would seem that the total net area required to meet global food and agricultural needs would be between 2 and 2.5 billion hectares.

Based on the assessments of land and water resources available, FAO and their collaborators have maintained that it should be possible to meet 2050 global food, feed, biofuel demand (including wastage) within realistic rates for land and water use expansion and yield development.

The 'hidden' reality and costs of conventional tillage-based production systems

While the quantities of yield and total output supply involved to support the food demand at 2050 appear agronomically doable, and there appears to be enough available land and water resources to support the required output, the reality on farmland tells a different story.

The FAO future projections are based on assessments that assume the continued use of tillage-based agricultural production systems. The assessments do not explicitly take into account the resulting degradation and loss of crop and land productivity that has been occurring over the past years and which will continue in the future, leading to loss in productivity and marginalisation and abandonment of agricultural lands. The marginal suitability category of land in the FAO assessments includes much of the degraded and abandoned agricultural land whose original agroecological suitability status is unknown. Additionally, it is assumed that yield gaps can continue to be filled based on the current practice of intensive tillage and increased application of costly and excessive production inputs. In other words, the paradigm assumed to meet future food demand in the future scenarios of FAO and their collaborators is 'business as usual'.

Conventional tillage-based production systems (sometimes referred to as the Green Revolution paradigm) have generally become unsustainable for the future. This is because they have been causing land and ecosystem degradation, including loss of agricultural land, and loss of productivity and ecosystem and societal services. This Green Revolution approach does not seem to be going anywhere now, even in the nations where it is claimed to have made an impact in the 1960s and the 1970s. For example, it is often stated that countries in Asia were the first to benefit from the Green Revolution, but the question is why did it not continue to spread? In fact, the conventional 'modern' approach to crop production intensification based on expensive intensive tillage, seeds, agrochemicals and energy is often not affordable by resource-poor smallholder farmers, nor does it lend itself to socio-culturally inclusive development, given that all the individual production-enhancing interventions of increased inputs must fit into some form of 'neoliberal business model' in which it is assumed that farmers must purchase additional inputs from dealers who are buying those inputs from the manufacturer or supplier in the supply chain.

Also, where the Green Revolution approach is forced upon a country or communities, for example in India, Zambia or Malawi, the expected increases in yields have not occurred - sometimes quite the opposite - leading to indebtedness, corruption, marginalisation and even suicides. This has led some donors such as the Bill and Melinda Gates Foundation and Rockefeller Foundation to set up 'special' research-led development initiatives such as AGRA - Alliance for Green Revolution in Africa - but these are based on the conventional tillage-based paradigm and the Asian Green Revolution mind-set of the need for increased purchased inputs to support any likely increased output. However, the special AGRA initiative does not seem to be creating much impact so far, leading some

to question the very assumptions that inform the AGRA mind-set and development strategy.

The point we are making here is that the so-called Green Revolution approach has led, particularly since WWII, to a paradigm for production intensification that is based on intensive tillage and the notion that more output can only come from applying more purchased inputs. This mind-set also includes the indoctrination and creation of a behavioural culture in agri-*culture* that farmers and their service providers and governments do not need to worry about the negative externalities. The approach does not even call for an understanding of what should be the ecological basis of sustainable production intensification that can enhance both productivity and ecosystem services, while at the same time perform at the highest possible levels of efficiency and resilience, including coping with the impacts of climate change. Nor is there any concern being expressed in the Green Revolution approach about agricultural land area continuing to be severely degraded and being abandoned in the North and the South due to the negative impact of the conventional tillage-based production paradigm.

Further, as tillage intensity and topsoil pulverisation has increased with production intensification in conventional production systems in recent decades, this has been accompanied by greater exposure of bare soils to changes in weather and of crops to climatic stresses. There has also been a decrease in the diversity of crops in cropping systems, and a corresponding increase in mono-cropping. These practices in the tillage-based conventional production systems have all contributed, at all levels of development, to soil degradation and loss of agricultural land, decrease in attainable yields and input factor productivity, and excessive use of seeds, agrochemicals, water and energy, increased cost of production, and poor resilience. They have also led to dysfunctional ecosystems, degraded ecosystem and societal services, including water quality and quantity, nutrient and carbon cycles, suboptimal water, nutrient and carbon provisioning and regulatory water services, and loss of landscape biodiversity. In total, they constitute unacceptable food, agricultural and environmental costs being passed on to the public and to future generations.

This is why we say that if we are to: (i) mobilise greater crop and land potentials sustainably to meet future food, agriculture and environmental demands; (ii) maintain the highest levels of productivity, efficiency and resilience (*ie* produce 'more from less'); and (iii) rehabilitate degraded and abandoned agricultural land and ecosystem services, we need to replace the faltering production 'engine'- the conventional tillage-based production paradigm - and transform the food and agriculture systems that are built upon it.

Switching over to hope for the future: replacing the faltering production engine with Conservation Agriculture

The soil's productive capacity is derived from its many components (physical, biological, chemical, hydrological, climate), all of which interact dynamically in space and time within cropping systems and within agroecological and socio-economic environments. A productive soil is a living biological system and its health and productivity depends on managing it as a complex biological system, not as a geological entity.

A regularly-tilled soil, whether with a hand hoe or with a plough, eventually collapses and becomes compacted, cloddy and self-sealing. Instead of having 50 to 60 percent air space in a healthy undisturbed soil, tilled soils have a much lower volume of air space and no significant network of biopores. Of the 50 to 60 percent air space in a healthy soil, some 50 percent is able to be filled with water, thus serving as a major buffer against climate variability. On the other hand, a regularly-tilled soil would hold much less water due to its much lower air space.

Scientific studies and empirical evidence have shown that the biology of the soil and all the biological processes along with the other chemical, hydrological and physical processes depend on soil organic matter content. So the real secret of maintaining a healthy soil is to manage the carbon cycle properly, so that the soil organic matter content is always as high as possible above 2 percent, that the soil is not disturbed mechanically to minimise the decomposition of organic matter, and that the soil surface is protected with a permanent layer of organic mulch cover which also serves as a substrate for soil microorganisms. In addition to maintaining and supporting natural enemies of pests, a food web must be allowed to establish itself in the field, and this can only occur if there is a source of decomposing organic matter upon which to establish a food web above and below the ground surface, providing habitats for the natural enemies of pests.

To harness the conditions that are sufficient for achieving sustainable production intensification, agriculture must literally return to its roots and rediscover the importance of healthy soils, landscapes and ecosystems while conserving resources, enhancing natural capital and the flow of ecosystem and societal services at all levels - field, farm, community, landscape, territory and nation (and beyond).

The no-till production paradigm, known as Conservation Agriculture (CA), is totally compatible with the above multi-dimensional goal as defined by its following three interlinked principles:

- **Minimising soil disturbance by mechanical tillage** and whenever possible, seeding or planting directly into untilled soil, in order to maintain soil organic matter, soil structure and overall soil health.
- **Enhancing and maintaining organic mulch cover on the soil surface**, using crops, crop residues and cover crops. This protects the soil surface, conserves water and nutrients, promotes soil biological activity and contributes to integrated weed and pest management.
- **Diversification of species** - both annuals and perennials - in associations, sequences and rotations that can include trees, shrubs, pastures and crops, all contributing to enhanced crop nutrition and improved system resilience.

Implementing the above three principles using locally-appropriate practices, along with other good practices of crop, soil, nutrient, water, pest, energy management, appears to offer an entirely appropriate solution, potentially able to slow or reverse productivity losses and environmental damage. They

also offer a range of other benefits, which generally increase over time as a new and healthier soil productivity equilibrium is established, including:-

- Increase yields, farm production and profit, depending on the level of initial degradation and yield level.
- Up to 50 percent less fertiliser required if already applying high rates, and greater nutrient productivity with increased soil organic matter level.
- Some 20-50 percent less pesticides and herbicides required if already applying high rates, and greater output per unit of pesticide or herbicide. In the case where pesticides and herbicides are not used or available, integrated weed and pest management can achieve adequate pest and weed control.
- Up to 70 percent less machinery, energy and labour costs. In manual production systems, there can be a 50 percent reduction in labour requirement as there is much less or no labour required for seed bed preparation and for weeding.
- Increase water infiltration, water retention and up to 40 percent reduced water requirement and increased water productivity.
- Greater adaptability to climate change in terms of more stable yields, and lower impact of climate variability from drought, floods, heat and cold.
- Increased contribution to climate change mitigation from increase soil carbon sequestration, reduced greenhouse gas emissions, and decrease in the use of fossil fuel. Additionally, a lower carbon and environmental foot print due to reduced use of manufactured inputs such as agrochemicals and machinery.
- Lower environmental cost to society due to reduced levels of water pollution and damage to infrastructure such as roads, bridges and river banks as well as water bodies due to reduced erosion and floods.
- Rehabilitation of degraded lands and eco-services from all agricultural land under use as well as from abandoned agricultural land in which the eroded topsoil and the soil profile need to be rebuilt.
- Greater opportunity for establishing large-scale, community-based, cross-sectoral ecosystem service programmes such as the watershed services programme in the Paraná Basin in Brazil, and the carbon offset trading scheme in Alberta, Canada.

The above benefits have now been documented on large and small farms throughout the world. Consequently, increasingly greater attention is being paid to support the adoption and up-scaling of CA by governments, international research and development organisations, national research and development bodies, NGOs and donors. They all see it as a viable option for sustainable production intensification to support local and national food security, poverty alleviation, especially of smallholders, improving ecosystem services, and reducing cost of production and minimising land degradation.

In 2013, the global spread of CA was 157 million hectares, and since 2008/09, the global area under CA has expanded at an annual rate of expansion of 10 million hectares. Some 50 percent of the area is located in the developing regions and 50 percent in the industrialised world.

Conclusions

In light of the above, we draw the following conclusions:

- Meeting the projected 2050 food demand is agronomically doable, and enough land and water resources are available.
- But business-as-usual and continuing to rely on conventional tillage-based farming systems for further intensification of agricultural production is not an option to meet future needs sustainably.
- Production systems based on an ecosystem approach must contribute to meeting future needs.
- CA systems (including for rice-based systems) do this most effectively.
- CA is potentially applicable in most land-based agro-ecosystems and all cropping systems in rainfed and irrigated conditions.
- CA is increasingly seen as a real alternative, and constraints to adoption are being addressed. It is now increasing at the annual rate of 10 million ha, and covers some 157 million ha.
- Land, water and climate constraints affect regions differently. All regions, but especially resource-poor regions, would benefit from CA.
- For developed regions, CA can improve profit, sustainability and efficiency at high yields with less degradation.
- For developing regions, CA offers greater output and profit to small and large farmers with fewer resources and less land degradation.
- CA is capable of rehabilitating degraded lands and ecosystem services on land-based production systems world-wide.
- Policy and institutional (including educational) support, farmer organisations and champions are needed to mainstream the adoption of CA.

News from the Field

Transforming Mountain Forestry, ICIMOD Conference, 18-22 January 2015

This major 5-day conference, organised by the International Centre for Integrated Mountain Development (ICIMOD), aimed to bridge trans-boundary challenges with 21st century paradigms for the welfare of mountain people, forests and the environment in the Hindu Kush Himalayas. It was held in the magnificent Edward Lutyens-designed Forest Research Institute in Dehradun, Uttarakhand, north India. The event was co-sponsored by DFID. I was privileged to be invited to attend as a Panellist.

Figure 1. The Forest Research Institute, Dehradun, India

As with all such conferences, the greatest value was in connecting like-minded people - in this case 250 delegates from Nepal, Bhutan, Bangladesh, China, India, Afghanistan and Myanmar. Indeed, one aim was to encourage collaboration in managing this region of immense bio-diversity, forest resources and stored water (in glaciers and snow). Sadly, Pakistan was not represented due to a recent inter-government tiff over granting visas. It was also disappointing that there were only about 15 women present, and yet the bulk of work in the forests is done by women.

Many lessons were learnt. We should use more wood to reduce the huge carbon impact of concrete, but forests need to be managed to ensure a balanced bio-diverse landscape. The new use of the term 'landscape approach' to describe a variety of forest, grassland and farmland was reminiscent of the 'land systems' used in the 1960s. The earlier system of government management of forests is evolving into community forests (especially in Nepal) and the third generation of 'community forest enterprises' was predicted. The Afghan delegation sought advice on how to develop community forestry, especially where there are no trees. From Nepal, we learnt of the new 'Collaborative Forestry' approach on the Terai, with benefits shared equally between government and the users, similar to joint forest management widely used in India. A counterview was expressed from India that 'reducing community dependence on forests will improve the forests'. One delegate noted that ICIMOD adopts what he described as an 'eagle-eye view' but we need to consider the 'stoat-eyed view' as to what happens at the grass roots.

Much consideration was given to the payment for environmental services (PES) of mountain areas, whereby downstream users fund upstream investments: it was rightly pointed out that a better term would be payment for environmental *benefits* and it was also suggested that PES should include 'cultural' benefits. We also learned about the new byword ABS (access and benefit sharing), arising from the Convention on Biodiversity, which is now being applied to ensure that benefits from exploitation of forest products (such as medicinal plants by pharmaceutical companies) lead to royalties for communities from which the material was sourced.

It was perhaps symptomatic of the continued lack of international collaboration, when the Chair of the session on 'Trans-border Cooperation' asked the panellists and delegates for comments on the papers presented: there were no comments! However, the session on 'Conducive mountain forest policies' provoked some valuable recommendations. Bhutan was happy with their policy of 70 percent forest cover for eternity. The Indian team doubted the value of written policies that were never read but sought provision for a specific mountain forestry policy because 'one hat does not fit all' in such a diverse country.

Climate change was covered extensively. A warning was expressed that simply planting trees would have little significant overall global effect on sequestrating carbon; it should be seen as carbon cycling. REDD ('Reduced [carbon] Emissions from Deforestation and Degradation'), REDD+ and REDD Readiness were discussed at length, especially in terms of the real benefits to forest users who register for this complex international programme. One wonders what King Ethelred the Unready would have thought of this! Interest was generated by the session on FSC (Forest Stewardship Council) which is a voluntary system to certify forests so that their products may carry the FSC brand. Many forests have indeed been certified.

There was a hasty preparation of recommendations by five groups of delegates, which were presented at the closure ceremony. The latter was accompanied by due pomp and ceremony as His Excellency the Governor of Uttarakhand State entered to the skirl of Gorkha Rifles bagpipers playing '*Scotland the Brave*'!

Keith Virgo

Enchanting entrepreneurs in the Philippines

Eilidh Forster

Eilidh Forster, an MSc Tropical Forestry student from Bangor University in Wales, recently visited a unique 'incubator farm' community in the Philippines, Gawad Kalinga Enchanted Farm (GK EF). Inspired by this unique 'Enchanted Farm' model she explains how it is helping to reduce poverty across the Philippines. Eilidh plans to return to the Philippines later this year to research cacao agroforestry systems and the scaling-up of production to support growing businesses. (Photo: Eilidh Forster and Antonio Meloto, founder of Gawad Kalinga).

Summary

Gawad Kalinga Enchanted Farm (GK EF), located in Bulacan province around 50 km from Manila, is a unique farm community, conceived by the visionary social entrepreneur, Antonio Meloto. Mr Meloto is quick to emphasise that *Gawad Kalinga* is not a development *project* (he associates the term *project* with having an end point) but rather a social *movement*. *Gawad Kalinga* (which means 'to give care') aims to end poverty in the Philippines by making use of the staggering 12 million hectares of currently under-productive arable land and connecting farmers with social entrepreneurs to create sustainable Philippines-based agricultural businesses and jobs.

The problem

The Philippines, like many countries, suffers from chronic rural migration and young educated entrepreneurs and professionals are moving towards urban centres or abroad to pursue 'better' career opportunities: well-paid jobs working for big global corporations. This results in a loss of human capital that could potentially develop local industries with manufacturing or processing capabilities. As a result, the Philippines continues to import products that could otherwise be produced locally. For example, it sells cacao to Dutch traders and then buys back expensive chocolate, even though nationals know how to make (delicious) chocolate. The best chocolate brands are normally associated with the Swiss and Belgians despite not being able to grow cacao in their own countries.

The reverse is also true, wherein local businesses also choose to import raw materials to create products due to a lack of domestic industries able to supply them consistently. It is this vast opportunity presented by import replacement that *Gawad Kalinga* is using to inspire and develop a new generation of social entrepreneurs - with proven success.

The opportunity

Import replacement represents a huge opportunity for the Philippines to make better use of its rich natural and human resources in a sustainable, socially and environmentally responsible manner.

Gawad Kalinga's social entrepreneurship movement towards more inclusive growth is creating jobs, opportunities and wealth; reducing poverty; and helping the Philippines to become a more self-sufficient country with a stronger economy.

How *Gawad Kalinga* Enchanted Farm works

The *GK* Enchanted Farm is an inclusive platform for social entrepreneurship designed to be a conducive ecosystem for entrepreneurs and innovators to generate, share and test new models of business (whether for products or services) with the intention to have a positive impact on the ground.

As an ecosystem, the farm is able to connect interested entrepreneurs to the land, community partners, and the market, with the eventual goal of supporting these entrepreneurs to create proof-of-concept on the ground. The farm is intended to be an incubator for socially and environmentally responsible businesses.

Philippines facts

- 50 percent of the population depends on agriculture for their livelihood.
- The average age of farmers is around 57 years due to rural migration.
- Half the country's population is less than 23 years old and the average life expectancy is just 67 years.
- There are around 12 million hectares of under-productive arable land (owned mainly by absentee landlords and the Catholic church, but also by the state).
- The Philippines imports many of the products it consumes - from Europe, the Americas and Australasia. For example, 98 percent of its dairy is imported; 4 percent of which is from Singapore (which does not even produce its own dairy products).
- The Philippines is rich in natural resources and is among the most biodiverse countries in the world.
- The Philippines currently has the fastest growing economy in Southeast Asia - and is also among the fastest growing globally.

As *GK* EF start-ups are still in the initial stages of their development, a significant majority of their contribution to the community is long-term employment, as well as providing scholarships to raise a new generation of social entrepreneurs from the grassroots. They also pay rent for premises. While the focus of the social entrepreneur is developing their respective enterprises, their demonstration workshops and plots for their respective raw materials also contribute to the overall development of the Enchanted Farm - since one benefits the other symbiotically.

Gawad Kalinga has built a strong reputation over the years and central to this has been Antonio Meloto, who has huge credibility, both nationally and internationally, and who works tirelessly to raise its profile.

The growth of *Gawad Kalinga* Enchanted Farm

After its inception in 2003, the first phase of *GK's* development was the creation of communities. While the initial impression of *GK* to the general public is that of house and community building (Figure 1), there is a strong focus on instilling a new culture and mind-set in the communities so that they develop values and community organisation that ensure programmes and initiatives are sustained by the community in the long term. *GK* is now present in around 2,700 communities across the country and it continues to grow, especially in disaster areas such as those hit by Typhoon Haiyan. Community members become eligible to become residents of a GK community through a 'sweat equity' programme, wherein residents contribute their sweat, equivalent to the material cost of the house, by building their neighbours' houses through *Bayanihan* (community spirit).

Figure 1. Community homes

In 2011, *GK* began to prototype the second phase of its development: the birth of the *GK* Enchanted Farm model (a separate entity but only in a legal sense). This builds on the existing community platform and takes advantage of both the governance structure and value-based approach for sustainability through countryside development (focus on agriculture) and social entrepreneurship (inclusive growth). The initial two hectare property on which the *GK* EF Community stands was donated to the cause by a long term *GK* volunteer. As the initial idea for the *GK* Enchanted Farm began to form, land expansion was made through a combination of more donations, purchase and lease, eventually leading to the farm now being situated on a 34 ha site.

The *GK* EF in Bulacan is the first 'Farm Village University' to be developed, out of a planned 25 such establishments to be located in key provinces around the county. These Farm Village Universities will combine agricultural/enterprise activities (farm/industry), a community platform (village/people) and a learning environment (university) in one location.

The *GK* Enchanted Farm in Bulacan has become:

- **A destination for social tourism**. It showcases an alternative model of development, wherein rich and poor live and work alongside one another; sharing best practices, from both the private and public sectors of society in social enterprise development.
- **A university for social education**. The farm offers both formal (tertiary-level) and informal learning opportunities to share knowledge in this new field of sustainable development called social entrepreneurship. It has recently begun its own college for social business with the intent of raising a new generation of social entrepreneurs from the grassroots (mostly the children of farmers and construction workers). The farm also offers field trips and internship opportunities for those interested in learning more about this field or to complement existing curricula in their respective universities and colleges.
- **An incubator for social business**. The farm is an ecosystem for social entrepreneurship that is home to several start-ups at varying stages of development. Visitors can meet and interact with a variety of social entrepreneurs, coming from different regions of the world, intent on making the world safer, better and kinder through social business.

Figure 2. The organic farm

The Farm Village Community has now grown in size, with 50 local families and 34 ha of productive land. Indeed, the farm and its surrounding 100 ha has just been awarded protected status as an agro-innovation area. The community continues to grow and expand, featuring houses, an organic farm showcase (Figure 2) with a training centre, a two-year school for bright public high-school graduates, an arboretum, a 'bamboosetum', a one-hectare demonstration farm plot, production and processing buildings, a multi-purpose hall

shared by the community and farm visitors, and a conference centre sponsored by multinational companies (which hold regular educational tours). It will shortly have a high-end health and wholeness centre and has plans to expand the two-year school into an innovative, highly respected university for social entrepreneurship.

Gawad Kalinga Enchanted Farm success stories

In a short period of time the *GK* EF has incubated a number of successful businesses:

Case study 1: 'Human Nature'
Human Nature, was the first business created at the farm around six years ago, although it was started in the kitchen of Mr Meloto. It manufactures personal care products from natural organic ingredients, and provides the model of social enterprise to which each business connected to the Enchanted Farm aspires - scalable, mainstream and social impact outreach. The social enterprise now outsells its competition in the local market. It has 350 employees and over 50,000 retailers selling its products nationally. It has opened its own manufacturing plant in the country in preparation for its expansion for global export, initially through US offices just opened.

Case study 2: 'Bayani Brew'
One of the first products of the Enchanted Farm, *Bayani Brew* is an all-natural beverage originally created by the mothers in the community. In partnership with social entrepreneurs, who collaborated with the community to ensure product quality, consistency, branding, and to source packaging, *Bayani Brew* is now available in local cafes and convenience stores, and reaches a wide market in the country. Conceived three years ago, *Bayani Brew* has just moved its production from the Enchanted Farm into bigger premises to up-scale. It is now in mass production and sold widely across the Philippines.

Case study 3: 'Plush and Play'
The farm does not only focus on agribusiness. *Plush and Play* stuffed toys company was founded not on a new market opportunity but a human resource opportunity identified by the entrepreneur. The province of Bulacan was well-known in the local garment industry, but the industry began to change when local factories closed down as a result of cheaper labour costs abroad - causing the loss of employment for many women, mainly seamstresses. Starting with one mother from the community, the enterprise has since grown to employ 25 mothers. Six of the original women now have key management roles in the company and are managing around 60 staff (25 on a regular basis and double during the Christmas holidays). This will grow to around 500 staff after the next phase of development. The company is in negotiation with major city toy stores, and this year will become the first national soft-toy manufacturer to have its products sold in *Toy Kingdom*, the nation's largest toy outlet.

Funding Gawad Kalinga

Initial and ongoing investments to *GK* communities come from 'corporate social investment' (CSI). Mr Meloto calls it a 'unique partnership', not the usual donor charity arrangement implied by 'corporate social responsibility'. For example, Shell is a CSI partner and provides on-going investment, commitment and resources to *Gawad Kalinga* - first helping to build housing, and supporting food sufficiency programmes; and now supporting the development of better water systems.

What next for *Gawad Kalinga* and *Gawad Kalinga* Enchanted Farm?

The *GK* Community model continues to be replicated across the Philippines and also in other developing nations (including Cambodia, Indonesia and Papua New Guinea), with a vision of ending poverty for 5 million families by 2024.

A further goal is to replicate the *GK* Enchanted Farm in 24 additional sites throughout the Philippines, most of which are at state universities and educational institutions, as these already have the basic infrastructure: tracts of land, buildings, students and faculty, and the local community. The next five sites are currently in the early stages of establishment.

GK is developing and learning at the same time, creating a manual for replication as it progresses, and incorporating the experience and learning it gains along the way. In its short five-year journey, *GK* EF has achieved proof of concept, and shows signs of continued success as its communities develop and flourish.

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All information in this article was kindly provided orally and via email by numerous members of the *Gawad Kalinga* Enchanted Farm team.

Newsflash

The International Fair Trade Towns Conference, Bristol, 4-5 July 2015

Introduction

This event coincided with Bristol being 'European Green Capital' for 2015 and attracted over 200 delegates from 17 countries worldwide.

The writer attended as a representative of Keynsham Fair Trade town committee, of which he has been a member for over 10 years, following its incorporation into the movement as one of the first 100 towns in the UK. There are now 1,703 towns located in 26 countries. It is currently one of the biggest and most successful 'people lobbying' groups worldwide.

The Fair Trade Movement was initiated in 1992 by a resident, Bruce Crowther, of the Cumbrian town of Garstang, who addressed the meeting. He explained that it was he, his wife and a baby sitter who had come up with the idea over the kitchen table.

The organisation has certainly now come of age with a much more realistic view of the world market place and its attendant need for a fair deal for ALL producers taking into account the environment and social issues. The two days of talks and workshops were conducted in the most friendly and enjoyable manner with examples of activities in Europe, Lebanon and Latin American FT towns. The latter is of particular interest as it demonstrates the importance of producers being involved rather than being thought of as beneficiaries. As Adam Gardner, a senior FT employee explained "it is now a matter of producers and campaigners working side by side."

The Programme

A welcome by Jenny Foster the coordinator of the Bristol and South West FT region with some advice to the foreign visitors on communicating with the locals ("alright me luvvers") set the scene followed by a welcome from the mayor George Ferguson who has been a dynamic leader in this important year for the city of Bristol.

The welcomes were followed by a short film entitled *How Green is Fair Trade* followed by a presentation in Spanish (with translation) by Fatima Ismael Espinoza the manager of *Soppexcca*, a large Cooperative Union in Nicaragua. Harriet Lamb, known to many in the UK as being most tenacious for FT when chief executive, but now with FT International, then had the floor. She said that this is an important time with the new 'Sustainable Development Goals' which will replace the 'Millennium Development Goals' due to be established at a meeting in New York in September, and the United Nations Climate Change conference to be held in Paris in December. She went on to say that it was important for the FT movement to collaborate with other organisations, *eg* transition movements, with like-minded agendas.

Following a short coffee-break the discussion was broadened with an illustration of the importance of FT for small scale mining communities; the efforts of a major retailer to bring sustainability to the fore in sourcing their products; and an MEP's effort to ensure that FT and the SDGs are continually kept in mind in EU discussions. There was then a panel discussion on the morning's programme ably moderated by Eliza Anyangwe. She paraphrased a question that I raised, to the effect that our town is 'running out of steam on FT' and what should we do about it? Harriet Lamb backed up her earlier talk by saying that response to climate change is now a big part of the FT agenda so collaboration with other organisations is needed (*eg* TAA!).

In the afternoon I attended the Sustainable Food workshop and was delighted that a Belgian lady from the Flanders region demonstrated how their town is working on chocolate and beer, in other words products both from overseas and LOCAL. In this session the phrase "Source locally from around the world" was coined.

In the evening the delegates were provided with an FT dinner by *FairShare* an organisation that rescues out-of-date produce from Supermarkets and had obtained excess food from the recently concluded Glastonbury Festival. A barn dance followed for which the ample room in the 'Passenger Shed' at Temple Meads rail station was a very suitable venue.

The event resumed on Sunday morning with a short talk by Bruce Crowther and then by the President of the World FT organisation, the second workshop I attended was on *Emerging Fair Trade Markets*. Here there was an inspirational account of an organisation in Latin America for Small Producers *CLAC*. The presenter Marco Coscione (Italian) has written a book entitled *In defence of Small Producers* published by Fernwood Press (Canada) and gave a very inspirational account of his work all over Latin America.

The event concluded with a call to action with each delegate being requested to take one positive step to promote FT, such as a meeting with a local authority person or MP, and a declaration which was signed by the mayor of Bristol and also by a mayor from Lebanon and all the delegates. A unique feature of the meeting was that a keypad was available for all those present to vote on multiple choice questions that were put up on the screen. Within half a minute or so the result in graph form was displayed. When the views on the meeting were requested the response was overwhelming that the Conference had been a great success - a sentiment which I can fully endorse.

Summary

I believe that in the ten years in which I have participated in the Fair Trade movement it has evolved from being an idealistic and rather simplistic organisation into a modern organisation with a critical method of analysing and facing up to problems that challenge world humanity in the 21st century. It is a people's organisation that enhances world unity with a new bottom up approach to its remit. Those present found the experience inspirational including the organisers, of which there were many. I for one hope to be able to attend the next such meeting wherever that will be.

Tim Roberts
TAA SW Coordinator

News from the Regions

London and SE Curry Club Talk held on 7 November 2014

Linking African smallholder coffee farmers to international supply chains: a case study in Tanzania

Richard Bliault

Richard Bliault's first degree was in Archaelology and Anthropology at Oxford University, graduating in 2006. He then did an MSc in International Rural Development at RAU Cirencester, receiving a TAAF award for field research for his dissertation on establishment of fruit trees on smallholder farms in Kenya. In 2012, he took up a job with ECOM Agroindustrial Corporation in Tanzania, as Smallholder Coffee Extension Manager responsible for managing, buying and certification of supply by some 7,500 smallholder coffee farmers. For this work TAA awarded him the Young Development Agriculturalist of the Year award in 2014.

International coffee supply chains

Smallholder farmers throughout Africa are increasingly being linked to international supply chains. This offers them income opportunities, but it also poses significant challenges. In Africa, the majority of coffee-producing countries have low domestic consumption and therefore grow largely for export. As the second most traded commodity globally by value, coffee is particularly suited to an analysis of this trend and Tanzania illustrates this.

A key question is to what extent coffee farmers themselves are aware of their link to international supply chains and the demands that this places on them. Education of producers was driven initially by the demands of external certification and more recently by requirements of compliance with coffee marketing company standards. In an African context, these approaches are complicated by a shifting, highly politicised, regulatory environment and complex traditional buying structures.

As coffee drinkers in destination countries demand more traceability of what they consume, an emphasis on linking African smallholders into international supply chains has been developed by roasters keen to maintain their market share. This means transforming the long-standing traditional structure of smallholders selling to local buyers, which means that traceability or links in the supply chain are very often lost at the first level of transaction. The requirement by all certified standards for full traceability poses a real challenge. International traders are forced to work further down the supply chain, either directly with farmers or by improving existing structures. The recent commitments by major roasters in the sector to source only 100 percent 'certified or sustainable coffee' has re-enforced this need.

In Africa, low coffee yields, very small holdings and low literacy levels risk the exclusion of growers from many international supply chains. World standards have generally been designed in a literate and highly productive Latin American context. Also, for the Tanzanian grower, the entry cost into the chain presents an almost insurmountable barrier. This was addressed in the 2000s through a number of Public-Private Partnerships (PPPs), but as the cycle of development investment shifts away from coffee, a significant risk exists that the capacity built up will be lost. To counteract this, a shift is being made towards agro-industrial trader-managed standards: for example, ECOM Agro-industrial Corporation's Sustainable Market Services (SMS) verified, or OLAM's Sustainability Standard or Livelihood Charter, in which the cost of audit is passed on by traders to buyers so that the buyers themselves are asked to specify the level of traceability or standards. This shift will allow much greater flexibility in some supply chains, which have become strangled by the weight of current regulations.

Coffee production in Tanzania

To illustrate the challenges involved in connecting smallholders to international supply chains, it is worth understanding how the coffee supply operates in Tanzania. Coffee is picked from the tree as whole fruit (cherry). In the case of Arabica, this coffee is generally then de-pulped (*ie* the fruity mesocarp is removed). After de-pulping, the coffee is fermented such that the mucilage layer between the cherry skin and bean can be washed off to form 'parchment' coffee. This parchment coffee is then dried down to between 10.5-12 percent moisture content and dry milled to produce clean, green coffee. This is the internationally traded form of the crop.

In Tanzania, this process is set within a relatively basic farming environment. In Southern Tanzania, coffee is farmed as a cash crop to supplement subsistence crops. In general, minimum effort is put into production and the majority of farmers' income is used for alcoholic drink or immediate spending. Terrain is often very difficult, limiting field access and reducing services on offer to farmers. This means average yields are as low as 1,600 kg cherry (or 250 kg clean green coffee) per ha. For comparison, a 500-farmer supply chain in Central America can produce more or less the same volume of coffee as a chain of 9,500 farmers in Tanzania.

Since 2014, it has been illegal in Tanzania to purchase whole fruit

(cherry), but a washing station operator may process it on behalf of a nationally-registered group of growers and any person may sell parchment coffee. This means that parchment coffee can arrive at a licensed parchment buyer from three sources:

- An individual farmer who processes at home and then sells as parchment to a trader, generally through several middlemen.
- A group of farmers who process into parchment at their own facility.
- A trader-owned and operated facility.

These different paths to the parchment buyer cause significant variation in quality, which must be managed along with the traceability.

Parchment coffee must then be milled. A farmer group that is able to produce more than 50 tonnes of parchment is allowed to mill its own coffee and send it direct to auction. In Tanzania, clean coffee can only be sold at auction if it is approved for Direct Export, in which case it must meet stringent quality requirements.

To link any smallholder's coffee into an international supply chain, the quality of product must meet a buyer's standards. The alternative routes to market result in a variability in quality. Low capability in local institutions means that, in addition to managing quality, they must now also manage traceability and 'sustainability', which means that traders play an important role.

This situation has been further complicated in Tanzania by shifts in the regulations mentioned above that ban whole cherry buying. While the original intention of new legislation to channel more coffee through well-run washing stations is laudable on a quality front, politicisation of the regulation has complicated it, leading to confusion amongst farmers and disruption of buying structures. As a result, a significant proportion of the crop has lost its traceability. The cost of this instability is always passed on to the farmers, thereby dis-incentivising their active participation in the supply chain. Also, any premium generated for certified/traceable coffee has little impact when individual farmer production is so low. An ageing farming population and very low levels of literacy, are further limitations in the face of international standards that demand improved record keeping and documentation.

Average Tanzanian coffee farmer profile
Age: 52
Gender: Male
Education Level: Primary Class 3
Size of Holding: 1 ha
Average number of trees: 1,155
Average yield in whole cherry per tree: 1.5 kg

Future opportunities for African coffee

While the challenges are many, the situation does offer opportunities. Ultimately, the primary driver is quality and, when well-managed, Southern Tanzanian coffees are of very high quality. Low levels of production also mean that there is high potential for increased production at a time when global demand is growing but production is decreasing. For as long as domestic consumption of coffee in Africa remains low, it remains an imperative to link smallholders into international supply chains. However, to take advantage of the opportunities, work is needed to improve the producer base in terms of average age, literacy, and attitudes on how to manage income.

For this to happen, 'Africa-appropriate standards' need to be established that will allow better links to international markets. Such a shift would acknowledge the current high barriers to entry to these markets and work in stages towards surmounting them. A further, but little understood, major hurdle in the process is the assumption by planners that an African farmer does not know what he or she wants. Continued implementation of programmes designed from the top down do not allow farmers their own decision making or acknowledge that they may have wider interests than just a single crop. In order to encourage smallholder farmers' participation in the supply chains, international trade must be sensitive to farmers' interests and not just to those of the consumers.

London/SE Curry Club Talk held on 30 April 2015

Genes, Jeans and Bollworms - the changing world of cotton

Graham Matthews

Graham is Emeritus Professor, Pest Management, at Imperial College, London. He graduated in 1957 and joined the Colonial Office in 1958 as a Research Entomologist in the Cotton Pest Research Scheme, based in Southern Rhodesia. He later returned to Imperial College but was seconded to Malawi to continue cotton research, before taking over the unit at Silwood Park that became the International Pesticide Application Research Centre. Teaching, research on application technology and overseas visits have continued, together the publication of several books

Introduction to cotton

Cotton growing dates back centuries, but the modern cotton industry was initiated by large scale production in the USA in the 19th century with exports to Europe. Demand for cotton has continued to rise despite the availability of synthetic fibres since the 1960s as the pure cellulose provides a breathable fabric. However, in the early part of the 20th century, the boll weevil advanced from Central America through the US cotton states, affecting yields. Thus following WWI, both the UK and Russia were concerned about the supply of cotton for their textile industries, so endeavoured to open up new areas of production.

For Russia this was accomplished by taking over the Central Asian Khans and establishing cotton growing in Uzbekistan. After the discovery of DDT, they applied it aerially with other toxic pesticides, but due to many cases of poisoning, emphasis was then changed to biological control of pests, largely by releasing the parasitic wasp *Trichogramma*. Both the UK and France started to investigate cotton production in Africa in the 1920s. The UK set up the Empire Cotton Growing Corporation with research stations in several countries and continued to play an active role in cotton research until 1975.

Organic Cotton in East Africa

In Southern Rhodesia, the introduction of cotton from the USA was initially a disaster, as jassids (leaf hoppers) were a major pest on the glabrous cotton. Fortunately the plant breeders in South Africa (Parnell *et al*, 1949) had some hairy Indian varieties and selected a new variety 9L34 which became the key to obtaining low yields until the 1950s - an era of organic cotton (Figure 1). Many small bolls meant that some would survive the damage caused by bollworms, notably the red bollworm *Diparopsis castanea* and the American bollworm (*Helicoverpa armigera*) and by cotton stainers, *Dysdercus* spp.

Insecticide spraying in East Africa

Eric Pearson regarded the red bollworm as the key pest and in 1956 requested funds from the UK Government to set up a Research Project in Nyasaland which was enlarged to cover the Federation of Rhodesia and Nyasaland. John Tunstall was based in Gatooma with Charles Sweeney at Makanga, Nyasaland to work on bollworms and stainers respectively. DDT had been used in Texas to control bollworms, so Pearson thought similar research was needed in Africa and had suggested that a chemist should be recruited, but in the event this led to another entomologist, with chemistry as a subsidiary subject, joining the team. The research laid the foundations for careful selection of insecticides in relation to bioassays and single plant tests, combined with field trials on farms and development of application techniques with crop scouting to time spray applications based on pest numbers rather than a calendar schedule.

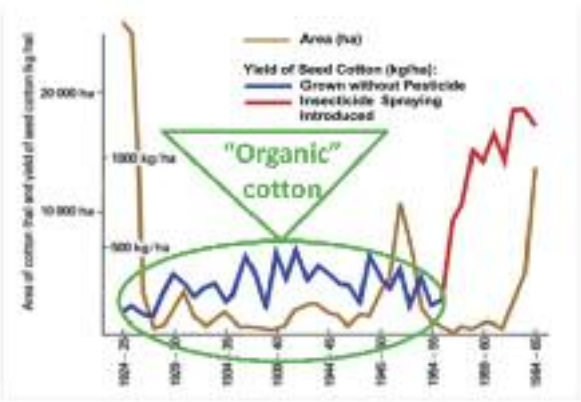

Figure 1. Area of cotton grown and yields of seed cotton per hectare in Southern Rhodesia from 1925-1965

Initial field studies included examining 24/7 red bollworms on plants from egg hatch to the larvae pupating. Small low-powered torches used like miner's lamps on the head enabled the insects to be observed at night. Larvae were only visible as the first instar very early in the morning before entering a bud or boll. A few that entered buds moved at night to a boll, but once inside a boll they remained feeding there until fully developed, before dropping to the ground to pupate. This indicated that the only time to control red bollworm was as first instar larvae.

By 1957, trials has started in Rhodesia using the insecticide, endrin using a sprayer, the Leo-Colibri compression sprayer, that had been used in spraying programmes against tsetse flies. The sprayer was used with two nozzles directed sideways into the rows of cotton as the barefooted operator, protected by an overall and goggles walked towards the spray. Concerns about the safety of the operator resulted in a vertical boom designed to be fitted to the rear of the spray tank of a much lighter lever operated knapsack sprayer. This allowed the number of nozzles to be increased as the cotton plants grew and the operator was always walking away from the spray (Figure 2). The spray could be directed between the branches and give good coverage of the bracts surrounding buds and bolls over which young larvae had to walk, whereas larvae were protected by the umbrella effect of leaves when sprays were applied straight down over the top of the crop. The hairs on plants also slowed the movement of larvae compared with glabrous cotton. Protecting the crop from red bollworm enabled the plants to flower more profusely and this attracted *Helicoverpa armigera*, the American bollworm. This bollworm could cause much greater damage as an individual larva could damage many buds or bolls.

Figure 2. Tailboom sprayer in Malawi

Considerable help from the extension service facilitated the introduction of spraying which involved using different insecticides to control the bollworms - carbaryl for red bollworm and DDT for the American bollworm. Counting the eggs of the bollworms to determine when an action threshold was reached, later facilitated by a simple pegboard, obviated any need for both insecticides to be used in every spray. Each insecticide was packaged in a plastic sachet containing the correct amount for one knapsack sprayer with 15 litres of water. On the larger farms in Rhodesia, there was an immediate requirement for a tractor version so further trials showed that multiple vertical booms with a shield to stop the branches being entangled with the nozzles could be used on a tractor mounted spray boom as well as on a high-clearance tractor. A sprayer pulled by oxen was also developed and could be used when very wet soil prevented access to a cotton field with a tractor. Aerial spraying was also used on large estates, initially using helicopters, but then fixed wing aircraft with Micronaire rotary atomisers. Yields of over 3,000 kg/ha seed cotton were obtained on irrigated areas.

The success of this approach led to a rapid increase in cotton yields and area of cotton sown in Rhodesia. In Malawi many small-scale farmers also adopted spraying, assisted by the availability of the sprayer at a 50 percent subsidy. The price of the insecticides was not subsidised but credit was available to the growers who were registered with the Farmers' Marketing Board, so that the amount owed was repaid when they harvested the crop. However, a lack of water meant many farmers were unable to use knapsack sprayers.

Ultra-low volume spraying

As many farmers were unable to spray, further research led to ultra-low volume (ULV) oil-based sprays (<3 litres/ha) to be applied using a rotary atomiser developed by Edward Bals (Micron Sprayers, UK). Trials showed that the yields with ULV were not significantly different from the higher volumes applied with a knapsack sprayer. In Malawi, this technique was not subsequently promoted but following a cotton conference in Malawi, French entomologists tried ULV spraying in West Africa. From 1975 until 1995, ULV spraying became the recommended spraying technique in Francophone Africa supported by the parastatal cotton companies. This led to a big increase in production (Figures 3 and 4), sustained from 1995 onwards, with a change to very low volume (VLV) sprayers using standard insecticide formulations diluted in water and applied at 10 litres/ha.

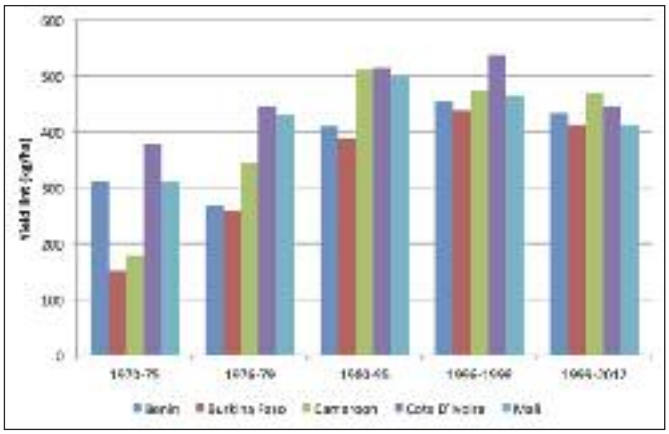

Figure 3. In Francophone Africa, parastatals ensured farmers had access to inputs and adopted ULV in 1975, then VLV spraying in 1995

Figure 4. ULV Spraying in Cameroon

GM cotton

Moving to the 21st century, the establishment of GM cotton utilising the gene to express toxins of *Bacillus thuringiensis* (Bt) *eg Cry 1* and later stacking several genes, meant that control of the youngest larvae could be achieved without sprays, as they consumed a toxic dose as soon as they started to bite into a bud or boll. The key to the success of using the Bt gene is to get the toxins expressed just where the first instar larvae start to feed, so a low dose is effective.

It strengthens the plant's own defence system of having gossypol in glands in the surface of leaves and bolls, expressed most in *Gossypium barbadense* rather than in *G. hirsutum*. In addition to the USA, Bt cotton has been widely grown with increased production in China and also in India, where greater quantities of cottonseed have enabled the country to reduce the need for importing vegetable oil. However, Africa has been slow to adopt the new technology. Apart from South Africa, Burkina Faso has been the first country to accept the new technology nationally, with nearly 700,000 hectares grown in 2013. In 2011, the average increase in yield for Bt cotton was 19.7 percent over conventional cotton, and insecticide sprays were reduced from 6 to 2 applications. Some insecticide may be needed as the Bt toxins do not affect sucking pests. Care is needed to have conventional cotton alongside Bt cotton to reduce the selection of bollworms resistant to the Bt toxins.

Farmers in other African countries want to have GM cotton but await legislation to approve the new biotechnology approach. What is needed is a re-establishment of adequate research so that new technology is studied in the tropical environment, with the goal of providing a stable income for cotton farmers. Cotton is now grown in many countries but, unlike other crops, there has not been an international cotton growing industry research programme.

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News from the Field

Grassroots Africa: the Africa Agricultural Network

This is an appeal to Members of the Tropical Agricultural Association to join friends and colleagues who are already on the panel of practitioners of **Grassroots Africa**. Please have a look at the website www.grassrootsafrica.org.

Members of the TAA will know the enormity of the challenges that are facing the poor in rural areas across sub-Saharan Africa. The physical environment is rapidly deteriorating; average temperatures around the tropics have increased in the last couple of decades. The rains are less reliable, the soil is becoming drier. The differences between the rainy and dry seasons are less marked than in the past and thus many pests do not die out but simply hibernate and mutate. The social context is also changing; there are larger families - because so many people have died of HIV/AIDS, and many members of TAA will have come across families that are headed by young teenagers. The population is increasing in the poorest countries, which means there is less arable land per person. Several governments, desperate to obtain investment, have leased large tracts of land to foreign investors, often at the expense of local nomadic and even sedentary groups. Things are getting worse, according to Professor William Otin-Nape, African Initiatives Institute, Kampala, Uganda.

Good information is the key to good agriculture. But information requires both education and tools for transmission; most farmers speak only a vernacular language, have little formal education and receive little support. Anyone who can read and write will try to get a job away from the land. Often there are no rural roads. This level of isolation means that government services do not reach these farmers: there are no clinics, no schools, and no agricultural extension services.

However, both the internet and mobile telephony are making very fast advances in various parts of Africa. In Tanzania, for example, mobile telephony at the end of 2013 covered some 40 percent of the surface of the country and 60 percent of the population. Mobile banking (for example *m-pesa* in Kenya) began earlier and with much greater success in Africa than in Europe.

Grassroots Africa (GRA) was started in 2010. The sponsor, Benny Dembitzer, who is a member of the TAA, made a presentation to the Executive Committee of the TAA in 2012, and received its blessing. After considerable research and preparation, the company started operating in Malawi, Uganda and Tanzania in January 2014. It is currently offering advice to farmers through the internet, in English and via people who are in touch with the farmers and can post questions on their behalf and pass on the replies to them in their own languages.

GRA aims to get large numbers of farmers supporting one another. The farmer would speak in her own language into a telephone, that question would be translated into English and posted on the website. Someone, somewhere in the world - very likely from a village not very far away, with the right expertise and practical experience - would suggest some ways of coping with the problem the farmer has raised. It would get back to the farmer in the language she has first used to ask the question.

For the time being, communication from and to the farmers will be maintained through a variety of intermediaries: government extension workers, secretaries of cooperatives and farmers' associations, local personnel employed by national voluntary agencies and sometimes international agencies, or heads of schools in rural areas. In addition, there are people employed by microfinance institutions and banks who sometimes work on commission. GRA aims to work through these intermediaries in order to support the farmers. Increasingly, most of them have access to computers and in some places to 4G telephony. In the long run - perhaps over three or four years - GRA will become a huge cooperative enterprise through which farmers will help one another.

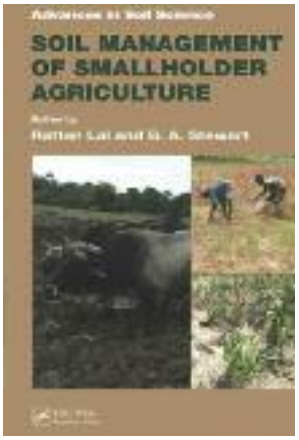
The range of questions being asked on GRA is rapidly widening; the forum is discussing issues concerning cassava, maize, sorghum, rice, beans, potatoes and the huge range of other indigenous African commodities. People with relevant knowledge are discussing questions that have been placed on the website. Sometimes they contradict one another, but often they improve on one another's comments and suggestions. They will bring experience from different backgrounds and different points of view. Most of the people who contribute to the discussions are based in Africa, working on a variety of projects in the field or for voluntary or government organisations, or in research establishments or are teaching different aspects of agriculture.

The project is guided by an advisory committee comprising people, all working in their personal capacity, with considerable experience of African agriculture and with a range of organisations, including the Gatsby Trust, *Foundations for Farming*, *FairTrade Foundation*, *Find-your-Feet*, and *Sidai* Africa. The aim of the project is that the advice given should be free of charge at the point of delivery to smallholders. Income from annual subscriptions to commercial farmers and intermediaries will help to pay for the service as well as advertising. The pilot study is being conducted in Malawi, Tanzania and Uganda. The project is also expanding slowly in Zambia and Zimbabwe because of the similarity of crops. Eventually, it will be extended to all countries in sub-Saharan Africa

For further information, please consult the website www.grassrootsafrica.com or write to director@grassrootsafrica.org.

Benny Dembitzer

Bookstack



Soil management of smallholder agriculture,
Rattan Lal and BA Stewart eds, 2014. Advances in Soil Science, CRC Press, Boca Raton.
Hardback, 420 pages, £80.75
ISBN 9781466598584

The *Advances in Soil Science* series of expert reviews is an outcome of 30 years of collaboration between distinguished professors Rattan Lal and Bobby Stewart. The volume on *Soil management of smallholder agriculture* considers challenges confronting hundreds of millions of smallholders in the tropics and sub-tropics. Sixteen chapters involving 45 authors include smallholder farming and global food security; specialist contributions on soil security, improved cultivars, fertilisers, grazing, water resources, agroforestry, gender implications, smallholders' decision making and the uptake of soil and water conservation practices; and case studies from the Indo-Gangetic Plain, the North China plain, Central, East and Southern Africa, and Moldova. The concluding chapter examines management opportunities to get around the soil constraints faced by smallholder farmers - but some critical issues are hard to get around: holdings are commonly less than a hectare; tenure insecure; the land, as often as not, marginal; and the farmers mostly not connected with the market economy but needing to sustain their families without access to external resources. And since they are also politically marginalised, external resources are not forthcoming.

The book is a mine of information, but hard labour is needed to extract that information and some of the contributors hardly adapt their message to the smallholders' situation. On soil security, Bouma *et al* focus on 'lighthouse' examples where smallholders and their organisations have grasped opportunities for change, especially through joint learning - still a novel relationship between scientists and the users of their information - and they underscore the inconvenient fact that opportunities are not equal as far as the soil is concerned. Gupta & Yadav remind us that the green revolution achieved stupendous increases in crop yields only under ideal conditions of soil, water supply and access to inputs - or where well-resourced farmers could impose these conditions; conservation agriculture can mitigate unfavourable natural conditions more often faced by smallholders, but there is need for responsive new cultivars appropriate for these farming systems, akin to the myriad locally-adapted landraces dispossessed by the green revolution. Hellums & Roy note differences in the uptake of promising and, on the face of it, adoptable technologies like integrated nutrient management and deep placement of fertilisers; uptake is weakest in sub-Saharan Africa and the finger points at inadequate agricultural policies - sometimes no policy at all.

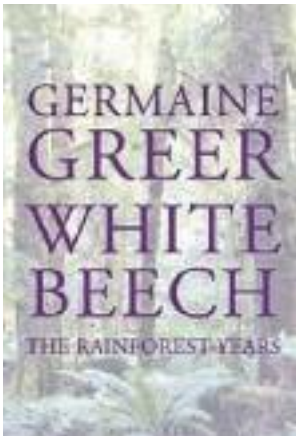
Soil organic matter is, perhaps, the best single indicator of soil condition. Collated data from long-term field experiments across the North China plains, comparing a range of systems of fertilisation representing local practices, reveal soil organic matter contents of <20t/ha on unfertilised arable land; the highest values, in the range 26-43t/ha, build up over a period of 15-23 years under combined application of organic manure and mineral fertilisers. This theme is reinforced by the data from long-term field experiments in Moldova. Water scarcity is another big issue, now exacerbated by climate change and demanding rapid adaptation of farming systems. Lal, reporting on the situation in South Asia, points out that the only buffer against water scarcity that is in smallholders' own hands is soil quality.

The optimistic message is that the vicious circle of farmers lacking resources, short-term imperatives, and land degradation can be broken by adopting appropriate, well-proven technology and by linking with niche markets, including provision of ecosystem services. Several case studies of conservation agriculture and the particularly well-referenced review of agroforestry illustrate well-documented benefits in reduced land degradation and increased food production. And, yet, uptake by smallholders, at least in Africa, is largely confined to participating farmers in externally funded projects; and effective local indigenous systems remain local.

We have to conclude that smallholder farmers weigh the pros and cons differently from the technologists, and different farmers also look at things differently. The social scientists discoursing on small-farmers' choices and factors affecting adoption of soil and water conservation practices are trying to tell us the same thing but at excruciating length and mostly with reference to historical proselytising of, frankly, unadoptable practices involving reshaping of the landscape. However, the editors' concluding chapter boils down the issues facing smallholders, and the rest of us who need these farmers to look after the global environment. Amongst the raft of policy initiatives that could alleviate poverty and enable smallholder farmers to be better stewards, they single out payments for environmental/ecosystem services like water management and carbon sequestration which could become a new income stream for smallholder farmers and very good value for the land.

(Based on an earlier review published in June 2015 in Soil Use and Mangement, ***31(2)****, 347, with the permission of the editors)*

David Dent



White Beech: The Rainforest Years, Germaine Greer, 2014
Bloomsbury Publishing, London, New Delhi, Ney York, Sydney
Hardback, 370 pages, £25
ISBN: 9781408846711

The White Beech of the title is neither white nor a beech but an endangered descendant of ancient Gondwanan rainforest - *Gmelina leichardtii*. This is the story of mankind's ruthless annihilation of natural habitats; and one woman's fruitful struggle to restore sanity in a forest relic.

Germaine Greer had been searching for a piece of damaged Australian wilderness for several years and her main interest was a desert ecosystem. That was until she visited a run-down, battered and abused 150-acre dairy farm at Cave Creek in south-east Queensland. Greer was on the point of losing all interest in the half-million Australian dollar property when she was seduced by a flirtatious, dancing, Regent Bowerbird (*Sericulus chrysocepalus*). (The use, throughout the book, of binomial Latin names, along with the common Australian equivalents, will be greatly appreciated by readers of *Ag4Dev*.) Helped by her botanist sister, Jane, Greer set about learning as much as she could about rainforest ecology and rehabilitation. Jane tried to warn her "you might think that you're restoring what was there, but in fact you're just another interloper, doing more harm than good". And, "you don't get it do you? There are no teachers".

The book is a record of the successes that Greer and her team of workers at the Cave Creek Rainforest Rehabilitation Scheme (CCRRS) achieved and is a celebration of the fruits of ten long years of eliminating weeds and propagating indigenous forest species. Tracing the history of the site, in the Numinbah Valley, Greer catalogues the chronology of destruction of the original forest by the European colonisers; previously the forest had lived in sustainable harmony with the Aboriginal population. Sugar cane production and cattle ranching were the economic activities initially favoured, but they required the destruction of the natural forest which was the strongest lure. Timber extraction was the economic mainstay under-pinning agricultural enterprises - Red Cedar being the species especially prized by the so-called timber-getters; White Beech was also sought-after quarry. (Red Cedar - *Toona ciliata* var. *australis* - is, in fact, a mahogany.) Timber extraction was exceedingly destructive as tracks needed to be carved out for access and removal of the 'carcasses'. Eventually, the Red Cedar and White Beech were exhausted in Numinbah, but the devastation continued with other valuable timber species. The despoliation of the ancient Gondwanan forest took just 100 years.

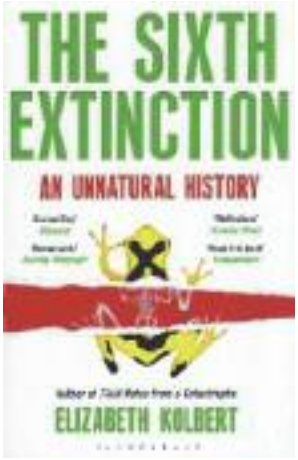
Greer then takes the reader along a series of historical insights as attempts were made to exploit the valley for quarrying, dairying, citrus, fruit and nut production and, most disastrously of all, bananas. Bananas were planted throughout Numinbah and were the preferred crop on cleared, steep and erodible hillsides. Frost killed them off at CCRRS and a glut, resulting in tumbling prices, caused the Numinbah plantations to be abandoned by 1935.

Two of the most entertaining chapters describe the fauna of the CCRRS forest. The 'non-furry' inhabitants described include invertebrates, amphibians (especially the myriad frog species), reptiles (lizards and snakes) and the multitude of birds. The 'furry' beasts may or may not include the marsupial tiger of legend, but certainly include a wide range of other marsupials including quolls, bandicoots, the antechinus that can unhinge its limbs to limbo-dance under doors with the thickness of a credit card, possums, koalas and many other survivors of Gondwanan families. The author is at pains to emphasise the holistic inter-connectedness of the rainforest ecosystem. All the species hang together and rely on each other, removal of one species, like the attempted annihilation of flying foxes, can have a domino effect which can result in incalculable unforeseen consequences.

There is just a whiff of Greer being the most ardent, ladder-raising, conservationist; she eloquently describes the profound awe that she experiences when walking through 'her' forest; and then concludes that 'eco-tourism is not the answer' for rainforest survival. Another view would be that allowing more people to enjoy the experiences that she has access to would be a major catalyst to more widespread green thinking and could, perhaps, help to save some of the planet's remaining tropical forest resources.

The CCRRS is now a registered charity under the name of Friends of Gondwana Rainforest. Current news and developments, including fascinating videos, can be accessed at: http://gondwanarainforest.org/cave-creek.

Brian Sims



The Sixth Extinction: An Unnatural History, Elizabeth Kolbert, 2014
Bloomsbury Publishing, London, New Delhi, Ney York, Sydney
Paperback, 319 pages, £8.99
ISBN 978-1-4088-5124-1

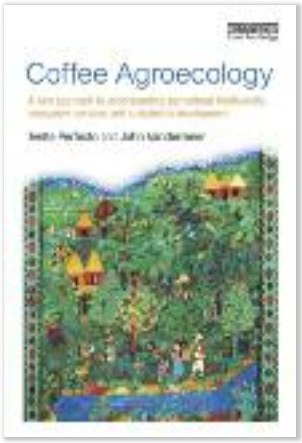
This is a deeply troubling account of the devastating impact of humans on our planet's biodiversity. The world has suffered five major extinctions in the last half-billion years, but never has one been precipitated by one 'weedy' species. The current sixth, Holocene or Anthropocene, extinction is caused by humans who are changing the planetary ecological landscape at such a rate that many species are failing to adapt and are falling out (at many thousands of times faster than the naturally occurring background rate). However, by behaving in this destructive manner, *Homo sapiens* (surely a misnamed species!) is bringing about the end of its own existence. As ecologist Paul Ehrlich puts it: "In pushing other species to extinction, humanity is busy sawing off the limb on which it perches".

Kolbert traces the history of mass extinctions from the first (end-Ordovician some 450 million years ago) to the following events in late-Devonian, end-Permian, late-Triassic and end-Cretaceous (when we lost the

dinosaurs). The reasons for sudden losses of species are varied, ranging from glaciation, global warming and ocean chemistry change to the Chicxlub asteroid impact 65 million years ago. Kolbert's vehicle for taking us through previous events to arrive inexorably at the current human-induced crisis is a series of chapters relating to the demise of specific species. So we have the fate of the Panamanian golden frog (*Atelopus zeteki*); the mastodon (*Mammut americanum*); the great auk (*Pinguinus impennis*); an ammonite (*Discoscaphites jerseyensis*); a graptolite (*Dicranograptus ziczac*); a limpet (*Patella caerulea*); a Great Barrier Reef coral (*Acropora millepora*); a tropical rainforest tree (*Alzatea verticillata*); the army ant (*Eciton burchellii*); the little brown bat (*Myotis lucifugus*); the Sumatran rhino (*Dicerorhinus sumatrensis*); Neanderthal man (*Homo neanderthalensis*); and, of course, the biggest problem of all - *Homo sapiens*.

The book is extremely well-written, making it a pleasure to read; and it is well-constructed, building a case for the incontrovertible reality of species extinction at the hand of humans. Through a wide array of examples, Kolbert explores the spread of lethal diseases made possible by the rapid movement of causal agents around the world; the slaughter of large mammals; anthropogenic climate change resulting in global warming and ocean acidification; ocean pollution; forest destruction and fragmentation. The book is a condemnation of mankind's greed and myopia, and is an alarming 11th hour wake-up call. To put us into perspective, Kolbert imagines that "…a hundred million years from now, all that we consider to be the great works of man - the sculptures and the libraries, the monuments and museums, the cities and factories - will be compressed into a layer of sediment not much thicker than a cigarette paper". Some epitaph to our hubris!

Brian Sims



Coffee Agroecology: a new approach to understanding agricultural biodiversity, ecosystem services and sustainable development
Ivette Perfecto and John Vandermeer, 2015
Routledge, Abington and New York
ISBN: 978-0-415-82680-8 (hardback)
ISBN: 978-0-415-82681-5 (paperback),
336 pages
Hardback $155.00, Paperback $57.95/£32.99

(Note: the publishers have offered a 20% discount for TAA members. Quote discount code DC365 and the paperback version can be purchased for $46.36/£26.39 with free shipping)

This book provides a novel synthesis that links together agricultural biodiversity, ecosystem services and sustainable development. It uses the coffee ecosystem as an example, but the approach is applicable to sustainable production of other crops. The two authors are distinguished professors at the University of Michigan, so the book is not a light read. It is clearly aimed at Universities (a free e-book is available to professors wishing to incorporate it in their courses), students, researchers and scientists, although the approach utilised will have many practical applications. There are more than 750 references, listed in brief at the end of each chapter, and in full at the end of the book. The book is well-illustrated, in black and white, in contrast to the colourful cover illustration. There are lists of figures and tables, and a detailed index.

In the Preface, the authors explain how, as ecologists, they had learned from coffee farmers. They are not 'fortress conservationists' trying to isolate biodiversity conservation from people and their farming systems: they recognise the importance of integrating people and farming into biodiversity conservation. They take an interdisciplinary approach that rejects artificial disciplinary borders.

Chapter One compares two coffee plantations: a large commercial unshaded coffee plantation, and a smallholder shaded coffee farm. The two plantations differ in their production, ecology, economics and socio-politics. The first is 'capital' (or input) intensive, the second is 'thought' (or knowledge) intensive, and these represent two very different 'production syndromes'. One is an industrial model, the other is an agroecological model. One tries to dominate nature, the other farms with nature.

Philosophically, the book is positioned as the intersection of the classical dialectical approach (one thing cannot exist without another; one acquires its properties from its relationship with the other; the properties of both evolve as a consequence of their interpenetration) with the more modern complex systems approach (as parts begin to connect with one another and interact more, we move from the realm of complication to complexity, and reduction no longer gives us insight into construction). This provides a framework for synthesis that embraces complexity over the long-term.

The authors' notion of ecology incorporates the social and political context, as well as the classical subjects of ecology, in an approach referred to as 'political ecology'. The authors explain why the coffee agroecosystem is particularly well-suited as a model agroecosystem.

Chapter Two considers biodiversity, its loss and conservation. The authors claim that research on biodiversity has had taxonomic biases, a geographic bias, and has taken a negative attitude toward agriculture - all of which have been in error. A broader view of biodiversity, in small farms in developing countries, generates different perspectives of biodiversity conservation and agriculture. The authors distinguish between 'planned' biodiversity on farms (or 'agrobiodiversity') and 'associated biodiversity' (everything else). Not all associated biodiversity has a negative impact on the agrobiodiversity.

The coffee agroecosystem model is considered along an intensification gradient from rustic coffee, through traditional polyculture, commercial polyculture, and shaded monoculture, to unshaded monoculture. Biodiversity loss increases along this gradient, and the reasons for this are discussed. The problems of balancing

ecological and economic variables are considered.

Chapter Three considers biodiversity in a whole landscape context. The kind of agriculture (not only the fact of agriculture) affects biodiversity. An optimal balance between agricultural production and biodiversity conservation could be derived, but neither biodiversity nor landscape are static, both change over time - the 'dynamic nature of nature'. Biodiversity is dynamic because migrations and (local) extinctions often occur. The authors introduce the concept of the landscape as a mosaic of fragmented habitats. The quality of the matrix is key: a 'good' matrix provides a habitat for many organisms, but also allows them to move among patches of the matrix. The rest of the chapter is spent reviewing theories of meta-populations of organisms in fragmented landscapes.

Chapter Four deals with spatial ecology in coffee plantations. 'Space matters' because organisms are not only constantly surrounded, affected and shaped by it, but they in turn affect and shape space for themselves and other organisms in constantly shifting dialectics. This is illustrated by population studies of green scale insects in coffee plantations, their predator lady beetles, and their protecting *Azteca* ants, when coffee shade tree density is reduced.

Chapter Five looks at 'who's eating whom and how' in coffee plantations. Birds eat insects, including pests of coffee, and have been shown to reduce coffee berry borer, the main insect pest of coffee. However, since birds are usually omnivores, they also eat beneficial species such as spiders, which consume insects. The relative sizes of the birds, spiders and insects influence the effect. Furthermore, the effects of birds and bats, or birds and lizards, are additive. Many complicated interactions from coffee plantations are described to illustrate the complexity. Omnivory is described as a topological connection between polyphagy, trophic chains and competition, and it has many indirect effects. Overall, the result may be stabilising, or it may not.

Examples are provided to illustrate trophic cascades (for example, birds eating spiders that eat insects); trait-mediated cascades or 'effects on effects' (such as ants protecting aphids from predation by lady beetles); and trait-mediated indirect effects. **Chapter Six** explains how different spatial scales and patterns influence these interactions, and add to complexity.

Chapter Seven considers the links between biodiversity and ecosystem services such as pest control, pollination and resistance to climate change. Increasing intensification of agriculture results in a decline in biodiversity and ecosystem services. The higher yields thus obtained may therefore be short-lived.

Chapter Eight brings the concepts discussed in earlier chapters into the political context of farmers' livelihoods. The historical evolution of the agriculture versus biodiversity debate is described. The conclusion is that industrial agriculture is not a rational option for alleviating poverty, for ending hunger and malnutrition, or for sustainable development. Greater equality is needed in pursuit of these aims, and this is best achieved by land reform and redistribution among small- and medium-scale family farms. This is more likely to create a landscape mosaic that promotes biodiversity and produces more food for the local population.

The socio-economic impacts of the coffee business are then discussed. It is clear that the coffee consumers pay too much, the coffee farmers receive too little, and the four giant coffee corporations receive most benefit. Recent approaches to rectify this, such as certification schemes, community support schemes, fair trade coffee, the 'New Rurality', and *La Via Campesina*, are considered, and in most cases found wanting.

Chapter Nine, the final chapter, links together the findings from previous chapters. It looks at coffee syndromes of production as ecological regimes; and discusses changes in coffee agroecosystems from both ecological and economic perspectives.

This book is an academic *tour de force* that brings together history, ecology, agriculture, biology, economics, politics and social sciences in a single narrative around coffee production, thereby providing an example for other crop production systems. Its optimistic conclusion is that the ecosystems, biodiversity, agricultural production and famers' livelihoods can all benefit from appropriate, 'thought-intensive', agroecological syndromes of production.

Paul Harding

Tending a Schoolyard Garden: Best practices from field tests of the rural curriculum - Our Land Our Life,
Nyala Coelo, 2014
Distributed by: Peoples Books, 5 High Street, Camp, Belgaum 590 001, India
email: childrenstalim@gmail.com
Funded by: NEG-FIRE, A-1, 3rd Floor Sarvodaya Enclave, Behind Mother's International School, New Delhi 110 016, India
website: www.negfire.org

On a recent visit to India, Keith Virgo brought back a book of curricular ideas for knowledge and skill-based education which had been prepared at the behest of the organic farming community in India. The handbook introduces schools, teachers and children to the exciting world of gardening, cooking, food and nutrition, and composting of garden and kitchen waste, and, in doing so, teaching and learning vital lessons of life. The handbook is introductory in nature but it includes a CD with soft copies of 130 resources as an integral part of the book.

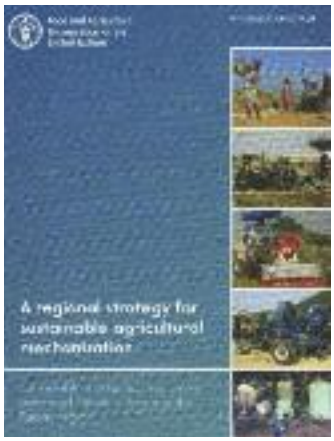
Many schools and educators are aware of the environmental deficit that human societies have created and continue to add to. Although many measures are being taken to reverse this trend worldwide, working with school children initiating gardening activity in the school is an ideal starting point to inculcating respect for the environment.

The handbook and associated CD offer teachers a ready reference for starting and keeping a school yard garden which can be used for further branching out into various academic and skill based topics. Best practices from the field are presented in a ready-to-use and easy-to-follow format for the benefit of teachers and anyone engaging with children through gardening. Detailed notes are provided on how gardening,

cooking and composting can be easily integrated into a school day. Also provided are curricular ideas, lesson plans, teacher notes, workbooks and practical do-it-yourself manuals. Beginning with creating a school garden, a teacher can link it to the ecology and environment of the school campus, weather, water and energy issues. If a school is able to achieve this, efforts should show tangible results on the ground as well as in pupils' knowledge, skill and aptitude and attitudes.

Clearly, the book is compiled and aimed at a growing community of gardening instructors and green teachers in schools around India. However, the principles and approaches it embodies have much to offer not only other developing countries but also developed ones. Best practices can easily be developed or modified to suit local environments and climatic conditions.

Jim Ellis-Jones



A regional strategy for sustainable agricultural mechanization: sustainable mechanization across agri-food chains in Asia and the Pacific Region.
Geoffrey Mrema, Peeyish Soni and Rosa Rolle, 2014

Food and Agriculture Organization of the United Nations (FAO), Rome. 74 pages.
ISBN 978-92-5-108676-6.
Available at: http://www.fao.org/3/a-i4270e.pdf

The Asia-Pacific region is rapidly replacing its draught animal agricultural technology with tractors for farm work and transport, and engines for irrigation and post-harvest processing. The region now has the largest annual sales of agricultural machinery in the world. The drivers of the shift from labour-intensive production to mechanised technologies include labour scarcity, ageing and feminising agricultural labour forces, rural-urban migration (especially of men), and the development of modern agricultural value chains.

With increased awareness of the need for environmental protection and adaptation to (and mitigation of) climate change, the paradigm of sustainable production intensification (SPI) is being actively promoted. This report advocates the formulation and implementation of sustainable agricultural mechanisation strategies (SAMS) as part of an enabling environment for the development of sustainable agri-food chains in parallel with the enhancement of the natural resource base. Inappropriate mechanisation can lead to increased pressure on fragile agro-ecosystems by accelerating soil erosion and compaction, promoting forest and rangeland destruction and encouraging the over-use of chemical inputs. There is currently a global movement towards reducing tillage and moving towards conservation agriculture.

A SAMS must take cognisance of the predominance of smallholders in the region and seek to improve their access to machinery inputs such as tractors, combines and stationary motors. This can be achieved through the provision of private sector custom hiring services, but will also require the provision of an enabling financial and infrastructural environment. Throughout the report, the importance of the private sector is emphasised for the delivery of sustainable mechanisation; the public sector's role should be confined to incubating and enabling, and should not be tempted to provide mechanisation services. Increased R&D investment in both the private and public sectors is required as the SPI paradigm is not yet mainstream.

The agricultural machinery manufacturing sector is already large in the region and it needs to be incentivised to manufacture equipment for sustainable mechanised agricultural practices. National and regional standards and testing centres are already being motivated and directed by the Asian Network for Testing Agricultural Machinery (ANTAM) under the auspices of the Beijing-based Centre for Sustainable Agricultural Mechanization (CSAM) of the UN Economic and Social Commission for Asia Pacific (UNESCAP). Capacity building for SAMS implementation will be an important undertaking as agricultural engineering training and education programmes are in decline world-wide. Capacity building must focus on the youth and integrate considerations of, *inter alia*, natural resource protection and gender issues.

The emerging mechanisation scenario in the region (and, in fact, in most developing countries) is novel and quite different from previous paradigms. New guidelines and processes are required, as is increased regional cooperation, to resolve common problems and learn from past experiences. This report is a solid stepping stone to indicate the way forward for the region's policy makers.

Brian Sims

Thirty five years of history for the Tropical Agriculture Association (TAA)

Elizabeth Warham and Jim Watson

Dr Elizabeth Warham FRSB is Head of the UKTI Agri-Tech Organisation which supports more trade and investment in the sector. Previously she provided advice and support on food and water security issues to Sir John Beddington during his tenure as Government Chief Scientific Adviser in the Government Office for Science. She has expertise and experience in plant sciences from the International Centre for Wheat and Maize (CIMMYT), Mexico and technology development more broadly working closely with technological sectors and their user industries in the former Department for Trade and Industry technology programme. In DFID she managed research programmes to develop appropriate technologies for different agricultural production systems in low- and middle- income countries. She joined TAA as a student in 1979, Ex-Co in 1999, and took on the role of General Secretary in 2004.

Dr Jim Watson spent his working life in agricultural research and development, mainly cotton growing, and is now retired. He was resident in Africa for 16 years and South East Asia for 3 years; and from 1986 to 1992 was a consultant with Minster Agriculture. He has been a committee member of the Tropical Agriculture Award Fund since its inception.

TAA Timeline

1960 Imperial College of Tropical Agriculture (ICTA) absorbed into University of West Indies.
1978 ICTA Association UK established.
1979 ICTA Association renamed Tropical Agriculture Association (UK).
1983 Charitable status application failed. 1st Ralph Melville Memorial Lecture.
1985 New TAA tie.
1989 The Tropical Agriculture Award Fund (TAAF) formally launched in Hyde Park. Charitable status obtained for the TAA.
1993 First stand at the Royal Agricultural Show.
1997 Regional Convenors established in London/South East, Scotland/Borders, and South West.
2002 (UK) dropped from name of the Association. East Anglia regional group established. TAAF made its 100th Award.
2003 Association for Better Land Husbandry (ABLH) joined TAA and became a specialist group.
2004 TAA began hosting the UK Forum for Agricultural Research for Development (UKFARD).
2005 Overseas Branch established in India.
2006 1st Hugh Bunting Memorial Lecture at Reading University.
2007 Golden Year Reunion of TAA members who were ICTA graduates. Agri-Business Group joined as member of British Expertise (formerly BCCB).
2008 *Agriculture for Development* journal launched. All Party Parliamentary Group on Agriculture and Food for Development launched.
2009 First TAA Honours awarded. Environmental Conservation specialist group established. Overseas Branch established in the Caribbean.
2013 Overseas Branch established in South-East Asia.
2014 TAA celebrated 25 years as a registered charity and joined LendwithCARE. Overseas Branch established in the Pacific.
2015 Scotland and North of England established as two separate Groups. Overseas Branch established in Ireland.

TAA Presidents

1978-1982	Ralph Melville
1983-1989	Roger Swynnerton
1990-2002	Charles Pereira
2003-	Andrew Bennett

TAA Chairs

1981-1984	VC Robertson
1985-1996	T S Jones
1997-2005	Roger Smith
2006-2008	Amir Kassam
2009-2013	Chris Garforth
2014-	Keith Virgo

Early years in Trinidad

The Tropical Agriculture Association grew out of the previous Imperial College of Tropical Agriculture (ICTA) Association. The college was established in Trinidad in 1924 and for some 30 years was the best known source of advanced training for UK and Commonwealth tropical agriculturalists. The Association of the ICTA consisted of diplomates of the college and correspondingly constituted the largest professional association of tropical agriculturalists in the Commonwealth for many years. In 1960, the college was absorbed into the University of the West Indies (UWI) Faculty of Agriculture and its international training function gradually diminished. Training of UK professionals continued through diverse channels such as the Associate Professional Officers Scheme with the help of the British Government, as well as through UK and Commonwealth Universities. In this new situation, the ICTA Association was no longer self-renewing and it was clear that a new broader-based and more modern professional association was required.

A new start in the UK

The ICTA Association UK was formed in 1978 and the first newsletter was issued from the Land Resources Development Centre, Tolworth Tower, Surbiton. Ralph Melville CMG was President and David Lang was Honorary Secretary. The 1978 AGM and Reunion was held on 21 July at the Royal Over-Seas League with subscriptions collected from 141 'active' members. Some members belonging to the Institute of Biology suggested ICTA members should join the Institute, but the arguments against were agreed at the AGM.

Establishment of the Tropical Agriculture Association

The ICTA Association was renamed the Tropical Agriculture Association (ICTA Association) at the 1979 AGM, and membership was opened to all qualified persons practising in tropical agriculture in the broadest sense, including associated disciplines. An annual subscription of £2 was levied, and John Dunsmore was appointed Honorary Treasurer. Activities of the Association were expanded with three Newsletters published each year, the first in June 1980.

In 1980, the AGM and Reunion moved to the Regent Palace Hotel, with sixty members attending. A working party to examine the prospects for development of the new Association was approved. Although the group defined services which could be offered, the impracticality of hiring secretarial assistance meant that most effort was directed to the preparation of brochures, to attract both corporate and individual members.

Permanent Committee appointed

In 1981, the working party recommended the establishment of a permanent committee to take over and run the new, more active Association. A new Chairman was elected at the AGM and Ralph Melville became President. The first Committee Meeting (with President, Chairman, General Secretary, Membership Secretary, Treasurer, and Editor) was held on 29 September 1981, to address administrative improvements, arrangements for meetings, publications, and long-term policy. The President nominated four individuals to attend future meetings of the Executive Committee. Membership had increased from 80 the previous year to 300. Professor Bunting was made Chairman of a Sub-Committee to draw up a Constitution for TAA and in this connection it was agreed that the title of the Association should in future be the Tropical Agriculture Association (United Kingdom), a title which would clarify the identity of the Association and facilitate its relationships with similar bodies in other countries. Another important decision taken was to investigate the possibility of establishing a computerised register, with CVs of members interested in employment, with the information to be available to members and sponsors. Sub-Groups of the Committee focused on University, Private Sector, and Public Sector constituencies.

Application for charitable status

In 1982, advice was sought from a Solicitor, and amendments to the Constitution were proposed to enable the Tropical Agriculture Association to achieve charitable status. The key focus incorporated into the Constitution was: '*to be an association of practitioners (including research workers, teachers and advisors, development specialists, and students) of the science and practice of agricultural and rural development in those regions of the earth that have tropical, sub-tropical and winter rainfall climates, particularly to developing countries as defined by the International Bank for Reconstruction and Development, and to emerging economies in other parts of the world, and to promote the public recognition of the work of such practitioners, whether or not they are members of the Association, as a field of professional endeavour.*'

In 1983, the initial application for charitable status for the TAA was unsuccessful: more evidence was needed that the TAA benefitted non-members: in effect the third world population.

Ralph Melville Memorial Lectures

On 8 December, 1982, A R Melville sadly passed away at the age of 70. The first Ralph Melville Memorial Lecture was delivered by Sir Charles Pereira in December 1983 on *Tropical Weather and Some Agricultural Consequences*. Professor Hugh Bunting gave the second Memorial Lecture on *Constraints to Change in Agricultural Development*. The lecture has been delivered annually since then, following the TAA AGM.

Future role of tropical agriculturalists

An Open Forum on the future for Tropical Agriculturalists based in the UK was held on 28 March 1984 to address the decline in the number of young people gaining residential experience in developing countries. Following this, the

Executive Committee of the TAA established a Working Group to collect evidence with a view to defining the future role of tropical agriculturalists based in the UK, and to identify ways in which that role may be assured and developed. By October 1984, membership was over 500.

The TAA tie

The TAA tie, designed by David Betts with art work by Christine Wilkins, was launched in the Newsletter of April 1985. The background is a replica of the old ICTA tie consisting of broad bands of dark green and dark brown divided by a narrow light blue band. Superimposed on this background in gold thread is the new logo of the TAA.

Professional recognition

With effect from 6 April 1985, the Association was formally recognised as a professional body and was granted approval under section 192, Income and Corporation Taxes Act 1970. Submissions to Inspectors of Taxes for tax relief in respect of subscriptions to the Association could then be made.

Directory of CVs

The Directory of CVs was launched in 1985 and by 1994 had 137 entries. It was available in hardcopy until 2002, and re-launched on the website in 2008, searchable by skills and geographical experience. In 2013, it was consolidated into the main website under a wider 'Expertise' section allowing members to enter their own CVs online at no charge. Many of the registered members have reported positive responses from potential employers.

Understanding the tropical agriculture skills gap

By March 1986, there were 660 TAA members, with 490 using UK addresses, and 170 abroad. At the AGM in December, the Working Group defined the '*future role of UK-based tropical agriculturalists and ways in which their role might be assured and developed*' and recommended the establishment of an 'Award Fund' to alleviate the 'experience gap' problem, to which commercial companies, charitable organisations, private individuals and benefactors could subscribe.

Improving the Newsletter

The Newsletter, first published in 1980, was an A5 sized typed booklet (Figure 1). In April 1987, the Newsletter took on a new printed format (32 pages in A4) and invited commercial advertisements for a charge of £60 full page, £30 half page, £15 quarter page. Each Newsletter had a yellow insert including details of forthcoming events; as well as a bank variation order form and bank standing order. In 2001, photographs were included in the Newsletter for the first time.

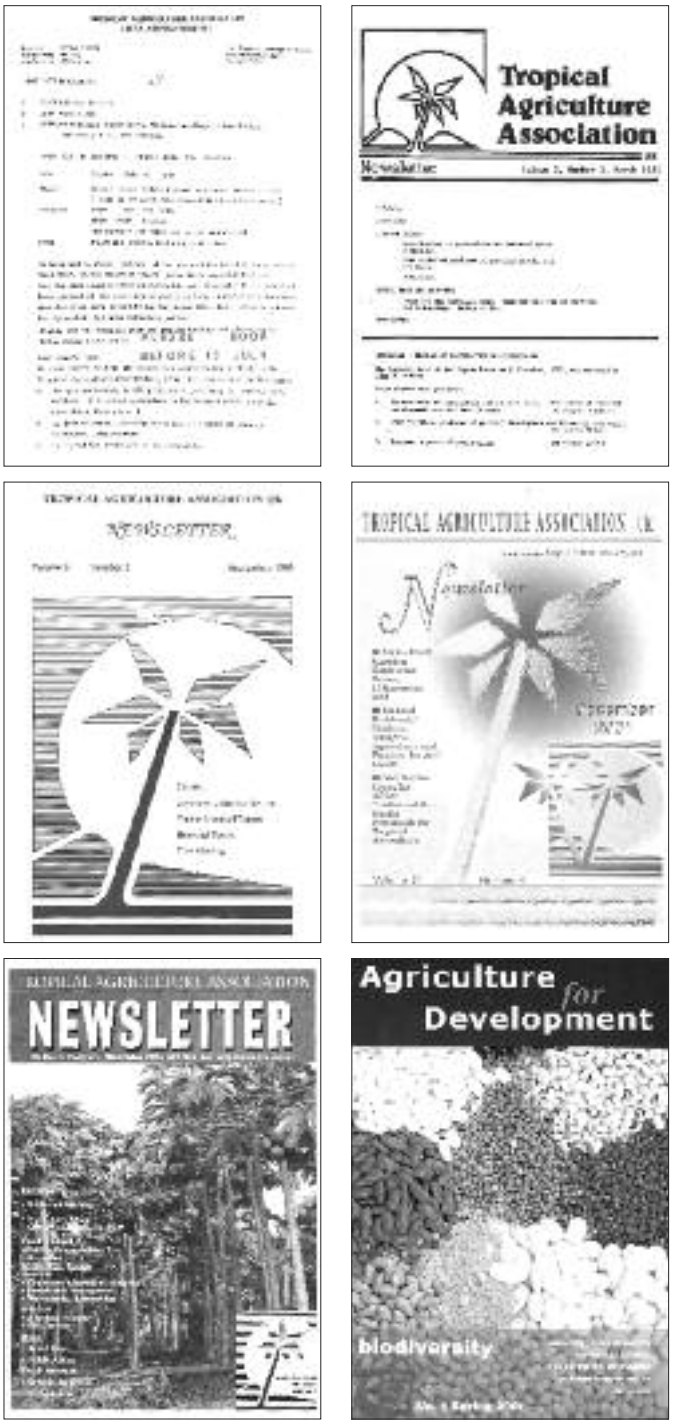


Figure 1. The evolution of the TAA Newsletter, from Volume 1 Number 1, published in June 1980, to the first issue of *Ag4Dev* in the Spring of 2008

Hosting the Annual General Meeting

In July 1987, the AGM was held at the Farmers' Club. The average age of members was 51 years and there were over 900 members. The report of the Working Group on the Future of British Tropical Agriculturalists was published in 150 hard copies and distributed free of charge. The annual membership fee was then £14 per year. In December 1988, the AGM moved to the Royal Marsden Hospital Conference Centre together with the 6th Annual Ralph Melville Memorial Lecture. The amended Constitution was adopted at this meeting. The Annual General Meetings continued to be hosted at the Royal Marsden Hospital Conference Centre from 1988 through to

2004, then at the Farmers' Club in 2005, after which it was relocated to the Royal Over-Seas League in 2006, where it has been hosted to this day.

Launch of the Tropical Agriculture Award Fund and new charity status

The Award Fund Sub-Committee was set-up for the first time in 1987 and potential donors (companies, corporations, foundations) were approached by letter for contributions. The Tropical Agriculture Award Fund was formally launched at the Festival of Food and Farming held in Hyde Park from 4-7 May 1989 and hence forward was known as the **TAAF**. Newspapers estimated that some 900,000 people attended to celebrate the 150th anniversary of the Royal Agricultural Society of England, the 100th anniversary of the Ministry of Agriculture, and coincidentally, the 10th anniversary of the TAA! By this time, £14,000 had been raised for the TAAF.

TAAF funded the first long term awards for a minimum of six months in 1990; but introduced the three month MSc awards in 2006 in response to demand. Each awardee has been allocated a member of the Sub-Committee as a personal mentor. Each year, one awardee has given a presentation on their overseas assignment at the Annual General Meeting, and awardees are encouraged to give presentations at their former University to encourage applications for the award scheme.

In 1989, the TAA became a registered Charity Number 800663, in recognition of the establishment of the Award Fund.

Links to other Associations

In 1990, the TAA jointly hosted a one day symposium with the Institute of Biology on *Britain's contribution to International Agriculture* at the Royal Society Conference Room; and a joint seminar on *Intermediate Technology* with the Institution of Civil Engineers. Annual joint meetings were held with the Institution of Agricultural Engineers until 2002. The TAA became a member of the newly established Society of Biology (formerly Institute of Biology) in 2012.

Membership and data protection

In 1990, TAA was granted exemption from registration under the Data Protection Act (which involves payment of fees and the making of returns) on the understanding that it is an unincorporated members 'club' holding data '*relating only to the members of the club, which data are used only for the purpose of distributing articles or information to the members*'.

The membership list was circulated in hard copy from 2002 to 2007 to members for their private use only, to enable them to make and retain contact with 'like-minded colleagues' and to encourage co-operation between members to advance the aims of the Association. The membership database was thoroughly overhauled in 2013/14 to improve tracking of different subscription rates and changes of addresses, remaining available to all members through the TAA website.

Purseglove Memorial Lecture

The Purseglove Memorial Lecture was established in 1992 and continued through 1993 and 1994. A computerised database was established in 1993, and the Executive Committee (ExCo) met six times a year at the Linnean Society. In 1995, ExCo included both Private Sector and Research Sector representatives. A Central Region Group also started, and met at the Royal Show each year.

Members' surveys

A survey in 1996 found that as many as 2,500 of the estimated 10,000 expatriate professionals in tropical agriculture were British. The contribution of these individuals towards the development of both commercial agriculture and the small farmer sector has been highly significant. In June 1997, the TAA published a brochure on TAAF with a summary of all awards and subsequent career paths for the TAAF awardees between 1990 and 1996. It contained 55 young graduates sponsored in more than 25 countries, on projects of value to those countries, with a disbursement of £46,800 of its income in grants.

A membership survey in March 1999 showed that 97 percent of respondents read the Newsletter, 32 percent of respondents said they had written for the Newsletter, some as a letter to the Editor. About 40 percent had attended an AGM, although only 8 percent had spoken there. With regard to the Royal Agricultural Show, 30 percent had visited the TAA show stand, and 9 percent had helped host the stand at one time or another. For TAA regional meetings the figures were low, with 31 percent having attended, 16 percent spoken, and 4 percent helped to organise the meetings. New members and members leaving the Association after 2 years in arrears were named in the Newsletter each year. Members under 25 years of age were entitled to a student membership.

Seminars and visits

Biennial Weekend Seminars were hosted at the Universities of Cambridge in 1995, Oxford in 1997, Edinburgh in 1999, and Bangor in 2001. Initially, the General Secretary had hosted all seminars in London and the regions until March 1997, when Regional Convenors were established for London/South East, Scotland and Borders, and the South West. The South West Regional Group hosted their AGM in January each year.

Figure 2. Participants at the TAA Biennial Seminar, entitled *Agriculture and forestry for arid lands*, held at the University of Wales, Bangor on 15-16 September 2001.

Annual visits took place to the Experimental Horticultural Unit in Wye in 1990, Rothamsted Research in 1993, Oxford Forestry Institute in 1994, Chelsea Physic Garden in 1995, Imperial College in 1996, Ireland in 1997, University of Reading in 1998, Brogdale in 1999, Scottish Plant Breeding Institute in 2000, Kew's Millennium Seed Bank Project in 2001, Rothamsted Research in 2002, East Malling Research, NR International, and Cambridge University Botanic Gardens in 2003, Writtle College in 2004, CAB International and UNEP WCMC in 2005, and Organic Enterprises Ltd. in 2006. There was a regular stand at the Royal Agricultural Show from 1993 until the Show ceased operations after 2008.

Figure 3. TAA at the Royal Show, 2005

TAA 2010 and new services

During 2001, the *TAA 2010* working group completed a lengthy process of widespread consultation with members on the future of the Association. The proposals were then discussed with members at a general meeting and subsequently endorsed at the AGM that followed. The '(UK)' was dropped from the name of the Association in 2002. A new Mission Statement was developed and included on the website, and the membership subscription increased. Members were offered access to the journal *Experimental Agriculture* and the CABI online database, which was sustained until 2011. ExCo responded formally to the DFID Consultation Document *Better Livelihoods for Poor People - the Role of Agriculture*, and some of TAA's points were incorporated in the final DFID Issues Paper on the subject.

New Specialist Groups, Regional and Overseas Branches

The Association of Better Land Husbandry was welcomed as a member of the TAA in 2003 and was established as one of the TAA Specialist Groups. At the same time the Agri-Business Group was formed, building on the strong foundation of an informal gathering of individuals who met monthly for a business lunch in Oxfordshire, under the auspices of Jim Turnbull's company Belmont Management Consultants (BMC). The same year the East African branch was established but folded within the year. Also during 2003, ExCo responded to a request from DFID to co-convene, together with the Appropriate Development Panel of the Institute of Civil Engineers, a seminar which had as its objective the identification of major, researchable issues to be addressed by a new DFID Research Strategy for 2005. The seminar, together with two other seminars - one on health issues and the other on social development issues - presented its report to DFID. The TAA/ICE seminar identified eight major areas which required DFID research support to make a significant contribution to attaining the Millennium Development Goals. Another Specialist Group, on environmental conservation, was established in 2009.

In 2004, Rothamsted International formally requested that TAA ExCo consider TAA hosting the UK Forum on Agricultural Research for Development. In 2005, an Overseas Branch was established in India, and the TAA joined the British Consultants and Construction Bureau (BCCB), which was of special interest to the Agri-Business group. TAA BCCB membership continued through British Expertise until 2012. Overseas Branches were established in SE Asia (2013), the Pacific (2014) and Ireland (2015); and the Caribbean Branch was re-established in 2014, after its earlier establishment in 2009. A convenor for corporate members was also established in 2014. The Scotland/North of England Regional Branch decided to split into two separate Branches in 2015, with occasional joint meetings to continue.

Hugh Bunting Memorial Lectures

In 2006, the first Hugh Bunting Memorial Lecture was hosted at the University of Reading, and these have continued each year to the present day. These, and the Ralph Melville Memorial Lectures at the AGM, have been promoted as high profile international public events, and the lectures recorded for wider dissemination to TAA members and the public.

New Business Plan and Sub-Committees

In 2007, the ExCo continued to strengthen and expand its partnerships; and forge new alliances to address common objectives. In this regard, ExCo paid particular attention to the *International Assessment of Science and Technology for Agriculture Development (IAASTD)* consultation processes and offered comments and suggestions. In addition, the actions proposed in the new *Business Plan: Strategic Directions for 2007-2010* were implemented, with efforts directed towards expanding its reach through the activities of special sub-committees (on Membership, Finance and Publications)

focusing on increasing the services offered to members and enhancing the image and effectiveness of TAA. In particular, these sub-committees included younger members and returning TAAF Awardees, to attract and engage younger members in the Association. Members were contacted by email for the first time, since approximately 60 percent of members had email addresses.

Golden Year Reunion

At the AGM in 2007, photographs were on display of the 'Golden Year Reunion', along with briefs compiled from the last reunion. Several TAA members celebrated 50 years since they graduated from ICTA with a Diploma in Tropical Agriculture. Some had worked in the CGIAR, others in chemical industries and animal husbandry, some had become teachers in Universities and Agricultural Colleges, while one had become a Barrister of Law.

Launch of the All Party Parliamentary Group on Agriculture and Food for Development

During 2008, the Executive Committee convened two workshops with corporate members to explore the contemporary issues they faced and their service needs from TAA. As a result the TAA business plan was revisited and the role of TAA and how it might be rebranded was considered. The All Party Parliamentary Group (APPG) on Agriculture and Food for Development was launched on 21 October 2008 with addresses from Government Chief Scientists Professor Robert Watson (Defra), and Sir Gordon Conway (DFID). The report of the first APPG inquiry into the UK's role in tackling the challenge of Global Food Security up until 2050 was launched early in 2010, following a series of high-profile evidence sessions with key stakeholders. During 2010, the Group initiated a second inquiry on how the UK is helping meet the MDGs by revitalising sustainable agriculture and improving global food security in both the short and longer term, and in particular how it is supporting smallholder farmers in Africa and South Asia. Two written submissions were made by TAA members to this inquiry, and the TAA Chairman spoke on extension, education and training for smallholders at an oral evidence session in December. The APPG continues to play an important role supported by the TAA and many of its Corporate members.

Agriculture for Development journal

The TAA Newsletter, originally focussing on contributions from members through Regional Groups, was transformed in 2008 into a new quarterly (later triannual) journal *Agriculture for Development* with invited articles and photographs from practitioners in the field. The new title encapsulated issues concerning conservation, sustainability and the environment foremost in the thinking of the younger generation at work in the 21st century. In 2013, it was further strengthened by the introduction of Special Issues on specific topics such as innovation systems, commercialisation of smallholders, climate change and agriculture, and soils.

A survey of members' views on the journal was undertaken during December 2014 and January 2015. Some 61 responses were received, representing about 10 percent of members. The average overall rating of *Ag4Dev* (on a 1-5 scale, where 1 is weak and 5 is excellent) was 4.1; with fourteen of the 20 regular features achieving an average rating of at least 4.00 and only the *Corporate Members' Page* dipping below 3.50. Most of the respondents thought the frequency of three issues per year, the number of Special Issues, the style, balance, and the presentation were 'about right'; some (nine) respondents thought it was 'not technical enough'. Responses to the suggestion of developing *Ag4Dev* into a peer-reviewed journal varied, with just over half of members advising against this idea.

Recognition of achievements - TAA Honours

The TAA Honours Panel was established in 2008 to consider nominations for 'Development Agriculturalist of the Year' in recognition of outstanding contributions to the science and practice of tropical agriculture, not restricted to TAA members. Nominations were also considered for Honorary Membership of TAA and TAA Awards of Merit. The first awards were made in 2009.

TAA Development Agriculturalist of the Year

2009 Philip Thornton for his contribution to a greater understanding of tropical agricultural systems in informing policies to address climate change, land use and poverty alleviation.

2011 Dr Nazmul Haq in recognition of his lifetime's work on underutilised crops for the alleviation of poverty, improved nutrition and the enablement of women in poor rural communities.

2013 Hugh Harries for coconut research and development, and making research work for farmers.

2014 John Witcombe for a lifetime's work developing novel participatory plant varietal selection strategies to breed crop varieties with higher yields and improved grain quality for farmers to improve livelihoods.

TAA Young Development Agriculturalist of the Year

2009 Jonathan Stern for his contribution to understanding of poverty reduction and environmental sustainability in Costa Rica.
2013 James Brockington for work on agroforestry in India and East Africa.
2014 Richard Bliault, for work on certification, with the Rainforest Alliance, of the first coffee supply chain in Tanzania, for 7,500 farmers.

TAA Awards of Merit

2009 Ian Hill for his contribution to development and analysis of TAA rebranding questionnaire.
2009 Francis Shaxson as Land Husbandry convenor and contribution to conservation agriculture.
2009 Mike and Mollie Long, Ted Wilmot and Henry Gunston for organising the TAA stand at the Royal Show.
2010 Amir Kassam for his contribution over many years to the sustainability of smallholder agriculture through research, teaching, advocacy and public education.
2010 FARM Africa for their contribution to agriculture since 1985 through training and support for poor rural communities in improving their food security and livelihoods.
2010 Royal Agricultural College for their innovative 'Africa Land and Food Fellowship' programme and 'Africa Fellowship Trust' initiative.
2011 Garry Robertson for his service to TAA as Chief Editor and Trustee for 10 years.
2011 John Landers OBE for his contribution over many years to the science and practice of conservation agriculture for development.
2012 Tony Reynolds for demonstration and promotion of transformational change in agricultural production.
2012 Hugh Brammer for many years of service to TAA's publication and advisory work, and his wide ranging professional contribution to agriculture for development.
2014 John Russell for his service as Chairman of TAAF Committee, Convenor of the SW Group, and a Trustee of the Bicton Overseas Agricultural Trust (BOAT).
2014 Antony Ellman as Chairman of the TAAF Committee since 2006 and for 20 years promotion of Artemisia cultivation by small farmers, for the antimalarial drug artemisinin.

Updated website

The new TAA website, with its modern and user-friendly image supported by comprehensive and easy to navigate content, established in 2011, was further refined in 2012. The range of information made available was expanded: with job and business opportunities (including the consultants' directory and technical advisors), *Reflections* and *Opinion* pages, and information on funding and resources available. A new 'email alert' feature allowed members to receive details of new updates on the website. The TAA brochure was also updated.

Twenty five years as a charity

In 2014, TAA celebrated 25 years as a registered charity and enhanced its charitable status by joining LendwithCARE. Operated by CARE International this is a peer-to-peer lending relationship with individuals in the UK raising micro-finance to help entrepreneurs in developing countries to lift themselves out of poverty. Generous contributions from TAA and individual members have strengthened TAAF, enabling it to support 141 long term award for a minimum of six months between 1990 and 2015, and 83 short term (MSc) awards for a maximum of three months between 2006 and 2015. A total disbursement of £221,445 has been made in support of these awards in 53 countries. The TAAF Committee is now considering establishing a formal Trust to accumulate funds and income more efficiently. Active membership of the TAA was 613 individual members and 22 corporate members.

News from the Field

Biodegradable plastic mulch: a coming trade-off between women's labour, production costs and environmental benefits?

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Abstract

Mulching acts to control weeds, conserves soil moisture and increases soil temperature in tropical and sub-tropical environments which has positive effects on vegetable yield and quality (Shrefler & Brandenberger, 2014). Plastic mulching material is now widely available in SE Asia at a relatively low cost. This cost is about 25 percent of that of new biodegradable plastic mulches which are now being tested owing to their ability to gradually degrade into water and CO_2 without leaving harmful residues. The effects of a biodegradable polyester mulch and a standard polyethelene (PE) mulch on kangkong (*Ipomoea aquatica*) were compared in a first observational experiment conducted at the AVRDC (The World Vegetable Center) headquarters in Taiwan from April to August 2014. After four weeks, degradation could be perceived in the biodegradable mulch; after 18 weeks, it had become torn into large pieces while the PE mulch remained intact. This resulted in apparently lower yields of kangkong as a broken mulching layer has a lower ability to retain soil water and heat, and to control weed growth. Implications for the environment and women's labour are considered.

Introduction

Plastic mulching for reduced labour requirements and better weed control was a technology first developed by the University of Kentucky in the USA in the 1950s (Emmert, 1957). Since the establishment of AVRDC - The World Vegetable Center - in the early 1970s, it has been a technology very widely disseminated by the Center in Asia and has proved to be effective in agronomic terms. It has much improved the control of weeds, reduced soil moisture evapo-transpirative losses and, as a result, has substantially reduced the drudgery and overall costs of the predominantly female labour which is typical in small-scale vegetable production in east and south-east Asia. By reducing direct contact with the soil surface, the proportion of marketable green vegetables can be increased and the post-harvest quality may also be improved. However, these plastic mulches are made from non-renewable petroleum-based materials and often only used for one growing season. Therefore, safe and environmentally friendly disposal of PE mulch is a pressing issue, not only for the environment, but also for the cost and additional female labour needs it implies for the grower (see Figure 1).

Figure 1. Silver/black polyethylene (PE) waste is unsightly and has a high cost for incineration or disposal in landfill. It can be recycled but only if an injection moulding industry is located nearby

The plastic film has to be removed and discarded, either by incineration (which releases toxic compounds into the air) or by taking it to landfill, where it takes up large volumes of land and takes a very long time (many years) to fully degrade. If there were more opportunities for the recycling of this plastic waste it would be highly desirable, but this option is not often available in south-east Asia. In Taiwan, recycling is possible as this material is used in the injection-moulding industry. However, collection and recycling would only be economic where large quantities are accumulated, such as at AVRDC HQ.

Environmentally-friendly industrial mulches are made from biodegradable polyester or vegetable starches and degrade into water and carbon dioxide, leaving no toxic residues. The time they need until their complete incorporation in the soil varies depending on their composition, the local environmental conditions and the soil type on which they are applied, but results indicate that this is an alternative to PE mulch with substantial benefits to the environment. This new mulching material now

needs suitable testing to assess its agronomic and cost effectiveness. Kangkong (*Ipomoea aquatica*), also known as 'water spinach', is a popular fast-growing crop in the summer season in Taiwan and throughout SE Asia, and it has been employed to make a rapid, initial evaluation of the comparative effects of biodegradable and standard plastic mulches.

Materials and Methods

The effects of two types of plastic mulch were compared in an experiment carried out for 2.5 months from 30 April 2014 at the headquarters of AVRDC in Tainan, Taiwan. The first mulch, *Bionolle* (Shoko Co Ltd, Japan), is a biodegradable mulch made from polybutylene succinate (PBS) and polybutylene succinate adipate (PBSA). It has a thickness of 18 μm (micrometers) and in its experimental phase, presently costs about 30 US cents per m^2. The second was a conventional silver/black PE mulch material manufactured by the Hermei Plastic Co Ltd, Taiwan, typically employed in the horticultural industry. It is made of polyethylene and costs about 7 US cents per m^2 for 35 μm thick sheeting.

Before the transplanting of the kangkong seedlings, four beds 6.5 by 1.35 m^2 were prepared. Compost and NPK fertiliser (#43 Compound Fertilizer, Taiwan Fertilizer Co Ltd, Taiwan) were mixed in the soil so that nutrients would be essentially non-limiting. While two beds were covered with the conventional silver/black PE mulch, the other two were mulched with the *Bionolle* biodegradable mulch (Figures 2A and B).

Figure 2. The appearance of (A) silver/black polyethylene (PE) mulch and (B) Bionolle biodegradable mulch on the day of kangkong transplantation

The kangkong seedlings were raised in a greenhouse for three weeks and transplanted on 30 April 2014 into the beds nine days after the mulches were installed as 26 plants in two rows per bed with 50 cm between plants and rows. Water was provided with a drip irrigation system to be non-limiting for plant growth until harvest. Soil temperature was monitored for the duration of the experiment.

Plants were harvested three times, at 26, 46 and 71 days after transplanting (DAT) and their accumulated yield/bed (fresh weight in kg) was measured. After harvest, the residual *Bionolle* biodegradable mulch was buried into the soil (at 10 cm depth) for six months to observe its degradation.

Results and Discussion

The total yield (Table 1) in this observation trial of kangkong was around 15 percent less under the *Bionolle* mulch treatment (6.9 kg/m^2) than under the conventional PE mulch (8.3 kg/m^2).

Table 1. Yield (kg/m^2) of kangkong covered with *Bionolle* biodegradable mulch and with silver/black polyethylene (PE) mulch.

Harvest Date	DAT*	Yield (kg/m^2)	
		Bionolle	**Silver/Black**
26 May 2014	26	1.2	1.4
16 June 2014	46	2.3	2.5
7 August 2014	71	3.4	4.3
Total		**6.9**	**8.3**

*DAT: days after transplanting

After four weeks in the field, the biodegradable mulch was observed to start to degrade, most evidently on the sides of the bed. After 18 weeks, it had become broken into large pieces and could easily be torn by hand. In contrast, the silver/black PE mulch remained intact and strong (see Figure 3). The early breakage of the biodegradable mulch reduced its ability to control weeds and retain soil moisture. Furthermore, some of the fertiliser applied may have been washed away as the seasonal rainfall was quite high (556 mm in the 71-days period).

Figure 3. The appearance of (A) silver /black polyethylene (PE) and (B) Bionolle biodegradable mulch after sixteen weeks cultivation of kangkong.

There were noticeable differences between the soil temperatures under the two mulches once the biodegradation process had advanced noticeably, which may also have influenced the performance of the crop. The soil temperature under the silver/black PE mulch was always somewhat higher by several ^{o}C later in the season than the temperature under the biodegradable mulch. Durability testing indicated that the strength of the new biodegradable mulch film proved to be adequate for application in the field by hand or machine, but it was evidently not as robust as the conventional PE mulch, requiring the initial application process to be more delicately handled.

The lifetime of the biodegradable mulch is influenced by climatic conditions: warm, moist conditions which favour microbial development speed up its degradation. Thus one needs to calculate the likely rate of decay and then to choose a mulch thickness strong enough to last for the entire growing season of the crop under test. If the mulch degrades too early, as was the case in this trial, then its agronomic efficiency is compromised.

In contact with microbes and water, the *Bionolle* mulch degraded into water and CO_2 and we observed that, after being buried in the soil for six months, the biodegradable mulch had become extremely fragile and could be broken into tiny pieces by hand. The fact that it can be incorporated in the soil with

simple ploughing implies the growers could further reduce the cost of both additional labour and for disposal (see Figure 4). This contrasted with the disposal needs of the conventional PE mulch which required additional female labour for removal, bulk storage and disposal costs (see Figures 5 and 1).

Figure 4. Twelve months after first application on beds (and then being buried in the soil for 6 months), biodegradable mulch can be easily broken into small pieces

Figure 5. It is a labour- and time-consuming process for the disposal of black/silver polyethylene (PE) mulch after vegetables were harvested

Conclusions

From the experience gained from this simple observation trial, it is evident that biodegradable mulches have advantages and disadvantages when growing green leafy vegetables. It is likely that further fine-tuning research on the thickness and strength of biodegradable mulch would reduce or overcome the yield advantage observed with the conventional plastic mulch in short-growing season crops such as kangkong. However, there remains a trade-off between the current purchase costs of the two materials, the need for more labour at establishment and for later in the season if weeding along the edges of the plots is required before harvest, and the final costs and labour requirements for disposal of the mulch material either by ploughing down (biodegradable) or hand-gathering and the subsequent landfill/incineration/recycling of the conventional material. AVRDC will plan further trials to fine-tune this information in subsequent seasons as we conclude that the new mulching material does have some future promise which requires further investigation.

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International Agricultural Research News

Expo Milan 2015 and the Plant Doctor Game

Expo Milan 2015 is now underway and more than 20 million people from all over the world are expected to visit before it ends on 31 October. At the Swiss Pavilion, and in line with the Expo theme *Feeding the Planet, Energy for Life*, the Swiss Agency for Development and Cooperation (SDC) is showcasing a number of its innovative projects that support farmers in the developing world. Notable among them is a video game that has been especially developed for Expo Milan by CABI[1]. Based on CABI's innovative *Plantwise* programme[2], which is supported by SDC among others, the *Plant Doctor Game,* enables players to step into the shoes of smallholder farmers who need to protect their crops from the ravages of pests and diseases.

Players first receive information about the situation of the world's smallholders and a general outline of the role and activities of the *Plantwise* plant clinics. Players are then shown a photo of a specific food item and have to guess its main ingredient before meeting a farmer who produces it. They are then invited to step into the farmer's shoes and sow the crop.

At this point, things take a turn for the worse - pests or diseases strike. Players have to take action to secure the food needed by their family. They have to seek the aid of a plant doctor in order to identify the pest or disease and determine the most effective way to treat it. The aim of the game is to earn as many 'food security points' as possible.

[1] See http://www.cabi.org/

[2] See: https://www.plantwise.org/

The interactive game sets out to show how modern technology can be used to improve the lives of smallholders. The app can be downloaded to a smartphone or computer[3] - and is available now in version 1.01 that fixes bugs that afflicted version 1.00!

A new strategy for the CGIAR

In May, the Consortium Board approved the new CGIAR Strategy and Results Framework (SRF) entitled *Harnessing New Opportunities*[4]. The document sets out some of the main achievements of past research and key challenges for the future. It describes broad goals for CGIAR research as well as some aspirational development targets for the period up to 2030. It also highlights new ways of doing business.

In spite of the many spectacular successes of past CGIAR research[5], critical challenges remain. Over a billion people still live on less than US$ 1.25 per day and more than 800 million are acutely or chronically undernourished. Around 2 billion people suffer from micronutrient deficiency or 'hidden hunger' and women remain particularly disadvantaged. Meanwhile, an estimated 3.5 billion ha of degraded land is unproductive due to overexploitation; unsustainable water use threatens 40 percent of the world's grain production; and it has been estimated that between 1980 and 2008 climate change reduced global maize yields by 3.8 percent and wheat yields by 5.5 percent.

Recognising these challenges, the Strategy has set three goals, referred to as System Level Outcomes (SLO), each with specific targets for 2022 and 2030.

By 2022 the CGIAR and its partners will-have:

SLO1: Reduced Poverty

- 100 million more farm households will have adopted improved varieties, breeds or trees and improved management practices (with 350 million more by 2030);
- 30 million people, of whom 50 percent will be women, will have been assisted to exit poverty (100 million by 2030).

SLO 2: Improved Food and Nutrition Security for Health

- Improved the rate of yield increase for major food staples from the current level of less than 1 percent to 1.2-1.5 percent per year (and to 2.0-2.4 percent per year by 2030);
- 30 million people, of whom 50 percent will be women, will meet minimum dietary energy requirements (with 150 million more people by 2030);
- 150 million people, of whom 50 percent will be women, will no longer be deficient in any of the following essential micronutrients: iron, zinc, iodine, vitamin A, folate and vitamin B12 (with 500 million more people with sufficient micronutrients in their diets by 2030);
- 10 percent reduction in women of reproductive age who consume less than the adequate number of food groups (33 percent by 2030).

SLO 3: Improved Natural Resource Systems and Ecosystems services

- 5 percent improvement in the water and nutrient (inorganic and biological) use efficiency in agro-ecosystems, including through recycling and re-use (20 percent by 2030);
- Reduced agriculturally related greenhouse gas emissions by 0.2 Gt CO_2 - equivalent per year (5 percent) compared with a business-as-usual scenario (0.8 Gt CO_2 - equivalent per year by 2030);
- 55 million ha degraded land area will have been restored (190 million ha by 2030);
- 2.5 million ha of forest will have been saved from deforestation (7.5 million ha by 2030);

In order to achieve these ambitious targets, the Strategy lays out eight research priorities:

- **Genetic improvement of crops, livestock, fish and trees:** to increase productivity, resilience to stress, nutritional value and efficiency of resource use.
- **Agricultural systems:** adopting a systems approach to optimise economic, social and environmental co-benefits in areas with high concentrations of poor people.
- **Gender and inclusive growth:** creating opportunities for women, young people and marginalised groups.
- **Enabling policies and institutions**: to improve the performance of markets, enhance delivery of critical public goods and services, and increase the agency and resilience of poor people.
- **Natural resources and ecosystem services**: focusing on productive ecosystems and landscapes that offer significant opportunities to reverse environmental degradation and enhance productivity.
- **Nutrition and health**: emphasising dietary diversity, nutritional content and safety of foods, and the development of value chains of particular importance for the nutrition of poor consumers.
- **Climate-smart agriculture**: focusing on urgently needed adaptation and mitigation options for farmers and other resource users.
- **Nurturing diversity**: ensuring that CGIAR in-trust plant genetic resources collections are safely maintained, and genetically and phenotypically characterised to maximise the exploitation of these critical resources for food security, productivity, nutrient rich crops and resilient farming systems.

In terms of geography, CGIAR will devote at least 50 percent of its research investment to Africa, about 30 percent to Asia, and about 20 percent to poverty hotspots in Latin America. A greater emphasis will also be placed on integrating the work of the Centres and CGIAR Research Programmes (CRP) in key countries and specific sites to maximise impact.

In order to implement the new Strategy and Results Framework, the Centres are currently engaged in developing the next round of CRPs to be implemented from 2017. These are expected to refocus much of the research with the context of agricultural production-to-consumption systems and put in place new measures to ensure more effective site integration. The outcome of the current CRP planning will be reported in a future edition of *Agriculture for Development*.

[3] The Plant Doctor Game can be downloaded as an iphone or ipad app from the iTunes store or as an Android app from:https://play.google.com/store/apps/details?id=com.konstruktor.plantwise

[4] See: http://www.cgiar.org/consortium-news/our-new-strategy-redefining-how-cgiar-does-business-to-2030/

[5] See, for example, http://www.cgiar.org/www-archive/www.cgiar.org/pdf/Forty-findings-CGIAR%20_March2011.pdf

ICARDA awarded the Gregor Mendel Innovation Prize

In March the International Centre for Agricultural Research in the Dry Areas (ICARDA) was awarded the prestigious Gregor Mendel Innovation Prize in recognition of its successful efforts to secure the globally important collections of crop genetic diversity stored in its genebank in Tel Hadya, Syria, despite the challenging civil war.

In receiving the award, Dr Mahmoud Solh, ICARDA's Director General, said: "Over the years, ICARDA had managed to safety-duplicate most of its genebank collections outside Syria. When the conflict there escalated, we sped up the duplication and have now secured 100 percent of the collection outside Syria. We have also already duplicated 80 percent of our collection in the Svalbard Seed Vault in Norway. I'm also glad to add that ICARDA had earlier rescued and safety-duplicated germplasm collections from Afghanistan and Iraq."[6]

ICARDA's germplasm collections comprise some 148,000 accessions and are among the world's largest collections of landraces and wild relatives of barley, lentil, chickpea, faba bean, forage and rangeland species, along with durum and bread wheat.

Dr HC Carstensen, President of the Gregor Mendel Foundation, in presenting the award said: "The efforts of Mahmoud Solh and his team are valuable not only for plant breeders who are highly dependent on diversity to improve agricultural varieties but also for following generations who benefit from drought tolerant and disease and pest resistant crops."

New Director General for IRRI

The Board of Trustees of the International Rice Research Institute (IRRI) have recently announced that, with effect from mid-December 2015, Dr Matthew Morell will be the next Director General of the Institute. Dr Morell is currently IRRI's Deputy Director General for Research, a position he has held since February 2014. Before joining IRRI, Dr Morell worked for 16 years with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.

[6] See following for an interview with Mahmoud Solh regarding the ICARDA genebank: https://www.youtube.com/watch?v=NtMoCczZsyE

Geoff Hawtin

News from the Regions

A TAA Scotland Branch

For some time now, John Gowing has been efficiently acting as convenor for the Scotland and NE England TAA Branch. This was a vast territory! John Ferguson has now kindly volunteered to become Convenor for a separate Scotland Branch, which will look after members 'north of the border'. He will work in close liaison with John Gowing, who will now be Convenor for the North of England.

Email contacts will now be Scotland_convenor@taa.org.uk for John Ferguson and NorthernEngland_convenor@taa.org.uk for John Gowing (although John's original address of Scotlandandne_convenor@taa.org.uk will continue to operate for a while.

John Ferguson is based in Edinburgh. He studied agriculture at the Scottish Agricultural College, followed by an MSc in Tropical Agricultural Development at the University of Reading. His Masters research was on the role of dairy goats in poverty reduction and development in Tanzania. Subsequently, he served an internship with ILRI in Kenya, before spending a couple of years with *VETAID*, delivering their development education. John then worked in Malawi with *Environment Africa* and supervised young British volunteers through *Progressio ICS*. He currently has his own ethical start-up business, working with sisal farmers in Tanzania and producing sustainable geotextiles which are marketed in the UK for environmental applications, such as peatland restoration and coastal realignment.

John has conducted a survey amongst members in Scotland to ascertain their needs and is now planning a seminar for later this year (see *Upcoming Events*). He has also opened a Facebook page www.facebook.com/groups/TAA.Scotland which is only visible to members and will be much more useful for discussions, advice, links *etc*. We wish John every success. Please find the new Facebook page and say hi! (in case anyone is confused, there are now two TAA members in Edinburgh named John Ferguson - our Convenor is John D Ferguson, his namesake is John A Ferguson!).

Keith Virgo

Mailbox

Ag4Dev24, Special Issue on Soils - Soil management approaches

Dear Sir,

Congratulations to the editors and contributors on a very interesting publication, which succeeded in bringing together contrasting views on soils and what might be done to sustain their use:

- *Rattan Lal* talks of the need for restorative land use strategies that focus on management of soil-carbon with site specific practices to decrease losses by erosion, mineralisation and leaching indicating that there is no silver bullet, with most practices having well defined trade-offs.
- *Shaxson & Kassam* argue that Conservation Agriculture (CA) embracing no-till, maintaining ground cover with crop residues, crop rotations and associations, building resilience from rain, sun and wind, controlling weeds and pests requires greater government, institutional, research and educational support.
- *Andriesse* & *Giller* make the point that CA in the Americas is often characterised as large farms often using herbicides, fertiliser and genetically modified crops (soya and maize), while in Africa CA has been portrayed as low-input agriculture with questions as to whether CA is appropriate for smallholder farmers because of increased labour demand, access to herbicides and use of crop residues for livestock feed. They also refer to high rates of dis-adoption of CA by farmers after a few years.

Whilst acknowledging the value of these contributions, it must be recognised that there have been decades of research on soils and perhaps we now need to concentrate on what makes sense, where and for whom? Experience demonstrates that blanket solutions are not appropriate. The high variability of soils means that they respond to inputs in radically different ways with distinct variations in input responsiveness. A critical lesson from past work is that a highly context-specific approach is required that takes into account not only the fertility status of the soil and the availability of organic inputs but also the ability to access and pay for inputs. Making investments profitable depends on the availability of output markets and the value of farm products.

Scoones in a recent blog (https://zimbabweland.wordpress.com/?s=soils) indicated that "Given resource constraints - of fertility inputs, labour and cash - maximising the agro-economic efficiency of input use must be a critical objective of any soil fertility management strategy". Unfortunately these vary enormously within regions, across countries and landscapes, and even between villages and individual fields. Hence, it is critical to consider both the socio-economic and biophysical context (Table 1, adapted from Scoones) and facilitate farmers to try alternative measures in their environments.

Table 1. Socio-economic and bio-physical context of soil fertility management

Socio-economic context *Profitability & affordability*	**High returns** *land tenure, market and other production constraints less important*	***Mixed strategy*** *Organic and inorganic*	***Application of inorganic fertilisers appropriate*** *Market based*
	Poor returns *due to high input prices, low prices of farm products with poor market and transport linkages*	***Low external input options*** *Mostly organic*	***Efficient application critical (such as micro dosing)***
		Low *Low organic matter, low rainfall*	**High** *High organic matter, high rainfall*
		Bio-physical context *Inherent soil fertility and potential*	

Using this contextual approach and encouraging farmer experimentation will help to ensure that resources are not wasted and much needed production boosts will be economically viable.

Yours sincerely,

Jim Ellis-Jones

Horticulture in Bangladesh

Dear Sir,

The statement in the article by Dyno Keatinge *et al* on page 40, column 2, of *Ag4Dev24* that, in Bangladesh, "horticulture is the exclusive domain of women" is incorrect. The study by Schreinemachers *et al* (2014) that is referred to describes a study of the role of women in home gardens. It makes no reference to the vastly greater production of horticultural fruit and vegetables for domestic use and market sale in fields beyond homesteads which - except in a few 'tribal' areas - is carried out by men.

Hugh Brammer

Opinions Page

(The views expressed here by individual members do not necessarily reflect those of the editors or the Tropical Agriculture Association)

Fiat panis - quo vadis?

As many readers will know, FAO (the Food and Agriculture Organisation of the UN) (motto: *Fiat panis* - let there be bread) was established in 1945. At the time, it had three main objectives. The first was to be a source of knowledge about agriculture globally, and a forum for the transfer of this knowledge to help farmers improve production. Second was to promote actions to improve agricultural production mainly, but not exclusively, in the developing world; and third, to provide technical assistance related to agriculture to governments as requested. The concept grew out of concerns about food security globally following the Second World War.

To some considerable extent in its early years, the agency was effective in meeting its mandates. The list of achievements is long and includes some of the following: soil surveys; land capability assessments; fertiliser requirements were determined for a wide range of crops; research capabilities (staffing and facilities) were introduced in developing countries for food crops; animal disease problems were addressed (*eg Peste des petits ruminants* (PPR) and Rinderpest); rural credit systems were designed; marketing policies were developed; irrigation requirements were quantified; improved seed was distributed and seed production systems were established; forest inventories were undertaken; fisheries and crop statistics were compiled; food safety standards were established. The full list of achievements, including the design of hundreds of agricultural investment projects, is impressive. But despite these achievements, some 850 million people, in the early years of the 21st century, are reported to go to bed hungry every day. Clearly, early hopes for the agency have not been met in full, and some observers think it is time for a review of its objectives and *modus operandi*.

Over the years, the rate of achievement slowed, partly because quite a number of achievements were not repeatable - soils can only usefully be surveyed once, but also because, as an advisory body, the FAO could not force countries to adopt better technologies and policies; it could only encourage and recommend. If, for example, after an FAO initiative, a country did not want to continue to finance a research station or stations established under an FAO project (*eg* the Food Crops Research Institute in Ibadan, Nigeria), there was little the FAO could do. It is also the case that, globally, over the past 40 years, much new technology development has arisen in the private, rather than, as heretofore, in the public sector; and the FAO has never for some reason felt comfortable associating with the private sector. The net result of these factors has been that, over time, a number of the technical divisions of the FAO have been slimmed down (Credit, Marketing, Animal Production and Seeds), or phased out (Plant Nutrition/Fertilisers and Agricultural Engineering). In an attempt to survive, almost all divisions have had to re-invent themselves and have looked for new technologies, and policies, to promote. In the early days, the technologies and policies promoted by FAO were not specific to either small or larger scale commercial farming; they were simply designed to improve production and output. Over time, however, the emphasis has moved noticeably and almost exclusively towards initiatives for small, resource-poor farmers, and low-cost interventions.

Such a move has been welcomed by the NGO sector, but it is not at all clear that the initiatives now being promoted by the FAO are actually always the best for small farmers. I came

across two developments during my time in FAO as a Senior Agricultural Officer that I think give considerable cause for concern. The first of these concerns plant nutrition and fertiliser usage. The background to this is outlined in Box 1.

Box 1. The FAO Fertiliser Unit

In the 1980s, the agency housed a Fertiliser Unit jointly funded by the International Fertilizer Association (an association of fertiliser manufacturers), and the FAO. The unit had some 20 technical officers whose main task was to carry out simple nutrient trials throughout the developing world. Basically, the unit provided information on the best combination of NPK mineral fertilisers to apply to achieve significantly higher yields of the main food crops grown in any country. In 1992, the then Director General of the FAO, Edouard Saouma, spent a short holiday in Germany where he spent some time with the Chancellor, Helmut Kohl. On his return to the FAO HQ in Rome, he summarily closed the Fertiliser Unit. Apparently Kohl needed the support of the Greens in parliament and they did not like the unit. They considered that it was little more than a marketing arm of commercial fertiliser manufacturers and suppliers, and that it was encouraging small scale farmers to buy mineral fertiliser they could not really afford. Fortunately, the good work the unit did has been digitised and is available on the FAO web site - so all is not lost.

Now it is true that getting small quantities of mineral fertiliser to small farmers living miles from the capital city is difficult, especially when the road system is bad, where there is no effective credit system, and few stores to keep and distribute fertiliser. Furthermore, in many countries, the limited amounts of subsidised fertiliser available annually are often 'grabbed' by the well-connected. But shutting down the Fertiliser Unit meant not only the loss of expertise in plant nutrition, but also expertise in the economics and marketing of fertiliser in difficult situations - something that was and should still be a major activity of the agency.

In 2015, the FAO does not employ a single officer with expertise in fertilisers. Not only is this a scandal in itself, given the urgent need to raise fertiliser use levels in SSA from today's paltry average levels of 10 kg per hectare; it also means that, when the agency is asked to provide fertiliser for emergency projects, there is no-one in the house who can advise on tenders. Instead the agency has allowed itself to be taken over by agro-ecologists who claim that sufficient nutrients can be supplied to crops by incorporating manure, crop residues or using legumes.

In 2011, the agency published a book *Save and Grow* (reviewed in *Ag4Dev16*) that emphasised the importance of "managing soil health" There *is* acknowledgment of the role played by mineral fertiliser in crop production, but the thrust of the text on farming systems and soil health is on a range of low external input technologies such as the use of legumes to provide nitrogen. These are nice ideas, and they have a place in modern farming, but - and it is a big 'but' - the use of legumes, either fodder legumes or grain legumes, has been promoted for years, but has not always caught on amongst smallholder farmers. Furthermore the book makes hardly any reference to phosphorus deficiency which is such a major problem in the acid soils of much of Africa, and for which the only realistic solution is to apply phosphate fertiliser. It is also the case that the book provides no quantitative information on how much nitrogen the technologies it promotes can provide, how much they cost farmers to use or what the expected increase in the value of output might be from using such technologies. It is as if the pundits in FAO are so convinced of their own ecological correctness that they have conveniently subsumed the basic needs of farmers in favour of a long-term common environmental good, rather than more food today. I think it is irresponsible practice at best, and at worst virtually criminal negligence.

The other story concerns integrated pest management (IPM) on rice in countries with seasonal climates, notably Bangladesh. This initiative grew out of some success in controlling rice pests in Indonesia and the Philippines, as outlined in Box 2.

Box 2. Integrated pest management (IPM) in rice in the Philippines and Indonesia

Some clever population dynamic studies of a major rice pest - the brown plant hopper – in the Philippines and Indonesia in the late 1980s had shown that indiscriminate use of pesticides can actually make a pest problem worse. What the work showed was that intensive use of pesticides kills off not only brown plant hoppers, but also all their natural predators. Subsequently, when there is a resurgence of hoppers, which reproduce very rapidly, there are no natural predators to control the pest, and what might have been a minor attack becomes devastating. The work also showed that a healthy rice crop of selected pest-tolerant varieties can, in many situations, withstand a limited hopper attack with only minor yield loss, less than the cost of any pesticides that might have been sprayed.

All that farmers needed to do was to monitor their crops regularly and carefully record the number of pests and the number of predators found on each inspection. Pesticides were only necessary if the ratio of natural predators to hoppers was below a previously pre-determined percentage. It was a marvellous example of IPM that really works if farmers are well trained, ideally according to FAO, through the use of Farmer Field Schools.

Encouraged by the success of large scale trials of the technology in Indonesia, the World Bank supported a project there to expand the use of the technology throughout the country, and the FAO convinced a handful of donors to support IPM projects wherever they could. In Bangladesh, two quite large rice IPM initiatives based on FAO project designs were implemented by CARE International, funded by the EU in the mid-1990s. I had the fortune to be involved in the *ex-post* evaluation of the two projects. It was an opportunity that provided a rare opportunity to investigate both IPM and Farmer Field Schools (FFS) in some depth. The evaluation was very thorough, and involved structured interviews with approximately 200 of the project beneficiaries some four years after the project ended, statistical analysis of the results of the survey, and follow-up interviews with a small sample of farmers to validate the survey findings and analyses. The overall results were amazingly consistent: the vast majority of farmers were still using pesticides, and the use of pesticides by rice growers has been increasing by about

5-10 percent a year for the past ten years. As for FFS, they existed whilst the project was operational, but ceased the moment Field Agents from the implementing NGO stopped visiting.

What makes the results particularly interesting is that the training provided to farmers during the project was high quality. The trainers were all graduates who had themselves received season-long training in how to grow a healthy rice crop and in IPM. They were also very regular in their visits to farmer groups. So poor training in IPM is not the reason why few farmers adopted IPM methods of pest control. The main reasons for limited adoption of IPM were that the IPM techniques that were promoted in Bangladesh were only partially effective (see Box 3), were very labour intensive, and only worked if everyone in the area used them. Most rice farmers in Bangladesh have tiny plots of land (typically less than 0.5 hectare), and they have to sell their labour for as many days as possible as well as tending their fields. If farmers used pesticides to control a pest attack, or as insurance against an attack, it cost them about the same as a day's labour (US$2 at the time). This then gave them 30 or more days in which they could sell their own labour, without having to worry about their rice field. If, on the other hand, they practised IPM, they had to visit their field every other day and walk through it to check on the ratio of pest to predator. This took time and, if things looked bad, they had to use labour-intensive methods of pest control.

Box 3. IPM in rice in Bangladesh

Rice cultivation in Bangladesh is very different from that in the tropics. In the first place, different varieties are grown at different times of the year, and these have different pest problems. At the time of the projects, no really cost-effective IPM existed that worked in Bangladesh. Attempts had been made to introduce parasitic wasps against one of the major pests (stem borer), but they had not succeeded. The only IPM techniques in the armoury were to make up a botanical pesticide, based on Neem tree leaves (not very effective), or use physical methods like netting, placing poles in fields for birds to perch on, light trapping to control attacks or, in desperation, hand picking insect eggs from rice leaves. Basically, there was no economically-attractive IPM technology, unlike the situation in Indonesia, and this was known and indeed reported on in the project formulation documents.

The real question is not really why IPM did not work in Bangladesh, but why IPM was promoted there in the first place in the absence of any economically-attractive IPM technologies. The answer can best be seen as cultural imperialism, *ie* "we in FAO and the West know how bad pesticides are (remember Rachel Carson's *Silent Spring*); you in the developing world need protection from the wicked pesticide companies, and we are going to show you how to protect yourselves". These are noble and not entirely improper motives. But the poor Bangladeshi farmer does not have the luxury of being able to worry about the environment tomorrow or even his own health prospects; he has to feed himself and his family today. His values are based on survival, not environmental niceties.

Our evaluation was shared with senior staff in FAO, some of whom had helped design the projects in the first place. Sadly, their response was, as anticipated, denial. If the FAO and fellow travellers in the aid community are really concerned about pesticide damage to health and the environment, rather than promote untried IPM technologies, they should be campaigning to get governments to improve the attitudes and behaviour of the pesticide companies. After all, not all pesticides are equally harmful, some break down quite rapidly in hot climates and are not very damaging to mammals, but do an adequate job of controlling insect pests. Surely the overall aim should be to get better information to all about all products, and the use of some products should be encouraged, while attention is focused on banning the really nasty ones, which are still used in some countries, including Bangladesh. More generally, much more thought and care should be put into projects funded by donors and executed by FAO.

The two case studies outlined above are by no means unique. The agro-ecological fraternity has taken over whole swathes of the agency and, when all such initiatives are taken together, they demonstrate that FAO has strayed far from its original remit. Promoting environmentally-correct, but economically-weak technologies does not help feed the poor. At the turn of the century, the agency was subject to an in-depth donor-funded evaluation. However, this focussed mainly on management and administration rather than the agency's role in technology transfer. Needless to say, that evaluation has anyway already been long forgotten. The current Director General of the FAO, José Graziano da Silva, claims he has a new strategy for the organisation, but in practice this seems to mean little more than down-sizing to reduce costs. What is really needed, if FAO is to retain the confidence of its members, is a thorough review of whether the original mandates are still relevant and if not what should be the agency's focus over the next decades. Some might even question whether the organisation is really needed in a world where the private sector is playing an increasingly important role in both small and large scale farming.

Charles Bevan

TAA Forum

Survey of readers of *Agriculture for Development*

Introduction

Our journal has undergone a lot of changes in recent years, since the former editor, Garry Robertson, coordinated its evolution from the TAA Newsletter into the journal *Agriculture for Development* in early 2008. Since then, the number and quality of articles have continued to improve, several new regular features have been introduced, and the lay-out and format of the journal have been modernised. The journal is now more than twice its original size, and the hard copy incorporates more colour pages. It now requires a considerable amount of time and resources to plan, compile and publish each issue.

The Publications and Communications (P&C) Committee have various ideas for further improvements, but before proceeding we wanted to know what our readers thought about the journal, and the direction of its future evolution. All readers were therefore invited to participate in a short survey, either online via the TAA website, or using a hard copy questionnaire enclosed with *Ag4Dev23*. Originally, the survey was planned for the month of December 2014, but this was later extended to include January 2015.

Respondents

A total of 61 responses were received: 41 were completed on-line using Survey Monkey and there were 20 hard copy responses. This represents about 10 percent of TAA members - a slightly disappointing response rate, but typical for surveys of this sort. Most of the respondents (46) reported receiving a printed copy of *Ag4Dev*; 12 received their copy on-line and three did not respond to how they received *Ag4Dev*. Since more than half of readers are on-line members of the TAA, this suggests that members receiving hard copies of the journal were more inclined to participate in the survey.

The age profile of respondents did not reflect that of TAA members. Of the respondents, 31 were 70 or over, 24 were between 50 and 69, only three between 30 and 49, and none were under 30 (there were three 'no responses'). Clearly, older members were more inclined to participate, possibly because most older members prefer to receive hard copy journals. The feedback from younger members is particularly disappointing, and perhaps justifies further attempts to elicit feedback from this very important group of members.

There were only two female respondents and 56 male (again with three 'no responses'). Like younger members, female members were under-represented in the survey. Ten of the respondents indicated that they are members of the Executive Committee or of the P&C Committee.

There was at least one missing or skipped response to each of the 36 questions, but most of the questions only had a small number of these. The only questions with more than 10 percent of missing/skipped responses (*ie* more than six) were some of the 'open ended' questions, namely: "Suggestions for additional features"; "How can you contribute to future issues?" (which was not relevant to those indicating that they would not be able to contribute), "What is your name?" (an optional response) and "Do you have any further comments?".

Satisfaction with *Ag4Dev* overall and with specific regular features

The average overall rating of *Ag4Dev* (on a 1-5 scale, where 1 = weak and 5 = excellent) was 4.15. This is an excellent overall satisfaction rating. Also on a 1-5 scale (where 1 = never read and could be omitted, and 5 = always read and enjoy and should not be omitted) respondents were asked to rate the 20 regular features in *Ag4Dev*. These responses are summarised in Table 1 on the following page.

Thirteen of the 20 regular features achieved an average rating of at least 4.00 and only the Corporate Members page dipped below 3.50. This represents a generally high degree of satisfaction, and provides an indication of where further improvements can be made.

There were some differences between categories of respondents. On-line (Survey Monkey) scores were often higher than those on hard copy questionnaires. This difference was statistically significant (Mann Whitney U test) for the following features: News from the Field ($p = 0.024$); International Agricultural Research News ($p = 0.036$); Mailbox ($p = 0.047$); TAA Forum ($p = 0.001$); Reports from TAA specialist groups ($p < 0.001$); News from the Regions ($p = 0.001$); Corporate Members page ($p = 0.038$) and Upcoming Events ($p = 0.005$).

Perhaps related to the above is the fact that members who receive the journal on-line tended to score higher than those who receive the printed edition. For this comparison, the Mann Whitney U-test statistic was significant for TAA Forum ($p = 0.025$), Reports from Specialist Groups ($p = 0.013$) and News from the Regions ($p = 0.001$).

Members of the Executive or P&C Committees were inclined to score higher than other TAA members. Again, calculating Mann Whitney U tests, this comparison was statically significant for eight regular features: Editorial ($p = 0.005$); Newsflashes ($p = 0.002$); Mailbox ($p = 0.015$); TAA Forum ($p = 0.018$); News from the Regions ($p = 0.026$); TAAF News ($p = 0.002$); Corporate Members Page ($p = 0.013$) and Reminiscences and Reflections ($p = 0.013$).

Table 1. Summary of responses on 1-5 scale (1 = lowest, 5 = highest) for overall rating of *Ag4Dev* and 20 regular features.

Feature	Mean	Maximum	Minimum	No of respondents
Overall rating	4.15	5	3	55
Editorial	4.28	5	2	58
Memorial lectures	4.15	5	1	59
Full technical articles	4.20	5	1	59
Full socio-economic articles	3.98	5	2	59
Full policy articles	4.11	5	2	56
Full current state of knowledge articles	4.32	5	3	56
Full case study articles	3.98	5	1	56
News from the Field	4.05	5	1	56
Newsflashes	4.09	5	1	57
Bookstack	4.02	5	2	56
International Agricultural Research News	4.16	5	2	57
Mailbox	3.93	5	1	56
TAA Forum	3.63	5	1	57
Reports from TAA specialist groups	3.61	5	1	56
News from the Regions	3.57	5	1	56
Obituaries	4.07	5	1	57
TAAF news	3.84	5	1	56
Corporate Members page	3.43	5	1	56
Reminiscences and Reflections	4.11	5	3	57
Upcoming Events	4.20	5	1	56

There did not appear to be any differences in the various mean scores associated with the different age groups.

Suggestions for additional features

Respondents suggested a number of possible additional features, including:

- Policies and priorities of main funding agencies;
- Features on ExCo members;
- Vacancies;
- Real (sustainable) success stories;
- Reviews of relevant websites;
- Contributions from NGOs;
- Less focus on the UK.

Suggestions for article content included:

- Special Issues on geographical areas;
- Articles on specific countries;
- More on Mediterranean regions;
- More on research, including historical impact;
- More economic analysis;
- More on gender and nutrition;
- More on organic agriculture;
- More on agroforestry;
- More on post-harvest losses;
- More on precision farming systems.

Frequency and focus of *Ag4Dev*

Most (43 recipients) think that the present number of issues per year, three, is appropriate. The remainder were fairly evenly split between two and four issues per year. No one suggested only one issue per year.

Most of the respondents (53) think that the number of Special Issues is "about right". There is also concurrence that the style and balance of *Ag4Dev* is "about right" (47), but there are some (nine respondents) who think that it is "not technical enough". The current presentation is "about right" according to 51 of the responses.

A peer-reviewed journal?

This is an important question, since publishing a peer-reviewed journal would require a significant increase in the time and effort necessary to publish the journal. The question "Should we aim to make *Ag4Dev* a peer-reviewed journal" did

reveal varying opinions. Although just over half (32) said "No", 21 said "Yes" and one mail-in respondent (these could ignore the responses offered and write in any answer) suggested that some technical articles should be peer reviewed (perhaps another "Yes"?). There were only three "don't knows" and four 'no responses'. It should be noted that there was a clear difference of opinion on this subject between those who receive the printed copy as opposed to those who receive *Ag4Dev* on-line ($p = 0.010$, chi squared test). Only 30 percent of printed copy recipients think the journal should be peer reviewed as against 72 percent of the on-line recipients.

Membership fees

Regarding the question of higher fees for printed copies of *Ag4Dev* as opposed to on-line copies, the number of respondents agreeing to this proposal was 28 and those opposed was 26; the other seven either did not respond or had some conditions if extra fees were to be applied. Perhaps not surprising, the proposal for higher fees for printed copies was strongly supported by on-line recipients (82 percent) as against printed recipients (45 percent): $p = 0.030$, chi squared test.

Assisting with the production of *Ag4Dev*

In response to the question "would you be willing to offer some of your time as a Coordinating Editor, Technical Editor, Occasional Editor, Proof Reader, Book Reviewer, or Coordinator of a specific feature?" over 45 percent of respondents answered positively. This is a very encouraging response, and the Coordinating Editor will follow-up with individuals as appropriate.

Other comments

Respondents were asked for any other comments or suggestions. About half of the respondents provided a wide range of comments and suggestions, including:

- A blog to enable easier interaction with TAA awardees in the field and sharing of experiences/networking between active in the field professionals (*Editor: this already exists*);
- TAA still seems a bit "when we" oriented;
- I think some flexibility in the maximum length of articles might be useful as it is presently quite constrained;
- Consider more colour pages (despite additional cost);
- Consider small stipend for editors;
- The present, 'open' and easily accessible format should be maintained;
- Thanks to all those stalwarts who not only put the newsletter together, but have done so much to improve it. I bet it's hard work and takes TIME!;
- Links with (Chartered) Institutes;
- If it costs £10 to print and copy each issue, why not have an electronic version as an alternative? (*Editor: we do of course have an on-line version - see website*);
- Please note that I never receive *Ag4Dev* but do follow references from TAA e-mails. This is probably because I only recently revised my standing order membership (*Editor: when membership fees are not paid in full, members are converted to 'on-line' membership*);
- Mini-conference run by TAA, in non-London location, for say two days;
- The journal is excellent, well produced and a vast improvement on earlier productions;
- Occasionally, there is a bit too much socio-economics for my taste;
- I fear the journal is moving towards the 'low input' movement, whereas globally agriculture is actually getting far more technical and commercial. A better balance is needed;
- An index with themes cross-referenced to the issue where the article(s) appear;
- The journal is more vibrant and informative now and should be circulated more widely;
- Could improve layout and design - consistent typeface and something less tacky and bold;
- Include an annual printed list of members;
- How much does the fancy pointless cover cost? *(Editor: the cover photographs are selected from the collections of members, so there are no additional costs involved)*;
- Well done the volunteer team and thank you.

Conclusions

Although only 10 percent of readers completed the survey, this sample size should be sufficient to provide representative feedback. Female members and younger members were, however, under-represented in the sample.

The journal was generally well received, with a high overall satisfaction rating. Regular features were all well received, although many useful suggestions for further improving content were provided. These will be considered.

Readers thought that three issues per year was the right number, and the proportion of Special Issues on selected topics was appropriate. Opinion was divided on whether printed copy recipients should pay higher membership fees, with most support coming from on-line members.

On the important question of becoming a peer-reviewed journal, respondents were divided. The P&C Committee will continue to consider this question in some detail.

Almost half of respondents offered to help with the production of the journal. This is greatly appreciated, and will be followed-up as appropriate. Many useful open-ended comments were received, and the P&C Committee will utilise them to further improve the journal. Additional comments and suggestions from readers, in the form of letters to the Editor, are always welcome.

Bruce Lauckner and Paul Harding

TAA Membership subscriptions: proposed increase in 2016-17

Membership subscriptions for the year (1 July 2015 to 30 June 2016) are due for payment on 1 August. Thank you to those who pay on time and at the correct rates. This ensures we are able to provide our full range of services (Box 1).

Box 1: TAA Services

- *Agriculture for Development* journal, three times a year;
- Regular email alerts on news, events, and vacancies;
- Support for young graduates to obtain overseas development experience through the Tropical Agriculture Award Fund (TAAF);
- Access to the members' section of the website;
- Seminars and field trips organised by five UK regional groups;
- Two annual memorial lectures by internationally known experts;
- Online directory of members available as consultants;
- Membership of the Biology Society and Cambridge Conservation Forum;
- Access to membership of the UK Forum on Agricultural Research for Development;
- Access to events hosted by the All Party Parliamentary Group on Agriculture & Food for Development;
- Networking between agriculture professionals, via our 'Opinions' and 'Reminiscences' pages;
- Provision for showing career summaries online;
- Latest job vacancies;
- Opportunities to contribute expertise and funds to development charities

Table 1: Membership categories and subscription rates, before and after 2008, and proposed

Membership Category	Rates (£)			No of members *2013-14*	% of Members
	Before 2008	**From 2008 to present**	**Proposed rates *from 1st July 2016***		
Full Individual: printed copy *Agriculture for Development*	30	40	50	157	23%
Full Individual 70 (aged 70 and over): printed copy *Agriculture for Development*	30	30		133	20%
Online Individual: online *Agriculture for Development*	20	30	40	238	36%
Online Individual 70 (aged 70 and over): online *Agriculture for Development*	20	20		39	6%
Student: online *Agriculture for Development*	5	10	15	46	7%
Corporate: two printed copies *Agriculture for Development*	80	100	120	23	3%
TAAF Awardee 1 year: online *Agriculture for Development*	Free	Free	Free	26	4%
Honorary: printed copy *Agriculture for Development*	Free	Free	Free	2	-
			Total	**664**	**100%**

Subscription increase

Unfortunately, we are faced with increasing costs, while at the same time wanting to improve our services, where this can be justified. The primary expenditures that face inflationary pressures include:

- ***Journal.*** Presently the Journal costs on average slightly over £10 per copy, therefore over £30 per year for those receiving a printed copy. For EU and overseas members the cost with postage is over £12.50 per copy. This is more than the subscription for many categories and takes no account of the editorial, management and intellectual costs of production. We are also keen to improve the quality of the Journal with colour printing where necessary.
- ***TAAF.*** TAAF is largely funded by external donations, but with TAA contributing £3,000 annually. Donations are however restricted for TAAF use and cannot be used for other purposes.
- ***Events.*** These include costs of the AGM and memorial lectures as well as support to regional branches, where warranted.
- ***Administration.*** These include the governance costs of the Association such as public liability insurance, accounting (audit) services and ExCo costs, which have been kept to 2-3 percent of total expenditure.

Presently we have eight subscription categories, which were last increased seven years ago, at which time differentiation between under- and over-70s was introduced. Although intended to assist older members, it has proved difficult to administer and has introduced, unintentionally, an increasing element of subsidy by the under-70s to the over-70s. The over-70s have not faced an increase since 2001. Unfortunately, most members do not disclose their dates of birth on the membership register, making administration difficult. We are therefore proposing to eliminate the differentiation between under- and over-70s and to increase all rates with effect from 1 July 2016 as indicated in Table 1.

The proposed increases are required to be approved at the Annual General Meeting scheduled for 11 November 2015 for implementation in our 2016-17 financial year.

Jim Ellis-Jones
Treasurer

Tropical Agriculture Association

Registered Charity No. 800633

Call for nominations for 2015 TAA Honours and Awards

Each year, the TAA honours those who have made significant contributions to agriculture for development and to the TAA itself. These are awarded at the AGM which is held in November.

There are three categories of award:

Development Agriculturalist of the Year is awarded in recognition of outstanding contributions to agricultural development, with a focus on increasing food production, improving food security, reducing poverty and improving environmental sustainability in developing countries.

Young Development Agriculturalist of the year recognises outstanding use of an opportunity (*eg* afforded by a TAAF Award) for gaining a better understanding of constraints to food security, poverty reduction and environmental sustainability in developing countries, and for making an initial contribution to overcoming these constraints.

Award of Merit or Honorary Membership is given to people who have made outstanding contributions to meeting the objectives of the Association. This category of award is restricted to TAA members.

The chair of the Honours Panel, Paul Harding (chairhonours@taa.org.uk) welcomes nominations for each of the above categories. Nominations close on **15th September**, after which the Honours Panel will make recommendations to the TAA Executive Committee.

Each nomination should include the name of the proposer and seconder (both should be TAA members or employees of Corporate Members) and a short statement of the ways in which the nominee meets the criteria for the award for which he or she is being nominated.

Nominees for Development Agriculturalist and Young Development Agriculturalist of the Year do not have to be members of TAA.

For more details, visit the TAA website, www.taa.org.uk and go to 'Honours and Awards'. Click here to see previous recipients of awards

Paul Harding
Chairman, TAA Honours Panel

Obituaries

Professor J T (Trevor) Williams, 1938-2015

John Trevor Williams (always known as Trevor) was a botanist and plant geneticist who was instrumental in promoting young scientists around the world to do scientific research on plant genetic resources and establishing worldwide genebanks to safeguard global food security. He was born at Thingwall on the Wirral on 21 June 1938. His father was in the Navy during WW2 and joined the Civil service after the war; his mother worked for the Post Office. Trevor died on 30 March 2015 at the age of 76.

Trevor loved plants from his early life and showed a love of writing while he was at Cheadle Etchell's Primary School. Even then, the teacher predicted that he would write something good for humanity. While he was in Moseley Hall Grammar School, Trevor discovered a specimen of a plant which had mutated and wrote to the Botanical Society of the British Isles for identification. Recognising his interest in plants, the Society invited him to join a field trip to the Yorkshire Dales. Trevor was also keen on scouting activities and was awarded the Queen's Scout Badge.

Trevor did an MA in Botany at Selwyn College, Cambridge, in 1959; and a PhD at the University of Wales (Bangor) in 1962. His PhD project was on *Chenopodium* (still an underutilised crop). After Bangor, Trevor went to the Swiss Technological University in Zurich as a research fellow, and received a DSc in 1964. He became Lecturer in Botany at Goldsmith College, London, and then the Lanchester Technical College, Coventry. In 1969, he became a course Tutor for the MSc in conservation and utilisation of plant genetic resources, where he taught students from around the world. He supervised many PhD students and many of his students established National Genebanks in their countries with his support and guidance.

Trevor joined FAO (the UN Food and Agriculture Organisation) and in 1974 he established the International Board for Plant Genetic Resources (IBPGR). As Director, he launched a programme to collect crops and their related wild species for conservation and for plant breeding and crop improvement. He pioneered an International Network on *ex situ* conservation and developed policy guidelines for national genebanks by using *in vitro* technology. He became the first Editor of the *Plant Genetic Resources Newsletter* published by FAO. He moved to Washington DC in 1990 and helped to organise INBAR (the International Network for Bamboo and Rattan). During his stay in Washington, Trevor was adviser to INBAR and the plant genetic resources magazine *Diversity*.

Because of his love of under-utilised crops, Trevor was one of the founder members of ICUC (the International Centre for Underutilised Crops) in 1988. He was a Board member, and he became Chair of the Board from 1998-2005. He developed policy guidelines for institutional development and helped to develop a strategy for "using genetic resources of underutilised species for food and industry". He was editor of the *Underutilised Crops* Series published by Chapman & Hall, and Chair of the Reviewing Committee of all ICUC publications, including eight Monographs of *Fruits for the Future* project. He was then Chair of ECUC (European Centre for Underutilised Crops) from 2005-2011.

Trevor received many accolades, including a Jubilee Medal from the Agrarian University, Peru; a certificate of honour from The Royal Government of Thailand for his outstanding scientific leadership; and a commendation for services to CIP, Peru. He also received honours from the British Ecological Society, the Botanical Society of the British Isles, Warwickshire Nature Conservation and the Birmingham Natural History Society.

Trevor Williams made recognised contributions to studies on plant genetic resources and their conservation world-wide. He was a man of vision, tenacity, boundless energy and enormous courage, and he had a remarkable and distinguished life. He will be remembered by many of his students and colleagues around the world for his many significant contributions to science and for promoting young scientists around the world to follow in his footsteps and become involved with plant genetic resources.

Nazmul Haq and Roger Smith

Maurice F Purnell

We are sad to report the death of Maurice Purnell on 8 July 2015.

Dr JBD (Brian) Robinson and Bill Reed

Shortly before going to print, we were sad to receive news of the deaths of Brian Robinson on 6 August and Bill Reed on 12 August 2015. Obituaries for Brian and Bill will be included in *Ag4Dev26*.

TAAF News

Antony Ellman and Alastair Stewart

Eight MSc students from six UK universities received TAAF awards in May 2014, enabling them to undertake overseas research for their dissertations. Summaries of reports by three of these awardees were included in *Ag4Dev23*, the remaining five reports are summarised here.

A report by one long term awardee from 2014, Martin Findlay, is also included in this issue. Martin spent 6 months in Cameroon as mentor/trainer for engineering students on a village water supply and small-scale irrigation programme. Following this experience he is about to begin work in the UK with the engineering firm Arup.

Ten new TAAF awards were offered in May 2015 to MSc students selected out of 20 applicants from ten UK universities. The list of awardees and the projects on which they are working are shown in Table 1.

It is encouraging that many of the TAAF awardees from 2014 and earlier years have succeeded in finding employment in various fields of development, following completion of their award period. This is an indication that TAAF is succeeding in achieving one of its main objectives: to help new graduates in natural resource-related subjects to overcome the 'experience gap' and get a foot on the ladder towards a career in development work.

More details of TAAF's work and plans for the future can be found in the Annual Report for 2013/14 which appeared in *Ag4Dev24*. The generous contributions received from individual members of TAA allow TAAF's work to continue and even to expand. We appreciate these donations enormously, and very much hope that they will continue to flow in!

Table 1. 2015 MSc award offers

Applicant/ University	Degree course	Project Title/Country	Amount of award
Aberystwyth			
(1) Callum Scotson	BSc Plant Biology	Heritability of cauliflory in *Theobroma cacao*, Trinidad	£250
Edinburgh			
(2) Bamnan Dagu	MSc International Development	Role of technology in the livelihoods of small scale farmers and fishermen in Peru	£1,000
Imperial			
(3) James Alden	MSc Environmental Technology, Economics and Policy	Development of an effective field kit to evaluate coffee farm adaptation to climate change, Guatemala	£1,000
(4) Paul Baranowski	MSc Environmental Technology, Economics and Policy	Modelling the economic viability of smallholder coffee farms in Central America (Guatemala)	£1,000
(5) Sean Denny	MSc Conservation Science	M&E of knowledge, attitudes and practices related to forest biodiversity and conservation in the Eastern Arc Mountains of Tanzania	£1,000
(6) Natasha Howard	MSc Conservation Science	Forest products from non-forest land use, Madagascar	£500
(7) Harriet Ibbett	MSc Conservation Science	Impact of grassland user groups on Bengal Florian populations in Central Cambodia	£1,000
Newcastle			
(8) Adam Southern	MSc International Marine and Environmental Consultancy	Impact of National Aquaculture Group facility on the marine environment, Saudi Arabia	£1,000
(9) Benjamin Taylor	MSc International Marine and Environmental Consultancy	Assessment of aquaculture outfall impacts on invertebrates, Saudi Arabia	£1,000
Sheffield			
(10) George Barrett	MPH International Development	Stakeholder responses to conservation and oil exploitation in Sanaga Basin, Cameroon	£1,000

Alex O'Connor, MSc Anthropology, Environment and Development, UCL

Environmental associations of North Peruvian Cocoa Communities

Alex writes, "I spent 2 months in the field living with cocoa farmers in Peru investigating their dependence on cocoa as a livelihood (Figure 1) and how being a member of local 'environmental associations' presented alternative income opportunities and promoted greater understanding of the forest ecosystems and climate change. I visited four communities and did forty-two interviews. My study concluded that dependence on cocoa was so strong that no other crops were even considered viable and that the various projects and initiatives presented by the environmental associations were too recent to have had an effect, although I was able to do some analysis of their potential. Association members were found to have a greater understanding of the benefits of reforestation to the local environment but understanding of global climate issues was poor in both member and non-member sample groups.

The study allowed for people to voice their concerns and thoughts about the subject. The conclusions and concerns brought to light can be taken on board and the organisations that manage and fund the projects can make changes as necessary to ensure long-term participation and success in securing non-cocoa livelihoods and protecting the forest."

Figure 1. Alex O'Connor with a cocoa farmer in Northern Peru

Alex Chaudhary, MSc Environmental Change and International Development, Sheffield University

Study of Cameroon's REDD+ mechanism.

Alex writes, "This project aimed to illuminate the interactions of civil society and state actors in providing representation for local forest communities and indigenous populations. From the offset I was aware that asking questions concerning local participation within a national setting may present a difficult situation, yet schemes such as Reducing Emissions from Deforestation and Forest Degradation (REDD+), with multiple actors and various social and environmental factors and consequences, require these questions to be faced. This is of increased importance due to the strong critiques of participatory processes in development and their not being recognised by international development and donor organisations. My questioning firstly assessed the process of indirect participation of forest-dependent people in Cameroon's REDD+ preparation, including the influences between Local Communities and Indigenous People (LCIP) stakeholders and civil society. This was then used as a basis for evaluating the attitudes towards LCIP participation in the REDD+ process by civil society actors, state representatives and other conservation and development initiatives and how this reflects participation discourses and post-participation critiques.

My research was carried out from within the Centre for Environment and Development in Yaoundé, Cameroon. Undertaking a placement within a respected national NGO with close links to both local and state actors was essential in allowing questions regarding the role of civil society in Cameroon's national REDD+ scheme to be understood and tackled adequately, and provided excellent experience of the day-to-day work within NGOs. However, both arranging and carrying out interviews towards meeting these aims was often met with difficulties due to the ongoing implementation of REDD+, with insecure funding prospects leading to the views of donor organisations being heavily repeated. Attempting to gain interviews with prominent REDD+ actors and discern individual's views compared with those of their respective organisations was a challenging and rewarding undertaking which helped increase my confidence in carrying out research in a foreign city as well as helping to illuminate the relationships between the different actors. The final findings showed that the value and critiques of participatory processes are acknowledged by local and regional organisations yet larger organisations and state actors are often unaware of the intricacies and heavy resource requirements for full and effective participation to be achieved. Although this is changing, the national and international emphasis on rapid REDD+ implementation means the likelihood for effective participation is low, casting doubts on the long-term success of Cameroon's national REDD+ scheme. By demonstrating the competence of civil society in implementing participatory processes, the report helps emphasise the requirements for increased time and resources for their success."

Islam Abdel-Aziz, MSc Agricultural and Environmental Science, Newcastle University

Impact of soil and water conservation techniques on soil fertility and sorghum crop yields in Burkina Faso.

Islam writes, "The seasonal nature of Burkina Faso's rainfall, a landlocked sub-Saharan country in West Africa, originates from the flow of the West African monsoon northeasterly during May to October, and southwesterly during November to April. As a result of the country's limited perennial river flows, and inadequate ground water reserves, Burkina Faso uses primarily a rainfed agricultural system. However, due to a changing climate, and years of land mismanagement, this predominantly flat country suffers from increasing land degradation, and highly variable production. Our aim was to understand the socioeconomic impacts of these environmental and climatic variables on local farming communities (Figure 2), and to collect data from current and pre-existing scientific experiments conducted by researchers at Saria Agricultural Research Station, a focal point for research in the central climatic zone of the country (Figure 3); allowing us to model production risk, and hopefully suggest improvements to current agricultural practices.

Figure 2. Islam Abdel-Aziz with farmers from a woman's group in Boukou, Burkina Faso

Figure 3. Islam with Jacques Kaboré, one of the farmers conducting field trials of soil and water conservation techniques

The fieldwork conducted in Burkina Faso has been invaluable to understanding the complexities of the numerous interconnected aspects of agricultural development work; not only the environmental conditions, but also the socio-economic, and infrastructural barriers which limit agricultural production. Interviews with farmers highlighted the need to adequately estimate onset and cessation dates of the growing season, and effective methods to mitigate against seasonal dry spells as their primary concerns. We are yet to fully complete our analysis, but from the data collected we hope to be able to show that an opportunity seems to exist for adaptive management based on an assessment of the rainfall pattern early in the rainy season; which may be optimised with complementary soil fertility and land management techniques.

Without the time spent at Saria and conducting interviews with farmers in the field, it is difficult to appreciate the processes involved in taking a project from experimental design, through collaboration and extension, to adoption and complete integration. I cannot thank the TAA enough for allowing me this opportunity, and for further confirming in my mind that this is the course that I should follow."

Richard Carpenter, MSc Climate Change and Development, Reading University

Testing climate-smart technologies in Malawi

Richard writes, "My project aims to research the effect that fuel efficient *biochar* cook-stoves can have upon reducing deforestation in Malawi, and the extent to which they can mitigate climate change through reduced carbon emissions via *biochar* sequestration. The project also seeks to establish the potential environmental and livelihood benefits associated with the use of agricultural wastes as a low cost fuel source within *biochar* cook stoves. Stoves being used within the project are based upon designs kindly supplied by Dr Paul Anderson of his *Troika Bingwa* gasifier stove. Since arriving in Malawi I have established links with project partners *Total Land Care Green (TLCG)* and *Lilongwe Wildlife Centre (LWC)*. TLCG are providing technical assistance regarding stove design (Figure 4), while LWC have given me access to work with their local community groups.

Figure 4. Jordan Kawalke (right) from project partners Total Land Care Green, and Richard Carpenter (left), testing the first prototype stove

We recently developed the first prototype *biochar* stove, which was a great success, and have since initiated full production of stoves using a local tinsmith recommended by TLCG (Figure 5). It will only be a matter of weeks now before we introduce the stoves to the communities and begin collecting data. It is fantastic being out here establishing a grass roots project that has the potential to positively impact people's lives and their environment. Hopefully this project will serve as a stepping stone towards a future PhD. In conjunction with project partners LWC I have recently developed and submitted funding proposals that build upon and expand existing project ideas to consider the environmental and livelihood impacts of using agricultural wastes and *biochar* within smallholder farms in Malawi."

Figure 5. Local tinsmith Jonas (right) putting the finishing touches to the first prototype stove

Sam Holmes, MSc Environmental Science, University of Southampton

Charcoal use in Zomba, Malawi: a necessity or a choice?

Sam writes, "My project investigated the use of charcoal in Zomba, a medium sized city in Malawi. The aims were to determine what drives the decision to use charcoal at the household level and how this varies between the different socio-economic elements of Malawian society. The aims were to be achieved primarily through conducting a household energy survey of Zomba city and with formal and informal interviews with key informants.

The fieldwork stage of the project has now been completed and has provided a strong dataset of over 300 respondents. I have gained valuable experience of the logistical challenges faced managing a project for an extended period in a particularly poor developing country, and also working with sustainability experts at *Leadership for Environment and Development, Southern and Eastern Africa (LEAD SEA)*.

The field work provided both a prominent and rewarding experience. Conducting the survey took me across many areas in Zomba and brought me into contact with some of the richest and the poorest elements of urban society in their own homes, from mansion to shanty. In contrast to my experiences of household surveys in the UK, the people of Zomba I encountered were very welcoming and enthusiastic to participate on a voluntary basis (Figure 6). Discussing charcoal use in depth with the different users themselves has given me unique knowledge of the complexity of the issues surrounding charcoal use in Africa. The opportunity to engage directly with those affected by many of the development

Figure 6. Sam Holmes conducts a village survey with the next generation of farmers looking on.

issues so commonly covered in lectures and in academic writing was invaluable. This has given greater depth to my understanding of the inseparable human aspect of development that is difficult to grasp from study alone.

The charcoal industry in Malawi is associated with a variety of socio-economic and environmental issues including: marginalisation and abuse of producers, transporters and traders, inequity, deforestation and forest degradation. However, charcoal also provides a key source of income for rural people and a reliable source of fuel for urban consumers. At present a lack of supportive legislation both exacerbates these issues and limits the potential benefits. The findings of this research will hopefully help raise awareness of the true nature of charcoal use in Malawi and, in combination with other research, help drive informed policy change for sustainable development of the energy sector."

Martin Findlay, six month award report
Bambui Water Engineer Mentoring Project, Cameroon
Martin reports, "I approached the Tropical Agriculture Award Fund (TAAF) to help finance a six month placement in Cameroon, alongside *Engineers without Borders-UK* and the local NGO *Reignite Action for Development*. I am very grateful to the TAA, who through the TAAF award made this project possible.

The main objective of the project was to train and mentor two graduate engineers in rural water supply engineering through a practical training programme. Together, Max, Denis and I worked at the Bambui Water Authority (BAWA), a community-run water authority delivering water to the village of Bambui in Northwest Cameroon. Bambui has a population of around 20,000 people, mainly subsistence farmers. Water shortages and poor water quality are common problems in Bambui. This has impacts not just on the health of the inhabitants, but also on how much and what types of food they can grow.

Throughout the programme, we assessed the capacity, maintenance procedures, future requirements and quality of the current water supply system; we made detailed recommendations and designs for the Bambui water supply system; and recommended designs for locally made drip irrigation systems.

Figure 7. A sensitisation session concerning water shortages with members of the village. We built a model to show the effect of leaving taps on or not reporting leaks

As for the legacy of the programme, we worked with the local water authority to prepare and develop an effective standard practice that effectively explains how best to run a rural water supply system. The plan is to share this with the other villages in the region. We also conducted several training sessions with the staff at BAWA, as well as the other water authorities in the region.

A personal highlight of mine was during the training session with the other local water authorities. As we were highlighting some simple procedures which could be undertaken to improve their maintenance procedures, several people started taking pictures of our Powerpoint slides, exclaiming "we always have these problems, but never knew how to solve them before!"

Another highlight was conducting simple hygiene sensitisation sessions with the schools in the village. Simple lessons such as washing hands with soap (Figure 8) and the safe storage of water can save lives in a rural village such as Bambui. The children were incredibly enthusiastic and the hand-washing song we sang with them followed us around the village for the entirety of my time in Cameroon!

Figure 8. One of the school sensitisation sessions concerning hand-washing and safe storage of water

Having achieved a significant amount in six months, I have left the project in the hands of *Reignite Action for Development*, who will carry on their good work in the community having now employed one of the graduate engineers I was mentoring.

Personally I have benefited greatly from conducting this project, having developed a number of key skills which will be essential in my future career. Through the unreliability of the local infrastructure I also became very good at improvising, a skill I am sure will come in handy in the future! Since returning to the UK I have worked at the Environment Agency and have most recently accepted a job at the engineering firm Arup. Although not directly related to international development, I still hope to return to such a career once I have gained some industry experience in the UK."

Corporate Members' Page

ECHO East Africa - the newest Corporate Member of the TAA

For thirty-four years, ECHO Inc, an American NGO, has equipped people with agricultural resources and skills in an effort to reduce hunger and improve the lives of the poor. ECHO's assistance has focused on smallholder farmers by providing them with new ideas, information, seeds and training. ECHO maintains a robust repository of technical information and resources available free of charge to international development workers at www.ECHOcommunity.org.

ECHO is located on a 55-acre farm in North Fort Myers, Florida, with one of the largest collections of tropical food plants in North America, and serves as a hub for supplying seeds, cuttings and excellent informational resources. ECHO prepares international agricultural workers with hands-on training and experiences in tropical and subtropical situations through classes, informal learning opportunities and annual agricultural conferences. ECHO also operates three Regional Impact Centers based in Chiang Mai, Thailand, for the Asia Region; Arusha, Tanzania, for the East Africa region; and Ouagadougou, Burkina Faso, for West Africa.

ECHO's growing network currently includes close to 10,000 members in over 160 countries. ECHO partners work alongside small-scale farmers to grow nutritious food for their families and communities. ECHO is a 501(c) (3) organisation which was ranked in 2014 by Charity Navigator as the ***number one*** international charity in Florida, and among the top 100 in the US, based on governance practices, financial information, donor policies, and management of administrative costs.

ECHO East Africa Ltd is the newest Corporate Member of the TAA. This partnership seeks to strengthen both TAA and ECHO networks through a mutual sharing of technical resources and membership, while making all of ECHO's free resources available to TAA members.

The establishment of ECHO's Regional Impact Center in East Africa in 2012 brought ECHO's services to frontline agricultural workers who now access appropriate technologies, training innovations and quality seeds for improving crop production and building soil fertility. These ECHO stakeholders in turn have influenced impoverished farmers subsisting on very small plots of land thereby providing one effective way in which ECHO achieves its mission.

The Regional Impact Center has supported low-external input, practical approaches to food security (especially among pastoralists) and dryland farmers in East Africa. These new resources and interventions are readily accessible through the East Africa section of www.ECHOcommunity.org which also contains a growing collection of resources in Kiswahili and English. As an organisation, ECHO focuses on networking to meet critical needs rather than competing with or duplicating the activities of other stakeholders.

These recent highlights demonstrate ECHO East Africa's engagement in the fight against hunger:

- A symposium for best practices in highland agriculture was held in Bujumbura, Burundi, in late October 2014 where 102 participants shared ideas and innovations for high-density populations in the East Africa highlands and focused on small-scale farmers and displaced persons from genocides who suffer food-insecurity.

Figure 1. Participants at the Burundi Symposium, 2014

- The 3rd Biennial Symposium on Sustainable Agriculture and Appropriate Technologies occurred in February 2014 for 196 participants from 22 nations. When combined with the Pastoralist Symposium in Machakos, Kenya, in March 2014, 415 participants from 24 countries have attended ECHO symposia over a 12-month period.
- The Regional Impact Center constructed a cold room to serve as a seedbank and began vacuum packing seeds for members and visitors. To date, over 120 accessions have

been gathered. While ECHO attempts to avoid duplication with several existing seed suppliers in East Africa, it sees its own niche as providing lesser known vegetables and fruits, green manure/cover crops (GM/CC), and agroforestry seeds to non-profit organisations and agriculture workers. In its efforts to promote Conservation Agriculture, ECHO addresses needs of GM/CC seeds currently unavailable from the private and public sector, as well as less common seeds for home gardens, agroforestry and soil conservation efforts.

- The Regional Impact Center produces documents in English and Kiswahili for publication on the ECHO website. Currently, an *East Africa Note* on *Wild Foods and Orange Fleshed Sweet Potatoes* and *Maize Lethal Necrotic Disease* are under development.
- ECHO has engaged two ECHO-Florida interns as technical assistants and hosted four local Tanzanian interns to gain development experience during the year.
- ECHO East Africa has remained responsive to technical inquiries while attempting to steer end-users to its website www.ECHOcommunity.org. Recent ECHO surveys indicate an encouraging growing number of East African users.
- ECHO East Africa also developed an appropriate technology demonstration and hired four Tanzanian nationals to support innovation design in local villages and engineering colleges. These efforts are supported by the International Design Innovation Network (IDIN), headed by the Massachusetts Institute of Technology (MIT) and funded by USAID.

Figure 2. Testing and displaying prototypes at the Innovation Development Design Summit, 2014

- ECHO East Africa obtained grants from USAID's Innovation Development Design Network through MIT whereby community initiatives are encouraged through the provision of training and small grants to develop low-cost appropriate technologies that might be useful in alleviating hunger, poverty and drudgery.
- ECHO's East Africa team members participated in a number of strategic meetings in the region including the National Conservation Agriculture Task Force, a Sustainable Intensification workshop and a workshop on Value-Chain Linkages in the Horticulture Sector.
- The team also provided the technical resources for radio and television programs to local and national media through the Habari Maalum Media College which has links to Farm Radio Network.
- The Impact Center developed demonstrations and disseminated planting materials to numerous visitors including monthly visits from the Jane Goodall Foundation's *Roots & Shoots* clubs (a youth-led community action and learning programme).
- The ECHO East Africa Director and Technical Advisor led a consultancy on reducing sedimentation in Lake Tanganyika through food security and soil conservation initiatives in villages adjacent to the Mahale Mountains National Park.

Figure 3. Farmers in the Mahale Mountains area establishing contours and vaccinating chickens

- ECHO's East Africa team provided training to orphan caregivers in collaboration with the Danish NGO, *Make Possible*.
- ECHO's East Africa Director assisted the *TOGETHER* program in Karamoja, Uganda to promote a Conservation Agriculture forum and training, an East Coast Fever Vaccination Pilot in Kacheri, Kotido District, and Newcastle Disease vaccinations.
- ECHO's Impact Center demonstrated practical soil conservation and agroforestry work by training village leaders and farmers in four areas around the Center. This initiative is beginning to gain momentum through small grants from the IDIN initiative and impacting communities near the ECHO Center.

Erwin Kinsey
Director, ECHO East Africa Impact Center

Reminiscences and Reflections

Early reflections from an itinerant phytopathologist

Jim Waller

Jim Waller was a former ODA Plant Pathology Liaison Officer, a former Head of Crop Protection Services at CABI, and is currently a CABI Emeritus Fellow.

Early years in East Africa

I started my overseas career in 1964, as a plant pathologist at the National Agricultural Laboratories in Nairobi, Kenya, during the year after independence. Apart from general plant disease diagnostic and advisory work, my other task was to develop a suitable screening technique for assessing smut disease resistance in sugarcane, although the ravages of coffee berry disease (CBD) was the major cause for concern at that time. My sugarcane project, and the many other crop disease problems that occurred, allowed me to travel throughout the country as well as visiting Tanzania and Uganda, all of which were closely linked at that time through the East African Common Services. I was also fortunate to participate in the annual Senior Agricultural Officer's tour of the Rift Valley province when my immediate boss, the late Raoul Robinson, went on leave. Most of my immediate colleagues and other contacts in the District Agricultural Officer network had served under the colonial regime and had a wealth of experience of the country's agriculture, and I learnt much in their company. Many years later, in the late 1990s, I was reminded of them at the annual Natural Resources Advisers Group meeting when a keen young socio-economist, while extolling the virtues of the new livelihoods approach, explained how we needed people in the field who were generalists able to understand the range of problems faced by local farmers - not specialists. One of the 'old guard' interjected "We used to have these people - they were called District Agricultural Officers!"

After the statutory two year contract, I returned to the UK and took up a position as an Overseas Development Ministry (ODM) 'home-based' plant pathologist at Rothamsted. However, before leaving Kenya, I had already made some provisions to return to work on coffee and I was duly seconded back to spend a further $2^1/_2$ years at the Coffee Research Station as part of a team tackling the problem of Coffee Berry Disease (CBD) where the spraying regime developed previously seemed to make the disease worse. We were able to develop successful control measures through the application of a rational fungicide spraying regime based on sound epidemiological principles. I continued my interest in CBD and, several years later, with students from East Africa (EU-funded and linked to Reading University), we were able to show that the injudicious use of fungicides did exacerbate the disease by removing competing microflora from coffee surfaces, thus negating their natural biological control effect on the CBD pathogen. We were also able to fully characterise the CBD pathogen (as *Colletotrichum kahawae*) about which there was some confusion.

In 1970, I returned to Rothamsted (together with an expanding family) to continue work on cereal root diseases. However, at that time, coffee rust disease had reached Brazil and its first appearance in the New World caused something of a stir. ODM sent a spraying expert who had visited us in Kenya and myself to provide advice on the problem in Brazil. This began a long association with the disease in Latin America and the start of a general 'trouble-shooting role' for me in tropical crop disease problems. In 1971, ODM established a Scientific Liaison Officer group to support the aid programme in those disciplines not covered by the 'in-house' scientific units of the Centre of Overseas Pest Research, Tropical Products Institute and Land Resources Development Centre. I was recruited in 1971 as a Plant Pathology Liaison Officer based at the Commonwealth Mycological Institute (CMI) at Kew. Previously, a pool of tropical plant pathologists had been based at CMI under the auspices of the old Colonial Office, but this had fallen into abeyance. There was therefore a need for ODM to better utilise the established links and tropical science base of CMI (and other parts of the Commonwealth Agricultural Bureaux).

ODM Scientific Liaison Officers

At CMI, I joined Ian Gibson, who was the recently-appointed Forest Pathology Liaison Officer. Around the same time, other Scientific Liaison Officers (SLO) were appointed covering weeds (Chris Parker), nematodes (John Bridge), timber products and fish; as well as statisticians for both tree and field crops. These were mostly based at appropriate Agricultural Research Centre (ARC) stations. The posts were funded by ODM on 3-year contracts. Basically, our role was to provide ODM and overseas governments with appropriate advice relative to our disciplines and to liaise

with other parts of the UK science base. We reported annually to ODM at a joint meeting with the Natural Resource Advisers that was preceded by a 'soirée' generously hosted by Hugh Bunting at Reading University. The group continued into the early 1980s, but the change of government, the switch from a Ministry to a department within the Foreign Office as the Overseas Development Administration (ODA), and cut backs in public funds made the group very vulnerable, and most posts were cut, as was much of the funding that supported ODA's 'out-house' science. The sole survivors of the Liaison Officer purge were a plant pathologist (myself) and a statistician based at Rothamsted. However, much of the work undertaken by the Liaison Officers had become widely recognised and continued in other ways with different funding formats.

The work of the Liaison Officers was quite varied. Apart from fulfilling an information and advisory role, we undertook short visits overseas to conduct surveys of crop problems, review the technical aspects of proposed research projects, provide technical back-up to crop protection workers overseas, and monitor ongoing projects, usually accompanied by ODA's Agricultural Research Adviser (Roger Smith) and the local Development Division Natural Resources (NR) Adviser. This was the age of project aid where expatriate Technical Cooperation Officers (TCOs) were recruited to undertake research on problems in conjunction with local overseas government institutions. I also maintained close links with the ODM in-house institutes, including Rothamsted, where expertise in virus diseases proved invaluable in many tropical situations, and Reading University where I was an associate lecturer and where ODA-funded projects were set up on pearl millet downy mildew variability with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and on the variability of the chick pea blight with the International Centre for Agricultural Research in the Dry Areas (ICARDA).

The base provided by CMI provided an ideal opportunity to develop a plant disease diagnostic and advisory service that built upon the established mycology and bacteriology identification services undertaken by the Institute and the unrivalled information base of CAB. Eventually, this aspect of the work at CMI developed into a fully-fledged plant clinic and a forerunner of what is now part of CABI's *Plantwise* initiative. Despite the varied and sometimes rather adventurous nature of the work, there were inevitably some frustrating aspects of being an SLO. One was that, having identified an important tropical crop disease problem and helped set up an appropriate research programme to tackle it, the challenge of undertaking the research was passed to someone else such as a TCO working overseas. However, this was offset by being able to follow and influence projects from conception to completion.

It is not possible to do justice in this short article to all the various activities and incidents in which I was involved in, but a few of the more interesting themes started in those early years are summarised below.

Surveys

Country surveys of crop diseases were the objective of many overseas visits and often as a team including the Nematology Liaison Officer (John Bridge) and an entomologist, and sometimes a weed expert. A few of these surveys were exploratory in nature, where there was little prior information on the crops or their problems: *eg* in the highlands of Papua New Guinea and in Oman in the 1970s. Many were undertaken in order to prioritise targets for development of better control methods and sometimes linked to existing projects, as in the Windward Isles, Bolivia and Kenya, or lead to the establishment of ODA-funded projects to tackle outstanding issues. Some involved single crops and, in collaboration with the International Maize and Wheat Improvement Centre (CIMMYT), I participated in surveying and identifying triticale diseases in Mexico, Ethiopia and Kenya.

Poor health of crops is often due in part to adverse growing conditions (drought, water logging, poor nutrition, cultivation damage, *etc*), so it was essential to have an open mind about local crops and agro-ecological conditions during these surveys. Only too often, farmers either did not recognise that the health of their crops (and hence performance) could be vastly improved, especially where soil-borne problems occurred, or they had misconceptions about the cause of a problem. By contrast, there were situations where poor performance of a crop due to agronomic reasons was attributed to some unspecified disease that could be miraculously cured by the visit of a plant pathologist or an intensive donor-funded research programme.

Coffee rust

A year after the visit to Brazil, I attended a meeting of the Central American Agricultural Health Organisation (OIRSA) that was convened to review the threat to the region posed by coffee rust. The meeting was held in Managua and appeared to be as much a social event as a serious review. With all the other delegates, I stayed at the splendid old Gran Hotel before that and much of old Managua was destroyed by an earthquake the following year. Over the next few weeks, I visited the different Central American countries on behalf of OIRSA to review their readiness to take action against the potential arrival of coffee rust. All in all, it was quite an eventful initiation into the role of an ODM Liaison Officer. When the disease did arrive, it appeared in a restricted locality in Nicaragua and I was contracted by FAO to provide advice on the situation. I paid a number of visits over a three-year period, which also coincided with the 'Sandinista' revolution. The initial affected area was limited to a few farms near Managua, so it could be well contained, but efforts to eradicate the outbreak proved futile. However, after the revolution, all the coffee in the area was uprooted and destroyed, and a massive replanting programme was planned. Unfortunately by then, coffee rust had spread to El Salvador and Honduras.

A few years later, I took part in a similar review of the coffee rust threat by the Colombian Coffee Federation and, when the disease eventually arrived, TL Wiles and Associates began a programme to assist the Federation in developing ULV techniques that could be used to spray coffee on the steep slopes of the cordilleras - a major problem facing cof-

fee farmers there. This problem had already been experienced in the Central American countries, and ODA had established a TCO project in Honduras to investigate ULV techniques. The Colombian operation was jointly funded by the Federation and ODA; and worked in close collaboration with Micron Sprayers Ltd with me involved as the ODA adviser to the project. The outcome was the development of the 'Motax' motorized back-pack ULV sprayer, but by then the new rust-resistant Catimor hybrids had been developed and the need for spraying declined.

Cloves

One of the most devastating plant diseases I encountered was the Sumatra clove 'sudden death' problem. I visited Indonesia to investigate this in 1973. In some areas of Sumatra, the landscape was dominated by the white skeletons of dead and dying clove trees. Cloves were an important cash crop (used in the production of *Kretek* cigarettes), especially for those farmers who had moved to Sumatra as part of the 'Transmigration' project. The disease was clearly a vascular infection and the 'jump spread' pattern of movement indicated an insect vector. There were no facilities in the region to undertake a programme to investigate and develop control measures, so ODM assisted the Indonesians to set up a research facility at Solok in West Sumatra where a couple of TCOs were recruited for the work. This turned out to be a long-running programme, with the research team expanded to work in Bogor in Java after the disease had spread there. The causal bacterium and insect vector, which had been identified in Malaysia, were identified, and this subsequently assisted the screening of germplasm for disease resistance.

Cloves are also an important crop in Zanzibar and a previous 'sudden death' problem had not been satisfactorily resolved by work in the 1950s. So, after an appropriate request from the Tanzanian government to try to boost clove production, I visited the country to review the problem. Once again, there was a need to set up an appropriate field station and recruit TCOs to tackle the problem with a fresh outlook. It transpired that there was a phytoplasma involved in the 'sudden death' problem, but this was slow moving. The major cause of poor yields was a dieback condition exacerbated by the age and size of the trees, and by poor cultural and harvesting practices, exacerbated by the low price farmers were receiving from the state marketing corporation.

This situation was again reflected when I became involved with the cashew downy mildew project in Tanzania. The answer had to include rehabilitation of the old cashew orchards and freeing the marketing regime. These experiences confirmed the need to integrate disease control and other aspects of crop health with general crop agronomy and the wider concerns of farmers, reinforcing the sentiments expressed at the NRAG meeting that I referred to at the beginning.

Upcoming events

Tropical Agriculture Association

Notice of the Tropical Agriculture Association's 2015 Annual General Meeting, 33rd Ralph Melville Memorial Lecture, and Annual Reunion

VENUE: The Royal Over-Seas League, Park Place, St James's Street, London, SW1A 1LR

DATE: Wednesday 11 November 2015

AGM AGENDA commencing at 5.00 pm

1/ Apologies
2/ Minutes of 2014 AGM
3/ Matters Arising
4/ Reports from Officers
5/ Adoption of Audited Accounts
6/ Approval of Accounts
7/ ExCo Elections
8/ AOB

33rd ANNUAL RALPH MEMORIAL LECTURE at 6:30 pm

Launching a career in international development with overseas assignments through the TAA's Tropical Agriculture Award Fund - Experiences from three recent and more distant past TAAF awardees.

THE ANNUAL REUNION will be held from 7:30 pm

A hot fork buffet will cost £25 per person.

How to get to the Royal Over-Seas League

Tube to Green Park (Piccadilly, Jubilee or Victoria Lines), take the exit marked Buckingham Palace, walk past the Ritz Hotel turning right on Arlington Street. At the end of Arlington Street there are some steps, and down the steps is the front entrance (approx 5 minutes).

Buses 8. 9, 14, 19, 22 and 38 stop outside Green Park tube station on Piccadilly, running west to Hyde Park Corner, Victoria and Knightsbridge, and east to Piccadilly Circus and Holborn.

Registration

Please register for the event by clicking here (http://www.eventbrite.co.uk/e/taa-agm-ralph-melville-memorial-lecture-and-annual-reunion-tickets-17893326421) or by advising the General Secretary at general_secretary@taa.org.uk

Cost

There will be a charge of £25 per person to cover room and facility hire and a hot buffet dinner, payable at the door, or in advance to the General Secretary, TAA, c/o Montpelier Professional Services, 1 Dashwood Square, Newton Steward, DG8 6EQ.

The 5th World Sustainability Forum: Transitioning toward Sustainability

Date and Time: 7 September 2015

Details: Reviewing the achievements and failures of the Millennium Development Goals. The period marked by the MDGs will end in December 2015. The international community is now working on a new set of goals, the Sustainable Development Goals, to be adopted at the 70th Session of the UN General Assembly in the second half of September 2015.

Conference Themes: the aim is to be a platform for researchers to present and engage with others on issues relating to sustainability in three areas: (i) Science, Technology, and Energy, (ii) Consumption, Lifestyles, Mobility, and Cities, (iii) Economics, Business, and Management. We seek to contribute to policy-relevant, change-oriented, and trans-disciplinary research and collaboration from science and technology, the life sciences, and the social sciences across these three thematic areas and sustainability dimensions

Venue: Basel, Switzerland (details on website)

Details at the website: http://www.sciforum.net/conference/wsf-5

email: wsf5@mdpi.com

https://sustainabledevelopment.un.org/sdgsproposal.html

SPACE 2015: Animal Production Show

Date and Time: 15 September 2015

Details: International Show for Animal Production: 15th to 18th September 2015, daily from 09.00 to 18.00.

Venue: Parc Expo of Rennes Airport, La Haie Gautrais, 35170 Bruz, France

Details at the website: www.space.fr

Contact: Tim Roberts Tel: 01761 470455

Summer Symposium Cambridge Conservation Forum (CCF) (Previously postponed to Sept 2015)

Date and Time: 21 September 2015, 09.30

Details: The Symposium will still have the theme 'People and Nature' and ask the question, 'Whose conservation?' Considering the different values of nature conservation and how these have changed from 'nature for itself' in the 1960s/70s towards an 'integrated human' focus in more recent years. Cambridgeshire's Local Nature Partnership (LNP), co-sponsors of the summer symposium, has a People and Nature mission.

Venue: Judge Business School, Trumpington Road, Cambridge CB2 1AG. UK

Website: www.cambridgeconservationforum.org.uk

Visit to East Malling Research; TAA L&SE Branch

Date: 23 September 2015, 12.30

Details: The TAA London & SE Branch invites members and friends to visit EMR for a comprehensive introduction to fruit production. For more details of EMR, click here. http://www.emr.ac.uk/

Programme: 12:30 Arrive and lunch. 13:30 Introduction to East Malling Research, Ross Newham. 13.55 Introduction to current challenges for tree fruit disease control, Dr Angela Berrie. 14:30 Current challenges for tree fruit disease control (field trip), Dr Angela Berrie. 15:00 Intensive tree fruit production & East Malling concept pear orchard, Graham Caspell. 15:30 Water and nutrient use efficiency, Dr Eleftheria Stavridou. 16:00 EMR rhizolab and root research at EMR, Dr Nicola Harrison. 16:20 Return to Conference Centre, tea and depart.

Cost £15 per head. Bring suitable clothing and footwear for the weather in the field.

Venue: East Malling Research, New Road, East Malling, Kent, ME19 6BJ, UK

Contact: Please reserve a place with Terry Wiles (southeast_convenor@taa.org.uk)

Soil functions and climate change

Details: International Congress about soil functions and climate change, specifically the thermal and hydraulic impacts on coupled hydraulic, biological and chemical processes under various land-use systems which will alter soil properties.

There is a need for detailed analysis of the role of the soil structure, its functions and changes under various climatic conditions in order to define the boundary conditions for reliable predictions in a changing environment. This first congress will deal with such interactions and necessary topics of soil physics, chemistry, biology and coupled processes which will be essential for more accurate prediction of soil processes and functions.

Venue: Christian Albrechts University, Kiel, Germany.

Details at the website: http://www.soils.uni-kiel.de/de/sustain-2015

Registration: http://www.soils.uni-kiel.de/de/sustain-2015/registration

2nd International Global Food Security Conference, NY

Date: 11 - 14 October 2015

Details: The conference aims to deliver state-of-the-art analysis, inspiring visions and innovative research methods arising from research in any of a wide range of disciplines. Join us in this exciting opportunity to ensure that the best science is garnered to support the emergence of the Sustainable Development Goals.

Further Details: http://www.globalfoodsecurityconference.com/index.html

Go to this website: http://www.globalfoodsecurityconference.com/submit-abstract.html

Venue: Cornell University, Ithaca, New York, USA.

http://www.globalfoodsecurityconference.com/conference-venue.html

Registration:
http://www.globalfoodsecurityconference.com/conference-register.html

Inaugural Meeting of TAA Scotland: Focus on Malawi

Date: 25 September 2015, 14.00

Details: The first meeting of the TAA Scotland Branch will take place on Friday 25 September from 14.00-17.00. The focus will be on bringing members up to date with "what Scottish-based organisations are currently doing in Malawi."

Programme: David Hope-Jones from the Scotland-Malawi Partnership will be speaking, and a couple of other speakers are still to confirm. More details to follow. See Facebook page:

www.facebook.com/groups/TAA.Scotland

Venue: Edinburgh Centre for Carbon Innovation (10 minute walk from Waverley train station), Infirmary Street, Edinburgh EH1 1LZ, UK

Contact: TAA members and friends welcome. Please reserve a place with John Ferguson (or johnf@hotmail.co.uk).

We request a £5 contribution per head to cover catering.

Meeting on Soils: TAA Southwest Branch Meeting: *Soils - where the answers lie*

Date and Time: 15 October 2015 10 am

Details: The programmes is as follows

10.00 Registration + payment £20
10.30 SW TAA Chairman's Welcome & Introduction: *Overview of Issues of Soil Management in this UN International Year of Soils 2015* – Prof John Wibberley
10.45 *Healthy Soils for Agriculture* - Prof David Hopkins
11.30 *Soil Degradation & Ecosystem Security - consequences & mitigation for food supply and other ecosystem services* - Prof Jane Rickson
12.10 *Travels with an auger: tropical soil diversity in practice* - Mr Alan Stapleton
12.30 Lunch
13.30 *Soil management lessons from and for Conservation Farming* - Prof Amir Kassam

14.15 *Reducing Soil Erosion through improved agricultural practices among smallholder farmers in Tanzania.*
Dr Richard Baines
14.40 *Soil Conservation via Tropical Tree Crop Management* – Mr Charles Hartley
15.00 Panel Forum: Questions invited
16.00 Tea/coffee, Chairman's summing up
16.15 Depart.

Venue: Royal Agricultural University, Cirencester, GL7 6JS. UK

www.rau.ac.uk/the-rau/how-to-find-us

Contact: Tim Roberts Tel 01761 470455

Curry Club lunchtime talk: Artemisia annua against malaria (TAA London & SE Branch

Date and Time: 29 October 2015, 11.30

Details: The Curry Club talk will be presented by Antony Ellman, TAA member, on "*Artemesia annua* against malaria: a smallholder remedy that works!' The event will commence with coffee from 11.30, followed by the presentation and discussion, with curry lunch (£14) scheduled for 13.30.

Venue: India Club, Hotel Strand Continental, 143 Strand, London WC2R 1JA, UK

Contact: Terry Wiles to book your place

southeast_convenor@taa.org.uk

African Celebration Meeting of the International Year of Soils

Date: 23 - 27 November 2015

Details: 28th Bi-annual Conference of the Soil Science Society of East Africa (SSSEA) & African Celebration Meeting of the International Year of Soils

Theme: Soils and Land Use for Climate Smart Agriculture. SSSEA Website:

www.cta.int/en/event/morogoro-tanzania/soil-science-society-of-east-africa-sssea-bi-annual-conference.html

Venue: Morogoro, Tanzania.

Contact: The Organising Committee, SSSEA - mumyambilila@yahoo.com

Contested Agronomy: Dynamics Cases and Implications

Date, Time: 23-25 February 2016, 10.00

Details: A conference about the battlefields in agricultural research, past and present, addressing the politics of knowledge within the field of agronomy.
The attendance fee is £150. Some limited financial support is available for people based in developing countries. Please email j.thompson@ids.ac.uk for details.

Website: http://contestedagronomy2016.com/

Venue: Institute of Development Studies, University of Sussex, Brighton, UK.

21st World Congress of Soil Science (WCSS)

Date: 12 - 17 August 2018

Details: The theme will be '*Soils to feed and fuel the world*'. The WCSS is the main event of the International Union of Soil Science. It takes place every four years and is open to all members of the IUSS and other participants.

For further information http://www.21wcss.org/

Venue: RioCentro Exhibition and Convention Centre, Rio de Janeiro, Brazil

Tropical Agriculture Association
Registered Charity No. 800663

How to become a member of the TAA

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 http://www.taa.org.uk/

Step One - Application: Applications can be made on-line at:
http://www.taa.org.uk/membership
Alternatively an application form can be downloaded, completed and sent to:
TAA Membership Secretary, 15 Westbourne Grove, Great Baddow, Chelmsford CM2 9RT.

Step Two - Membership Type: Decide on the type of membership you require – see the details and subscription rates below:

Types of Membership and Annual Subscription Rates (£)			
Full Individual (printed copies of *Agriculture for Development*)	40	Full Individual 70 (>70 years) (printed copies *Agriculture for Development)*	30
On-line Individual (on-line copies of *Agriculture for Development*)	30	On-line Individual 70 (>70 years) (on-line copies of *Agriculture for Development*)	20
Corporate Members (printed copies of *Agriculture for Development* and on-line access for company staff)	100	Student Membership (on-line copies of *Agriculture for Development*)	10

Step Three - Payment: Payment details are on the website with 'Bank Standing Order' being the preferred method since this ensures annual payment is made and is one less thing to remember!

Payment can also be made by bank transfer, on-line using PayPal, or by cheque.
Bank details are available from: treasurer@taa.org.uk

Step Four - Access to website and Journals: When application and payment has been received then the Membership Secretary will contact you with your membership number and log-in details for you to fully access the website and journals.
The latest journal will be sent to full members.

For membership enquiries contact: membership_secretary@taa.org.uk

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